Appendix 5

Air Quality Assessment

prepared by

Northstar Air Quality Pty Ltd

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This document has been prepared for **R.W.Corkery and Co. Pty Limited** on behalf of **Tomingley Gold Operations Pty Ltd**:

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Tomingley Gold Operations – Modification 5

Air Quality Assessment

Addressee(s):	Tomingley Gold Operations Pty Ltd
Site Address:	Tomingley NSW
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Date:	17 November 2020

Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	GCG	MD
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar Air Quality	GCG	MD
EXISTING CONDITIONS	Final	Northstar Air Quality	GCG	MD
THE MINE	Final	Northstar Air Quality	GCG	MD
PREVIOUS ASSESSMENTS OF AIR QUALITY	Final	Northstar Air Quality	GCG	MD
AIR QUALITY ASSESSMENT	Final	Northstar Air Quality	GCG	MD
MITIGATION AND MONITORING	Final	Northstar Air Quality	GCG	MD
CONCLUSION	Final	Northstar Air Quality	GCG	MD

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
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Based upon the above, the specific reference for this version of the report is:				**20.1136.FR2V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.

MDoyle

Martin Doyle **17th November 2020**

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Non-Technical Summary

R.W. Corkery & Co. Pty Limited has engaged Northstar Air Quality Pty Ltd on behalf of Tomingley Gold Operations Pty Ltd to support the application to modify development consent PA 09_0155 for the Tomingley Gold Mine. The Proposed Modification relates to the construction and use of Residue Storage Facility 2, extension of the Mine boundary to incorporate Residue Storage Facility 2, and an extension to Mine life to 31 December 2025.

An assessment of potential incremental changes in the emissions profile of the Mine during construction of Residue Storage Facility 2 indicate that the incremental change in emissions is likely to be less than 13 % (total suspended particulate) when compared to the original air quality impact assessment performed in 2011. In an air quality assessment associated with a previous modification for the Mine, it was concluded that any increase in total suspended particulate emissions up to 20 % of that assumed in the original air quality impact assessment would not be likely to result in a material change in the conclusions of that assessment. Given that the Proposed Modification would result in a change in the locations of emissions sources, a focussed dispersion modelling assessment has been performed to confirm that assumption.

The results of a dispersion modelling exercise confirm that the Proposed Modification would have minimal/insignificant impacts on surrounding receptor locations, when considering annual average air quality criteria. Even including suitable background air quality concentrations as measured within the Mine site, the annual air quality criteria are all easily achieved.

In relation to short-term (24-hour) impacts, the Proposed Modification is likely to result in minor impacts at all surrounding receptors. Inclusion of background air quality concentrations indicates that one additional, but marginal, exceedance may occur at a location in Tomingley village. However, given the magnitude of that exceedance ($< 0.1\ \mu g \cdot m^{-3}$), it is not likely to result in any measurable change at that receptor. The modelling exercise included a range of emissions controls currently outlined within the Air Quality Management Plan for the Mine. Although a number of those measures could not be included in the modelling assessment, including the modification of activities in 'adverse' weather conditions, it is considered that the marginal exceedance predicted would be managed so as to not occur.

At the receptor closest to the Proposed Modification and at all other surrounding receptors, no additional exceedances of the air quality criteria are predicted to occur which indicate that the level of emissions controls, and the scale of activities proposed is appropriate and can be managed to not result in any adverse impacts at those locations.

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1. INTRODUCTION

R.W. Corkery & Co. Pty Limited (RWC) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Tomingley Gold Operations Pty Ltd (the Proponent) to support the application to modify development consent PA 09_0155 for the Tomingley Gold Mine (the Proposed Modification).

The Tomingley Gold Mine (the Mine) is located immediately to the south of the village of Tomingley in central western NSW (see **Figure 1**). The Mine is operated by Tomingley Gold Operations Pty Ltd, a wholly owned subsidiary of Alkane Resources Ltd (Alkane). PA 09_0155 applies to, and the Mine operates within, an area referred to for the purposes of this document as the TGO Mine Site (**Figure 2**).

PA 09_0155 has been modified four times previously as follows.

- MOD1 (November 2013) - to adjust a range of commitments made during the original application which were no longer appropriate.
- MOD2 (April 2015) – to permit enhancement of the approved and constructed amenity bund and a cut back of the approved Caloma 1 Open Cut.
- MOD3 (July 2019) – to permit establishment of the Caloma 2 Open Cut, underground extraction from the Caloma 1 and 2 deposits and amendments to waste rock, surface water and soil management.
- MOD4 (May 2020) – to permit an increase the capacity of Residue Storage Facility 1 (RSF1) and a commensurate increase in the height and aerial extent of the facility.

The Proposed Modification (MOD5) seeks consent for the following.

- Construction and use of Stages 1 and 2 of RSF2.
- An extension of Mine Life from 31 December 2022 to 31 December 2025.
- Extension of the Mine Site boundary to incorporate RSF2.

No other changes to the approved Mine are proposed.

This AQIA has been commissioned by the Proponent to assess the potential for any additional air quality impacts related to the Proposed Modification (MOD5).

1.1 Scope of this Study

Given the nature of this development, a focussed assessment has been performed to examine the potential incremental change that may be associated with MOD5.

The scope therefore focusses on the following:

- The incremental change in the overall emission budget of:
    i. approved activities; and
    ii. MOD5.
- This has been performed through preparation and presentation of air emission inventories, so that the relative change in emission budgets may be determined;
- A limited modelling assessment to examine the significance of contributions of MOD5 as it is located closer to a number of receptors than the approved activities. The additional incremental impact of particulates (as TSP, PM_{10} and $PM_{2.5}$ and dust deposition) have been determined in isolation to understand the additional level of air quality risk associated with MOD5.

