

SNAPPER MINE

Northern Extension Modification

Modification Report

TRONOX 



SNAPPER MINE
NORTHERN EXTENSION MODIFICATION

MODIFICATION REPORT



NOVEMBER 2019
Project No. CMA-19-08
Document No. 1004900

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres north-east of Wentworth and approximately 170 kilometres south-east of Broken Hill in western New South Wales (NSW).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning & Assessment Act 1979* (Project Approval [06_0168]) in 2007.

This Modification Report is a Statement of Environmental Effects that has been prepared by Tronox to support a request to modify Project Approval (06_0168) under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

ES.2 OVERVIEW OF THE MODIFICATION

The Snapper Mine integrates with the following Tronox mineral sands mining and processing operations located in western NSW:

- Broken Hill Mineral Separation Plant (MSP).
- Ginkgo Mineral Sands Mine (the Ginkgo Mine).
- Atlas-Campaspe Mineral Sands Project (Atlas-Campaspe Mine).

Mineral concentrates produced at the Snapper and Ginkgo Mines are currently processed at the MSP.

Production from the approved Atlas-Campaspe Mine (once operational) will progressively replace Snapper and Ginkgo Mine production as the feed material for the MSP. Construction activities at the Atlas-Campaspe Mine commenced in 2018, and production is scheduled to commence in late 2021.

Production at the approved Snapper Mine is currently scheduled to conclude in mid-2020. The Snapper Mine workforce is then planned to transition to the Atlas-Campaspe Mine.

Based on current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine Northern Extension Modification (the Modification) would minimise the risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around Mining Lease Application 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The indicative general arrangement of the modified Snapper Mine is shown on Figure ES-1.

The additional surface development areas and Nob Road realignment (Figure ES-1) are herein referred to as the Modification area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

Table ES-1 provides a comparative summary of the existing/approved and modified Snapper Mine.

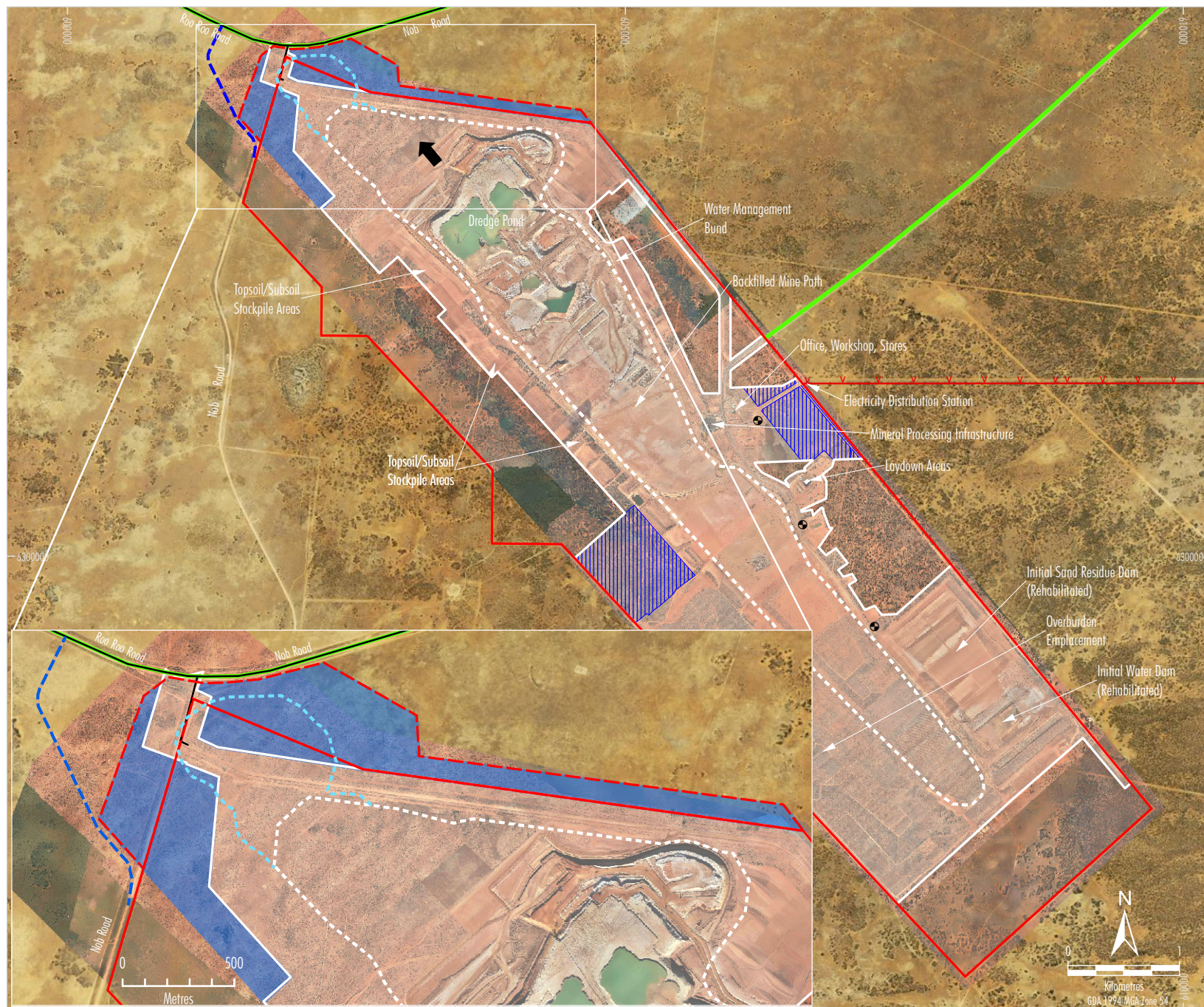


Table ES-1
Comparison of the Existing/Approved and Modified Snapper Mine

Snapper Mine Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Life	Mining operations until 10 July 2026.	No change.
Tenement	Mining Lease 1621.	New Mining Lease Mining Lease Application 1.
Surface Development Area	Approximately 1681 hectares.	Overall net reduction in surface development area of approximately 3 hectares.
Mining	- Dredge mining producing approximately 14 million tonnes per annum of ore. - Conventional mining (dozers and/or scrapers) for ore unable to be dredge mined.	No change.
Mineral Concentration and Mineral Concentrate Transport	- Mineral concentrate production up to 621,000 tonnes per annum. - Mineral concentrate transport from the Snapper and Ginkgo Mines combined to the MSP up to 975,000 tonnes per annum. - Ore concentrated in the primary gravity concentration unit (comprising a screen, surge bin and wet concentrator) to produce heavy mineral concentrate. - Heavy mineral concentrate washed in the salt washing facility prior to processing in the wet high intensity magnetic separation circuit to produce ilmenite-rich, leucoxene-rich and non-magnetic (containing rutile-rich and zircon-rich) mineral concentrates.	No change.
Overburden Management	- Overburden removal ahead of ore extraction areas using conventional truck and shovel methods (e.g. excavators and haul trucks). - A conveyor system and/or haul trucks are approved to transport the overburden to either the mine void behind the advancing dredge pond or in the overburden emplacement.	- No change. - Additional temporary off-path overburden emplacements.
Sand Residue and Coarse Reject Management	Sand residues and coarse rejects placed in either an initial sand residue dam or dredge pond behind the advancing ore extraction area.	No change.
MSP Process Waste Management	- MSP process waste placed behind the advancing ore extraction areas at either the Ginkgo Mine, Snapper Mine or Atlas-Campaspe Mine. - MSP process waste transport up to 300,000 tonnes per annum to the Snapper and Ginkgo Mines.	No change.
Water Supply	Water requirements supplied by the Snapper Mine borefield.	No change.
Electricity Supply	Electricity supplied by distribution station connected to grid.	No change.
Site Access	- Access to the Snapper Mine via the Highway Access Road. - Eastern and northern (not constructed) access roads connect the Snapper Mine to the Highway Access Road.	- No change. - Northern access road would not be constructed.
Employment	Up to approximately 200 personnel during operations.	No change.
Rehabilitation Works	- Progressive rehabilitation undertaken as mining advances. - Two final depressions associated with the final dredge pond and water disposal dam, respectively.	- No change to rehabilitation strategy. - Reduction in the number of final depressions from two to one. - Increased size of the remaining final depression.

In accordance with Clause 3BA(6) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the consent authority is required to satisfy itself that any consent as modified would result in the Snapper Mine remaining substantially the same development as was last modified under Section 75W of the EP&A Act (i.e. Modification 5, February 2015 which is the existing/approved Snapper Mine), inclusive of consideration of the changes arising from previously approved modifications.

Based on a review of the proposed changes, Tronox considers that the modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.

ES.3 STAKEHOLDER ENGAGEMENT OVERVIEW

Tronox has consulted with a number of stakeholders during the development of the Modification, including:

- Department of Planning, Industry and Environment;
- other relevant NSW Government agencies;
- Wentworth Shire Council;
- Aboriginal stakeholders; and
- relevant leaseholders.

The outcomes of engagement with these stakeholders has informed the development of the scope of the Modification and Tronox's preparation of the Modification Report.

ES.4 ENVIRONMENTAL REVIEW

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment. The key environmental issues identified are summarised in Table ES-2 below.

ES.5 EVALUATION OF MERITS

Approval of the Modification is considered to be justified given that:

- The modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.
- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine.
- The Modification would allow Tronox to continue to supply its downstream operations (including the MSP) and other customers mineral concentrate until the commencement of production from the Atlas-Campaspe Mine avoiding disruption to existing supply chains.
- The Modification would promote the efficient and economic recovery of additional mineral sands resources while maximising the use of Tronox's established facilities and associated returns on existing financial investment.
- The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy and other measures.
- The WSC and relevant leaseholders have provided in-principle support for the Modification.

In weighing up the main environmental impacts (costs and benefits) and socio-economic benefits associated with the Modification as assessed and described in this Modification Report, the Modification is on balance, considered to have merit.

Table ES-2
Key Outcomes of Environmental Review for the Modified Snapper Mine

Environmental Aspect	Summary of Key Environmental Review Conclusions
Biodiversity	- The Modification would not increase impacts on biodiversity values. Instead, it would result in a net positive outcome for biodiversity values in the local area. - As the Modification would not increase impacts on biodiversity values, it is considered that a Biodiversity Development Assessment Report is not required.
Aboriginal Cultural Heritage	No known Aboriginal cultural heritage sites are present within the Modification area.
Historic Heritage	No historic heritage sites are present within the Modification area.
Land and Agricultural Resources	The Modification would result in a net reduction in surface development area, therefore there is expected to be no additional impact on potential land and agricultural resources.
Air Quality	Potential air quality impacts associated with the Modification would not contribute to any exceedances of the relevant air quality criteria at the closest sensitive receivers.
Noise	Noise emissions due to the Modification would not result in any material increase in noise levels, and relevant noise criteria are predicted to be achieved at the closest sensitive receivers, during the day, evening and night, under neutral and adverse meteorological conditions.
Road Transport	- A portion of Nob Road would be realigned in consultation with the WSC. - The Modification would have acceptable impacts on the capacity, efficiency and safety of the road network surrounding the Snapper Mine.
Groundwater Resources	- The Modification is not expected to have any measurable effect at leaseholder bores given the negligible groundwater drawdown effects expected. - The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River). - The Modification would have "minimal impact" as defined in the <i>Aquifer Interference Policy</i>. - Tronox holds sufficient entitlements (21,442 share components [units or million litres]) under the <i>Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011</i>.
Surface Water Resources	Potential surface water impacts associated with the Modification would be minimal with the implementation of existing surface water management measures.
Social and Economic	- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine. - The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the regional economy would continue as a result of the Modification. - The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would however avoid potential negative social impacts associated with the loss of employment opportunities at Tronox's operations.
Visual	The potential visual impact associated with views of the modified Snapper Mine operations along a short section of the highway access road would be low given the very low number of road users on the highway access road.
Greenhouse Gas	The total greenhouse gas emissions from the Snapper Mine (over the whole mine life) would not change significantly as a result of the Modification.
Hazards and Risks	As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.
Community Infrastructure	As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved social and community infrastructure impacts is expected.

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Appendix B	Aboriginal Cultural Heritage Assessment
Appendix C	Air Quality Review
Appendix D	Noise Review
Appendix E	Road Transport Review
Appendix F	Hydrogeological Review
Appendix G	Land Contamination Assessment

1 INTRODUCTION

Tronox Mining Australia Limited (Tronox) is the owner and operator of the Snapper Mineral Sands Mine (the Snapper Mine), which is located approximately 85 kilometres (km) north-east of Wentworth and approximately 170 km south-east of Broken Hill in western New South Wales (NSW) (Figure 1).

The Snapper Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (Project Approval [06_0168]) (Attachment 1) in 2007.

This Modification Report is a Statement of Environmental Effects that has been prepared by Tronox to support a request to modify Project Approval (06_0168) under Section 4.55(2) of the EP&A Act.

The Snapper Mine Northern Extension Modification (the Modification) includes an extension to the existing/approved mine path to extend operations at the Snapper Mine within the approved mine life and without increasing the size of the approved surface development area.¹

1.1 DESCRIPTION OF THE EXISTING/APPROVED SNAPPER MINE

1.1.1 Development History

The Snapper Mine integrates with the following Tronox mineral sands mining and processing operations located in western NSW (Figure 1):

- Broken Hill Mineral Separation Plant (MSP).
- Ginkgo Mineral Sands Mine (the Ginkgo Mine).
- Atlas-Campaspe Mineral Sands Project (Atlas-Campaspe Mine).

Construction of the Snapper Mine commenced in August 2008, and mining operations commenced in December 2009.

Project Approval (06_0168) has been modified on six occasions since the commencement of construction at the Snapper Mine (Attachment 1):

- June 2009 – to modify the approved offset area for the offset of environmental impacts associated with the Snapper Mine.

- December 2009 – to allow for the road transport of ore to the Ginkgo Mine for processing.
- October 2010 – to increase the total ore mined at the Snapper deposit, increase the maximum annual production of mineral concentrates, reduce the life of mine and transport high grade ore from the Snapper Mine to the Ginkgo Mine.
- October 2014 – to integrate the Atlas-Campaspe Mine into the existing Tronox mineral sands mining and processing operations located in western NSW (i.e. the Snapper and Ginkgo Mines, and the MSP).
- December 2014 – to increase the ore extraction rate and mineral concentrate transport limits.
- February 2015 – to increase the maximum annual ore extraction rate to maintain the approved maximum mineral concentrate production rate.

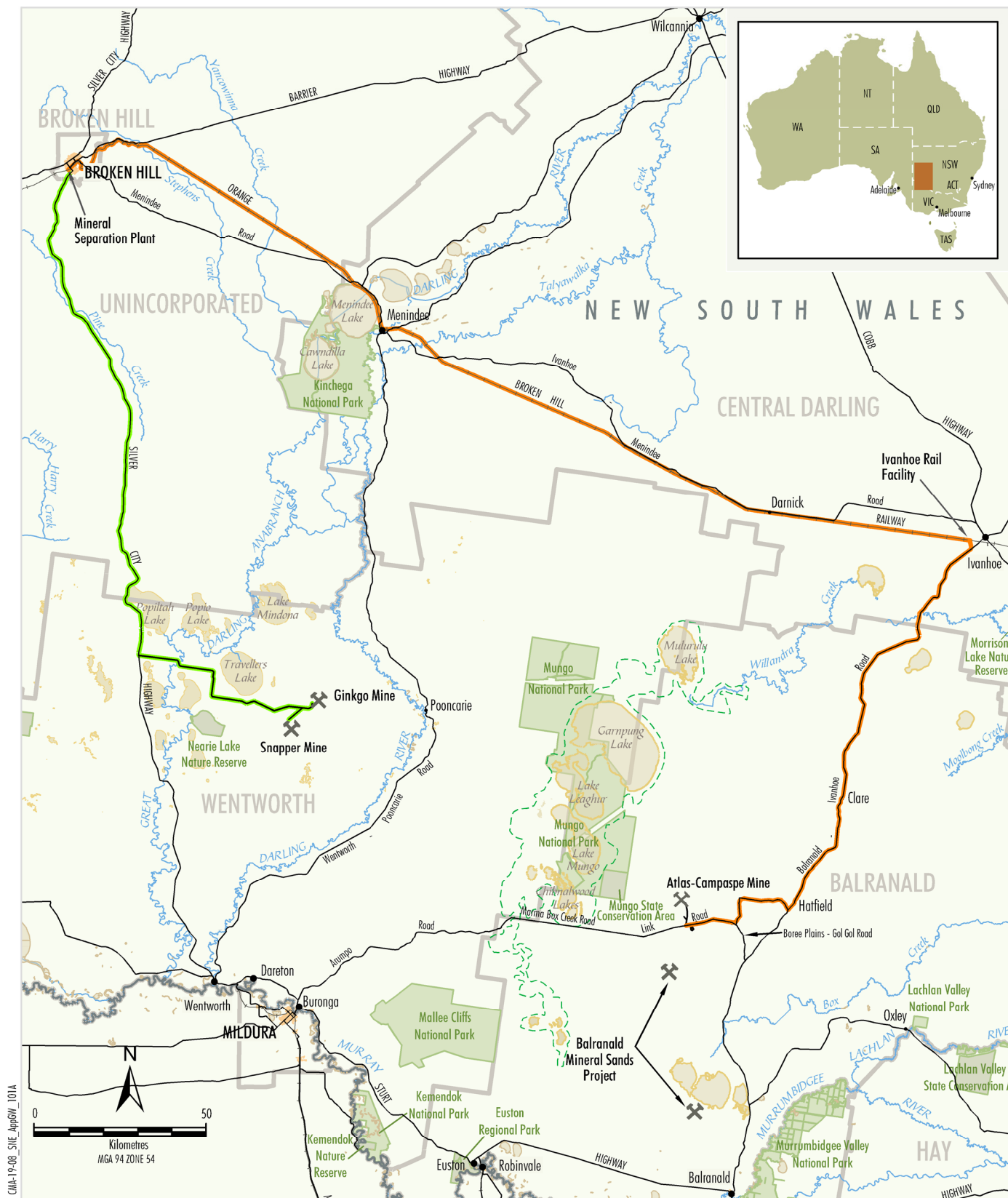
1.1.2 Snapper Mine Operations

The Snapper Mine is currently approved to extract up to 14 million tonnes per annum (Mtpa) of mineral sands ore, producing a maximum 621,000 tonnes per annum (tpa) of mineral concentrate for processing at the MSP (Figure 1). The Snapper Mine is also approved to receive MSP process waste for designated stockpiling, prior to depositing on the sand residue beach and/or with overburden.

The existing/approved Snapper Mine is comprised of the following major site components:

- dredge pond (including a primary and secondary (mini) dredge, primary gravity concentration unit and associated equipment);
- overburden conveyor system (not constructed to date);
- overburden emplacement;
- sand residue dam;
- mineral processing infrastructure including:
 - heavy mineral concentrate (HMC) treatment facility including a reverse osmosis plant, salt washing facility and a wet high intensity magnetic separation (WHIMS) circuit (not constructed to date);
 - towers and stackers for stockpiling mineral concentrates/HMC;
- mineral concentrate/HMC stockpiles;
- office, workshop and store buildings and car parking facilities;

¹ Considering the mine path extension and the area of currently approved surface development area being relinquished (Section 2.2).



LEGEND

- National Park, Regional Park or State Conservation Area
- Willandra Lakes Region World Heritage Area
- Local Government Area Boundary
- Mine Site
- Existing Mineral Concentrate Transport Route and MSP Process Waste Transport Route
- Approved Mineral Concentrate Transport Route*

Source: © NSW Department of Finance, Services & Innovation (2018);
Cristal Mining Australia (2012)

TRONOX
S N A P P E R M I N E
Regional Location

* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines.

Figure 1

- fuel and consumables storage facilities;
- water supply bores and associated pumps and pipeline systems;
- wastewater (including sewage) treatment plant;
- water disposal dam (not constructed to date);
- laydown areas;
- highway access route (HAR), internal access roads and haul roads;
- electricity transmission line (ETL), electricity distribution station and associated internal ETLs; and
- other associated minor infrastructure, plant, equipment and activities.

Mining of the approved mine path is scheduled to be completed in mid-2020 (i.e. before the end of the approved mine life) as mining progression to date has been faster than planned.

The general arrangement of the existing/approved Snapper Mine is shown on Figure 2.

1.1.3 Environmental Monitoring and Management

An Environmental Management Strategy (GHD, 2016a) has been developed to minimise environmental impacts by providing the strategic context for environmental management at the Snapper Mine.

Management and monitoring plans and control strategies have been developed in consultation with relevant agencies as part of the Environmental Management Strategy. These monitoring programs and control strategies include the following:

- Water Management Plan (GHD, 2016b);
- Transport Management Plan (GHD, 2015a);
- Flora and Fauna Management Plan (GHD, 2017a);
- Land Management Plan (GHD, 2015b);
- Bushfire Management Plan (GHD, 2016c);
- Offset Management Plan (GHD, 2017b);
- Cultural Heritage Management Plan (GHD, 2015c);
- Radiation Management Plan (Cristal Mining Australia [CMA], 2015a);
- Waste Management Plan (GHD, 2019);
- Noise Management Plan (GHD, 2018);
- Energy Saving Environmental Management Plan (GHD, 2014); and
- Air Quality Management Plan (GHD, 2015d).

A more detailed description of the management and monitoring plans and control strategies described above relevant to the Modification is provided in Section 6.

Tronox maintains an extensive environmental monitoring network for the Snapper Mine, including meteorological, dust and water monitoring.

An overview of environmental management actions and environmental monitoring results, including review of the Tronox's performance against the requirements of the management and monitoring plans and control strategies, is presented each year in an Annual Environmental Management Report (AEMR) and distributed to government agencies, stakeholders and interested parties.

1.1.4 Workforce

The approved Snapper and Ginkgo Mines combined operational workforce is up to approximately 420 personnel (Tronox employees and contractors).

The current Snapper Mine workforce is approximately 110 personnel.