Figure 1 Mine location

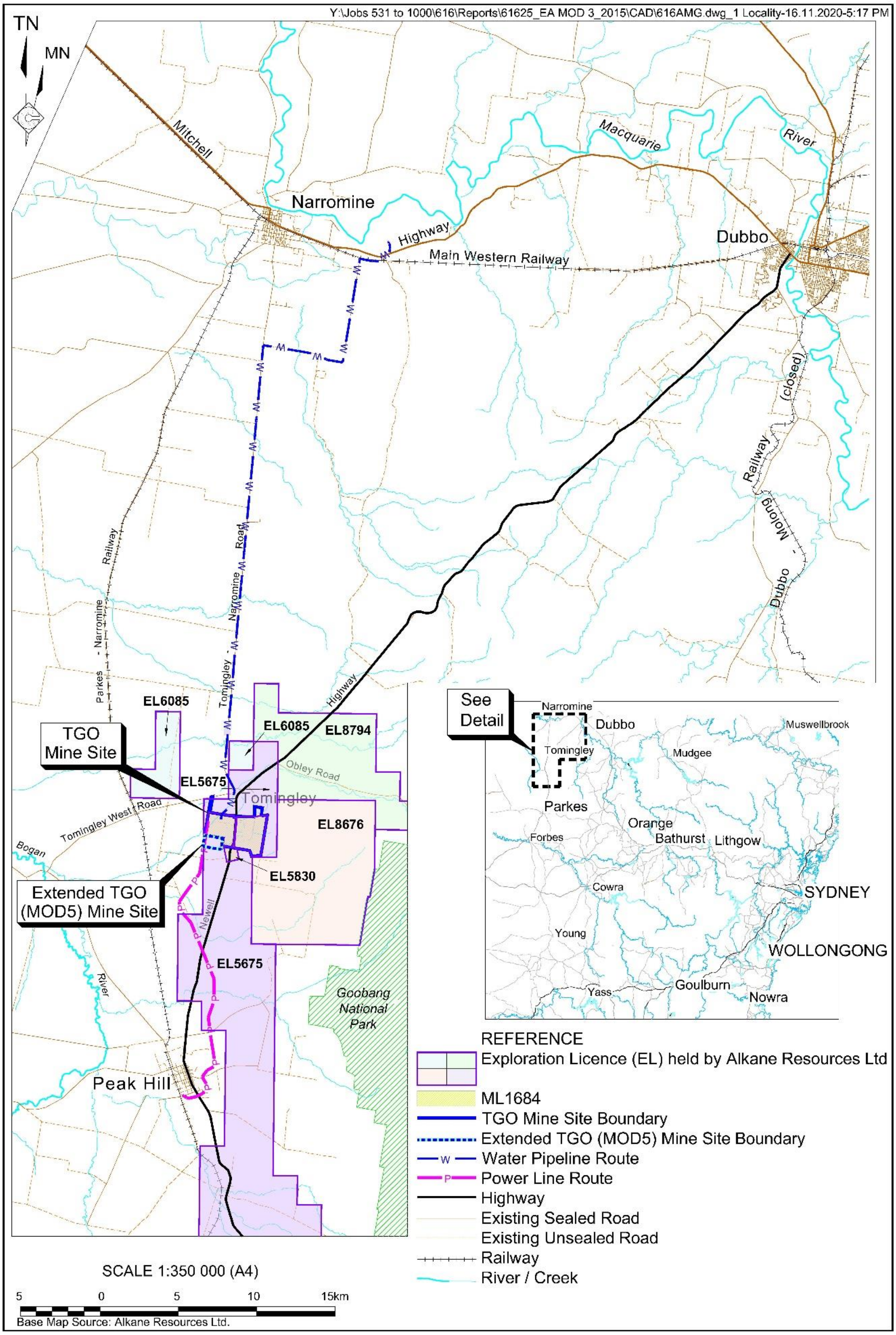
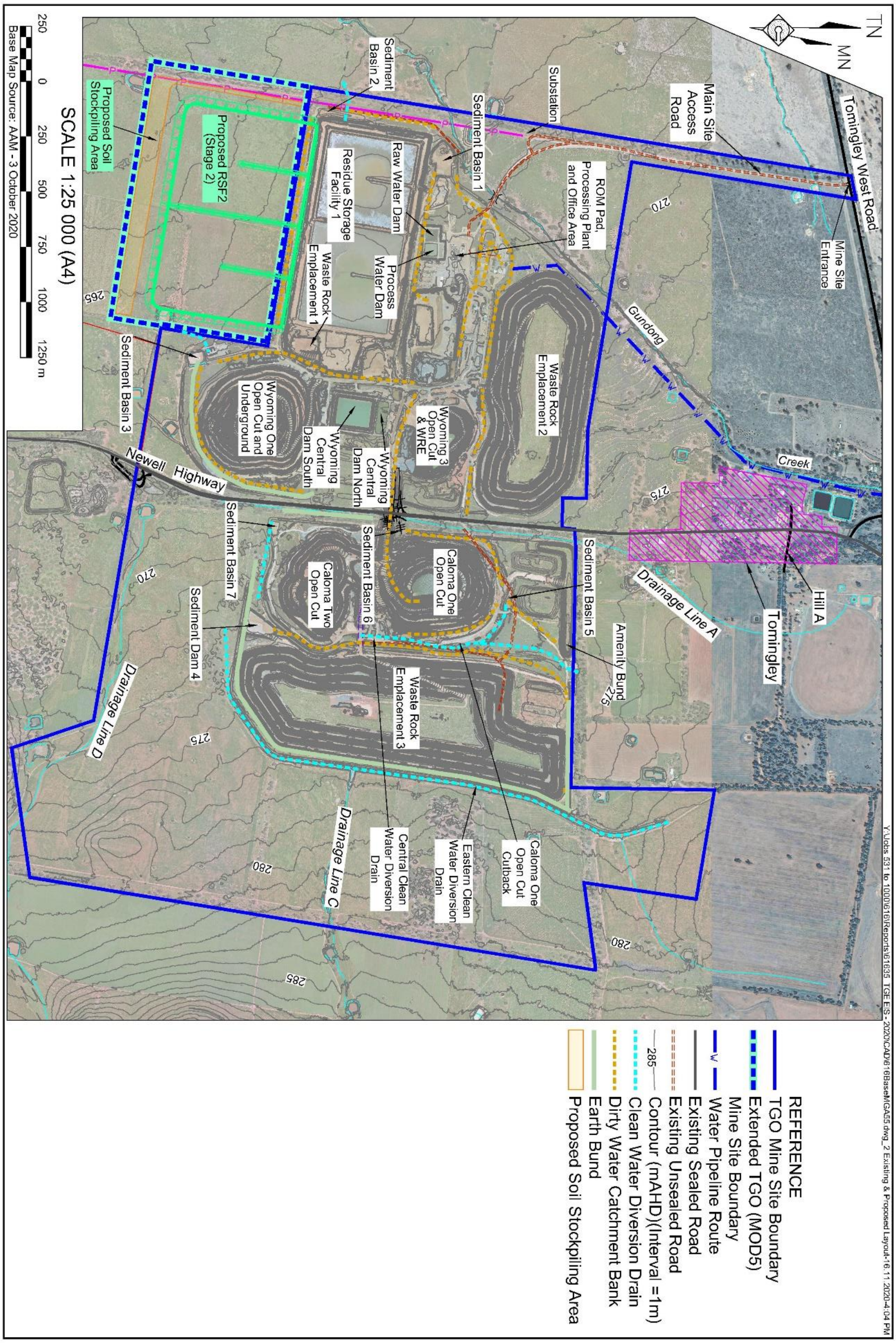


Figure 2 Mine layout



2. LEGISLATION, REGULATION AND GUIDANCE

2.1 NSW EPA Approved Methods

State air quality guidelines adopted by the NSW EPA are published in the *'Approved Methods for the Modelling and Assessment of Air Quality in NSW'* (NSW EPA, 2017) (the Approved Methods) which has been consulted during the preparation of this report.

The criteria listed in the Approved Methods are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], Department of Environment [DoE] (now the Department of Agriculture, Water and the Environment), and World Health Organisation [WHO]).

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW are presented in **Table 1**.

Table 1 NSW EPA air quality standards and goals

Pollutant	Averaging period	Units	Criterion	Notes
Particulates (as PM_{10})	24 hours	$\mu g \cdot m^{-3}$	50	Numerically equivalent to the Ambient Air Quality National Environment Protection Measure (AAQ NEPM)[b] standards and goals.
	1 year	$\mu g \cdot m^{-3}$	25	
Particulates (as $PM_{2.5}$)	24 hours	$\mu g \cdot m^{-3}$	25	
	1 year	$\mu g \cdot m^{-3}$	8	
Particulates (as total suspended particulate [TSP])	1 year	$\mu g \cdot m^{-3}$	90	
Deposited dust	1 year	$g \cdot m^{-2} \cdot month^{-1}$[c]	2	Assessed as insoluble solids as defined by AS 3580.10.1
		$g \cdot m^{-2} \cdot month^{-1}$[d]	4	

Notes: (a): micrograms per cubic metre of air
(b): National Environment Protection (Ambient Air Quality) Measure
(c): Maximum increase in deposited dust level
(d): Maximum total deposited dust level

2.2 NSW Voluntary Land Acquisition and Mitigation Policy

The NSW Government published the "*Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments*" (hereafter, the policy) in September 2018 (NSW Government, 2018). The policy is to be applied by consent authorities when assessing and determining applications for mining, petroleum and extractive industry developments that are subject to State Significant Development provisions of the *Environmental Planning and Assessment Act* 1979.

A number of policies and guidelines include Air Quality Assessment criteria to protect the amenity, health and safety of people, including those outlined in **Section 2.1**. They typically require applicants to implement all reasonable and feasible avoidance and/or mitigation measures to minimise the impacts of a development. In some circumstances however, it may not be possible to comply with these assessment criteria even with the implementation of all reasonable and feasible avoidance and/or mitigation measures. This can occur with large resource projects where the resources are fixed, and there is limited scope for avoiding and/or mitigating impacts. However, as outlined within the policy it is important to recognise that:

- Not all exceedances of the relevant assessment criteria equate to unacceptable impacts.
- Consent authorities may decide that it is in the public interest to allow the development to proceed, even though there would be exceedances of the relevant assessment criteria, because of the broader social and economic benefits of the development.
- Some landowners may be prepared to accept higher impacts on their land, subject to entering into suitable negotiated agreements with applicants, which may include the payment of compensation.