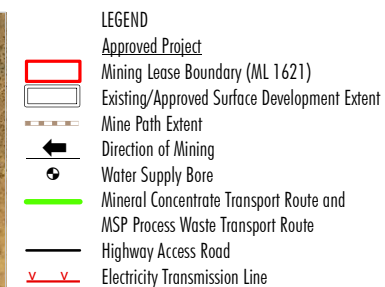
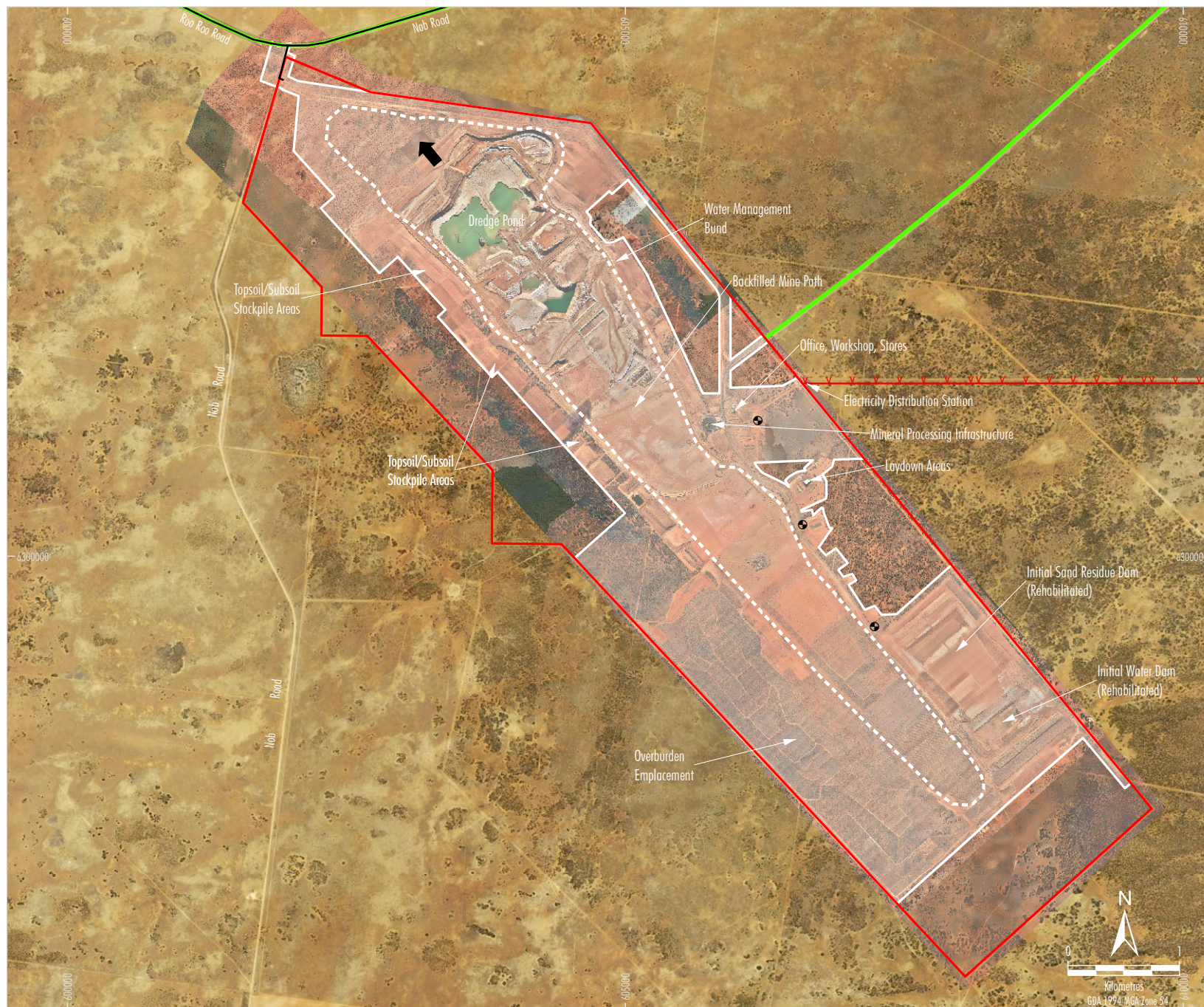
1.1.5 Community Contributions

Tronox plays an active role in the local community through sponsorships of community organisations. Tronox strives to support local communities in the vicinity of its operations including financial support through sponsorships, support programs, employment and the indirect economic growth and benefits that flow from significant company expenditure within these communities.

Tronox is also a regular contributor to schools, sporting groups, festivals, service organisations and the Aboriginal community.

1.2 MODIFICATION OVERVIEW

The Snapper Mine integrates with Tronox's other mineral sands mining and processing operations located in western NSW. Mineral concentrates produced at the Snapper and Ginkgo Mines are currently processed at the MSP.



Source: NSW Spatial Services (2019); Tronox (2019)
 Orthophoto: Tronox (2019)

TRONOX
 S N A P P E R M I N E
 Existing/Approved Snapper Mine -
 General Arrangement

Figure 2

Production from the approved Atlas-Campaspe Mine (once operational) will progressively replace Snapper and Ginkgo Mine production as the feed material for the MSP. Construction activities at the Atlas-Campaspe Mine commenced in 2018, and production is scheduled to commence in late 2021.

Production at the approved Snapper Mine is currently scheduled to conclude in mid-2020 (Section 1.1.2). The Snapper Mine workforce is then planned to transition to the Atlas-Campaspe Mine.

Based on this current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations.

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine Northern Extension Modification (the Modification) would minimise the risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations without extending the mine life or the size of the approved surface development area.

A detailed description of the Modification is provided in Section 2.

Section 5	Describes the consultation undertaken in relation to the Modification.
Section 6	Provides a review of the existing environmental management at the Snapper Mine and an environmental assessment of the Modification.
Section 7	Evaluates the merits of the Modification, and provides justification for approval of the Modification.
Section 8	References.

Attachment 1 and Appendices A to G provide supporting information as follows:

Attachment 1	Project Approval (06_0168)
Appendix A	Biodiversity Assessment
Appendix B	Aboriginal Cultural Heritage Assessment
Appendix C	Air Quality Review
Appendix D	Noise Review
Appendix E	Road Transport Review
Appendix F	Hydrogeological Review
Appendix G	Land Contamination Assessment

1.3 STRUCTURE OF THE DOCUMENT

This Modification Report is a Statement of Environmental Effects that has been prepared in consideration of the draft *Preparing a Modification Report* Guidelines (Department of Planning and Environment [DP&E], 2019).

This Modification Report is structured as follows:

Section 1	Provides an overview of the existing/approved Snapper Mine, and the background to the Modification.
Section 2	Provides a description of the Modification.
Section 3	Describes the strategic context of the Modification.
Section 4	Describes the general statutory context of the Modification and how the Modification meets relevant statutory requirements.

2 MODIFICATION DESCRIPTION

2.1 OVERVIEW

Tronox proposes to extend the existing/approved mine path at the Snapper Mine to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine (Section 1.2).

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into Mining Lease Application (MLA) 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

Although the Modification would extend mining operations at the Snapper Mine by approximately one year, mining operations would still be completed within the approved mine life (i.e. before 10 July 2026) as mining progression to date has been faster than planned,

The indicative general arrangement of the modified Snapper Mine is shown on Figures 3 and 4.

The additional surface development areas and Nob Road realignment (Figures 3 and 4) are herein referred to as the Modification area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;

- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

Table 1 provides a comparative summary of the existing/approved and modified Snapper Mine. Based on a review of the proposed changes, Tronox considers that the modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine (Section 4.1.1).

The following sub-sections provide a detailed description of the Modification components.

2.2 GENERAL ARRANGEMENT

The Modification would include an approximate 87.4 hectare (ha) increase in the extent of the existing/approved surface development area at the northern end of the Snapper deposit to allow for (Figure 3):

- an extension of the existing/approved mine path;
- temporary overburden emplacements;
- expanded soil stockpile areas; and
- the extension of other supporting infrastructure (e.g. internal access roads, internal ETLs and other associated minor infrastructure).

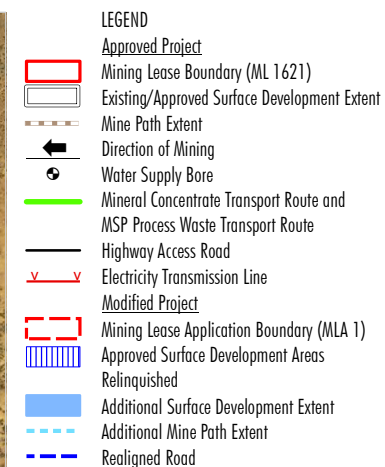
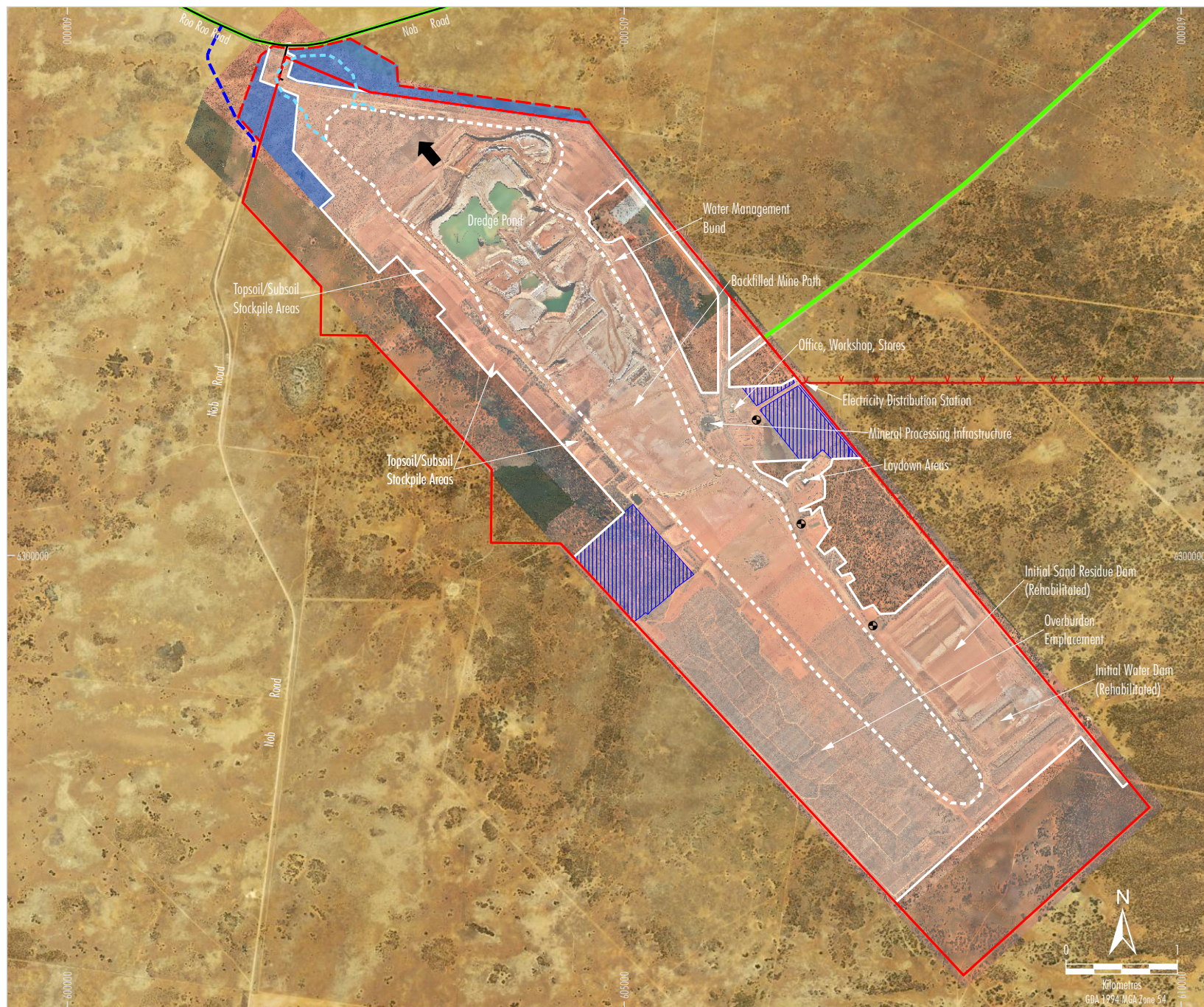
The Modification would also include the relinquishment of approximately 90.7 ha of approved surface development areas no longer required. The Modification would therefore result in an approximate 3.3 ha reduction in surface development area.

2.3 MINING OPERATIONS

2.3.1 Mine Path

The existing/approved mine path extends approximately 8 km in length and up to approximately 1,200 metres (m) wide (Figure 2).

The Modification would include extension of the existing/approved mine path by approximately 600 m at the northern end (Figures 3 and 4). The mine path extension would be up to approximately 500 m wide (Figures 3 and 4).



Source: NSW Spatial Services (2019); Tronox (2019)
 Orthophoto: Tronox (2019)

TRONOX

S N A P P E R M I N E

**Modified Snapper Mine -
 Indicative General Arrangement**

Figure 3

Table 1
Comparison of the Existing/Approved and Modified Snapper Mine

Snapper Mine Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Life	Mining operations until 10 July 2026.	No change.
Tenement	Mining Lease (ML) 1621.	New Mining Lease Application (MLA 1).
Surface Development Area	Approximately 1681 hectares (ha).	Overall net reduction in surface development area of approximately 3 ha.
Mining	- Dredge mining producing approximately 14 Mtpa of ore. - Conventional mining (dozers and/or scrapers) for ore unable to be dredge mined.	No change.
Mineral Concentration and Mineral Concentrate Transport	- Mineral concentrate production up to 621,000 tpa. - Mineral concentrate transport from the Snapper and Ginkgo Mines combined to the MSP up to 975,000 tpa. - Ore concentrated in the primary gravity concentration unit (comprising a screen, surge bin and wet concentrator) to produce HMC. - HMC washed in the salt washing facility prior to processing in the WHIMS circuit to produce ilmenite-rich, leucoxene-rich and non-magnetic (containing rutile-rich and zircon-rich) mineral concentrates.	No change.
Overburden Management	- Overburden removal ahead of ore extraction areas using conventional truck and shovel methods (e.g. excavators and haul trucks). - A conveyor system and/or haul trucks are approved to transport the overburden to either the mine void behind the advancing dredge pond or in the overburden emplacement	- No change. - Additional temporary off-path overburden emplacements.
Sand Residue and Coarse Reject Management	Sand residues and coarse rejects placed in either an initial sand residue dam or dredge pond behind the advancing ore extraction area.	No change.
MSP Process Waste Management	- MSP process waste placed behind the advancing ore extraction areas at either the Ginkgo Mine, Snapper Mine or Atlas-Campaspe Mine. - MSP process waste transport up to 300,000 tpa to the Snapper and Ginkgo Mines.	No change.
Water Supply	Water requirements supplied by the Snapper Mine borefield.	No change.
Electricity Supply	Electricity supplied by distribution station connected to grid.	No change.
Site Access	- Access to the Snapper Mine via the HAR. - Eastern and northern (not constructed) access roads connect the Snapper Mine to the HAR.	- No change. - Northern access road would not be constructed.
Employment	Up to approximately 200 personnel during operations.	No change.
Rehabilitation Works	- Progressive rehabilitation undertaken as mining advances. - Two final depressions associated with the final dredge pond and water disposal dam, respectively.	- No change to rehabilitation strategy. - Reduction in the number of final depressions from two to one. - Increased size of the remaining final depression.

2.3.2 Mine Fleet

The existing mine fleet includes dozers, excavators, front end loaders and haul trucks. Additional detail on the mine fleet is provided in the Noise Review (Appendix D).

The number of excavators and haul trucks would be reduced as part of the Modification due to narrowing of the mine path as mining progresses north into MLA 1 and therefore fewer excavators and haul trucks are required for overburden removal and handling.

Details of the modified mine fleet are provided in the Noise Review (Appendix D).

2.3.3 Overburden Removal and Handling

The existing/approved overburden removal and handling process involves the removal of overburden ahead of the advancing dredge pond using excavators, dozers and front-end loaders.

Haul trucks and/or a conveyor system are approved to transport overburden behind the advancing dredge pond for backfilling of the mine path or in the overburden emplacement. Haul trucks are currently used to transport overburden.

As the mine path has sufficiently progressed, overburden is now only placed in the mine void behind the advancing dredge pond (i.e. the overburden emplacement is no longer utilised).

The overburden placed in the mine void behind the advancing dredge pond is mounded up to approximately 10 m above the natural ground surface.

As part of the Modification, overburden would be placed temporarily around the crest of the mine path extension (Figure 4), rather than be placed behind the advancing dredge pond. At the end of the mine life, the overburden would be dozer pushed into the mine path to establish the final landform (Section 2.5).

The use of temporary overburden emplacements would minimise overburden handling and reduce costs associated with the development of the final landform.

2.4 WATER MANAGEMENT

Site water management at the Snapper Mine is conducted in accordance with the Water Management Plan (GHD, 2016b).

The key objectives of the Snapper Mine water management system are (Bemax Resources Limited [Bemax], 2007a):

- separation of undisturbed area runoff from disturbed area runoff;
- collection and re-use of surface runoff from disturbed areas (including mining areas and overburden replacement);
- capture and on-site containment of potentially contaminated mine site waters; and
- priority re-use of captured and contained water for dust suppression or process requirements.

To meet these objectives, the water management system is developed progressively over the life of the Snapper Mine.

The objectives of the Snapper Mine water management system would continue to be adopted at the modified Snapper Mine.

2.4.1 Up-catchment Runoff and Sediment Control System

Both temporary and permanent up-catchment diversion bunds/drains will be constructed over the life of the Snapper Mine to divert runoff from undisturbed areas around the mine path, overburden emplacement, soil stockpiles, sand residue dam and other fixed infrastructure areas.

Drainage from disturbance areas within the Snapper Mine surface development area is directed to the evaporation/sediment sumps for containment. Water collected in evaporation/sediment sumps is utilised for dust suppression at the mine site or allowed to evaporate.

The existing/approved Snapper Mine up-catchment runoff and sediment control system would be extended to incorporate the additional Snapper Mine surface development area.

2.5 REHABILITATION STRATEGY

2.5.1 Rehabilitation Objectives

The existing rehabilitation objectives for the Snapper Mine are outlined in Condition 19, Schedule 3 of Project Approval (06_0168), and are summarised in Table 2.

Table 2
Summary of Project Approval Rehabilitation Objectives

Snapper Mine Component	Objectives
Mine Site	• Safe, stable and non-polluting. • Final land use compatible with surrounding land uses. • Final landforms designed to incorporate micro-relief, natural drainage lines and minimise visual prominence by integration with the surrounding landscape. • Restore self-sustaining ecosystems, including establishing local native plant species.
Final Void	• Minimise the size and depth of the final voids as far as is reasonable and feasible. • Minimise the drainage catchment of the final voids as far as reasonable and feasible.
Overburden Emplacement Areas	• Ensure that areas subject to slurried overburden emplacement are covered with a minimum of: – 1 m of non-slurried overburden on the initial slurried sand storage dam; – 3 m of non-slurried overburden for all other areas; in addition to at least 0.2 m of topsoil and at least 0.2 m of subsoil.
Surface Infrastructure	• To be decommissioned and removed (unless otherwise agreed with the Department of Resources and Geoscience).
Agriculture	• Reinstatement of the infrastructure areas to land suitable for light intensity grazing.
Community	• Ensure public safety and minimise the adverse socio-economic effects associated with mine closure.

The Mining Operations Plan² (CMA, 2015b) outlines the following short-term rehabilitation objectives:

- *Minimise clearing disturbance areas*
- *Commence vegetation pre clearance in accordance with the Flora and Fauna Management Plan*
- *Clear approved vegetation areas 12 months in advance of mining operations in the appropriate season (late summer – early winter)*
- *Carry out topsoil assessments as part of the Vegetation Clearance Protocol VCP*
- *Employ suitable topsoil removal and storage practices to allow maximum survival of soil biota*
- *Schedule mine planning operations so that OB placement to be consistent with rehabilitation requirements and designs*
- *Progressive rehabilitation*
- *Pest flora and fauna control*
- *Monitoring, Evaluation, Reporting and Improvement to ensure continual improvement*

The Mining Operations Plan also outlines the following long-term rehabilitation objectives (CMA, 2015b):

- *Restoration of a self-generating native landscape that is capable of supporting light intensity grazing*
- *Development and completion of low maintenance, non-polluting and stable rehabilitation landforms*
- *Removal/burial of all required infrastructure and complete rehabilitation of the site*
- *Relinquishment of the mining lease and release from any further liabilities*

These rehabilitation objectives would continue to be adopted at the modified Snapper Mine.

2.5.2 Final Landform Concepts

The existing/approved and modified final landform design concepts for the Snapper Mine are summarised in Table 3.

The Modification would not change the existing/approved final landform concepts with the exception of the final depressions (Table 3).

The number of final depressions would reduce from two to one as a result of the Modification. The water disposal dam final depression would be integrated within the final dredge pond final depression at the northern extent of the mine path (herein referred to as the modified final depression).

² The Snapper Mine Mining Operations Plan also addresses the Rehabilitation Management Plan requirements in Condition 19B, Schedule 3 of Project Approval (06_0168).

The extent of the modified final depression would increase as it would incorporate the water disposal dam final depression and more overburden has been able to be placed in the existing backfilled mine path than originally forecast in the *Snapper Mineral Sands Project Environmental Assessment* (Snapper Mine EA) (Bemax, 2007a).

The modified final landform is shown on Figure 5.

The modified final depression would be rehabilitated consistent with the approved design concept, with the exception of improvements to the batter slopes. The batter slopes of the final depression would reduce from 1:4 to between 1:5 and 1:10 (Table 3).

A conceptual cross-section of the modified final depression is shown on Figure 6.

2.5.3 Final Land Use

The approved final land use at the Snapper Mine is light intensity grazing (CMA, 2015b).

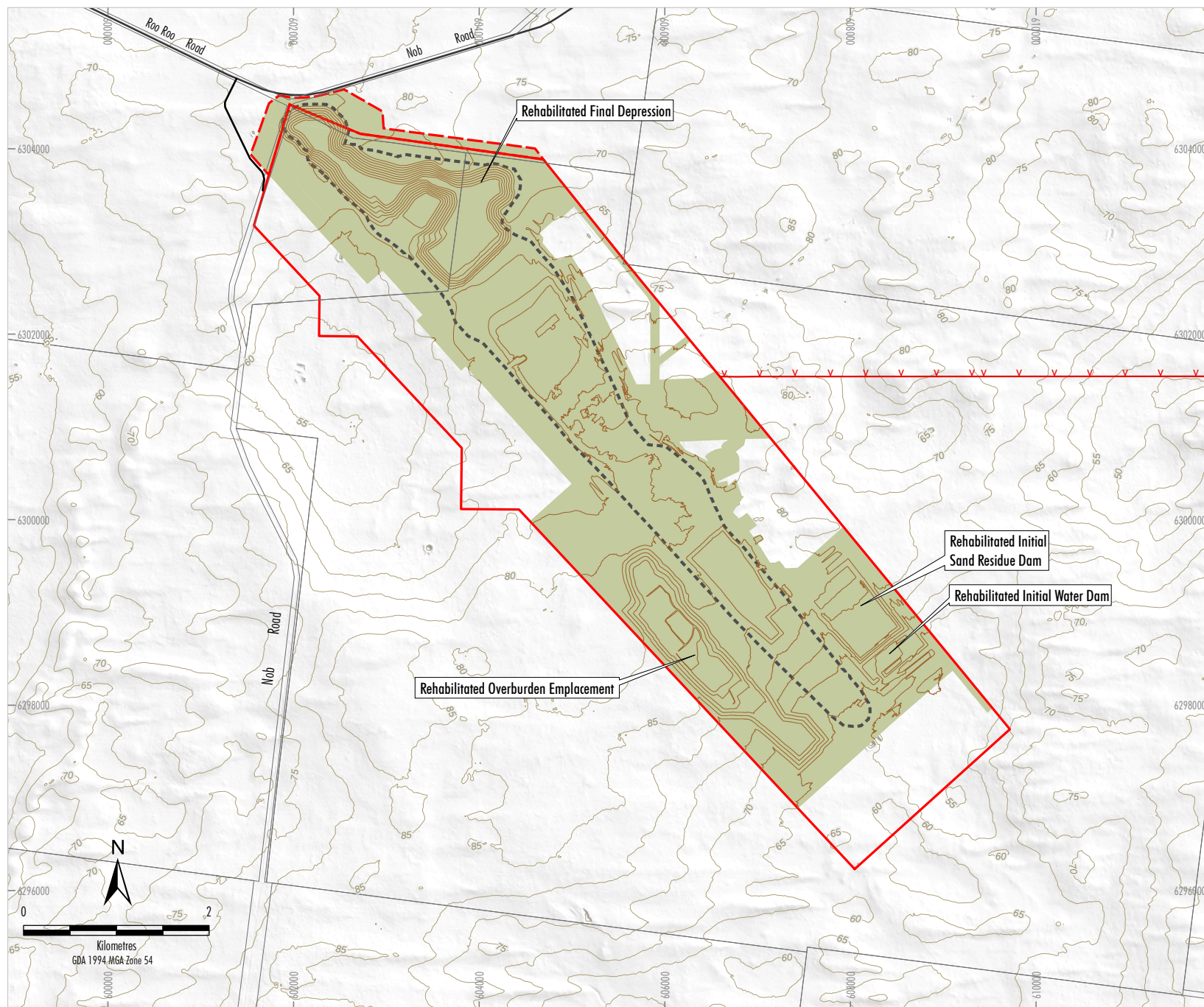
The approved final land use would remain unchanged as a result of the Modification.

2.5.4 Rehabilitation Management

In accordance with Condition 19A, Schedule 3 of Project Approval (06_0168), Tronox will progressively rehabilitate the Snapper Mine, as soon as reasonably practicable following disturbance.

Table 3
Comparison of Existing/Approved and Modified Final Landform Concepts

Final Landform Component	Existing/Approved Snapper Mine	Modified Snapper Mine
Mine Path	- Mine path will be progressively backfilled, shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated. - The final elevation of the shaped mine path will be up to approximately 10 m over the pre-existing landform.	Unchanged.
Overburden Emplacement	- The height of the overburden emplacement will be up to 20 m. - The batter slopes will be approximately 1:7 or an appropriate alternative determined by slope and erodibility investigations. - The overburden emplacements will be shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Sand Residue Dam	- The height to the sand residue dam will be up to 20 m. - The batter slopes will be approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. - The sand residue dam will be shaped, overburden placed over sand residues, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Infrastructure Areas	- Infrastructure will be removed following the cessation of mining, unless otherwise agreed with the relevant landholder and leaseholder during closure planning. - The infrastructure areas will be shaped, soil materials (e.g. subsoil and topsoil) replaced and revegetated.	
Final Depression (Water Disposal Dam)	- The water disposal dam will be retained as a depression with batter slopes of approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. - The emptied water disposal dam will include salt-affected surfaces within the storage area. Overburden will be placed over the salt-affected material prior to soil material (e.g. subsoil and topsoil) replacement and revegetation.	Incorporated into the final dredge pond final depression (see below).
Final Depression (Final Dredge Pond)	- A final depression will be located at the northern extent of the mine path with batter slopes of approximately 1:4 or an appropriate alternative determined by slope and erodibility investigations. - The final depression will be partially backfilled with overburden material pushed down from the pit walls and from the overburden emplacement area to a level approximately 2 m to 4 m above the local groundwater table. - The resulting final depression will be similar in nature to the localised topographic depressions that occur in the region. - The salt-affected surface will be covered using the same cover strategy as for the water disposal dam.	- Increased size of the final depression. - The batter slopes of the final depression would reduce from 1:4 to between 1:5 and 1:10. - No other changes to rehabilitation strategy.

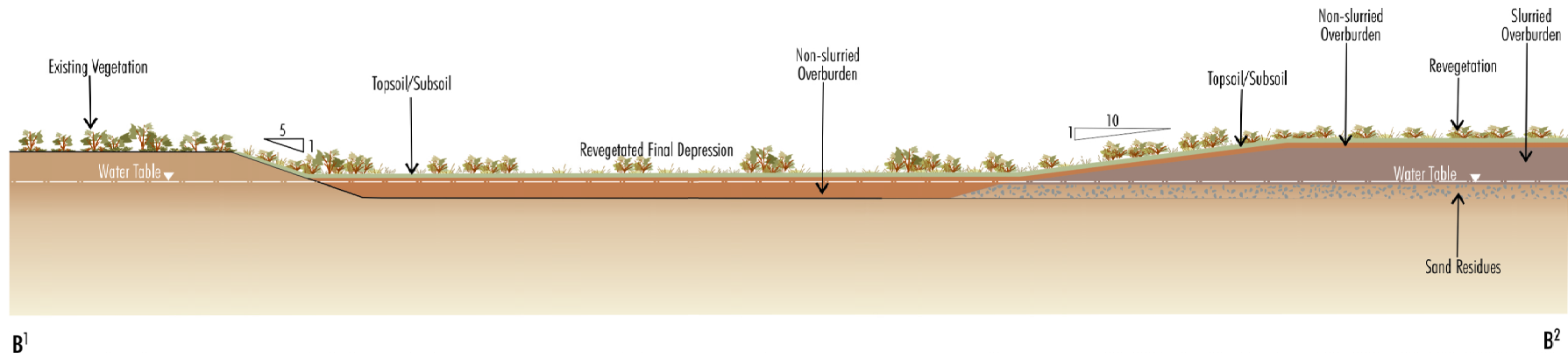
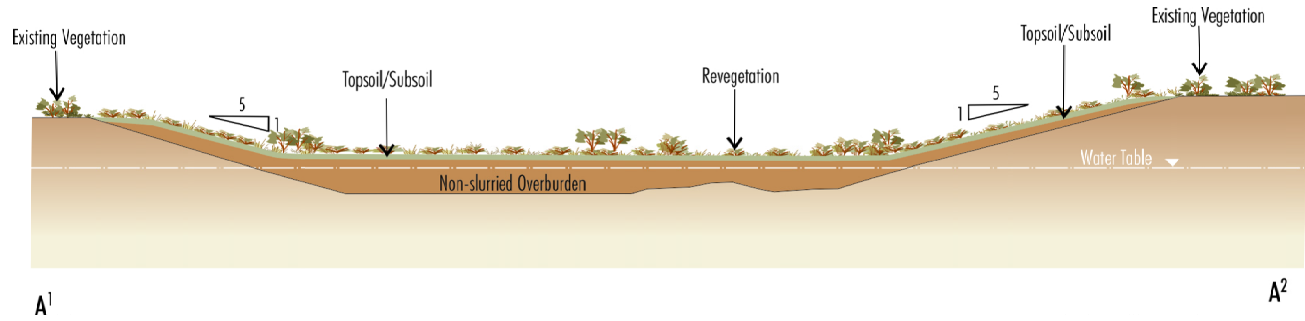
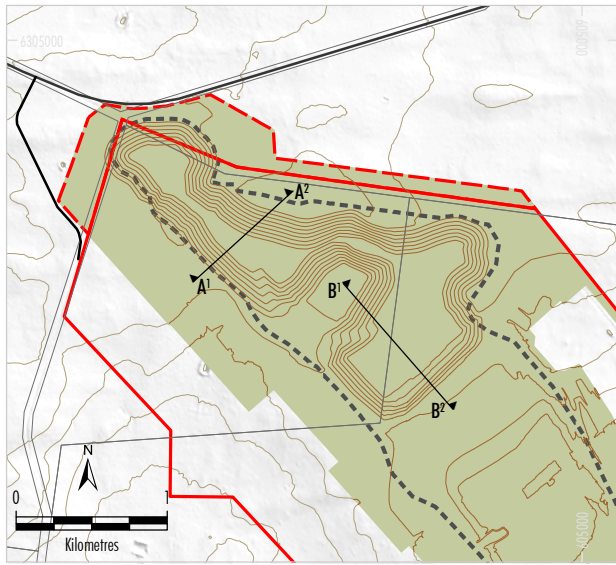


- LEGEND**
- Mining Lease Boundary (ML 1621)
 - Mining Lease Application Boundary (MLA 1)
 - Extent of Backfilled Mine Path
 - Extent of Rehabilitation
 - Electricity Transmission Line

Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX
S N A P P E R M I N E
 Modified Snapper Mine -
 Indicative Final Landform

Figure 5



Source: NSW Spatial Services (2019); Tronox (2019)

Figure 6

The management of rehabilitation at the Snapper Mine is conducted in accordance with the Mining Operations Plan (CMA, 2015b), which includes:

- rehabilitation objectives;
- final landform design;
- rehabilitation domains and objectives;
- rehabilitation methods;
- rehabilitation monitoring and research programs; and
- performance indicators and relinquishment criteria.

The Mining Operations Plan would be updated to incorporate the Modification.

2.6 NOB ROAD REALIGNMENT

The Modification would include the realignment of approximately 1 km of Nob Road south of its intersection with Roo Roo Road. The Nob Road realignment would be approximately 1.35 km long (Figure 3).

The Nob Road realignment would be constructed in accordance with the with the principles outlined in the *Unsealed Roads Manual* (Australian Road Research Board [ARRB], 2009), the requirements of *Guide to Road Design Part 4: Intersections and Crossings – General* (Austroads, 2017a) and *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2017b), and in consultation with the Wentworth Shire Council (WSC).

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC has provided in-principle support for the Modification.

A detailed description of the Nob Road realignment is provided in Section 6.7.2 and Appendix E.

As a result of the Modification (including the Nob Road realignment), the approved northern access road would not be constructed (Table 1).

3 STRATEGIC CONTEXT

The Snapper Mine is an existing mineral sands mining operation and forms part of Tronox's operations in western NSW including the Ginkgo Mine, Atlas-Campaspe Mine and the MSP (Section 1).

The western NSW regional economy is centred around agriculture and mining which directly contribute almost 40 percent (%) to the western region's gross regional product (NSW Trade and Investment, 2015).

Land use in the vicinity of the Snapper Mine reflects these dominant industries and comprises pastoral leasehold lands that are used for light intensity rangeland grazing and mineral sands mining.

The area around the Snapper Mine is sparsely populated, with the closest sensitive receivers located significant distances from the Snapper Mine (Section 6.5.1).

The strategic context of the Modification includes consideration of the following:

- maintaining employment for the existing Snapper Mine workforce;
- mineral concentrate production continuity; and
- efficient recovery of additional mineral sands resources in a manner that minimises environmental impacts.

3.1 CONTINUED EMPLOYMENT OPPORTUNITIES

Tronox is a significant employer in western NSW (Section 1.1.4). In addition, Tronox engages a range of local contractors at its western NSW operations (Section 6.11).

The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine in late 2021.

The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in western NSW would, therefore, continue as a result of the Modification.

In addition, the Modification would allow transition of an existing skilled workforce to the Atlas-Campaspe Mine once operational, which would reduce Tronox's costs associated with hiring and training a new workforce for the Atlas-Campaspe Mine.

3.2 MINERAL CONCENTRATE PRODUCTION CONTINUITY

The Modification would allow Tronox to maintain continuity of mineral concentrate production until the commencement of operations at the Atlas-Campaspe Mine.

The Snapper Mine mineral concentrates are separated further off-site to produce ilmenite, leucoxene, rutile and zircon products.

Ilmenite, leucoxene and rutile are sources of titanium dioxide. Demand for titanium dioxide is driven by the pigment, plastic, printing, inks, food colourings, fabric delustering agents, sunscreens, cosmetics, and paper industries.

Rutile is used to make titanium metal used for aircraft component manufacture, golf clubs, sports equipment, surgical implants and water desalination plants. In addition to existing demand, new technology for production of titanium metal is being developed.

Zircon is a key raw material used in the production of floor tiles, sanitary ware, glass and steel refractories, metal castings and specialised glass, as well as faceplates for television monitors and computer screens.

The Modification would allow Tronox to continue to supply mineral concentrate to its downstream operations (including the MSP) and other customers until the commencement of production from the Atlas-Campaspe Mine, thereby avoiding disruption to existing supply chains.

3.3 RECOVERY OF ADDITIONAL MINERAL SANDS RESOURCE

The Modification would promote the efficient and economic recovery of additional mineral sands resources at the Snapper Mine.

An additional 8.5 million tonnes (Mt) of ore producing approximately 170 kilotonnes (kt) of mineral concentrate product would be recovered from the Snapper Mine utilising Tronox's existing western NSW operations. This maximises the use of these established facilities and associated returns on existing financial investment.

The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6).

4 STATUTORY CONTEXT

This section outlines the statutory requirements relevant to the assessment of the Modification.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The EP&A Act and *Environmental Planning and Assessment Regulation 2000* set the framework for planning and environmental assessment in NSW.

4.1.1 Applicability of S4.55(2) of the Environmental Planning and Assessment Act 1979

The Snapper Mine was approved under Part 3A of the EP&A Act in 2007 (Project Approval [06_0168]) (Attachment 1).

As a result of amendments made to the EP&A Act that took effect on 1 March 2018, it is no longer possible for Project Approval (06_0168) to be modified under the former Section 75W of the EP&A Act.

The Snapper Mine was declared a State Significant Development (SSD) under Clause 6 of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* via Government Gazette on 22 February 2019.

Given that the Snapper Mine is now considered to be SSD, Tronox is seeking to modify Project Approval (06_0168) under Section 4.55(2) of the EP&A Act.

Section 4.55(2) of the EP&A Act relevantly provides:

4.55 Modifications of consents-generally

...

(2) Other modifications

A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:

- (a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and

- (b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and
- (c) it has notified the application in accordance with:
 - (i) the regulations, if the regulations so require, or
 - (ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and
- (d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.

Subsections (1) and (1A) do not apply to such a modification.

Clause 3BA(6) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* relevantly provides:

3BA Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications

...

- (6) In the application of section 4.55 (1A) or (2) or 4.56 (1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W):
 - (a) development that was previously a transitional Part 3A project and whose approval was modified under section 75W,

...

The consent authority is, therefore, required to satisfy itself that any consent as modified would result in the Snapper Mine remaining substantially the same development as was last modified under Section 75W of the EP&A Act (i.e. Modification 5, February 2015), inclusive of consideration of the changes arising from previously approved modifications.

Consideration of the key comparatives detailed in the draft guideline *Modifying an Approved Project* (NSW Government, 2017) when considering whether the Modification could be considered to be “substantially the same” is provided in Table 4.

The Snapper Mine has demonstrably remained a large mineral sands mine that incorporates the following key elements approved under Project Approval (06_0168) (Table 1):

- mining of a mineral sands deposit;
- overburden and sand residue emplacement and backfilling;
- mineral handling and processing facilities;
- mineral concentrate transport activities;
- water supply and water management systems; and
- supporting infrastructure and facilities.

This would also clearly continue to be the case if the Modification was approved (Table 1) and therefore the consent authority can be satisfied that the Snapper Mine incorporating the Modification would remain “substantially the same”.

This Modification Report is a Statement of Environmental Effects that has been prepared in support of the application to modify Project Approval (06_0168).

4.1.2 EP&A Act Objects

Section 1.3 of the EP&A Act describes the objects of the EP&A Act as follows:

- to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,*
- to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,*
- to promote the orderly and economic use and development of land,*
- to promote the delivery and maintenance of affordable housing,*
- to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,*
- to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),*
- to promote good design and amenity of the built environment,*
- to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,*
- to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,*
- to provide increased opportunity for community participation in environmental planning and assessment.*

Table 4
Summary Evaluation for “Substantially the Same” Test

Key Comparatives	Approved Snapper Mine ¹	Modified Snapper Mine
Development size, scale and footprint	Large mineral sands mine.	No change.
Intensity including rates of production	14 Mtpa (ore). 621,000 tpa (mineral concentrate).	No change. No change.
Primary, secondary and ancillary use	Secondary use of the area behind the advancing ore extraction area for sand residue and process waste emplacement. Rehabilitation for light intensity grazing.	No change.
Project life and hours of operation	Project Approval to 2026. Operating hours are 24 hours per day, seven days per week.	No change.
Extent, duration and severity of impacts	Snapper Mine life to 2026. Mining within ML 1621. Approved surface development area approximately 1681 ha	No change. Additional mining within MLA 1. Net decrease.

¹ Modification 5 approved in February 2015.

The Modification is considered to be generally consistent with the objects of the EP&A Act, because it is a Modification that:

- incorporates:
 - continued development of NSW mineral resources from the Snapper Mine in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6);
 - measures to minimise potential amenity impacts associated with air quality and noise impacts on surrounding land uses (Sections 6.5 and 6.6, respectively);
 - continued employment and other socio-economic benefits to the community;
- involves the orderly and economic use of land as the Modification area is the minimum amount of land required to accommodate the Modification;
- would be conducted in accordance with relevant lease/licence/reserve conditions over Crown land within ML 1621 and MLA 1;
- would support the ongoing provision of community services and facilities through contributions to NSW Government royalties, NSW Government taxes, Commonwealth tax revenue and voluntary contributions to community initiatives;
- is an application under Section 4.55(2) of the EP&A Act that would be determined by the Minister for Planning and Public Spaces however, consultation with the WSC and a range of stakeholders has been undertaken (Section 5); and
- involves public involvement and participation through Tronox's consultation activities (Section 5), which would be ongoing following the public exhibition of this Modification Report and the Department of Planning, Industry and Environment's (DPIE) assessment of the Modification in accordance with the requirements of the EP&A Act.

4.2 OTHER NSW LEGISLATION

In addition to the EP&A Act, the following NSW Acts may be applicable to the Snapper Mine, incorporating the Modification:

- *Biosecurity Act 2015*;
- *Biodiversity Conservation Act 2016* (BC Act);

- *Contaminated Land Management Act 1997*;
- *Crown Land Management Act 2016*;
- *Dams Safety Act 2015*;
- *Dangerous Goods (Road and Rail Transport) Act 2008*;
- *Fisheries Management Act 1994*;
- *Heritage Act 1977*;
- *Local Land Services Act 2013*;
- *Mining Act 1992*;
- *National Parks and Wildlife Act 1974*;
- *Protection of the Environment Operations Act 1997* (PoEO Act);
- *Radiation Control Act 1990*;
- *Roads Act 1993*;
- *Water Management Act 2000*; and
- *Work Health and Safety Act 2011*.

Relevant licences or approvals required under these Acts would continue to be obtained for the modified Snapper Mine. Key plans that would require revision to incorporate the Modification are outlined in Section 4.6.

Additional detail on the likely requirements under some of the key Acts is provided in the sub-sections below.

Mining Act 1992

The modified Snapper Mine would extend beyond the boundary of ML 1621. Tronox would apply to the NSW Division of Resources and Geoscience (DRG) for a new authority (ML) over the MLA 1 area under the *Mining Act 1992*.

Under the *Mining Act 1992*, environmental protection and rehabilitation are regulated by conditions of mining leases, including requirements for the submission of a Mining Operations Plan prior to the commencement of operations, and subsequent Annual Environmental Management Reports (or Annual Reviews).

The current Mining Operations Plan (CMA, 2015b) would require revision to reflect the Modification (including MLA 1).

Protection of the Environment Operations Act 1997

The PoEO Act is the primary NSW legislation that regulates pollution control and licensing. One key feature of the Act is the statutory requirement to apply for and obtain an Environment Protection Licence (EPL) in circumstances where a scheduled activity or activities are being carried out (those activities being defined in Schedule 1 of the PoEO Act).

The approved Snapper Mine is currently licensed under EPL 12799 to conduct “crushing, grinding or separating”, “metallurgical activities” and “mining for minerals” as defined in Schedule 1 of the PoEO Act.

Tronox would review EPL 12799 in consultation with the Environment Protection Authority (EPA), and if necessary, vary EPL 12799 under the PoEO Act to incorporate the Modification.

Water Management Act 2000

The *Water Management Act 2000* contains provisions for the licensing, allocation, capture and use of water resources. Under the *Water Management Act 2000*, water sharing plans are being introduced (and many have commenced) for water sources. Water sharing plans establish rules for sharing water between different users and between the various environmental sources (namely rivers or aquifers).

The Snapper Mine is located within the Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* (Appendix F).

Tronox currently holds a combined total of 21,442 share components (units or million litres [ML]) in the Western Murray Porous Rock Water Source for the Snapper, Ginkgo and Atlas-Campaspe Mines. No additional water licences under the *Water Management Act 2000* are required for the Modification (Section 6.9).

Biodiversity Conservation Act 2016

The BC Act sets the legislative framework for biodiversity conservation in NSW.

Section 6.2 considers the potential biodiversity impacts associated with the Modification.

As described in Section 6.2, with reference to Clause 30A, Sections 1(a) and 2(c) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, the Modification would not increase impacts on biodiversity values and therefore, it is considered that a Biodiversity Development Assessment Report (BDAR) is not required.

Roads Act 1993

The Modification would include the realignment of Nob Road around MLA 1 (Section 2.6).