Consequently, the assessment process can lead to a range of possible outcomes.

In the application of the policy, the applicant must demonstrate that all viable alternatives have been considered, and all reasonable and feasible avoidance and mitigation measures have been incorporated into the project design. Should acquisition or mitigation criteria (see **Table 2** and **Table 3**) be exceeded as a result of the project operation then the applicant should consider a negotiated agreement with the affected landowner or acquisition of the affected land. Full details of the negotiated agreement and acquisition process is provided in the policy (NSW Government, 2018).

In relation to air quality, the policy applies specifically to particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition). Applicants are required to assess the impacts of the development in accordance with the Approved Methods guidance (NSW EPA, 2017). Should exceedances of the relevant particulate matter criteria (refer **Table 1**) be predicted, then comparison with the mitigation and acquisition criteria is performed.

2.2.1 Voluntary Mitigation

As outlined in the policy, a consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management, the development contributes to exceedances of the mitigation criteria outlined in **Table 2**.

- At any residence on privately owned land; or
- At any workplace on privately owned land where the consequences of those exceedances in the opinion of the consent authority are unreasonably deleterious to worker health or the carrying out of business at that workplace, including consideration of the following factors:
  - the nature of the workplace;
  - the potential for exposure of workers to elevated levels of particulate matter;
  - the likely period of exposure; and,
  - the health and safety measures already employed in that workplace.

Table 2 Particulate matter mitigation criteria

Pollutant	Averaging period	Units	Criterion	Impact type
Particulates (as $PM_{2.5}$)	Annual	$\mu g \cdot m^{-3}$ (a)	8	Human health
	24 hour	$\mu g \cdot m^{-3}$ (b)	25	Human health
Particulates (as PM_{10})	Annual	$\mu g \cdot m^{-3}$ (a)	25	Human health
	24 hour	$\mu g \cdot m^{-3}$ (b)	50	Human health
Total suspended particulate (as TSP)	Annual	$\mu g \cdot m^{-3}$ (a)	90	Amenity
Deposited dust	Annual	$g \cdot m^{-2} \cdot month^{-1}$ (b)	2	Amenity
		$g \cdot m^{-2} \cdot month^{-1}$ (a)	4	Amenity

Notes: (a): Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources)
(b): Incremental impact (i.e. increase in concentrations due to the development alone), **with zero allowable exceedances of the criteria over the life of the development**

Mitigation measures should be directed towards reducing the potential human health and amenity impacts of the development and must be directly relevant to the mitigation of those impacts.

2.2.2 Voluntary Acquisition

A consent authority should only apply voluntary acquisition rights where, even with the implementation of best practice management, the development is predicted to contribute to exceedances of the acquisition criteria in **Table 3**:

- At any residence on privately owned land; or
- At any workplace on privately owned land where the consequences of those exceedances in the opinion of the consent authority are unreasonably deleterious to worker health or the carrying out of business at that workplace, including consideration of the following factors:
  - the nature of the workplace;
  - the potential for exposure of workers to elevated levels of particulate matter;
  - the likely period of exposure; and

   - the health and safety measures already employed in that workplace.
- On more than 25 % of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls[1].

Table 3 Particulate matter acquisition criteria

Pollutant	Averaging period	Units	Criterion	Impact type
Particulates (as $PM_{2.5}$)	Annual	$\mu g \cdot m^{-3}$ (a)	8	Human health
	24 hour	$\mu g \cdot m^{-3}$ (b)	25	Human health
Particulates (as PM_{10})	Annual	$\mu g \cdot m^{-3}$ (a)	25	Human health
	24 hour	$\mu g \cdot m^{-3}$ (b)	50	Human health
Total suspended particulate (as TSP)	Annual	$\mu g \cdot m^{-3}$ (a)	90	Amenity
Deposited dust	Annual	$g \cdot m^{-2} \cdot month^{-1}$ (b)	2	Amenity
		$g \cdot m^{-2} \cdot month^{-1}$ (a)	4	Amenity

Notes: (a): Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources)
(b): Incremental impact (i.e. increase in concentrations due to the development alone), **with up to five allowable exceedances of the criteria over the life of the development**.

The difference between the voluntary mitigation and voluntary acquisition criteria are the allowable number of exceedances of the incremental short-term (24 hour) particulate matter criteria, and the incremental dust deposition criterion. The voluntary mitigation criteria allow zero exceedances of those air quality criteria over the life of the development, where the voluntary acquisition criteria allow five exceedances over the life of the development. Additionally, the voluntary acquisition criteria are applied not only at residential locations, but over privately owned land where residential properties exist, or could be developed.

2.3 Project Approval Conditions

2.3.1 Air Quality Criteria

Clause 17 of Schedule 3 of the Project Approval conditions, as modified most recently in May 2020, include air quality criteria for the project which are to be achieved at any residence on privately owned land, or on more than 25 % of any privately-owned land.

The project specific air quality criteria are presented in a consistent format with PA 09_0155 in **Table 4**, **Table 5** and **Table 6**. Notes to those tables are presented below **Table 6**.

[1] Voluntary land acquisition rights should not be applied to address particulate matter levels on vacant land other than to vacant land specifically meeting these criteria.

Table 4 Long term impact assessment criteria for particulate matter (PA 09_0155)

Pollutant	Averaging period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a]90 $\mu g \cdot m^{-3}$
Particulate matter < 10 µm (PM_{10})	Annual	[a]30 $\mu g \cdot m^{-3}$

Table 5 Short term impact assessment criteria for particulate matter (PA 09_0155)

Pollutant	Averaging period	[d]Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a]50 $\mu g \cdot m^{-3}$

Table 6 Long term impact assessment criteria for deposited dust (PA 09_0155)

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 $g \cdot m^{-2} \cdot month^{-1}$	[a,d]4 $g \cdot m^{-2} \cdot month^{-1}$

Notes to tables:

a Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources);

b Incremental impact (i.e. incremental increase in concentrations due to the project on its own);

c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2016: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method, or its latest version; and

d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary.

Note that there are discrepancies between the air quality criteria presented in **Section 2.1** (NSW EPA, 2017) and those outlined above (PA 09_0155). Specifically:

- The annual average PM_{10} criterion is numerically different
  - 25 $\mu g \cdot m^{-3}$ (NSW EPA, 2017)
  - 30 $\mu g \cdot m^{-3}$ (PA 09_0155)
- The 24-hour average PM_{10} criterion reference different contributors
  - The criteria are numerically identical although NSW EPA (2017) is a cumulative criterion, where the criterion in PA 09_0155 references incremental impacts
- No $PM_{2.5}$ criteria (annual average or maximum 24-hour) included in PA 09_0155

As part of this AQIA, the air quality criteria as referenced in **Section 2.1** have been adopted as they are up to date, and are more stringent than the criteria applied to the currently approved project.

2.3.2 Operating Conditions

Clause 18 of Schedule 3 of the Project Approval conditions, as modified most recently in May 2020, include requirements associated with operating conditions to minimise air quality impacts:

The Proponent shall:

- *a) implement best management practice, including all reasonable and feasible measures to minimise the off-site odour, fume and dust emissions from the project;*
- *b) regularly assess the predictive meteorological forecasting data and real-time air quality monitoring data to guide the day-to-day planning of mining operations and implementation of both proactive and reactive air quality mitigation measures to ensure compliance with the relevant conditions of this approval;*
- *c) minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events (see Note d [in Section 2.3.1]);*
- *d) monitor and report on compliance with the relevant air quality conditions in this approval; and*
- *e) take all practical measures to minimise dust emissions from the residue storage facility, to the satisfaction of the Secretary.*

2.3.3 Air Quality and Greenhouse Gas Management Plan

Clause 19 of Schedule 3 of the Project Approval conditions, as modified most recently in May 2020, include requirements associated with the preparation and implementation of an Air Quality and Greenhouse Gas Management Plan (AQMP) for the project.