Approximately 1 km of Nob Road (within MLA 1) would be closed to the public (Figures 3 and 4) to allow mining and ancillary development associated with the modified Snapper Mine. Tronox would apply for the relevant approvals under the *Roads Act 1993* to close this section of Nob Road.

In addition, Tronox would apply for the necessary consents under Section 138 of the *Roads Act 1993* for these works.

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC have provided in-principle support for the Modification.

Crown Land Management Act 2016

The *Crown Land Management Act 2016* provides for the management of Crown land in NSW.

The Modification Area is located on the Manilla and Carstairs properties, which are located on Western Lands Lease 4090 (Lot 1926 DP 763904) and Western Lands Lease 4086 (Lot 1927 DP 763905), respectively.

Tronox has consulted with the DPIE – Crown Lands regarding the Modification (Section 5.3) and would obtain relevant *Crown Land Management Act 2016* approvals for the Modification.

4.3 ENVIRONMENTAL PLANNING INSTRUMENTS

Local environmental plans and NSW environmental planning policies that may be relevant to the Modification are discussed below.

4.3.1 Wentworth Local Environmental Plan 2011

The Snapper Mine is located wholly within the Wentworth Local Government Area (LGA) (Figure 1). The following identifies the provisions in the *Wentworth Local Environmental Plan 2011* (Wentworth LEP) which may have relevance to the Modification.

Permissibility

The Snapper Mine is located within Zone RU1 (Primary Production) within the Wentworth LGA.

Under the Wentworth LEP, open cut mining is listed as permissible activity with consent on lands zoned RU1 (Primary Production). Roads are permissible without consent on lands zoned RU1 (Primary Production).

Zone Objectives

Clause 2.3, Section 2 of the Wentworth LEP provides:

The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.

The Snapper Mine is located within Zone RU1 (Primary Production) within the Wentworth LGA. The objectives of Zone RU1 (Primary Production) include:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- **To encourage diversity in primary industry enterprises and systems appropriate for the area.**
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To ensure the protection of both mixed dryland and irrigation agricultural land uses that together form the distinctive rural character of Wentworth.
- To ensure land is available for intensive plant agricultural activities.
- **To encourage diversity and promote employment opportunities related to primary industry enterprises, including those that require smaller holdings or are more intensive in nature.**

4.3.2 State Environmental Planning Policies

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* (Mining SEPP) regularises the various environmental planning instruments that previously controlled mining activities and aims to provide for the proper management of and development of mineral resources.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the *State Environmental Planning Policy [State Significant Precincts] 2005* and *State Environmental Planning Policy [Coastal Management] 2018*).

Clause 7

Clause 7(1) of the Mining SEPP states that development for any of the following purposes may be carried out only with development consent:

- (b) mining carried out:
 - (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or
 - (ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999,
 - ...

The modified Snapper Mine is on land where agriculture is permissible. Therefore, the Modification activities are permissible with development consent.

Part 3 of the Mining SEPP outlines the matters to be considered when determining development applications. Relevant clauses are discussed further below.

Clause 12

Clause 12 of the Mining SEPP requires that, before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

- (a) *consider:*
 - (i) *the existing uses and approved uses of land in the vicinity of the development, and*
 - (ii) *whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and*
 - (iii) *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and*
- (b) *evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and*
- (c) *evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).*

Existing/approved land use in the vicinity of the Snapper Mine is characterised by a combination of mineral sands mining operations and agricultural land uses.

The Modification components are considered to be compatible with existing and future land uses in the vicinity of the Snapper Mine.

The potential impacts of the Modification on land resources are described in Section 6.8.

The Modification would allow for the continued economic extraction of mineral concentrate from the Snapper Mine.

Tronox would implement a range of measures to avoid or minimise incompatibility of the modified Snapper Mine with existing and future land uses in the area. This would be achieved through the implementation of the existing Environmental Management Strategy (GHD, 2016a), with updates to the relevant environmental management plans listed in Section 1.1.3.

Clause 13

Clause 13 of the Mining SEPP outlines considerations for an application for consent for development in the vicinity of an existing mine, petroleum production facility or extractive industry. The modified Snapper Mine does not overlap with any other mineral or petroleum tenements or other extractive industry. Therefore, the Modification would not have a significant impact of current or reasonably foreseeable extraction or recovery of minerals, petroleum or extractive materials.

Clause 14

Clause 14(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

- (a) *that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,*
- (b) *that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,*
- (c) *that greenhouse gas emissions are minimised to the greatest extent practicable.*

In addition, Clause 14(2) requires that, without limiting Clause 14(1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable state or national policies, programs or guidelines concerning greenhouse gas emissions.

The potential impacts of the Modification on groundwater and surface water resources are discussed in Sections 6.9 and 6.10, respectively, including measures to minimise potential impacts.

The potential biodiversity impacts as a result of the Modification are described in Section 6.2.

An assessment of the potential greenhouse gas emissions due to the Modification is provided in Section 6.13.

Clause 15

Clause 15 of the Mining SEPP requires that:

- (1) *Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.*
- (2) *Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.*
- (3) *The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.*

The Modification would promote the economic recovery of mineral sands resources at the Snapper Mine (i.e. through allowing additional/continued mineral sands extraction at an existing mineral sands mining operation). As such, the Modification aims to achieve efficient resource recovery.

Clause 16

Clause 16(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

- (a) *require that some or all of the transport of materials in connection with the development is not to be by public road,*
- (b) *limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,*
- (c) *require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.*

Mineral concentrates generated at the Snapper Mine are transported by road to the MSP via the mineral concentrate transport route for further processing and transport by rail to port.

The transport of mineral concentrate along the mineral concentrate transport route has been undertaken since the commencement of operations at the Ginkgo Mine in 2005.

The Modification would not increase the maximum mineral concentrate production rate for the Snapper Mine, and would not result in any transport impacts on the mineral concentrate transport route (Section 2.1).

Road transport at the Snapper Mine is currently managed in accordance with the Transport Management Plan (GHD, 2015a).

The potential impacts of the Nob Road realignment on the surrounding road transport network are discussed in Section 6.7.

The Road Transport Review concluded that subject to the proposed mitigation measures, no significant impacts on the performance capacity, efficiency and safety of the road network are expected to arise as a result of the Modification (Appendix E).

Clause 17

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. In particular, the consent authority must consider whether conditions of the consent should:

- (a) *require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or*
- (b) *require waste generated by the development or the rehabilitation to be dealt with appropriately, or*
- (c) *require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under clause 3 of Schedule 6 to the Act and the Contaminated Land Management Act 1997), or*
- (d) *require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.*

The rehabilitation of the modified Snapper Mine would generally be conducted in accordance with the existing/approved rehabilitation strategy for the Snapper Mine (Section 2.5).

The Mining Operations Plan (CMA, 2015b) would be updated to incorporate the Modification.

**State Environmental Planning Policy No. 33
(Hazardous and Offensive Development)**

Clause 13 of the *State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)* (SEPP 33) requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

- (c) *in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and*
 - (d) *any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application),*
- ...

The environmental management plans relevant to risks and hazards, and their relevant mitigation measures, would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval [06_0168] conditions).

**State Environmental Planning Policy No. 55
(Remediation of Land)**

The *State Environmental Planning Policy No. 55 (Remediation of Land)* (SEPP 55) aims to provide a State-wide planning approach to the remediation of contaminated land. Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of the site for its proposed use.

A consent authority must consider the following under Clause 7(1):

- (a) *it has considered whether the land is contaminated, and*
- (b) *if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
- (c) *if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

Further, under Clause 7(2), before determining an application for consent to carry out development that would involve a change of use of land, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned, carried out in accordance with the contaminated land planning guidelines.

Tronox (2019) prepared a Stage 1 Preliminary Land Contamination Investigation for the Modification area (Appendix G), in accordance with the Department of Urban Affairs and EPA (1998) *Managing Land Contamination* and the NSW Office of Environment and Heritage's (OEH) (2011b) *Guidelines for Consultants Reporting on Contaminated Sites*.

Tronox (2019) found that further investigation is not required and that the Modification area is suitable for the proposed industrial development (i.e. the mine path extension and associated supporting infrastructure, and Nob Road realignment).

**State Environmental Planning Policy No. 44
(Koala Habitat Protection)**

The *State Environmental Planning Policy No. 44 (Koala Habitat Protection)* (SEPP 44) applies to certain LGAs (including the Wentworth LGA), and requires the consideration of whether land that is the subject of the Development Application is considered to be "potential Koala habitat" or "core Koala habitat".

Clause 3 of SEPP 44 outlines the aim of the SEPP, which is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline:

- (a) *by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and*
- (b) *by encouraging the identification of areas of core koala habitat, and*
- (c) *by encouraging the inclusion of areas of core koala habitat in environment protection zones.*

Clause 9 of SEPP 44 requires:

- (1) *Before a council may grant consent to a development application for consent to carry out development on land to which this Part applies that it is satisfied is a core koala habitat, there must be a plan of management prepared in accordance with Part 3 that applies to the land.*
- (2) *The council's determination of the development application must not be inconsistent with the plan of management.*

An assessment of Koala habitat for the purposes of SEPP 44 was undertaken by the Western Research Institute and Resource Strategies (2007) for the Snapper Mine EA. The assessment concluded that the Snapper Mine area (including the Modification area) does not comprise potential Koala habitat (Western Research Institute and Resource Strategies, 2007).

4.4 NSW GOVERNMENT POLICY

Aquifer Interference Policy

The *Aquifer interference Policy* (AIP) (Department of Primary Industries [DPI], 2012) has been developed by the NSW Government as a component of the NSW Government's Strategic Regional Land Use Policy. The AIP applies State-wide and details water licence and impact assessment requirements.

The stated purpose of the AIP is to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities, such that the take is accounted for in the water budget and water sharing arrangements.

The *Water Management Act 2000* defines an aquifer interference activity as that which involves any of the following:

- *the penetration of an aquifer;*
- *the interference with water in an aquifer;*
- *the obstruction of the flow of water in an aquifer;*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations; and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

The minimal impact considerations in the AIP (DPI, 2012) have been addressed in Section 6.9, and Appendix F.

A Hydrogeological Review (Appendix F) has been prepared in consideration of the AIP for the Modification and the key conclusions are summarised below.

Water Source

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan.

The Water Sharing Plan relevant to the Snapper Mine is the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011*. Therefore, licensing under the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* is required to account for the Modification.

Modelling of Potential Impacts

The potential hydrogeological impacts of the Modification have been reviewed by GEO-ENG (2019), which included a review of the existing groundwater model for the Snapper and Ginkgo Mines (Appendix F).

Licensing Requirements

As described above, the Snapper Mine is located within Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000*.

As described in Section 4.2, Tronox currently holds a combined total of 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Snapper, Ginkgo and Atlas-Campaspe Mines. No additional water licences under the *Water Management Act 2000* are required for the Modification (Section 6.9).

Minimal Impact Considerations

The AIP establishes minimal impact considerations for highly productive and less productive groundwater.

The DPIE – Water mapping indicates that there is no highly productive groundwater in the vicinity of the Snapper Mine. The Snapper deposit lies in the shallow, saline aquifer of the Loxton-Parilla Sands. The water supply bores at the Snapper Mine lie in the deep, saline aquifer of the tertiary Lower Olney Formation/Warina Sands.

An assessment of the Modification against the minimal impact considerations in the AIP was conducted as part of the Hydrogeological Review and is presented in Appendix F.

The Hydrogeological Review concluded that the Modification would meet the "Level 1" minimal impact considerations outlined in the AIP (Appendix F).

Other Groundwater Users

The closest productive groundwater bore to the Snapper Mine is located approximately 16 km north-east, and the drawdown at this bore due to the Modification is predicted to be negligible (Appendix F).

4.5 DEVELOPMENT APPLICATION AREA

The Modification necessitates an extension to the Development Application Area for Project Approval (06_0168). The proposed extension to the Development Application Area includes part of Lot 1926 DP 763904, part of Lot 1927 DP 763905 and the road reserves between these two lots.

Lot 1927 DP 763905 is listed in Appendix 1 (Schedule of Land) of Project Approval (06_0168) however, Lot 1926 DP 763904 is not listed in Appendix 1 of Project Approval (06_0168) as it currently does not form part of the Snapper Mine Development Application Area.

Part of Lot 1926 DP 763904 would therefore need to be added to Appendix 1 of Project Approval (06_0168). In addition, the road reserve would need to be included in Appendix 1 of Project Approval (06_0168).

4.6 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The objective of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to provide for the protection of those aspects of the environment that are of national environmental significance.

Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a controlled action under the EPBC Act. A proposal that is, or may be, a controlled action is required to be referred to the Commonwealth Department of Environment and Energy to determine whether or not the action is a controlled action.

It is concluded that the Modification would not have a significant impact on Matters of National Environmental Significance (MNES) for the following reasons:

- The Modification would not have a significant impact on listed threatened species and ecological communities and/or migratory species as these have not been identified in the vicinity of the Modification area, which comprises of a paddock subject to grazing by goats, introduction of non-native vegetation and past clearing.
- The Modification would not have a significant impact on wetlands of international importance.
- The Modification would not have a significant impact on world heritage properties or national heritage places (i.e. Willandra Lakes Regional World Heritage Area) as the Snapper Mine is located approximately 80 km from the Willandra Lakes Regional World Heritage Area.
- The Modification would not impact the Great Barrier Reef Marine Park and/or Commonwealth marine areas.
- The Modification is not a nuclear action.
- The Modification is not a coal mining or coal seam gas project that could have an impact on a water resource.

It is considered that there is no need to refer the Modification to the Commonwealth Minister for the Environment.

4.7 MANAGEMENT/MONITORING PLANS

As described in Section 1.1.3, the Snapper Mine has an Environmental Management Strategy in place that has been developed to minimise environmental impacts by providing the strategic context for environmental management of the site.

Tronox will continue to implement the existing Environmental Management Strategy at the Snapper Mine, and would review and revise it where necessary (subject to any modified Project Approval conditions) for the Modification.

A more detailed description of the monitoring programs and control strategies relevant to the Modification is provided in Section 6.

4.7.1 Mining Operations Plan

The management of rehabilitation at the Snapper Mine is conducted in accordance with the Mining Operations Plan (CMA, 2015b) (Section 2.5).

The Mining Operations Plan would be updated to incorporate the Modification.

5 ENGAGEMENT

Consultation has been conducted with relevant leaseholders, Aboriginal stakeholders, key NSW Government agencies and the WSC during the preparation of this Modification Report. A summary of this consultation is provided below.

It is anticipated that consultation will continue during the public exhibition of this Modification Report and the assessment of the Modification by the NSW Government.

5.1 RELEVANT LEASEHOLDERS

Tronox provided the leaseholders of the land associated with the Modification area (Section 4.4) a briefing on the Modification, the environmental approval process and the scope of the Modification Report in October 2019, and is continuing to consult with these leaseholders regarding the Modification.

In November 2019, the leaseholders of the land associated with the Modification area provided in-principle support for the Modification.

Furthermore, Tronox undertook consultation with the leaseholders of the land associated with the Modification area during the preparation of the MLA.

5.2 ABORIGINAL STAKEHOLDERS

Aboriginal stakeholders were consulted throughout the preparation of the Aboriginal Cultural Heritage Assessment (ACHA) for the Modification (Appendix B). Consultation was conducted with reference to the DPIE – Biodiversity and Conservation Division (BCD) policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (Department of Environment, Climate Change and Water [DECCW], 2010a).

Further detail on consultation with Aboriginal stakeholders for the Modification is provided in Section 6.3.1.

5.3 NSW GOVERNMENT AGENCIES

Tronox continues to consult with relevant NSW Government agencies on a regular basis in relation to the current activities at the Snapper Mine.

Department of Planning, Industry and Environment

Tronox met with the DPIE on 22 August 2019 to provide an overview of the Modification, proposed approval pathway and the proposed scope of the environmental assessment.

Following the meeting, Tronox wrote to the DPIE regarding the Modification, the proposed approval pathway and the proposed scope of the environmental assessment. The DPIE subsequently wrote to Tronox on 18 October 2019, confirming it agreed with the proposed approval pathway and outlining additional environmental assessment aspects to be considered as part of the Modification application. These environmental assessment aspects have been considered in this Modification Report.

Biodiversity and Conservation Division

Tronox provided a briefing package and held a teleconference with the BCD on 20 September 2019 to provide an overview of the Modification and discuss the approach to assessing potential Aboriginal cultural heritage impacts associated with the Modification. The BCD provided in-principle support for the ACHA approach adopted in this Modification Report.

In addition, Tronox met with the BCD on 8 November 2019 to discuss the approach to assessing potential biodiversity impacts associated with the Modification, and present the preliminary results of the biodiversity assessment and threatened species surveys undertaken for the Modification (Appendix A). During the meeting, the BCD provided in-principle support for the biodiversity assessment approach adopted in this Modification Report.

Natural Resources Access Regulator

Tronox provided a briefing package to the NSW Natural Resources Access Regulator (NRAR) on 13 November 2019 to provide an overview of the Modification, outline the approach to assessing potential water resource impacts associated with the Modification and offer further information if requested.

The NRAR did not request any additional information regarding the Modification.

Environment Protection Authority

Tronox provided a briefing package to the EPA on 13 November 2019 to provide an overview of the Modification, outline the approach to assessing potential noise, air quality and water resources impacts associated with the Modification and offer further information if requested.

The EPA did not request any additional information regarding the Modification.

Crown Lands

Tronox provided a briefing package to the DPIE – Crown Lands on 28 October 2019 to provide an overview of the Modification and outline the leaseholder consultation conducted to date regarding the Modification.

A discussion with the DPIE – Crown Lands was subsequently held on 29 October 2019 to discuss the Modification and the relevant *Crown Land Management Act 2016* approvals required for the Nob Road realignment.

Tronox will continue to consult with the DPIE – Crown Lands regarding the relevant *Crown Land Management Act 2016* approvals required for the Nob Road realignment.

Division of Resources and Geoscience

Tronox provided a briefing package to the DRG on 22 November 2019 to provide an overview of the Modification and MLA 1.

Tronox will continue to consult with the DRG regarding the Modification and MLA 1.

NSW Resources Regulator

Tronox provided a briefing package to the NSW Resources Regulator on 13 November 2019 to provide an overview of the Modification, outline the rehabilitation-related aspects of the Modification (Section 2.5) and offer further information if requested.

The NSW Resources Regulator did not request any additional information regarding the Modification.

Tronox has consulted with the WSC regarding the Modification (including the Nob Road realignment) and the WSC have provided in-principle support for the Modification.

Tronox is continuing to consult with the WSC in relation to the opening and/or closing of road reserves associated with the Nob Road realignment.

Further details on the required road works associated with the Nob Road realignment are provided in Section 6.7.

5.4 WENTWORTH SHIRE COUNCIL

The Snapper Mine is located within the Wentworth LGA.

Tronox consulted with the WSC throughout October and November 2019 regarding the Modification, particularly the realignment of Nob Road.

6 ASSESSMENT OF IMPACTS

The key environmental issues identified are summarised in Table 5 and addressed in Sections 6.2 to 6.13 and the relevant appendices.

6.1 IDENTIFICATION OF KEY ISSUES

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment.

Table 5
Summary of Key Potential Environmental Issues/Impacts

Environmental Aspect	Key Potential Environmental Issues/Impacts Snapper Mine	Report Section/Appendix
Biodiversity	Potential impacts on biodiversity, Aboriginal cultural heritage and historic heritage associated with surface development in the Modification area.	Section 6.2 and Appendix A
Aboriginal Cultural Heritage		Section 6.3 and Appendix B
Historic Heritage		Section 6.4
Air Quality	Potential air quality impacts due to the mine path extension and associated supporting infrastructure, and changes to overburden management.	Section 6.5 and Appendix C
Noise	Potential noise impacts due to extension of the mine path and associated supporting infrastructure, and minor changes to the approved mining fleet.	Section 6.6 and Appendix D
Road Transport	Potential road transport impacts associated with the realignment of Nob Road around MLA 1.	Section 6.7 and Appendix E
Land and Agricultural Resources	Potential land and agricultural resources impacts associated with surface development in the Modification area.	Section 6.8 and Appendix G
Groundwater Resources	Potential groundwater impacts associated with the mine path extension.	Section 6.9 and Appendix F
Surface Water Resources	Potential impacts on surface water resources associated with surface development in the Modification area.	Section 6.10
Social and Economic	Potential social and economic impacts associated with maintaining continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.	Section 6.11
Visual	Potential visual impacts associated with the extension of the mine path and associated supporting infrastructure in MLA 1.	Section 6.12
Greenhouse Gas	Potential increase in greenhouse gas emissions associated with the mine path extension.	Section 6.13
Hazards and Risks	As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.	N/A
Community Infrastructure	As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved community infrastructure impacts is expected.	N/A

6.2 BIODIVERSITY

6.2.1 Background

A Biodiversity Assessment has been prepared by Biodiversity Monitoring Services (2019) in accordance with the requirements of Clause 30A(2)(c) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* and is provided in Appendix A.

The Modification involves extension of the existing/approved mine path and associated supporting infrastructure into additional surface development areas but also relinquishment of approved surface development areas, resulting in a net reduction in surface development area (Section 2.2).

Survey Results

Ecological surveys of the Modification area and approved surface development areas to be relinquished were carried out in October 2019 by Biodiversity Monitoring Services (Appendix A).

The surveys involved vegetation mapping and the collection of vegetation condition (vegetation integrity) data from 23 vegetation plots in accordance with the *Biodiversity Assessment Method* (BAM) (OEH, 2017), threatened flora traverses in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH, 2016) and diurnal bird surveys, call playback, nocturnal spotlighting, pitfall trapping, funnel trapping and habitat assessments in accordance with *Threatened Species Survey & Assessment: Guidelines for developments and activities (working draft)* (Department of Environment and Conservation, 2004) (Appendix A).

The Plant Community Types (PCTs) identified in the Modification area and the approved surface development area to be relinquished are provided in Table 6 and shown on Figure 7.

Table 6
Vegetation Quantification

PCT ID	PCT Name	Approved Surface Development Areas Relinquished (ha)	Modification Area (ha)
Aeolian Chenopod Shrublands			
153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	7.7	52.7
154	Pearl Bluebush low open shrubland of the arid and semi-arid plains	-	28.3
Sand Plain Mulga Shrublands			
143	Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	-	0.7
Semi-arid Sand Plain Woodlands			
58	Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	79.5	5.7
221	Black Oak – Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones	3.5	-
Total		87.4	90.7
Net Change		Net reduction of 3.3 ha	

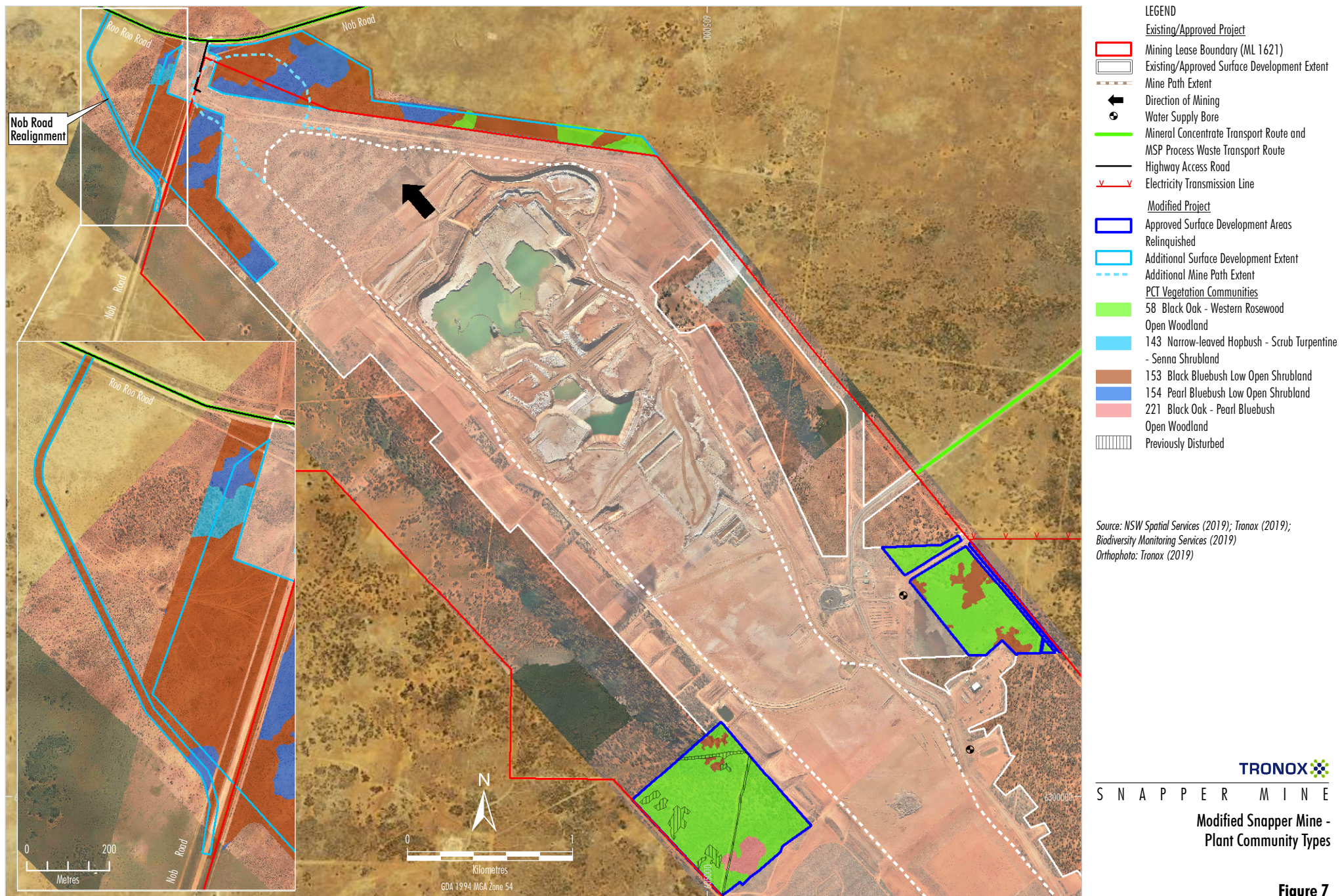


Figure 7

No threatened flora species or ecological communities listed under the BC Act or EPBC Act are present within the Modification area (Appendix A).

No threatened fauna species listed under the BC Act have been recorded within the Modification area. A feather of the Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) was recorded however the location of the individual when the feather was lost is unknown (Appendix A). There is no breeding habitat for this species in the Modification area.

Offset Areas

Tronox currently has a number of existing offset areas in the surrounding locality, comprising three offset areas for the Ginkgo Mine and two offset areas for the Snapper Mine. The Ginkgo Mine offset areas total approximately 4,274 ha, and the Snapper Mine offset areas total approximately 5,470 ha (i.e. a combined area of 9,744 ha in three distinct areas).

Management and Monitoring Regime

In accordance with Condition 16, Schedule 3 of Project Approval (06_0168), a Flora and Fauna Management Plan (GHD, 2017a) has been prepared for the Snapper Mine, and includes:

- a Vegetation Clearance Protocol;
- a Threatened Species Management Protocol;
- measures to control weeds and feral pests;
- management measures for the establishment of habitat during rehabilitation; and
- a vegetation monitoring program to assess the performance of the rehabilitation areas.

Furthermore, in accordance with Condition 17, Schedule 3 of Project Approval (06_0168), an Offset Management Plan (GHD, 2017b) has been prepared for the Snapper and Ginkgo Mine Offsets, and includes measures for the short, medium and long term management of the offset areas.

6.2.2 Potential Impacts

Overall, the Modification would result in an approximate 3.3 ha reduction in the approved surface development area (Table 6). The Modification area is predominantly within disturbed shrublands whereas the approved surface development areas to be relinquished are predominantly woodland (Figure 7). The PCTs in the additional surface development areas and approved surface development areas to be relinquished are listed in Table 6. The total Modification area would be approximately 87.4 ha.

Table 7 provides an assessment of the impacts of the Modification on biodiversity values. In summary, the Modification would not increase impacts on vegetation abundance, vegetation integrity, habitat suitability, threatened species abundance, habitat connectivity, threatened species movement, flight path integrity or hydrological processes that are known to sustain a threatened species or ecological community. Instead, the Modification would result in a net positive outcome for biodiversity values in the local area.

As the Modification would not increase impacts on biodiversity values, it is considered that a BDAR is not required.

6.2.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in an increased impact on biodiversity values, there would be no change to mitigation measures, management and monitoring already in place for the Snapper Mine.

Notwithstanding, the Flora and Fauna Management Plan (GHD, 2017a) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

Table 7
Impacts of the Modification on Biodiversity Values

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
<i>Vegetation abundance</i> 1.4(b) BC Regulation	<i>Occurrence and abundance of vegetation at a particular site</i>	✓	Figure 7 shows the PCTs present in the Modification and Relinquishment areas. The Modification has been designed to avoid or minimise impacts on native vegetation by predominantly locating the supporting infrastructure in derived shrubland subject to grazing. The Modification area is predominantly within disturbed shrublands whereas the approved surface development areas to be relinquished is predominantly woodland. Accordingly, the Modification would not result in an increased impact on vegetation abundance.
<i>Vegetation integrity</i> 1.5(2)(a) BC Act	<i>Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state</i>	✓	The VI scores calculated using the BAM Calculator indicates that the majority of the native vegetation to be cleared is generally low. The zone with the highest VI score (83.5) would be the least impacted (0.7 ha), while the majority of surface development (52.7 ha) would occur in the zone with the lowest VI score (19.2). When native vegetation is removed the VI score becomes zero. However, vegetation zones within the areas to be relinquished would no longer become zero and instead would remain at their current VI scores. Accordingly, the Modification would not result in an increased impact on vegetation integrity.
<i>Habitat suitability</i> 1.5(2)(b) BC Act	<i>Degree to which the habitat needs of threatened species are present at a particular site</i>	✓	The PCTs present in the Modification area provide marginal habitat for threatened fauna (e.g. some birds may forage on grass seeds from time to time). The native vegetation that would be cleared has been subject to past disturbances (such as vegetation clearance and grazing), which makes the habitat generally poor quality. The derived shrubland of PCT 58, grazed shrubland of PCT 143, intact and grazed shrublands of PCT 153 and intact and grazed shrublands of PCT 154 are not threatened ecological communities (TECs) and no threatened flora species have been recorded within the Modification area. The Modification has been designed to avoid impacts on habitat by predominantly locating the supporting infrastructure in derived shrubland subject to grazing and lacking in many habitat features such as waterbodies and hollow-bearing trees. The Modification would not impact rocks, karst, caves, crevices, cliffs, human made structures or non-native vegetation known to be associated with any threatened species. The Modification is unlikely to reduce the viability of any adjacent habitat due to noise, dust or light spill during construction or operation due to the following: • there would be no change to the mining method, fleet or production rate; • any dust effects would be mitigated by regular watering of roads and soil stockpiles; and • there would be no change to the use of artificial lighting. In addition, measures would be implemented to minimise bushfire risk associated with the Modification. Accordingly, the Modification would not result in an increased impact on habitat suitability.

Table 7 (Continued)
Impacts of the Modification on Biodiversity Values

Biodiversity Value	Meaning	Relevant (✓ or NA)*	Explanation
<i>Threatened species abundance</i> 1.4(a) BC Regulation	<i>Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site</i>	✓	The Modification is unlikely to impact the occurrence and abundance of threatened species, or their habitat, in the locality. The Modification has been designed to avoid potential habitat as far as practicable in consideration of other environmental and practical constraints. The Modification area was generally depauperate of habitat features that would be considered important to the target threatened fauna species and as such the majority of species are considered unlikely to occur. Additionally, vegetation clearance measures would be implemented to minimise potential impacts on biodiversity, including pre-clearing fauna inspections. Accordingly, the Modification would not result in an increased impact on threatened species abundance.
<i>Habitat connectivity</i> 1.4(c) BC Regulation	<i>Degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range</i>	✓	The majority of clearance for the Modification would be of shrubland. Given the previous amount of disturbance through clearing and grazing activities and the lack of important habitat features (hollow-bearing trees, water bodies, native grassland, etc), habitat is generally of low quality in the Modification area. Additionally, approved surface development areas with better quality habitat would be relinquished for the proposed surface development in the Modification area. Any existing connectivity associated with the approved surface development areas to be relinquished would remain. Accordingly, the Modification would not result in an increased impact on habitat connectivity.
<i>Threatened species movement</i> 1.4(d) BC Regulation	<i>Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle</i>	N/A	The Modification is not likely to impact a well-defined movement pattern for any particular species, given the majority of clearance would be of shrubland. Accordingly, the Modification would not result in an increased impact on threatened species movement.
<i>Flight path integrity</i> 1.4(e) BC Regulation	<i>Degree to which the flight paths of protected animals over a particular site are free from interference</i>	N/A	The Modification would not interfere with any flight paths of protected animals, given the majority of clearance would be of shrubland. Accordingly, the Modification would not result in an increased impact on flight path integrity.
<i>Water sustainability</i> 1.4(f) BC Regulation	<i>Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site</i>	N/A	The Modification would not impact water quality, water bodies or hydrological processes that are known to sustain a threatened species or TEC. The Modification area does not contain any watercourses or artificial watering points. Accordingly, the Modification would not result in an increased impact on hydrological processes that are known to sustain a threatened species or TEC.

* A biodiversity value is not relevant to a proposed development if the value is not present on the development site and there is no potential for direct or indirect impacts on the biodiversity value if it occurs off-site (Department of Planning & Environment, 2018).

6.3 ABORIGINAL CULTURAL HERITAGE

An ACHA has been prepared for the Modification by Landskape Natural and Cultural Heritage Management (Landskape) (2019) and is presented in Appendix B.

6.3.1 Background

The ACHA for the Modification has been undertaken in consideration of relevant requirements of various advisory documents and guidelines, including but not limited to (Appendix B):

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a);
- *Due Diligence Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b); and
- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011a).

Previous Archaeological Investigations

A Cultural Heritage Assessment was previously prepared for the Snapper Mine EA by Landskape (2007).

Landskape (2007) recorded 22 Aboriginal cultural heritage sites within ML 1621 (Figure 8), consisting of ten stone artefact scatters, two scatters of stone artefacts with associated hearths, four stone quarries with associated scatters of stone artefacts, four isolated finds of stone artefacts, and two hearth sites.

Nineteen of these sites were recorded in the approved surface development area, while three sites were recorded outside of the approved surface development area. The majority of these sites are located in the southern portion of ML 1621, several kilometres from the Modification area (Figure 8).

Landskape (2010) undertook an ACHA for the area associated with the Snapper Mine ETL corridor, however, no Aboriginal cultural heritage items or places were recorded in the ETL corridor (Landskape, 2010).

A detailed description of previous archaeological investigations and assessments undertaken in the region surrounding the Snapper Mine is provided in Appendix B.

Management and Monitoring Regime

In accordance with Condition 20, Schedule 3 of Project Approval (06_0168), a Cultural Heritage Management Plan (CHMP) (GHD, 2015c) has been prepared for the Snapper and Ginkgo Mines. The CHMP:

- identifies Aboriginal heritage sites and values;
- details the management of Aboriginal heritage sites, including:
 - protocol for the ongoing involvement of the Aboriginal community; and
 - monitoring, management and avoidance measures for known and unknown Aboriginal objects;
- establishes a contingency plan; and
- establishes the roles and responsibilities of Tronox staff with regard to the CHMP.

Consultation

The ACHA included consultation with nine Registered Aboriginal Parties (RAPs), consistent with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a) (Appendix B).

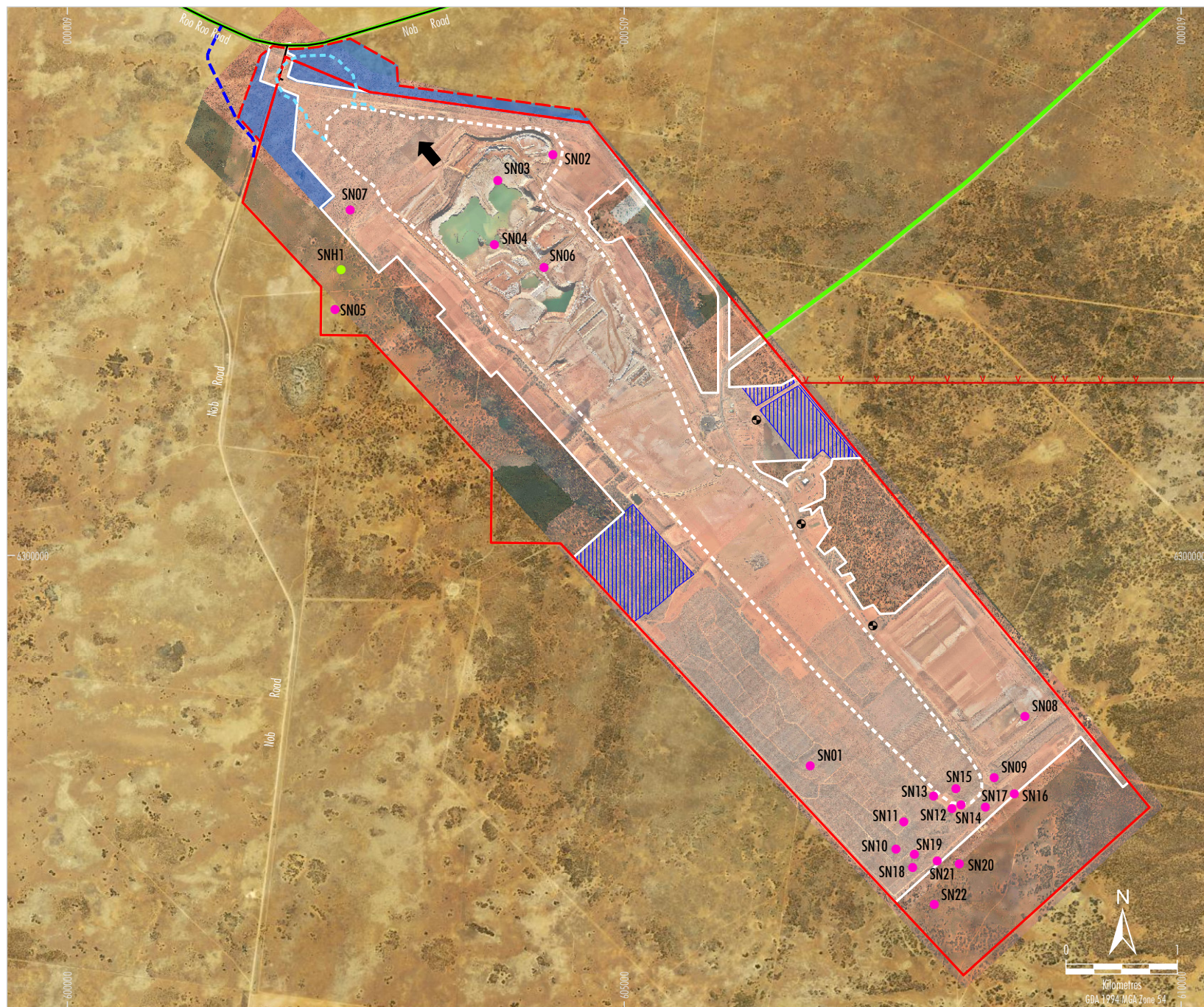
Consultation with the Aboriginal community regarding the Snapper Mine to date has been extensive, and involved various methods of communication including public notices, meetings, written and verbal correspondence, and archaeological survey attendance (Landskape 2007; 2010), review of the draft *Snapper Mineral Sands Project Heritage Management Plan* (Bemax, 2007b)³ and archaeological salvage at the Snapper Mine (Appendix B).

A detailed description of the consultation undertaken with the RAPs for the Modification is provided in Appendix B, and a summary is provided below.

Information Session

Information regarding the Modification was provided in writing to all RAPs on 30 September 2019, which included an invitation to attend an information session about the Modification, proposed to be held on 5 November 2019 at the Ginkgo Mine. No RAPs attended the information session (Appendix B).

³ Subsequently, the original *Snapper Mineral Sands Heritage Management Plan* and the *Ginkgo Mine Aboriginal Heritage Management Plan* were consolidated into the existing CHMP (GHD, 2015).



- LEGEND**
- Approved Project**
- Mining Lease Boundary (ML 1621)
 - Existing/Approved Surface Development Extent
 - Mine Path Extent
 - Direction of Mining
 - Water Supply Bore
 - Mineral Concentrate Transport Route and MSP Process Waste Transport Route
 - Highway Access Road
 - Electricity Transmission Line
- Modified Project**
- Mining Lease Application Boundary (MLA 1)
 - Approved Surface Development Areas Relinquished
 - Additional Surface Development Extent
 - Additional Mine Path Extent
 - Realigned Road
 - Aboriginal Cultural Heritage Site
 - Historical Cultural Heritage Site

Source: NSW Spatial Services (2019); Tronox (2019)
 Orthophoto: Tronox (2019)

TRONOX

S N A P P E R M I N E

**Modified Snapper Mine -
 Aboriginal and Historic Heritage Sites**

Figure 8

Aboriginal Cultural Heritage Field Survey

All RAPs were invited to attend a field survey of the Modification area, which was held on 5 November 2019. No RAPs attended the field survey (Appendix B).

Review of the Draft ACHA

A copy of the draft ACHA was provided to all RAPs on 8 November 2019. As at 22 November 2019, no comments have been received on the draft ACHA (Appendix B).

Desktop Review

An Aboriginal Heritage Information Management System (AHIMS) search was undertaken in October 2019 for the Modification area and surrounds. The search identified no Aboriginal heritage sites located within the Modification area (Appendix B).

Archaeological Survey and Results

The field survey of the Modification area was undertaken by suitably qualified archaeologist Dr Matt Cupper (Landskape, 2019) on 5 November 2019.

No Aboriginal cultural heritage sites were identified in the Modification area (Figure 8).

6.3.2 Potential Impacts

No known Aboriginal cultural heritage sites are present within the Modification area, so no known Aboriginal cultural heritage sites, items or values would be potentially impacted by the Modification (Appendix B).

Although the Modification area was sufficiently surveyed, there remains the potential for Aboriginal cultural heritage sites to be located within this area. Such previously unidentified features, should they occur, would probably be isolated finds or low density concentrations of stone artefacts (Appendix B).

The CHMP (GHD, 2015c) contains management measures for any newly identified Aboriginal cultural heritage sites.

6.3.3 Mitigation Measures, Management and Monitoring

Given the Modification would not result in any Aboriginal cultural heritage impacts, no additional management measures are proposed as part of the Modification.

Notwithstanding, the CHMP (GHD, 2015c) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.4 HISTORIC HERITAGE

This section considers potential historic heritage impacts associated with the Modification area.

6.4.1 Background

Previous Archaeological Investigations

A Cultural Heritage Assessment was previously prepared for the Snapper Mine EA by Landskape (2007).

Landskape (2007) recorded one historic heritage site within ML 1621, namely SNH1, located outside the approved surface development area (Figure 8).

Site SNH1 consists of an approximately 100 m x 100 m area that once contained timber stockyards and a nearby area where station workers have camped, known as "Kertne Nob" (Landskape, 2007).

No other items of state or regional historic heritage significance have been identified at the Snapper Mine to date (Figure 8).

Archaeological Survey and Results

A field survey of the Modification area was undertaken by suitably qualified archaeologist Dr Matt Cupper (Landskape, 2019) on 5 November 2019.

No historic heritage sites were identified in the Modification area (Figure 8).

6.4.2 Potential Impacts

No known historic heritage sites are present within the Modification area, so no known historic heritage sites, items or values would be potentially impacted by the Modification (Appendix B).

Although the Modification area was sufficiently surveyed, there remains the potential for historic heritage sites to be located within this area. The CHMP (GHD, 2015c) contains management measures for any newly identified historic heritage sites.

6.4.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any additional historic heritage impacts, no additional management measures are proposed as part of the Modification. Notwithstanding, the CHMP (GHD, 2015c) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.5 AIR QUALITY

An Air Quality Review was undertaken for the Modification by Katestone Environmental Pty Ltd (Katestone) (2019) and is presented in Appendix C.

6.5.1 Background

Sensitive Receivers

The Snapper Mine is located at significant distances from sensitive receivers. The closest sensitive receivers to the Snapper Mine are located approximately 4 km to the north (Manilla homestead) and 7 km to the south (Trelega homestead). Other properties within the proximity of the Snapper Mine include the Roo Roo homestead (12 km north-west) and the Waukeroo homestead (12 km south-west) (Figure 9).