The most recent version of the AQMP was originally prepared in April 2016 and outlines a range of air quality management measures to be implemented during construction and operation of the project, and also includes management measures to be implemented during adverse weather conditions. Of relevance to the Proposed Modification, the following outlines the dust management measures to be adopted during construction activities, which would be adhered to during construction of RSF2 (from section 6.1.1 of the AQMP).

- Disturb only the minimum area necessary
- Shape soil stockpiles and rehabilitate completed sections as soon as practical
- Use water carts to minimise windblown and traffic dust
- Delineate haul roads
- Rehabilitate roads as soon as possible once they are no longer in use
- Limit the development of minor roads
- Monitor weather forecast to assist in planning construction activities
- Include in the project induction the following information:
  - the requirement to keep to designated haul roads and not develop minor roads
  - to notify a supervisor if you observe wind-blown dust
  - to call for the water cart if you see a potential problem.

The AQMP also provides a range of management measures to be adopted during adverse weather conditions, defined in the AQMP as:

> *"during dry conditions, and high wind speeds at the mine, especially when the wind is blowing toward the village (that is when winds are blowing from the south/south-west)".*

Additionally, section 8.1 of the AQMP defines adverse weather as:

> *"Adverse weather in terms of dust impacts relates to hot, dry and gusty / windy conditions and specifically in relation to this project is:*
>
> *- Little or no rainfall forecast and little or no rainfall in past 48 hours; and*
>
> *- High wind speeds (> 30 km/hr) from the south/south-west and towards nearest sensitive receptors."*

The management measures defined in section 6.1.3 of the AQMP to be implemented during adverse weather conditions are:

- Activities capable of generating dust will be curtailed in the higher exposed areas;
- Additional water will be applied to internal roads in use by haul trucks;
- Any other open areas capable of generating dust will be watered by the water truck and potentially with the water truck's water cannon; and
- Activities capable of generating dust will be curtailed or ceased across the Mine.

Preparatory measures that can be put in place for adverse weather include:

- Aim to have surface moist before the on-set of windy conditions. The area of focus should be where significant site work will be taking place for that day;
- Prepare for the instigation of the water cart spraying or sprinkler system during high winds;
- Prepare to cease certain activities or reduce activity level; and
- Schedule maintenance for plant and equipment to reduce dust generating activities.

All periods of curtailed activities will be recorded for inclusion in the Annual Review.

It is noted that, Clause 5(d) of Schedule 5 of the Project Approval conditions requires that the AQMP is updated within three months of any modification to the Project Approval conditions. Hence, although not explicitly included in the above discussion, all relevant sections of the AQMP would be adhered to during construction of RSF2, including (but not limited to) the triggers and corrective actions as required (section 8.3 of the AQMP), and the ongoing implementation of real time dust management (section 8.2 of the AQMP), and that the AQMP would be revised as required, should the Proposed Modification be approved.

3. THE MINE

The following provides a description of the current operations at the Mine and describes the Proposed Modification and potential for impacts on air quality.

3.1 Approved Activities

The Mine is operated under Development Consent PA 09_0155 which was granted in 2012 and has since been modified four times. Approved activities include the following:

- Mining of four open cuts, with underground mining under three of the approved open cuts, namely Wyoming 1, Caloma 1 and Caloma 2 Open Cuts, until 31 December 2022.
- Placement of waste rock into three out-of-pit waste rock emplacements and one in-pit waste rock emplacement, namely the Wyoming 3 Open Cut.
- Construction and use of a carbon-in-leach (CIL) processing plant and associated infrastructure, including a run-of-mine (ROM) pad, crushing, grinding and leaching circuits, workshops, ablution facilities, stores, office area and car parking. The maximum approved rate of processing is 1.5 million tonnes per annum (Mtpa).
- Construction and use of a residue storage facility (RSF1) for the storage of processing residues.
- Construction and use of supporting infrastructure for the Mine.

Construction of the Mine commenced in February 2013 with open cut mining commencing in November 2013. The initial phase of open cut mining was completed in January 2019. During 2019, the Proponent processed previously stockpiled low-grade ore, with the processing plant placed into care and maintenance from between December 2019 and February 2020.

Underground development from a portal in the Wyoming 1 Open Cut commenced in January 2019, with ore production from stopes under the Wyoming 1 Open Cut commencing in December 2019. The Proponent continues to mine underground at Wyoming 1 and is currently developing an underground drive to Caloma 2.

Open cut mining recommenced within the Caloma 1 Open Cut in October 2020 and is expected to continue until September 2022. Processing operations recommenced in February 2020.

Finally, the Proponent commenced construction of Stage 7 of RSF1 in July 2020, with initial residue placement expected in November 2020.

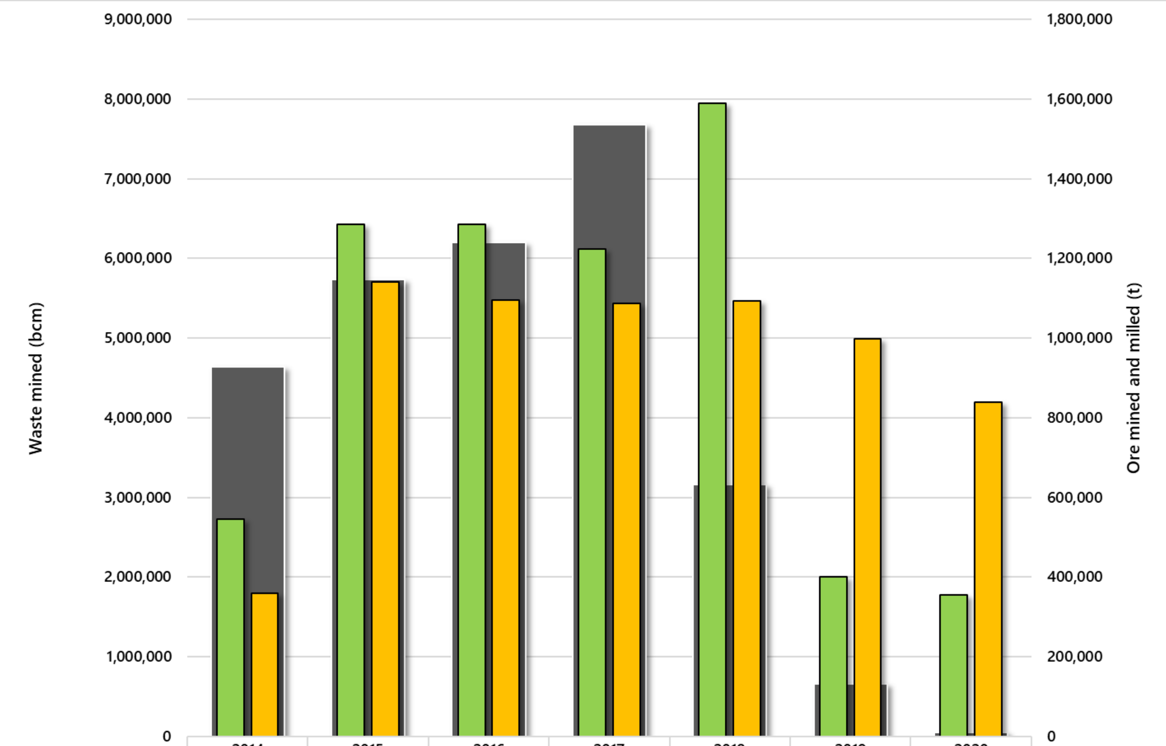
Table 7 presents the publicly available production figures for the Mine for each financial year to June 2020. In summary, approximately 6.61 Mt of ore was processed between the commencement of mining operations and 30 June 2020. The maximum annual rate of processing was 1.14 Mt in 2015, less than the approved maximum rate of processing of 1.5 Mtpa. These data are presented visually in **Figure 3**.