Previous Assessments

A number of air quality assessments have been conducted for the Snapper Mine to date, namely:

- the Air Quality Assessment undertaken for the Snapper Mine EA by Holmes Air Sciences (2007a);
- the Air Quality Assessment undertaken for the 2010 Snapper and Ginkgo Mines Modification by PAE Holmes (2010a); and
- the Air Quality Review undertaken for the 2014 Snapper Mine Production Increase Modification by Pacific Environment Limited (2014a).

The previous air quality assessments assessed the potential air quality impacts at the nearest sensitive receivers to the Snapper Mine operations and HAR.

Pacific Environment Limited (2014a) concluded that no exceedances of the relevant air quality criteria for total suspended particles (TSP), particulate matter 10 micrometres or less in diameter (PM₁₀) and dust deposition were predicted at the nearest sensitive receivers to the Snapper Mine (i.e. the Manilla and Trelega homesteads).

Pacific Environment Limited (2014a) also concluded that non-mine related sources of PM₁₀, such as bushfires and dust storms, could result in occasional exceedances of the 24-hour average criterion for PM₁₀ at sensitive receivers.

Management and Monitoring Regime

In accordance with Condition 14, Schedule 3 of Project Approval (06_0168), an Air Quality Management Plan (GHD, 2015d) has been prepared for the Snapper Mine. The Air Quality Management Plan includes measures to:

- minimise the amount of dust generated during drilling and mining operations;
- minimise the amount of surface disturbance ahead of mining operations;
- rehabilitate surface disturbance areas no longer required as soon as practicable;
- minimise the generation of dust along haulage routes; and
- maintain plant and equipment to increase efficiency and minimise emissions.

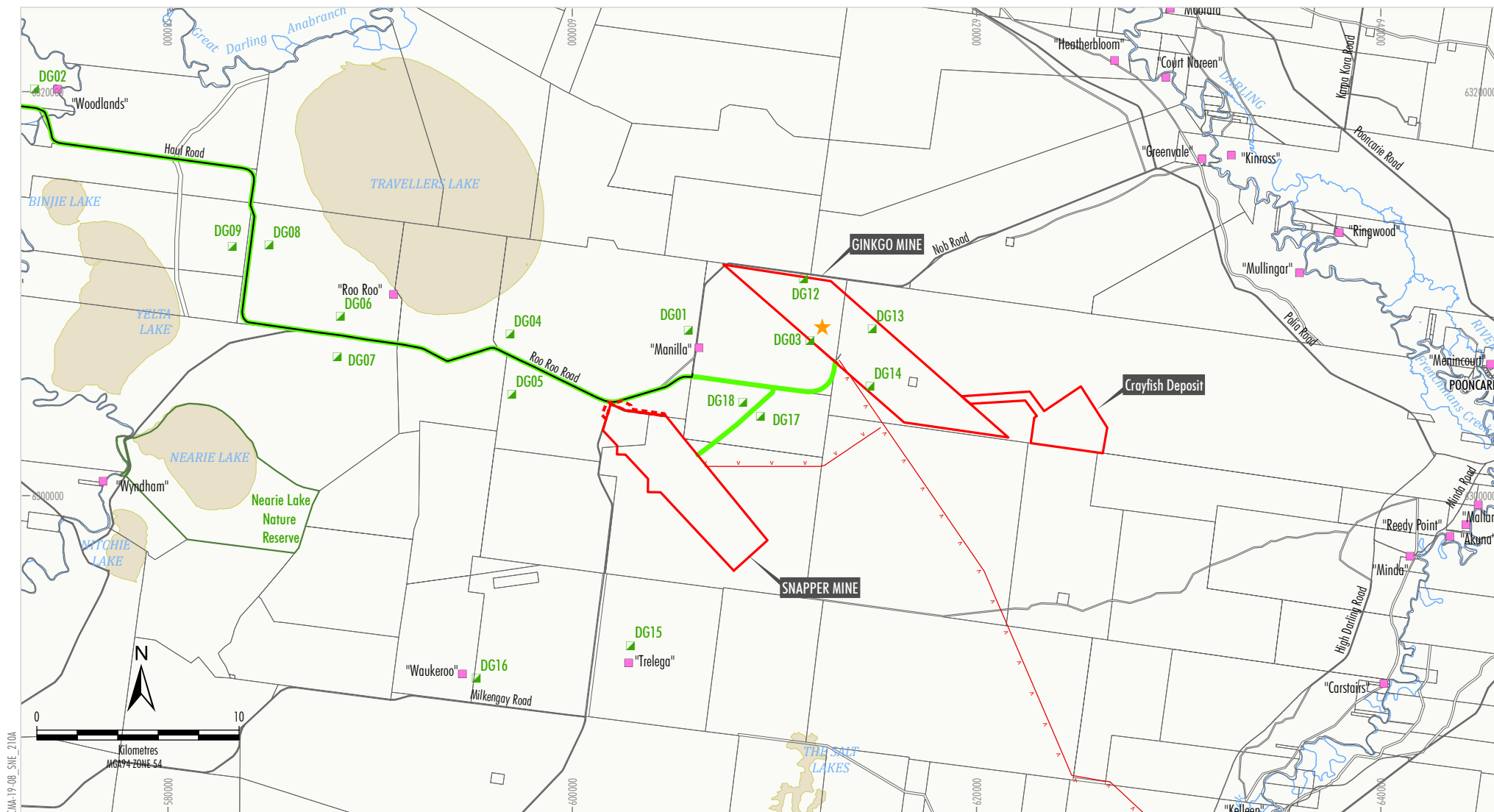
Dust deposition monitoring is conducted at 18 locations (DG01 to DG18) in the vicinity of the Snapper Mine and HAR (Figure 9).

The results of the air quality monitoring program are assessed against the air quality criteria described in Condition 13, Schedule 3 of Project Approval (06_0168).

Monitoring Results

Dust deposition monitoring to date generally indicates compliance with the Project Approval (06_0168) annual average air quality criterion of 4 grams per square metre per month (g/m²/month) since the commencement of operations at the Snapper and Ginkgo Mines (Appendix C).

Records at the Trelega homestead in 2012 and 2013 exceeded the annual average air quality criterion of 4 g/m²/month (Appendix C). Pacific Environment Limited (2014a), however, concluded that these elevated dust deposition records were contaminated, and compliance with the annual average air quality criterion of 4 g/m²/month is achieved after excluding the contaminated measurements.



Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX
SNAPPER MINE
 Sensitive Receiver and
 Air Quality Monitoring Locations

Figure 9

Records at the Waukeroo and Manilla homesteads in 2018, and the Manilla homestead in 2019, exceeded the annual average air quality criterion of 4 g/m²/month (Appendix C). Katestone (2019) concluded that the persistent warm and dry conditions throughout 2018 and 2019 would have contributed to elevated ambient dust levels in the region, and it is likely that these elevated dust deposition records were primarily due to regional dust sources and not operations at the Snapper or Gingko Mines.

To date, Tronox has not received any complaints in regard to air quality (Appendix C).

Air Quality Criteria

Subsequent to the grant of Project Approval (06_0168), the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (DEC, 2005) was updated to include criteria for particulate matter less than 2.5 micrometres in diameter (PM_{2.5}).

The updated Approved Methods (EPA, 2016) also include a reduced annual average PM₁₀ criterion of 25 micrograms per cubic metre (µg/m³).

Katestone (2019) has assessed the potential air quality impacts of the Modification against the updated Approved Methods (EPA, 2016).

6.5.2 Potential Impacts

The Air Quality Review (Appendix C) has evaluated the potential air quality impacts of the Modification and a summary is provided below.

The following components of the Modification would have the potential to alter particulate matter (e.g. dust) emissions at the Snapper Mine (Appendix C):

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1; and
- temporary placement of overburden around the crest of the mine path extension rather than placing behind the advancing dredge pond, reducing haulage distances.

Pacific Environment Limited (2014a) estimated that haul trucks transporting overburden account for approximately 78% of the total emissions of TSP at the Snapper Mine.

The Modification would result in a decrease in overburden haulage distances of approximately 30%, as overburden would be placed temporarily around the crest of the mine path extension (Figure 4) rather than behind the advancing dredge pond (Section 2.3.2).

Dust emissions generated by overburden haulage would, therefore, be expected to decrease by approximately 30% as a result of the Modification (Appendix C).

The mine path extension for the Modification would be located further from the Manilla homestead (4.3 km) than the existing/approved mine path (3.8 km). The Modification would also result in a minor decrease in distance between soil stockpiles/surface development areas and the Manilla homestead (from approximately 3.6 km to 3.3 km). The relative size of soil stockpiles would not change for the Modification. These changes are expected to result in negligible change to the existing/approved dust deposition rates at the Manilla homestead (Appendix C).

Given the above, and the conclusions of Pacific Environment Limited (2014a) (i.e. compliance with the relevant air quality criteria), it is expected that the modified Snapper Mine would continue to comply with the relevant air quality criteria (including PM₁₀ and PM_{2.5}) at all sensitive receivers surrounding the Snapper Mine (Appendix C).

Furthermore, as the Modification would result in a reduction in total dust emissions from the Snapper Mine, it is considered there would be no change to the approved potential cumulative air quality impacts, as described by PAE Holmes (2010a), as a result of the Modification (Appendix C).

6.5.3 Mitigation Measures, Management and Monitoring

The Air Quality Management Plan (GHD, 2015d) would continue to be implemented for the Modification.

Given that the Modification is not expected to contribute to any additional exceedances of the relevant air quality criteria at any sensitive receptors in the vicinity of the Snapper Mine, Tronox does not propose any additional air quality management measures.

Notwithstanding, the Air Quality Management Plan (GHD, 2015d) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.6 NOISE

A Noise Review was undertaken for the Modification by Wilkinson Murray (2019) and is presented in Appendix D.

6.6.1 Background

Sensitive Receivers

The Snapper Mine is located at significant distances from sensitive receivers (Section 6.6.1) (Figure 9).

Previous Assessments

A number of noise assessments have been conducted for the Snapper Mine to date, namely:

- the Noise Assessment undertaken for the Snapper Mine EA by Holmes Air Sciences (2007b);
- the Noise Assessment undertaken for the 2010 Snapper and Ginkgo Mines Modification by PAE Holmes (2010b); and
- the Noise Review undertaken for the 2014 Snapper Mine Production Increase Modification by Pacific Environment Limited (2014b).

The previous noise assessments assessed the potential noise impacts at the nearest sensitive receivers to the Snapper Mine operations and HAR.

Most recently, Pacific Environment Limited (2014b) concluded that the approved Snapper Mine will comply with the Project-specific noise criteria at the closest sensitive receiver to the Snapper Mine (i.e. the Manilla homestead) under neutral and adverse meteorological conditions (Appendix D).

Pacific Environment Limited (2014b) also concluded that the approved Snapper Mine would comply with the road traffic noise criteria along the HAR.

Management and Monitoring Regime

In accordance with Condition 12, Schedule 3 of Project Approval (06_0168), a Noise Management Plan (GHD, 2018) has been prepared for the Snapper Mine. The Noise Management Plan includes:

- a noise monitoring program to assess compliance with the Snapper Mine operational and road traffic noise criteria;
- contingency measures for controlling noise at the source and the receiver, and mitigating the transmission of noise between the source and receiver;

- a noise awareness program to educate employees on the effects of noise and quiet work practices – such as staff education programs to reinforce quiet driving styles/attitudes;
- a complaint handling and response protocol for the reporting and assessment of noise complaints, and identifying suitable preventative/corrective actions.

Noise monitoring at the Snapper Mine is undertaken in accordance with the Noise Management Plan (GHD, 2018). In accordance with the Noise Management Plan, compliance noise monitoring was conducted annually from the commencement of Snapper Mine operations until 2015 at the Manilla and Woodlands homesteads (i.e. the closest sensitive receivers to the Snapper Mine and HAR, respectively).

Subsequently, and in accordance with Condition 10, Schedule 3 of Project Approval (06_0168), Tronox obtained signed agreements with the residents of the Manilla and Woodlands homesteads to discontinue noise monitoring at these locations due to ongoing compliance with the relevant noise criteria. Tronox advised the DPIE of these agreements in March 2016.

Monitoring Results

Compliance noise monitoring at the Manilla homestead up to and including 2015 demonstrated compliance with the Project Approval (06_0168) noise criterion of 35 dBA. On occasions where recorded noise levels exceeded 35 dBA, review of monitoring results (and associated recordings) indicated that windy conditions, wildlife and traffic noise were the causes of noise levels exceeding 35 dBA, and were not related to operations at the Snapper Mine (GHD, 2018).

From the commencement of operations to the end of the 2018 Annual Review reporting period, Tronox received no complaints in regard to noise (Appendix D).

A noise complaint from the Manilla homestead was, however, received in early 2019, and in accordance with the Noise Management Plan (GHD, 2018), attended and unattended compliance noise monitoring was undertaken by Tronox and Renzo Tonin & Associates (2019), respectively.

Attended noise monitoring conducted by Tronox indicated that operations at the Snapper Mine were only audible during periods with low ambient noise, periods which corresponded with noise levels below 35 dBA (Renzo Tonin & Associates, 2019).

Renzo Tonin & Associates (2019) conducted unattended noise monitoring at the Manilla homestead from Tuesday 6 August to Saturday 10 August 2019, and found that compliance with the Project Approval (06_0168) criterion of 35 dBA at the Manilla homestead is being achieved.

Noise Criteria

The previous noise assessments undertaken for the Snapper Mine (Holmes Air Sciences, 2007b; PAE Holmes, 2010b; Pacific Environment Limited, 2014b) were prepared in accordance with the *Industrial Noise Policy* (INP) (EPA, 2000), which has since been superseded by the *Noise Policy for Industry* (NPfI) (EPA, 2017).

The INP defines a minimum noise criterion of 35 dBA for the day, evening and night-time. Based on background monitoring conducted by Holmes Air Sciences (2007b), the project-specific noise criteria determined for the Snapper Mine were the minimum applicable criteria (i.e. 35 dBA for the day, evening and night-time).

The NPfI increased the minimum daytime noise criterion to 40 dBA, while the evening and night-time criteria remained at 35 dBA. Wilkinson Murray (2019), therefore, considered the potential noise impacts of the Modification against the NPfI criteria (Section 6.7.2).

6.6.2 Potential Impacts

Operational Noise

The Noise Review (Appendix D) has evaluated the potential noise impacts of the Modification and a summary is provided below.

The following components of the Modification would have the potential to alter noise emissions generated at the Snapper Mine (Appendix D):

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1; and
- minor change to the approved mining fleet.

The Modification would reduce the number of excavators and haul trucks at the Snapper Mine. The reduction in the number of excavators and haul trucks for the Modification would not result in any significant change to the approved overall total sound power level (SWL) associated with the mining fleet (Appendix D).

To quantify the potential increase in operational noise levels at the closest receiver (Manilla homestead) due to extension of the existing/approved mine path and associated supporting infrastructure into MLA 1, Wilkinson Murray (2019) modelled the SWL associated with the modified mining fleet under typical maximum case operational scenarios when all plant and fleet are working concurrently within the Modification area.

Wilkinson Murray (2019) found noise levels at the closest sensitive receiver (i.e. the Manilla homestead) would achieve the Project Approval (06_0168) criterion of 35 dBA, and the NPfI Project noise trigger levels of 40 dBA, 35 dBA and 35 dBA for the day, evening and night-time respectively, under the neutral and adverse meteorological conditions defined by the NPfI.

Road Noise

The Modification would not result in any changes to mineral concentrate transport. The Modification would, therefore, not result in any changes to the approved potential road traffic noise impacts at the sensitive receivers along the HAR (Appendix D).

The Modification would however include the realignment of Nob Road. Given that the Nob Road realignment would be further away from the closest sensitive receiver (i.e. Manilla homestead) than the current alignment of Nob Road, there would, therefore, be a slight reduction in noise levels at Manilla from the vehicles travelling along this portion of Nob Road (Appendix D).

Cumulative

The predicted cumulative noise level (i.e. due to operations at the Snapper and Ginkgo Mines) at the Manilla homestead would achieve the minimum (night-time) NPfI recommended amenity noise level of 40 dBA under neutral and adverse meteorological conditions. Compliance will therefore be achieved at Trelega, and other sensitive receivers located at greater distances from the Snapper Mine (Appendix D).

6.6.3 Mitigation Measures, Management and Monitoring

The Noise Management Plan (GHD, 2018) would continue to be implemented for the Modification.

Given that the Modification is not expected to contribute to any additional exceedances of the relevant noise criteria at any sensitive receptors in the vicinity of the Snapper Mine, Tronox does not propose any additional noise management measures.

Notwithstanding, the Noise Management Plan (GHD, 2018) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.7 ROAD TRANSPORT

A Road Transport Assessment was undertaken for the Modification by The Transport Planning Partnership Pty Ltd (TTPP) (2019) and is presented in Appendix E.

6.7.1 Background

Local Roads

Local roads in the vicinity of the Snapper Mine relevant to the Modification include Nob Road and Roo Roo Road (Figure 3).

Roo Roo Road is a local unsealed formed road that provides a link between Nob Road and Old Broken Hill Road. The eastern 16 km of Roo Roo Road forms part of the mineral concentrate transport route. In the vicinity of Snapper Mine, Roo Roo Road supports travel speeds in the order of 100 kilometres per hour (km/h).

Nob Road is a local unsealed formed road that provides a link between High Darling Road approximately 38 km north of Wentworth and Polia Road 20 km northwest of Pooncarie. The portion of Nob Road immediately to the west of the Snapper Mine has a poor surface, with rutting and corrugations evident. An approximate 4 km portion of Nob Road forms part of the mineral concentrate transport route, which supports travel speeds in the order of 100 km/h.

The intersection of Nob Road and Roo Roo Road is a basic T-intersection, at which the southern approach of Nob Road meets Roo Roo Road at 90 degrees. Nob Road (south) is the minor road and Roo Roo Road (approaching from the west) and Nob Road (approaching from the east) form the major road. A give way sign controls traffic at the intersection (Appendix E).

Traffic Volumes

Traffic volumes on Nob Road south of Roo Roo Road are an average of 32 vehicles per day (Appendix E).

Traffic volumes on Roo Roo Road west of Nob Road an average of 24 vehicles per day (Appendix E).

Previous Assessment

Traffix (2007) prepared a Road Transport Assessment for the Snapper Mine EA in accordance with the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). The assessment included consideration of the Snapper and Ginkgo Mines, and other road traffic movements not associated with Tronox's operations.

Traffix (2007) found that traffic generation due to the approved Snapper Mine would have little effect on the levels of service and safety of the surrounding road network.

Management and Monitoring Regime

In accordance with Condition 24, Schedule 3 of Project Approval (06_0168), a Transport Management Plan (GHD, 2015a) has been prepared for the Snapper Mine. The Transport Management Plan includes:

- a description of the transport-related environmental controls and associated limits to meet objectives, targets and regulatory approvals;
- measures to be implemented to address the relevant requirements in the *Code of Practice for the Safe Transport of Radioactive Materials* (Australian Radiation Protection and Nuclear Safety Agency, 2008, or its latest version); and
- a Code of Conduct for all drivers transporting materials to and from the Snapper and Ginkgo Mines.

During the 2018 Annual Review reporting period, Tronox received no traffic-related complaints (Appendix E).

Road Maintenance

Tronox contributes to the maintenance of the HAR and other local roads (including Nob Road) in accordance with Conditions 4 and 7, Schedule 3 of the Ginkgo Mine Development Consent (DA 251-09-01).

6.7.2 Potential Impacts

As the Modification would not change Tronox-related traffic generation, the Road Transport Review (Appendix E) has evaluated the potential road transport impacts associated with the realignment of Nob Road, and a summary is provided below.

Nob Road Realignment

The Nob Road realignment would be constructed in accordance with the principles outlined in the *Unsealed Roads Manual* (ARRB, 2009), the requirements of Austroads (2017a) *Guide to Road Design Part 4: Intersections and Crossings – General* and Austroads (2017b) *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*, and in consultation with the WSC.

The Nob Road realignment would be constructed as an unsealed road (Class 4B) to meet the relevant design requirements of the WSC and/or Austroads as required.

The BAR/BAL intersection treatment, as described in Austroads (2017c), would be applied to the new intersection.

Signage would be provided in accordance with Australian Standard 1742.2 (2009).

Intersection Operation

TTPP (2019) concluded that the predicted peak hourly traffic volumes are well below the threshold volumes for analysis and, as such, there is no capacity concern regarding the operation of the proposed intersection of Roo Roo Road with the realignment of Nob Road (Appendix E).

Formal analysis of the operation of the intersection is not justified, and delays experienced by drivers would be very low (Appendix E).

Roadway Capacity and Efficiency

The Modification would not change the number, timing or distribution of vehicle trips on the local road network, and so would have no impact on the midblock capacity available on the roads, nor on the likely interaction between drivers (Appendix E).

Although the Nob Road realignment would be approximately 350 m longer than the current alignment, it would permit higher vehicle travel speeds than occur currently because the road would be constructed to an improved surface standard than the existing road, which would improve the level of service experienced by drivers (Appendix E).

Road Safety

The realignment of Nob Road is expected to have positive impacts on the safety of the Snapper Mine workforce and the road network (Appendix E).

TTPP (2019) considered the potential safety impacts of the modified Snapper Mine operational lighting on the HAR, and concluded that it would not present a potential risk to road safety with the implementation of the proposed visual management measures (Section 6.12.3).

6.7.3 Mitigation Measures, Management and Monitoring

The Transport Management Plan (GHD, 2015a), and its relevant mitigation and management measures, would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.8 LAND AND AGRICULTURAL RESOURCES

This section considers potential land and agricultural resource impacts associated with the Modification area.

6.8.1 Background

Topography

The landform within the Snapper Mine area shows limited relief and comprises generally flat to undulating sandplains covered by a combination of grasslands, low woodland and shrublands (Bemax, 2007a). Elevations in the Modification area range from approximately 70 to 80 m Australian Height Datum (AHD).

Land Use and Agricultural Production

Land use in the Modification area comprises pastoral leasehold lands that are used for light intensity rangeland grazing (Bemax, 2007a).

The Modification Area is located on the Manilla and Carstairs properties, which are located on Western Lands Lease 4090 (Lot 1926 DP 763904) and Western Lands Lease 4086 (Lot 1927 DP 763905), respectively (Section 4.2).

Land and Soil Capability

The Land and Soil Capability system is used to give an indication of the land management practices that can be applied to a parcel of agricultural land. Agricultural land is classified by evaluating biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards (OEH, 2012).