Table 7 Previous production statistics

Production	Units	Financial Year ending 30 June							Total
		2014	2015	2016	2017	2018	2019	2020	
Waste mined	bcm	4 635 684	5 730 661	6 199 820	7 679 110	3 165 414	657 647	50 743	28 118 809
Ore mined	t	545 550	1 286 291	1 285 454	1 222 868	1 589 811	400 187	355 879	6 686 040
Ore milled	t	359 096	1 140 704	1 096 105	1 087 983	1 092 602	998 703	838 743	6 613 936

Notes: bcm: bank cubic metres, t: tonnes

Figure 3 Production data associated with the Mine FY2014 to FY2020



	2014	2015	2016	2017	2018	2019	2020
Waste mined (bcm)	4,635,684	5,730,661	6,199,820	7,679,110	3,165,414	657,647	50,743
Ore mined (t)	545,550	1,286,291	1,285,454	1,222,868	1,589,811	400,187	355,879
Ore milled (t)	359,096	1,140,704	1,096,105	1,087,983	1,092,602	998,703	838,743

3.2 The Proposed Tomingley Gold Extension Project

The Proponent has identified a number of exploration prospects located to the south of the TGO Mine Site. The Proponent has been actively exploring the identified prospects, including in particular the San Antonio and Roswell (SAR) deposits.

Inferred Mineral Resource estimates have been released for the SAR deposits as follows.

- Roswell 7.02 Mt grading 1.97 grams per tonne ($g{\cdot}t^{-1}$) (445 000 ounces [oz])
- San Antonio 7.92 Mt grading 1.78 $g{\cdot}t^{-1}$ (453 000 oz)

Resources drilling is ongoing, with updated resource and reserve estimates to be released once available.

The Proponent anticipates that the proposed operations would include the following. The proposed Tomingley Gold Extension Project does not form a component of this application and the following information is provided for information only.

- A single open cut (the SAR Open Cut) approximately 1.7 km long, 700 m wide and up to 310 m deep, to be mined in stages, indicatively from south to north.
- Underground development under each open cut stage, with a portal located in the initial, southernmost stage of the open cut. Mining operations, both open cut and underground, would be undertaken for a period of up to 10 years.
- Placement of waste rock into the following waste rock emplacements.
  - An in-pit waste rock emplacement within the Caloma 1 and 2 open cuts, with a "cap" of waste rock over the top of the backfilled open cuts.
  - One or two out-of-pit waste rock emplacements located adjacent to the SAR Open Cut.
  - An in-pit waste rock emplacement within the central section of the Open Cut. The northern and southern sections of the SAR Open Cut are not able to be backfilled because mineralisation extends to the south, north and at depth below of the Open Cut.
- Realignment of the Newell Highway, including:
  - reestablishment of the existing overtaking lanes;
  - construction of intersections for Back Tomingley West Road, the realigned Kyalite Road and McNivens Lane; and
  - installation of under road drainage to ensure safe passage of surface water flows.
- Realignment of Kyalite Road, including a grade separated underpass to separate mine and non-mine vehicles. An alternative route for Kyalite Road re-entering the Newell Highway within the Tomingley village is also under investigation.
- Construction and use of the following infrastructure.
  - A haul road from the SAR Open Cut to the TGO Mine Site.
  - Water management infrastructure, including clean water diversions and dirty and mine water containment structures.

- An open cut infrastructure area.
- A magazine and explosives store.
- Realigned infrastructure, including powerlines and communications infrastructure.

In addition, the following modifications would be required within the TGO Mine Site to accommodate the Project.

- Importation of waste rock and backfilling of the Caloma 1 and 2 Open Cuts.
- Importation of ore from the SAR Open Cut for processing using the existing TGO processing plant at a maximum rate of up to 1.5 Mtpa for a period of approximately 10 years, with the resulting residue placed in both the approved RSF1 and the proposed RSF2, including approval of Stages 3 to 9 of RSF2.
- Incorporation of one or more additional water supply bores in the vicinity of the existing water supply pipeline. The bore(s) would be located within Zone 6 of the Lower Macquarie Groundwater aquifer.
- Additional Biodiversity Offset Areas (BOAs) in the form of Stewardship sites would be established across the Proponent's landholding.

The Proponent anticipates that PA 09_0191 would be relinquished following granting of any development consent for the Tomingley Gold Extension Project. The Tomingley Gold Extension Project application is currently in progress, with submission of the application anticipated in 2021. A detailed AQIA would be submitted to support the Tomingley Gold Extension Project.

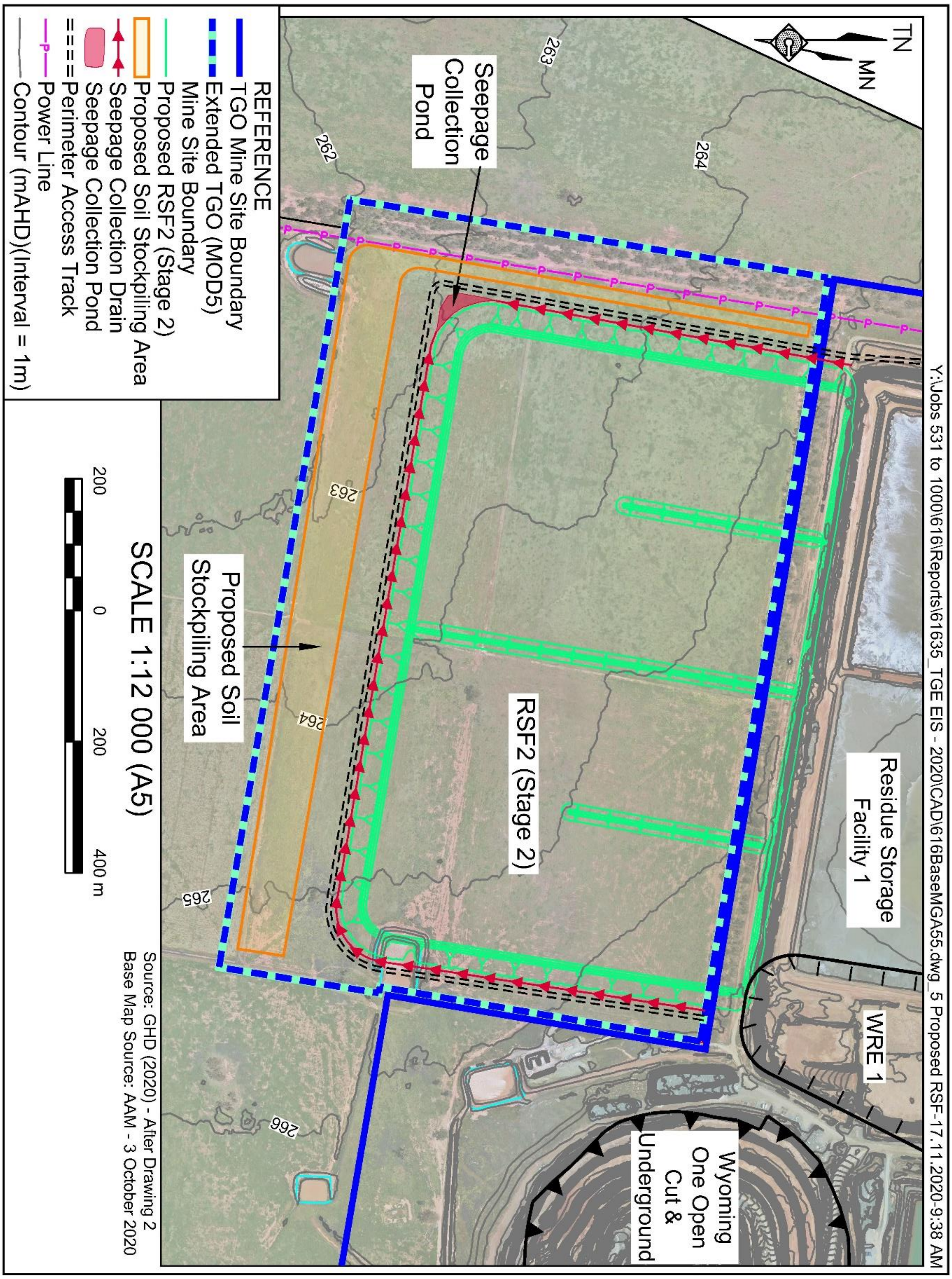
3.3 The Proposed Modification

The Proposed Modification seeks consent for the following. **Figure 4** presents the proposed layout of RSF2 and the extended TGO Mine Site Boundary.