The Modification area is identified as having Land and Soil Capability Classes of 4 and 5. These Land and Soil Capability Classes are defined as (OEH, 2012):

Class 4 - Moderate capability land:

Class 4 land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.

Class 5: Severely limited land:

Class 5 land has severe limitations for high impact land management uses such as cropping. There are few management practices generally available to overcome these limitations. However, highly specialised land management practices can overcome some limitations for high value crops or products. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment.

Land Contamination

A Land Contamination Assessment was undertaken in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011b) by Tronox (Appendix G). It was undertaken in the form of a Stage 1 (or Preliminary Investigation) Land Contamination Assessment.

No potentially contaminating activities or contaminated areas were identified in the Modification area (Appendix G).

On the basis of the Stage 1 (or Preliminary Investigation) Land Contamination Assessment, the Modification area is suitable for the proposed industrial development (i.e. the mine path extension, associated supporting infrastructure and Nob Road realignment) (Appendix G).

Land Resources Management

The Land Management Plan (GHD, 2015b) includes:

- soil management measures;
- remnant vegetation management;
- livestock and pasture management; and
- feral animal and noxious weed control measures.

The Water Management Plan (GHD, 2016b), prepared in accordance with Condition 2, Schedule 3 of Project Approval (06_0168) relevantly includes:

- a summary of erosion and sediment control structures;
- erosion and sediment control management measures;
- soil-stripping management measures;
- salinity management measures;
- monitoring and reporting requirements; and
- contingency measures.

The Bushfire Management Plan (GHD, 2016c), prepared in consultation with the WSC and the NSW Rural Fire Service, relevantly includes:

- procedures for the detection, response, co-ordination and reporting of bushfire events;
- details of fire-fighting activities;
- an Emergency Response Plan for bushfire emergency response procedures and evacuation procedures;
- a Fuel Management Plan; and
- provision of adequate fire breaks/protection works and the fire-fighting equipment on-site (including an Emergency Response team).

Potential land resource impacts associated with the existing/approved Snapper Mine surface development area (Figure 2) have been managed generally in accordance with this existing land resource management regime.

6.8.2 Potential Impacts

The Modification would require approximately 87.4 ha of additional surface development area (Section 2.3.1).

The following land and agricultural resource aspects could potentially be impacted by Modification:

- topographic features;
- soils and erosion potential; and
- land use and capability.

It is noted that the Modification would, however, result in a net reduction in surface development area of approximately 3.3 ha at the Snapper Mine, therefore, there is expected to be no additional impact on potential land and agricultural resources.

These potential impacts and how they relate to the Modification area are described in the following sub-sections. Measures to mitigate these potential impacts are also provided in this sub-section.

Topographic Features

The main features of the Modification area would comprise:

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas; and
- re-alignment of Nob Road around MLA 1.

Given the relative size of the Modification area to the existing/approved Snapper Mine footprint (e.g. 3.5% increase in the length of the mine path), the landform changes outlined above represent a minor extension of the existing/approved topographical changes at the Snapper Mine into the Modification area.

Soils and Erosion

The low rainfall and lack of defined drainage channels in the region generally limit the potential for fluvial erosion and sedimentation.

The potential soil and erosion-related impacts relevant to the Modification include:

- loss of *in situ* soil resources associated with the Nob Road realignment;
- alteration of physical and chemical soil properties during stripping and stockpiling operations;
- reduced soil quality (structure, fertility and microbial activity) of long-term stockpiles; and

- erosion and sediment movement due to exposure of soils during clearance and construction activities.

Potential soil and erosion impacts would be managed by the implementation of the measures outlined in the Water Management Plan (GHD, 2016b).

Land Use and Capability

The Modification would result in a net reduction of approximately 3.3 ha in the amount of potential agricultural land that would be disturbed by the Snapper Mine. Additionally, the approved surface development areas to be relinquished are identified as being comprised entirely of Land and Soil Capability Class 4, while the Modification area is identified as having Land and Soil Capability Classes of 4 and 5.

In addition, the approved final land use at the Snapper Mine is light intensity grazing (Section 2.5), and the Modification would not change the approved final land use.

Land Contamination

Potential land contamination risks were identified as part of the Preliminary Hazard Analysis for the Snapper Mine EA (Bemax, 2007c), and included:

- leaks/spills;
- fire;
- explosion;
- failure (e.g. equipment); and
- vehicle accident.

The Modification would not change the potential impacts identified in the Preliminary Hazard Analysis (Bemax, 2007c) relevant to the potential land contamination risks described above.

6.8.3 Mitigation Measures, Management and Monitoring

The Land Management Plan (GHD, 2015b) would continue to be implemented for the modified Snapper Mine.

In addition, the land and agricultural resource aspects of the Land Management Plan and Water Management Plan would be reviewed and, if necessary, revised for the Modification (subject to any modified Project Approval conditions).

6.9 GROUNDWATER

A Hydrogeological Review was undertaken for the Modification by GEO-ENG (2019) and is presented in Appendix F.

6.9.1 Background

Previous/Existing Assessments

A number of hydrogeological studies (including hydrogeological test work) that are applicable to the Snapper and Ginkgo Mines area have been conducted, including:

- Golder Associates Pty Ltd (2001) *Hydrogeological Assessment of the Ginkgo Mineral Sands Project*.
- Golder Associates Pty Ltd (2007) *Snapper Mineral Sands Project Hydrogeological Assessment*.
- GEO-ENG (2010) *Snapper and Ginkgo Mines – Hydrogeological Assessment*.
- GEO-ENG (2012) *Ginkgo Mine Modification Crayfish Deposit – Hydrogeological Assessment*.
- GEO-ENG (2013) *Ginkgo Mine Modification Modified Request Project Crayfish Deposit – Hydrogeological Assessment*.
- GEO-ENG (2014) *Snapper Mine Production Increase Modification – Hydrogeological Review*.
- CMA (2016) *Ginkgo Mineral Sands Mine Southern Extension Modification Environmental Assessment*.

GEO-ENG (2013) evaluated the potential cumulative impacts of the Snapper and Ginkgo Mines on groundwater resources using hydrogeological conceptualisation and a supporting numerical groundwater model.

The numerical groundwater model was used to simulate the potential effects of the approved Snapper and Ginkgo Mines on the Western Murray Porous Rock Groundwater Source, as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* groundwater dependent ecosystems and existing groundwater users.

GEO-ENG (2013) concluded that:

The results from the groundwater modelling indicate negligible groundwater impacts at all potential receiving environments

The conclusions of GEO-ENG (2013) were reviewed in the context of the Snapper Mine Production Increase Modification and it was concluded that (GEO-ENG, 2014):

The [Snapper Mine Production Increase] Modification is not expected to result in any significant change to the cumulative groundwater impacts associated with the Snapper and Ginkgo (including the proposed Crayfish deposit) Mines (Table 1).

CMA (2016) evaluated the potential impacts of the Southern Extension Modification and concluded that (Cristal Mining, 2016):

Overall changes to impacts on groundwater resources were considered negligible and within the Minimal Impact Considerations of the NSW Aquifer Interference Policy. Groundwater resources would continue to be monitored and managed in accordance with the Borefield Impact Management Plan.

Regional and Local Hydrogeological Setting

A number of large-scale ridges and basins (likely fault bounded blocks) form the pre-Tertiary basement profile, over which the relatively flat lying Tertiary and Quaternary sediments of the Murray Basin have formed (Appendix F).

Specific groundwater information is provided by the Murray Basin Hydrogeological Map Series (Australian Geological Survey Organisation, 1993), which indicate the general geometry of various aquifers and aquitards, based on sparse distribution of drillholes (Appendix F).

The Snapper, Ginkgo and Crayfish ore bodies lie in the shallow, saline aquifer of the Loxton-Parilla Sands beneath the shallow Quaternary Woorinen and Shepparton Formation Layers (Figure 10) (Appendix F).

Saline aquifers within the underlying Renmark Group have been mapped to include sand beds of the Upper, Middle and Lower Olney Formation and basal Warina Sand (Figure 10). At the Snapper Mine the Upper Olney is indicated to be a thin zone of fine sand directly beneath, and connected to, the Loxton-Parilla Sands (Appendix F).

The Middle Olney Formation is not well defined locally but is more significant to the north where it connects with both the Upper and Lower Olney Formations. The Lower Olney Formation and Warina Sand are located beneath the mine sites overlying pre-Tertiary bedrock. The Geera Clay Aquitard is approximately 130 m thick in the local area and separates the saline Upper and Lower Olney Formation units (Appendix F).

The groundwater flow in all aquifers is from recharge areas in the north and east to discharge in the south-west towards the Murray River and Lake Victoria. The groundwater gradient is very flat with a local gradient of about 1 vertical:10,000 horizontal. Groundwater pressures in each aquifer are similar, with a small downward gradient in the recharge areas (north) and a larger upward gradient in the discharge zone (south) (Appendix F).

The Snapper deposit lies in the shallow, saline aquifer of the Loxton-Parilla Sands (the upper aquifer). The water supply bores at the Snapper Mine lie in the deep, saline aquifer of the tertiary Lower Olney Formation/Warina Sands (the lower aquifer).

Groundwater Quality

Groundwater monitoring results from the Snapper Mine and the Murray Basin Hydrogeological Map Series (Australian Geological Survey Organisation, 1993) indicates salinity in excess of 35,000 milligrams per litre (mg/L) for the upper aquifer and between 14,000 mg/L to 35,000 mg/L for the deep Tertiary Lower Olney Formation/Warina Sand aquifer (the lower aquifer) (Appendix F).

Monitoring to date indicates that salinity (total dissolved solids [TDS]) levels have been stable since the commencement of Snapper Mine operations (i.e. salinity levels have remained high in both the upper and lower aquifers).

Groundwater Users

Previous investigations have identified that groundwater use in the local area is limited to three private wells (Chalky Well, Court Nareen Well and Greenvale Well – Figure 11) which access fresh water lenses above the saline water table. The private bore at Trelega (Figure 11) is not used due to high salinity levels. The lack of active bores in the region is understandable given the poor quality of the groundwater (Appendix F).

Groundwater Dependent Ecosystems

There are currently no high-priority groundwater dependent ecosystems identified in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000* (Appendix F).

In addition, GEO-ENG (2014) considered that it is unlikely that there is a groundwater dependent ecosystem at the Snapper Mine as the groundwater table is located approximately 30 m below the surface and there is no evidence of any perched water tables.

Groundwater Licensing

The Snapper Mine is located within the Western Murray Porous Rock Water Source as defined in the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011* under the *Water Management Act 2000*.

Tronox currently holds a combined total 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Snapper and Ginkgo Mines.

Management and Monitoring Regime

In accordance with Condition 2, Schedule 3 of Project Approval (06_0168), a Water Management Plan (GHD, 2016b) has been prepared for the Snapper Mine. Relevant to groundwater, the Water Management Plan includes:

- relevant groundwater criteria;
- a program for groundwater management and monitoring;
- mitigation measures related to groundwater; and
- a description of the auditing, reporting and reviewing requirements of the Water Management Plan.

During the 2018 Annual Review reporting period, no incidents relating to groundwater occurred and no complaints were received by Tronox (CMA, 2018).

6.9.2 Potential Impacts

The potential groundwater impacts associated with the Modification include:

- Changes to predicted groundwater drawdown effects in the upper aquifer due to the proposed minor mine path extension and change to the size of the modified final depression.
- Changes to predicted impacts on groundwater users and groundwater-related features due to changes in the predicted groundwater drawdown effects.
- Changes to predicted groundwater quality impacts.

These potential impacts are discussed in more detail below.

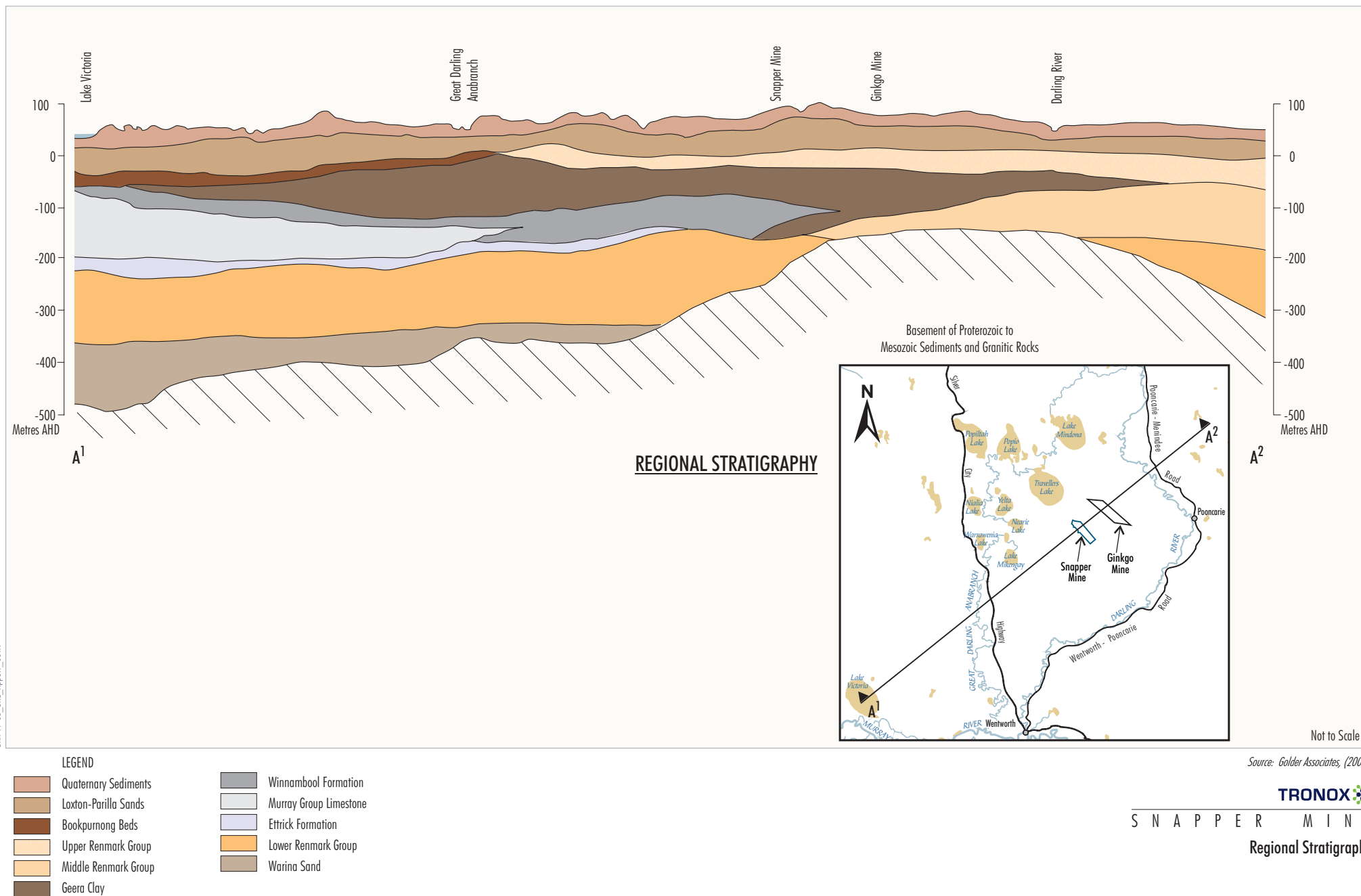
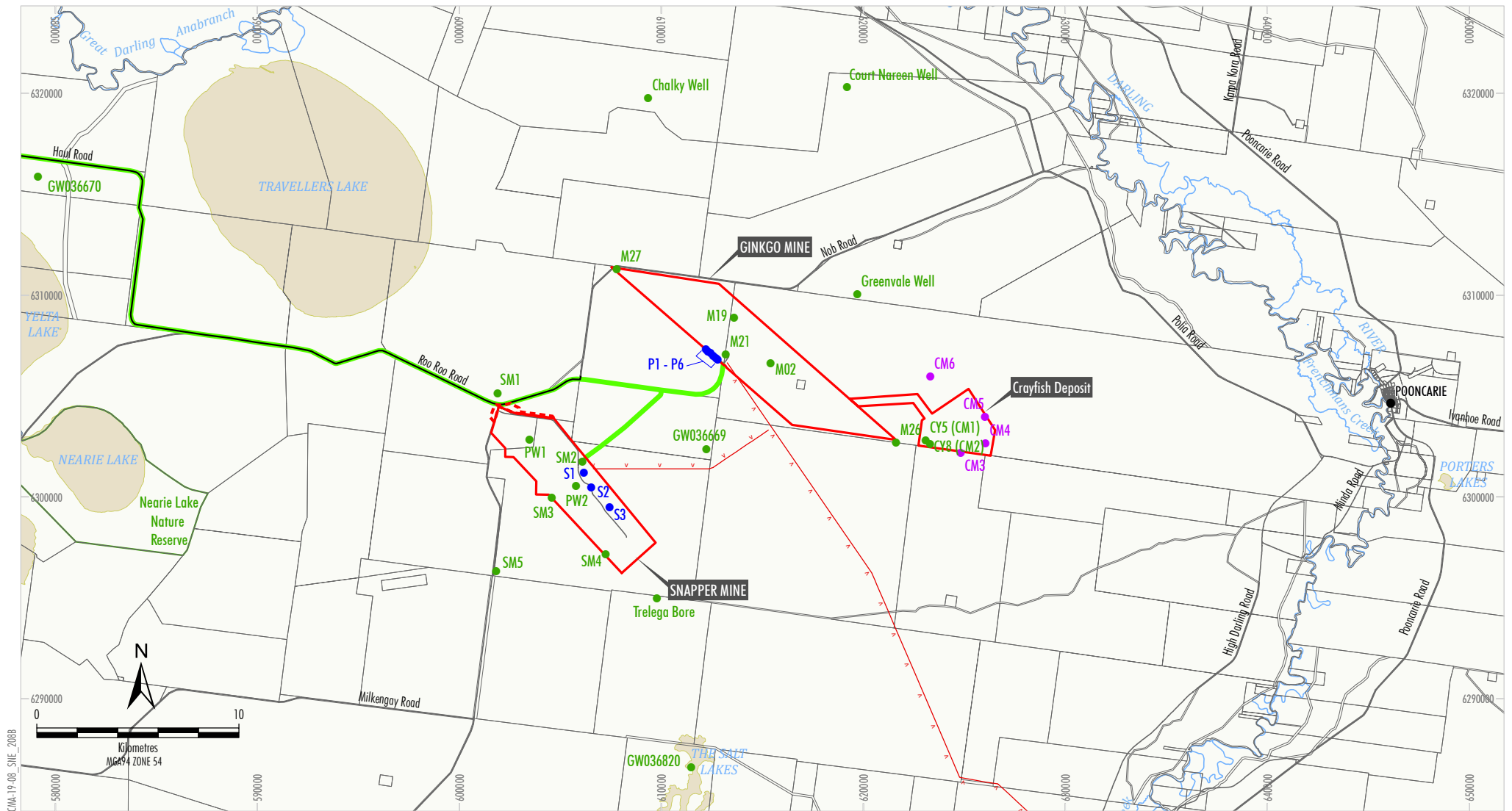


Figure 10



Source: NSW Spatial Services (2019); Tronox (2019)

TRONOX
S N A P P E R M I N E
Location of Groundwater
Monitoring Sites

Figure 11

Groundwater Drawdown Predictions

As the Modification would not result in any changes to water demand, there would be no change to extraction from the lower aquifer. The Modification would therefore not change the existing/approved potential impacts on the lower aquifer (Appendix F).

The minor (i.e. approximately 600 m) extension to the existing/approved mine path would result in changes to the predicted negligible groundwater drawdown effects in the upper aquifer associated with the existing/approved Snapper Mine (Appendix F).

Specifically, the Modification would result in a minor northern extension to the predicted negligible drawdown in the upper aquifer associated with lowering the dredge pond water level in the extended mine path. Given the minor nature of the proposed mine path extension in the context of the existing/approved mine path, the Modification is not expected to significantly change the approved predicted negligible drawdown effects in the upper aquifer (Appendix F).

The increased extent of the final depression (Section 2.5.2) would, however, result in mounding in the upper aquifer in a portion of the northern section of the mine path due to increased infiltration (Appendix F).

Groundwater Users

The Modification is not expected to have any measurable effect at the three local leaseholder bores (Chalky Well, Greenvale Well and Court Nareen Well [Figure 11]), given the negligible groundwater drawdown effects expected.

Regional Groundwater-Related Features

The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River) (Appendix F).

Groundwater Quality

The Modification is expected to result in negligible impacts on groundwater quality as no significant changes to the mining operations or water management are proposed (Appendix F).

Aquifer Interference Policy

An assessment of the potential groundwater impacts of the Modification against the minimal impact considerations in the AIP (NSW Government, 2012) concluded that the Modification is within "Level 1" minimal impact considerations outlined in the AIP given:

- The *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources, 2011* does not list any high-priority groundwater dependent ecosystems in the vicinity of the Ginkgo Mine.
- The Modification would not result in a cumulative drawdown of more than 2 m at any privately owned water supply work.
- The Modification would not lower the beneficial use category of the groundwater source as it is expected to have negligible impact on groundwater quality.

Further discussion on the AIP is provided in Section 4.4.

Licensing

Tronox currently holds a combined total 21,442 share components (units or ML) in the Western Murray Porous Rock Water Source for the Ginkgo and Snapper Mines (Section 6.9.1).

The Modification would not change the Snapper Mine water supply or make-up water demand (Section 2) and, therefore, the existing volumetric licence allocations held by Tronox are considered to be adequate.

6.9.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any material groundwater water impacts, no additional management measures are proposed as part of the Modification.

Groundwater would continue to be managed in accordance with the Water Management Plan (GHD, 2016b).

Notwithstanding, the Water Management Plan (GHD, 2016b) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.10 SURFACE WATER RESOURCES

This section considers potential surface water impacts associated with surface development in the Modification area.

6.10.1 Background

The Snapper Mine is located within the lower Darling River system, which extends from the Menindee Lakes to the junction of the Darling River and the Murray River at Wentworth. The closest significant regional surface water systems are the Darling River and Great Darling Anabranch, located approximately 30 km south-east and 23 km north-west of MLA 1, respectively (Figure 1).

Due to the limited topographical relief and well dispersed annual rainfall, sandy soils, and high evaporation rates, no well-defined drainage channels are located within the Modification Area. Surface water flows may occur during prolonged rainfall events, where surface waters accumulate in topographic depressions before evaporating and/or seeping into the groundwater table.