- Construction and use of Stages 1 and 2 of RSF2 (with Stages 3 to 9 being subject to assessment as part of the Extension Project described in **Section 3.2**).
- An extension of Mine Life from 31 December 2022 to 31 December 2025.
- Extension of the Mine Site boundary to incorporate RSF2.

No other changes to the approved Mine are proposed.

Figure 4 Proposed Modification



3.3.1 Construction

RSF2 will be constructed in 2 stages. The initial stage will involve the following:

- Impoundment clearing and grubbing:
  - Clearing and grubbing of the RSF2 footprint of 540 000 m^2 using scrapers and bulldozers.
  - Soil stripping to a depth of 300 mm.
  - Soil stockpiling adjacent to RSF2.
- Embankment foundation clearing and grubbing of an area of 150 000 m^2 using scrapers and bulldozers.
- Embankment foundation trench excavation and backfilling of a volume of 50 720 m^3 using bulldozers (for ripping), scrapers (for replacing material), and vibrating rollers
- Embankment construction using bulldozers and haul trucks.
  - Zone 1 (see design documentation for description) using 133 000 m^3 of sandy clay obtained from the RSF2 footprint.
  - Zone 2 filter using 6 000 m^3 of material required to be transported from offsite or obtained from on-site WRE1.
  - Zone 3 using 228 000 m^3 of material obtained from the RSF2 footprint or on-site WRE1.
- Liner construction (Zone 1) using 540 000 m^3 of sandy clay obtained from the RSF2 footprint using bulldozers (ripping), scrapers (to replace material), and vibrating rollers.

Water carts will be used throughout the RSF2 construction period.

Stage 2 of RSF2 construction will involve less material and fewer items of plant.

It is anticipated that Stage 1 and Stage 2 will each take approximately 6 months to complete, with Stage 2 construction to indicatively commence 2 years after the completion of Stage 1.

Hours of construction will be as per modified PA 09_0155 schedule 3, item 4, reproduced in **Table 8**.

Table 8 Operating hours as per PA 09_0155 Schedule 3

Activity	Averaging period
Vegetation clearing and topsoil stripping	6 am to 6 pm, 7 days a week
Construction	24 hour, 7 days a week
Mining maintenance and processing operations	
Rehabilitation	7 am to 10 pm, 7 days a week

3.3.2 Operation

Emissions of cyanide associated with the storage of processing residues in the RSF have not been considered quantitatively within this AQIA. In submissions to the original AQIA for the Tomingley Gold Project (PAEHolmes, 2011), NSW EPA raised the issue of cyanide emissions from the Tailings Storage Facility (TSF, now termed the RSF). In the Response to Submissions (RWC, 2012), the following discussion was provided, which is also relevant to the Proposed Modification:

> *Whilst the TSF will contain cyanide, as detailed in Section 2.6.3.3 of the Environmental Assessment, in order to ensure protection of fauna, the plant cyanide levels will be managed to reduce concentrations of WAD cyanide in the residue at low concentrations (90th percentile of 20mg/L and maximum of 30mg/L).*
>
> *Cyanide emissions (cyanide gas - HCN) from tailings dams accepting residues at these or even greater concentrations are normally very low to non-detectable. This is due to the fact that most of the cyanide in the residue is weak acid dissociable (WAD), i.e. attached to metals such as zinc, cadmium or copper and only dissociates under acidic conditions. In order to generate cyanide gas (HCN), the cyanide ion CN- must dissociate from the metal ion. Due to the alkaline environment of the tailings slurry (pH 9 to 9.5), the WAD cyanide remains bound to the metals, and generally lodges within the solid material during the evaporation phase of the residue deposit cycle.*
>
> *It is only the dissolved HCN component of the much smaller proportion of free cyanide within the residue (CN- ion or HCN) that has the potential to be released as cyanide vapour. The free cyanide within the liquid residue is vulnerable to UV radiation (broken down to Carbon and Nitrogen by), as is any HCN gas which evaporates from solution. In the pH range of 9 to 9.5, the free cyanide is split approximately 50:50 between the CN- ion and dissolved HCN.*
>
> *Considering the above physical and chemical properties of the discharged residue (low cyanide concentration with the majority to remain bound to metal ions), it is concluded that the available HCN in solution on discharge and within the decant pond will be very low, and likely to be destroyed by UV radiation before it can vaporise. Should any HCN gas be emitted, it will quickly be dispersed by wind and destroyed by UV radiation. Given the large size of the RSF cells, any HCN gas is quickly diluted to undetectable levels.*
>
> *Further advice is provided with respect to the possible accumulation of cyanide within the RSF by the United Nations Environment Program fact sheet on cyanide (ASTDR, 2010):*
>
>> *"Cyanides are not persistent in water or soil. Cyanides may accumulate in bottom sediments, but residues are generally as low as 1 mg/kg even near polluting sources. Majority of accidental release of cyanide is volatilised to the atmosphere where it is quickly diluted and degraded by ultra violet. Other factors, such as biological oxidation, precipitation and the effects of sunlight also contribute to cyanide degradation. There is no evidence of bioaccumulation in the food chain, and hence, secondary poisoning does not occur".*
>
> *As such, there is limited potential for any adverse air quality impacts due to cyanide emissions from the TSF.*

Emissions of cyanide have not been considered within this AQIA.

3.4 Identified Potential for Emissions to Air

The processes which may result in the emission of pollutants to air during RSF2 construction would include:

- Upgrade of access roads;
- Clearing and grubbing of impoundment area and embankment foundation;

- Excavation and backfill of embankment cut-off trench;
- Embankment construction;
- Impoundment liner construction;
- Loading of haul trucks with material at WRE1, haulage and unloading at RSF2;
- Haulage of required material from offsite, and unloading at RSF2;
- Wind erosion of disturbed areas; and,
- Emissions from vehicle and equipment exhaust.

The specific pollutants of interest associated with those activities are:

- Total suspended particulate (TSP);
- Particulate matter with an aerodynamic diameter of 10 microns (PM_{10});
- Particulate matter with an aerodynamic diameter of 2.5 microns ($PM_{2.5}$); and,

Although emissions of NO_X, carbon monoxide (CO) and sulphur dioxide (SO_2) related to diesel combustion in plant and machinery would be experienced, in addition to particulates considered above. Given the quantity of equipment operating on site, it is not anticipated that emissions associated with diesel combustion (other than particulate matter which have been assessed) would be a significant contributor to total site emissions and have not been addressed further.

4. EXISTING CONDITIONS

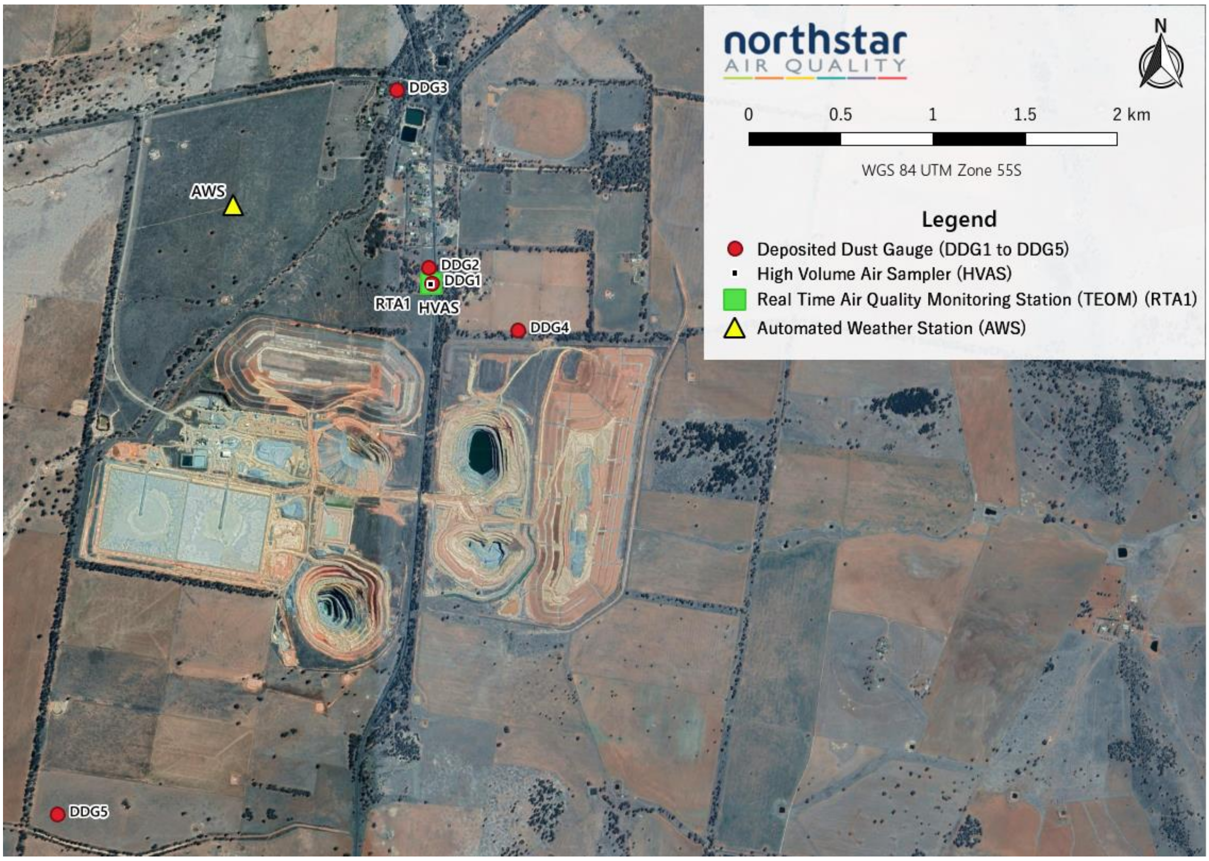
The following sections have been prepared to provide general context and description of the existing conditions around the Mine site, and also provide information used in the focussed modelling assessment to quantify the incremental change associated with the Proposed Modification.

4.1 Air Quality

Air quality parameters (including ambient concentrations of TSP and PM_{10}, and the rate of dust deposition) are measured at the Mine by the Proponent.

A Tapered Element Oscillating Microbalance (TEOM), which continuously measures particulate matter (PM_{10}) has been operated at the Mine since May 2014. Total Suspended Particulate (TSP) is measured by a High Volume Air Sampler (HVAS) at the same location as the TEOM. There are also five dust depositional gauges (DDG) at various locations around the perimeter of the Mine. The site also operates an on-site meteorological monitoring station. The locations of the air quality and meteorological monitoring equipment operated by the Mine are presented in **Figure 5**.

Figure 5 Meteorological and air quality monitoring at the Mine



Typically, air quality studies may also use historical air quality monitoring data generated by other operators, particularly the NSW Department of Planning, Industry & Environment (DPIE). It is noted that the Mine is located at significant distance from any of the air quality monitoring stations (AQMS) operated by DPIE and these data are not used in this study.

A summary of the data collected to date is presented in the following sections.

4.1.1 Air Quality Monitoring - PM_{10}

The results of continuous measurements of PM_{10} collected at the Mine between 13 May 2014 and 30 June 2020 are summarised in **Table 9**.

The annual average PM_{10} concentration as measured within the Mine boundary is presented, as are the number of measured exceedances of the NSW EPA 24-hour PM_{10} criterion of 50 µg·m^{-3}. The annual average calculated without the influence of those exceedances is also presented. Exceedances of the NSW EPA impact assessment criterion are highlighted.

Table 9 Measured annual average and 24-hour PM_{10} concentrations at the Mine

Year	Annual average PM_{10} µg·m^{-3}	Number of exceedances of 24-hour PM_{10} criteria	Annual average PM_{10} µg·m^{-3} less exceedances
2014 (from 13 May)	19.9	10	18.1
2015	20.0	11	18.3
2016	18.2	5	17.7
2017	19.9	5	19.2
2018	26.1	31	20.0
2019	42.5	76	23.5
2020 (to June 30)	65.6	31	16.3

It can be seen from **Table 9** that the measured annual average PM_{10} concentrations significantly increased in 2018 relative to the preceding years, and is a trend which continued in 2019 and also in 2020 (up to June 2020). The number of exceedances of the 24-hour PM_{10} criterion are also shown to increase significantly in those years, a trend which is replicated at many AQMS across NSW due to regional pollution episodes including bushfires and dust storms.

To illustrate this, **Figure 6** and **Figure 7** presents a summary of the concentrations of PM_{10} measured at the Mine, and at the NSW DPIE AQMS at Bathurst (approximately 150 km to the southeast of the Mine) for the years 2014 to 2020. These data indicate that increases in PM_{10} were experienced at both locations over the same time period, indicating a more regional (rather than local) influence.