Surface Water Users

There are no known surface water users in the Snapper Mine area (CMA, 2017).

Previous Assessments

The potential surface water impacts of the approved Snapper Mine were considered by Bemax (2007a) for the Snapper Mine EA.

Bemax (2007a) concluded that the potential impacts of the approved Snapper Mine on surface water systems are limited due to the distance of the mining activity from any significant surface water systems.

Management and Monitoring Regime

As described in Section 6.8, a Water Management Plan (GHD, 2016b) has been prepared for the Snapper Mine, and includes the following measures:

- a summary of erosion and sediment control structures;
- erosion and sediment control management measures;
- soil-stripping management measures;
- salinity management measures;
- monitoring and reporting requirements; and
- contingency measures.

6.10.2 Potential Impacts

Potential surface water impacts of the Modification would be associated with the proposed surface development in the Modification area.

Water flow direction may change and in places a localised reversal of direction may occur where areas of temporary surface ponding are excavated and exist adjacent to the Modification area (e.g. following rainfall events).

Surface water runoff from the Modification area could potentially contain sediments, dissolved solids, oil, grease, metals and salts. The existing erosion and sediment controls and land contamination controls would be implemented for the Modification, and are described in Section 6.8.

The complex landform and semi-arid climate combine to provide conditions in which the risk of off-site surface water impacts is minimal.

The modified final depression would continue to capture incident rainfall and local surface water runoff, which would temporarily pond in the final depression, prior to evaporating or infiltrating into the upper aquifer. In accordance with the Snapper Mine rehabilitation objectives (Table 2), the drainage extent of the modified final depression would be minimised as far as reasonable and feasible.

No significant surface water impacts are expected as a result of the Modification with the implementation of the measures outlined in the Water Management Plan (GHD, 2016b).

6.10.3 Mitigation Measures, Management and Monitoring

Given that the Modification would not result in any significant material surface water impacts, no additional management measures are proposed as part of the Modification. Surface water will continue to be managed at the Snapper Mine in accordance with the Water Management Plan (GHD, 2016b).

Notwithstanding, the Water Management Plan (GHD, 2016b) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

6.11 SOCIAL AND ECONOMIC

6.11.1 Background

An economic assessment was undertaken for the Snapper Mine EA by Gillespie Economics (2007), which included a regional economic assessment. Gillespie Economics (2007) concluded that the Snapper Mine will stimulate demand in the regional economy leading to increased business turnover in a range of sectors and increased employment opportunities.

Approximately 110 Tronox employees and contractors are employed at the Snapper Mine.

Local contractors engaged at Tronox's existing operations include:

- Chisholm Earthmoving Pty Ltd;
- Basin Sands Logistics Pty Ltd;
- Cully's Earthmoving Pty Ltd;
- Sunraysia Crane and Rigging Pty Ltd; and
- Ecotypic Pty Ltd.

6.11.2 Potential Impacts

Based on current scheduling, there is a risk of production and employment discontinuity between the cessation of Snapper Mine operations and commencement of Atlas-Campaspe Mine operations (Section 1.2). The Modification would include the extension of the approved mine path and associated supporting infrastructure into MLA 1, to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Modification would therefore allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine in late 2021. The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the regional economy would therefore continue as a result of the Modification.

The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would, however, avoid potential negative social impacts associated with the loss of employment opportunities at Tronox's operations.

The proposed mine path extension would result in the extraction of approximately 8.5 Mt of ore, producing approximately 170 kt of mineral concentrate product. The estimated NSW Government royalties associated with the mine path extension would be approximately \$2.4 million.

In addition, the Modification would allow for the continuation of the collection of taxes by the NSW Government and the Commonwealth Government.

6.11.3 Mitigation Measures, Management and Monitoring

Given that the Modification would result in positive socio-economic impacts, no specific management measures are proposed as part of the Modification.

6.12 VISUAL AMENITY

6.12.1 Background

The Manilla homestead is the closest residence to the Snapper Mine and is located within a slight topographical depression some 4 km to the north. Other properties within the proximity of the Snapper Mine include the Trelega homestead (7 km south), the Roo Roo homestead (12 km north-west) and the Waukeroo homestead (12 km south-west) (Figure 9).

Public viewpoints providing opportunities to view the Snapper Mine are available along Nob Road and the HAR, although views are limited due to the low-rolling topography and intervening vegetation. In addition, the number of potential viewers is limited due to the sparse settlement in the region and the low use of local public roads (Bemax, 2010).

The overburden emplacement, initial sand residue dam and the initial water dam were identified as permanent landscape components that could present limited visual impacts to the viewscape from surrounding viewpoints (Bemax, 2010).

The glow produced by night-lighting at the Snapper Mine is visible at nearby residences and along transport routes, while direct views of mobile machinery lights and operational lighting are not available.

6.12.2 Potential Impacts

Potential visual impacts associated with the Modification would be associated with extension of the mine path towards the HAR (a public viewpoint) and would be either temporary or permanent impacts.

Potential temporary visual impacts would be associated with temporary structures required during operations that would be removed or decommissioned at various stages during and after the mine life (e.g. supporting infrastructure, temporary overburden emplacement, soil stockpiles).

Although the majority of operations would be undertaken below the natural ground level and there is some intervening vegetation between the HAR and the modified Snapper Mine, there is potential for views of the modified Snapper Mine operations to be available along a short section of the HAR. However, given the very low number of road users on the HAR (Section 6.7) a low level of visual impact is expected.

Permanent visual impacts would result from the development of mine landforms that would remain post-mining. The Modification would change the location and size of the final depression (Section 2.5). The level of visual modification associated with the rehabilitated final depression would not be significant, due to its low elevation (i.e. below ground surface level) and the presence of intervening vegetation between the HAR and the modified final depression. Given this insignificant level of visual modification and the very low number of road users on the HAR (Section 6.7), a low level of visual impact would be expected.

As the Modification would not change the existing/approved overburden emplacement, initial sand residue dam and the initial water dam, the potential visual impacts associated with these permanent mine landforms would be unchanged.

The scale and intensity of night-lighting for the modified Snapper Mine would be of a similar intensity when compared to the existing night-lighting at the Snapper Mine.

6.12.3 Mitigation Measures, Management and Monitoring

Tronox would implement the following visual management measures at the modified Snapper Mine:

- Locate lighting plants in the mining areas so that they would be directed away from vehicles travelling along the HAR.
- Continued use of directional lighting and light shields to minimise light spill.

6.13 GREENHOUSE GAS

6.13.1 Background

Previous Assessments

The greenhouse gas emissions associated with the Snapper Mine were estimated in 2010 (Bemax, 2010). The total mine life (including construction) Scope 1 emissions were estimated to be approximately 0.17 million tonne of carbon dioxide equivalents (Mt CO₂-e), with the Scope 2 and Scope 3 emissions estimated to be approximately 0.3 Mt CO₂-e and 1.06 Mt CO₂-e, respectively (Bemax, 2010).

Management and Monitoring Regime

In accordance with Condition 25, Schedule 3 of Project Approval (06_0168), greenhouse gas emission management and monitoring at the Snapper Mine is conducted in accordance with the Energy Saving Environmental Management Plan (GHD, 2014) with the objective to maintain efficient energy use of all equipment and buildings to minimise energy consumption and associated greenhouse gas emissions.

Minimising fuel and electricity usage is an inherent objective of Snapper Mine planning and cost control systems and measures to mitigate greenhouse gas emissions at the Snapper Mine include:

- consideration of energy efficiency in plant and equipment selection/purchase; and
- regular maintenance of plant and equipment to minimise fuel consumption and associated emissions.

Tronox conducts assessments of energy use at the Snapper Mine to identify cost effective energy savings and energy-efficiency opportunities in accordance with the Energy Saving Environmental Management Plan (GHD, 2014).

The effectiveness of these measures to reduce the greenhouse gas emissions (and energy consumption) at the Snapper Mine will be monitored, as Tronox will annually estimate greenhouse gas emissions and energy consumption in accordance with National Greenhouse and Energy Reporting (NGER) scheme requirements.

6.13.2 Potential Impacts

The Modification would not change the mining and/or processing rates at the Snapper Mine (Section 2.1). As diesel and electricity consumption at the Snapper Mine are predominately related to production, it is expected that the total diesel and electricity consumption at the Snapper Mine on an annual basis would not change significantly as a result of the Modification. It follows that greenhouse gas emissions on an annual basis would also not change significantly as a result of the Modification.

Although the Modification would extend mining operations at the Snapper Mine by approximately one year, mining operations would still be completed within the approved mine life (i.e. before 10 July 2026) and therefore the Bemax (2010) greenhouse gas emission estimates would have considered mining operations during this period.

Given the above, the total greenhouse gas emissions from the Snapper Mine (over the whole mine life) estimated by Bemax (2010) would not change significantly as a result of the Modification.

6.13.3 Mitigation Measures, Management and Monitoring

The Energy Saving Environmental Management Plan (GHD, 2014) would continue to be implemented for the Modification and no specific additional management measures are proposed as part of the Modification.

Notwithstanding, the Energy Saving Environmental Management Plan (GHD, 2014) would be reviewed and, if necessary, revised by Tronox to include the Modification (subject to any modified Project Approval conditions).

7 EVALUATION OF MERITS

The Snapper Mine was approved under Part 3A of the EP&A Act (Project Approval [06_0168]) in 2007.

Tronox proposes modify Project Approval (06_0168) to extend the existing/approved mine path to maintain continuity of production and associated employment of the Snapper Mine workforce until the commencement of operations at the Atlas-Campaspe Mine.

The Modification would include:

- extension of the existing/approved mine path and associated supporting infrastructure into MLA 1;
- development of temporary off-path overburden emplacements;
- additional soil stockpile areas;
- re-alignment of Nob Road around MLA 1;
- reduction in the number of final depressions from two to one;
- increased size of the remaining final depression; and
- relinquishment of approved surface development areas no longer required, resulting in a net reduction in surface development area.

The Modification would not change the following approved Snapper Mine components:

- mine life;
- mining rate or mining method;
- mineral concentrate processing;
- mineral concentrate transport;
- process waste management;
- water management, supply or demand;
- electricity supply;
- other supporting infrastructure;
- operational hours;
- rehabilitation strategy; or
- workforce.

7.1 STAKEHOLDER ENGAGEMENT OVERVIEW

Tronox has consulted with a number of stakeholders during the development of the Modification, including:

- DPIE;
- other relevant NSW Government agencies;
- WSC;
- Aboriginal stakeholders; and
- relevant leaseholders.

The outcomes of engagement with these stakeholders has informed the development of the scope of the Modification and Tronox's preparation of the Modification Report.

7.2 CONSOLIDATED SUMMARY OF ASSESSMENT OF IMPACTS

Tronox operates in accordance with its existing environmental management plans and environmental monitoring programs (Section 1.1.3).

Tronox has undertaken a review of the potential environmental impacts of the Modification to identify key potential environmental issues requiring assessment. The key environmental issues identified are summarised in Table 8.

7.3 JUSTIFICATION FOR THE MODIFICATION

Approval of the Modification is considered to be justified given:

- The Modification would allow for the continued operation of the Snapper Mine within the approved mine life and without increasing the total area of approved surface development area.
- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine.
- The Modification would allow Tronox to continue to supply its downstream operations (including the MSP) and other customers with mineral concentrate until the commencement of production from the Atlas-Campaspe Mine, avoiding disruption to existing supply chains.

Table 8
Key Outcomes of Environmental Review for the Modified Snapper Mine

Environmental Aspect	Summary of Key Environmental Review Conclusions
Biodiversity	- The Modification would result in a net positive outcome for biodiversity values in the local area. - As the Modification would not increase impacts on biodiversity values, it is considered that a BDAR is not required.
Aboriginal Cultural Heritage	No known Aboriginal cultural heritage sites are present within the Modification area.
Historic Heritage	No historic heritage sites are present within the Modification area.
Land and Agricultural Resources	The Modification would result in a net reduction in surface development area, therefore there is expected to be no additional impact on potential land and agricultural resources.
Air Quality	Potential air quality impacts associated with the Modification would not contribute to any exceedances of the relevant air quality criteria at the closest sensitive receptors.
Noise	Noise emissions due to the Modification would not result in any material increase in noise levels, and relevant noise criteria are predicted to be achieved at the closest sensitive receptor, during day, evening and night, under neutral and adverse meteorological conditions.
Road Transport	- A portion of Nob Road would be realigned in consultation with the WSC. - The Modification would have acceptable impacts on the capacity, efficiency and safety of the road network surrounding the Snapper Mine.
Groundwater Resources	- The Modification is not expected to have any measurable effect at leaseholder bores given the negligible groundwater drawdown effects expected. - The Modification is not expected to have any measurable effect on regional groundwater-related features (e.g. Salt Lakes, Darling River, Great Darling Anabranch and Murray River). - The Modification would have "minimal impact" as defined in the AIP. - Tronox holds sufficient entitlements (21,442 share components or ML) under the <i>Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011</i>.
Surface Water Resources	Potential surface water impacts associated with the Modification would be minimal with the implementation of existing surface water management measures.
Social and Economic	- The Modification would allow for the continued employment of approximately 110 Tronox employees and contractors at the Snapper Mine until the commencement of operations at the Atlas-Campaspe Mine. - The economic benefits associated with these employment opportunities (e.g. increased wages, business turnover) in the regional economy would continue as a result of the Modification. - The Modification would not change existing/approved social impacts associated with the Snapper Mine. It would, however, avoid potential negative social impacts associated with the loss of employment opportunities at Tronox's operations.
Visual	The potential visual impact associated with views of the modified Snapper Mine operations along a short section of the HAR would be low given the very low number of road users on the HAR.
Greenhouse Gas	The total greenhouse gas emissions from the approved Snapper Mine (over the whole mine life) would not change significantly as a result of the Modification.
Hazards and Risks	As the Modification would not change the existing potential risks or hazard consequences identified in the Preliminary Hazard Analysis for the approved Snapper Mine, no significant changes to the approved potential hazards and/or risks are expected.
Community Infrastructure	As the Modification would not result in any additional demand for employees or change the expected employee residential distribution, no material alteration to the approved social and community infrastructure impacts is expected.

- The Modification would promote the efficient and economic recovery of additional mineral sands resources while maximising the use of Tronox's established facilities and associated returns on existing financial investment
- The recovery of this additional mineral sands resource would be conducted in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 1.1.3) and other measures (Section 6).
- The WSC and relevant leaseholders have provided in-principle support for the Modification.

7.4 CONCLUSION

The modified Snapper Mine would be substantially the same as the existing/approved Snapper Mine.

In weighing up the main environmental impacts (costs and benefits) and socio-economic benefits associated with the Modification as assessed and described in this Modification Report, the Modification is, on balance, considered to have merit.

8 REFERENCES

- Australian Geological Survey Organisation, Brown, C.M., Stephenson, A.E. and Wooley, D. (1993) *Murray Basin Hydrogeological Map Series. Sheet SI 55-44, Jerilderie, New South Wales and Victoria*, 1st ed, The Organisation, Canberra.
- Australian Radiation Protection and Nuclear Safety Agency (2008) *Code of Practice for the Safe Transport of Radioactive Material*.
- Australian Road Research Board (2009) *Unsealed Roads Manual*.
- Austrroads (2017a) *Guide to Road Design Part 4: Intersections and Crossings – General*.
- Austrroads (2017b) *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*.
- Austrroads (2017c) *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings*.
- Bemax Resources (2007a) *Snapper Mineral Sands Project Environmental Assessment*.
- Bemax Resources (2007b) *Snapper Mineral Sands Project Heritage Management Plan*.
- Bemax Resources (2007c) *Snapper Mineral Sands Project Environmental Assessment Rehabilitation Materials Assessment*.
- Bemax Resources (2010) *Snapper Mineral Sands Mine and Ginkgo Mineral Sands Mine April 2010 Modification Environmental Assessment*.
- Biodiversity Monitoring Services (2019) *Snapper Mine Northern Extension Modification Biodiversity Assessment*.
- Cristal Mining Australia (2015) *Radiation Management Plan*.
- Cristal Mining Australia (2015) *Snapper Mineral Sands Mine Mining Operations Plan*.
- Cristal Mining Australia (2016) *Ginkgo Mineral Sands Mine Southern Extension Modification Environmental Assessment*.
- Cristal Mining Australia (2017) *Ginkgo Mineral Sands Mine Extension Modification Environmental Assessment*.
- Cristal Mining Australia (2018) *Snapper Mineral Sands Mine Annual Environmental Management Report September 2017 – August 2018*.
- Department of Environment and Conservation (2004) *Threatened Species Survey & Assessment: Guidelines for developments and activities (working draft)*.
- Department of Environment and Conservation (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Approved Methods)*.
- Department of Environment, Climate Change and Water (2010a) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Part 6 National Parks and Wildlife Act 1974)*. NSW Department of Environment, Climate Change and Water, Sydney.
- Department of Environment, Climate Change and Water (2010b) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. NSW Department of Environment, Climate Change and Water, Sydney.
- Department of Planning and Environment (2018) *Biodiversity Development Assessment Report Waiver Determinations for SSD and SSI Applications*.
- Department of Planning and Environment (2019) *Preparing a Modification Report Guidelines (Draft)*.
- Department of Primary Industries (2012) *NSW Aquifer Interference Policy*. September 2012.
- Department of Urban Affairs and Planning and Environment Protection Authority (1998) *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land*.
- Environment Protection Authority (2000) *NSW Industrial Noise Policy*.
- Environment Protection Authority (2017) *Noise Policy for Industry*.
- GEO-ENG (2010) *Snapper & Ginkgo Mines – Hydrogeological Assessment, Pooncarie, NSW*.
- GEO-ENG (2012) *Ginkgo Mine Modification Crayfish Deposit – Hydrogeological Assessment*.
- GEO-ENG (2013) *Ginkgo Mine Modification Crayfish Deposit – Hydrogeological Assessment Pooncarie, NSW*.
- GEO-ENG (2014) *Snapper Mine Production Increase Modification Hydrogeological Review Pooncarie, NSW*.

GEO-ENG (2019) <i>Snapper Mine Northern Extension Modification Hydrogeological Review</i> , Pooncarie, NSW.	Landskape (2007) <i>Cultural Heritage Assessment: Snapper Mineral Sands Project</i> . Report to Bemax Resources Limited.
GHD (2014) <i>Mine Site Energy Saving Environmental Management Plan</i> .	Landskape (2010) <i>Snapper Mine Modification Aboriginal Cultural Heritage Assessment</i> . Report to Bemax Resources Limited.
GHD (2015a) <i>Traffic Management Plan and Code of Conduct</i> .	Landskape (2019) <i>Snapper Mine Northern Extension Modification Aboriginal Cultural Heritage Assessment</i> . Report to Tronox Mining Australia Limited.
GHD (2015b) <i>Mine Site Land Management Plan Environment Management</i> .	NSW Government (2017) <i>Modifying an Approved Project</i> .
GHD (2015c) <i>Murray Basin Mineral Sands Mines Cultural Heritage Management Plan</i> .	New South Wales Trade and Investment (2015) <i>Far West Economic Profile</i> , New South Wales Government, Sydney.
GHD (2015d) <i>Murray Basin Mineral Sands Air Quality Management Plan</i> .	Office of Environment and Heritage (2011a) <i>Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW</i> . Office of Environment and Heritage, Sydney.
GHD (2016a) <i>Murray Basin Operations Environmental Management Strategy</i> .	Office of Environment and Heritage (2011b) <i>Guidelines for Consultants Reporting on Contaminated Sites</i> .
GHD (2016b) <i>Ginkgo and Snapper Mines Water Environmental Management Plan</i> .	Office of Environment and Heritage (2012) <i>Land and Soil Capability Scheme</i> .
GHD (2016c) <i>Ginkgo and Snapper Bushfire Management Plan</i> .	Office of Environment and Heritage (2016) <i>NSW Guide to Surveying Threatened Plants</i> .
GHD (2017a) <i>Murray Basin Mines Flora and Fauna Environmental Management Plan</i> .	Office of Environment and Heritage (2017) <i>Biodiversity Assessment Method</i> .
GHD (2017b) <i>Murray Basin Mines Offset Management Plan</i> .	Pacific Environment Limited (2014a) <i>Snapper Mine Production Increase Modification Air Quality Review</i> .
GHD (2018) <i>Murray Basin Mines Noise Management Plan</i> .	Pacific Environment Limited (2014b) <i>Snapper Mine Production Increase Modification Noise Review</i> .
GHD (2019) <i>Murray Darling Basin Mine Landfill and Waste Environmental Management Plan</i> .	PAE Holmes (2010a) <i>Snapper & Ginkgo Mines Modification – Air Quality Impact Assessment</i> .
Gillespie Economics (2007) <i>Snapper Mineral Sands Project Socio-Economic Assessment</i> .	PAE Holmes (2010b) <i>Snapper & Ginkgo Mines Modification – Noise Impact Assessment</i> .
Golder Associates Pty Ltd (2001). <i>Hydrogeological Assessment of the Ginkgo Mineral Sands Project</i> . May 2001, Report No. 01612006.	Renzo Tonin & Associates (2019) <i>Snapper Mine Noise Monitoring Acoustic Report</i> . Report prepared for Tronox Holdings Limited.
Golder Associates Pty Ltd (2007) <i>Snapper Mineral Sands Project Hydrogeological Assessment</i> .	Roads and Traffic Authority (2002) <i>Guide to Traffic Generating Developments</i> .
Holmes Air Sciences (2007a) <i>Air Quality Assessment: Snapper Mineral Sands Project</i> .	The Transport Planning Partnership (2019) <i>Snapper Mineral Sands Mine Northern Extension Modification Road Transport Review</i> .
Holmes Air Sciences (2007b) <i>Noise Assessment: Snapper Mineral Sands Project</i> .	
Katestone Environmental Pty Ltd (2019) <i>Air Quality Review for the Snapper Mine Northern Extension Modification</i> .	

Traffix (2007) *Snapper Mineral Sands Project Road Transport Assessment*.

Tronox Mining Australia Limited (2019a) *Snapper Mine Northern Extension Modification Land Contamination Assessment*.

Western Research Institute and Resource Strategies (2007) *Snapper Mineral Sands Project Fauna Assessment*.

Wilkinson Murray (2019) *Snapper Mine Northern Extension Modification Noise Review*.