Figure 6 Trend in PM_{10} at the Mine 2014 to 2020

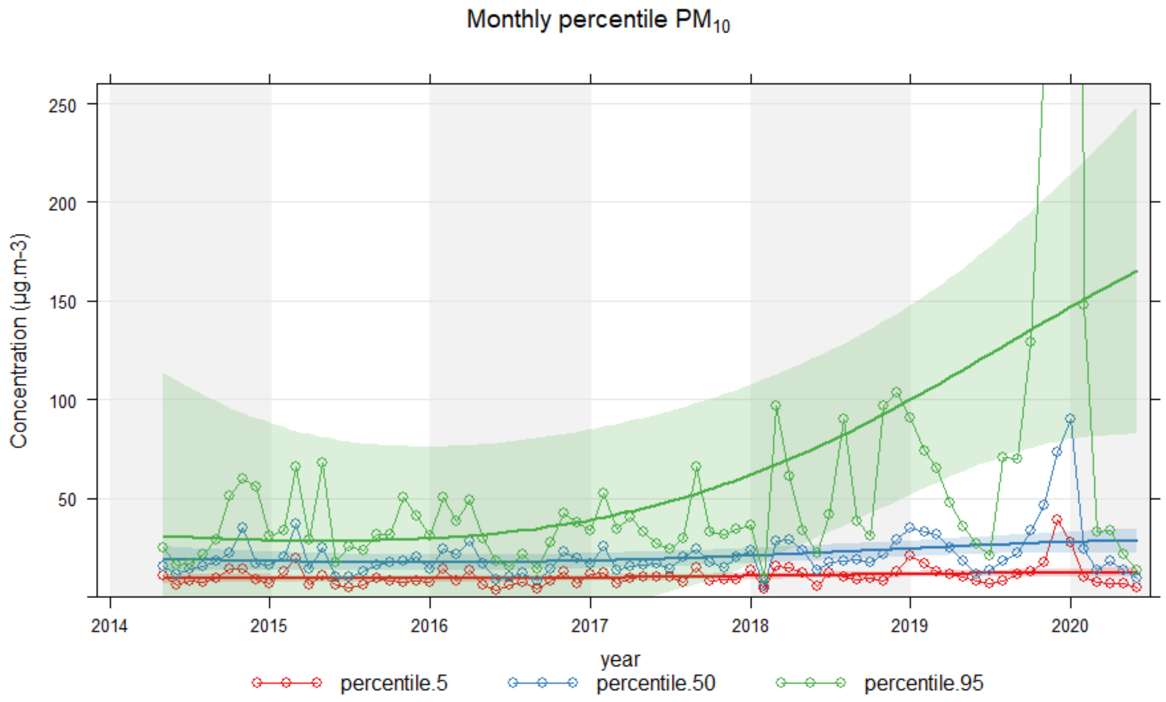
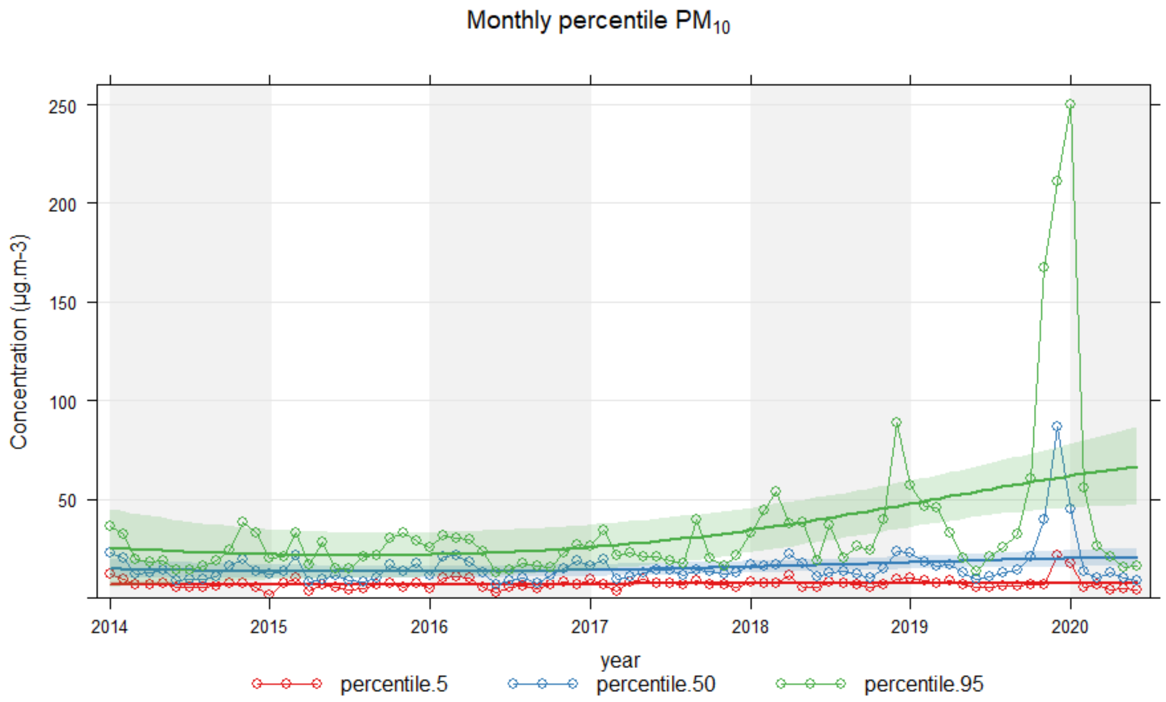


Figure 7 Trend in PM_{10} at Bathurst AQMS 2014 to 2020



It is widely acknowledged and reported that the impacts of drought related dust, hazard reduction burning and/or bushfire, were seen in the monitoring record across NSW in 2018, with impacts associated with the bushfire emergency of 2019/2020 significantly impacting air quality across NSW. The Annual Reviews compiled by the Proponent between 2014 and 2019 provide commentary on the exceedances of the 24-hour PM_{10} criterion as measured at the Mine. These, along with a comment on the exceedances measured in 2020, are presented in **Table 10**.

It is shown that with the exception of one event in 2016, caused by a non-conformance with established procedures, all exceedances of the 24-hour PM_{10} criterion as measured at the Mine can be attributed to non-Mine sources.

Table 10 Measured exceedances of the 24-hour PM_{10} criterion

Year	Number of exceedances of 24-hour PM_{10} criteria	Discussion relating to exceedances
2014	10	Numerous exceedances between October and December due to extended dry period (Tomingley Gold Operations Pty Ltd, 2015).
2015	11	Exceedances in March due to local meteorological conditions. Other exceedances due to regional smoke and dust vents (Tomingley Gold Operations Pty Ltd, 2016).
2016	5	Exceedance on 26 February due to non-conformance with TGO procedures. Other exceedances resulted from local meteorological conditions and non-mining activities (Tomingley Gold Operations Pty Ltd, 2017).
2017	5	Exceedances measured in February due to extreme heat and dry conditions. Other exceedances due to local meteorological conditions (Tomingley Gold Operations Pty Ltd, 2018).
2018	31	All exceedances due to local meteorological conditions and farming activities (Tomingley Gold Operations Pty Ltd, 2019).
2019	76	All exceedances attributed to extraordinary events such as dust storms and bushfires (Tomingley Gold Operations Pty Ltd, 2020).
2020	31	2020 Annual Review not published however, all measured exceedances have been recorded in January and February. These measurements may be associated with the bushfires that were present at this time.

4.1.2 Air Quality Monitoring - TSP

The results of TSP measurements performed at the Mine between 2014 and 30 June 2020 are presented in **Table 11**. These data generally reflect the increasing trend observed in the annual average PM_{10} concentration (see **Section 4.1.1**), with significant increases observed in 2019 and 2020 (up to June 2020). Given the discussion provided above regarding regional particulate events, the influence of the Mine operations on these concentrations cannot be quantified but is likely to be minor. Exceedances of the NSW EPA impact assessment criterion are highlighted.

Table 11 Measured annual average TSP concentrations at the Mine

Year	Annual average TSP $\mu g \cdot m^{-3}$
2014	60.0
2015	49.5
2016	38.6
2017	46.8

Year	Annual average TSP µg·m^{-3}
2018	56.5
2019	94.1
2020 (to June 30)	98.4

4.1.3 Air Quality Monitoring - Deposited Dust

The results of dust deposition monitoring performed at five locations around the Mine between 2014 and 30 June 2020 are presented in **Table 11**. Exceedances of the NSW EPA impact assessment criterion are highlighted.

Table 12 Measured dust deposition

Year	Annual average dust deposition (g·m^{-2}·month^{-1})				
	DDG 1	DDG 2	DDG 3	DDG 4	DDG 5
2014	1.2	1.2	1.2	8.7	1.7
2015	1.5	1.4	1.4	8.0	2.5
2016	1.2	1.0	1.3	1.3	1.1
2017	1.5	1.3	1.2	2.0	1.7
2018	1.9	2.0	1.9	2.1	2.0
2019	3.3	2.3	2.8	4.2	3.3

The measured exceedances of the annual average dust deposition criterion occur at DDG 4 which is located close to the northern Mine site boundary, immediately north of the Caloma One open cut. Refer to **Figure 5** for the location of DDG 4 and **Figure 2** for the locations of mining activities. The location of DDG 4 to mining activities makes it representative of dust deposition rates at that boundary, and highly likely to be prone to influence from heavy particulates that are typically settled from the air within, or close to the boundary. Previous measured rates at DDG 4 are higher than those of more recent years, with the exception of 2019 which is considered to be significantly influenced by the 2019/2020 regional bushfires, which can be seen as higher dust deposition rates at all DDG locations

Whilst it is useful to quantify the rate of dust deposition along the boundary, DDG4 is less likely to be representative of background conditions experienced beyond the boundary and at surrounding receptor locations. DDG 1 and DDG 2 are considered to be more representative of dust deposition rates at Tomingley, and the prevailing dust deposition rates are typically less than 2 g·m^{-2}·month^{-1}, with the exception of 2019 (as discussed above).

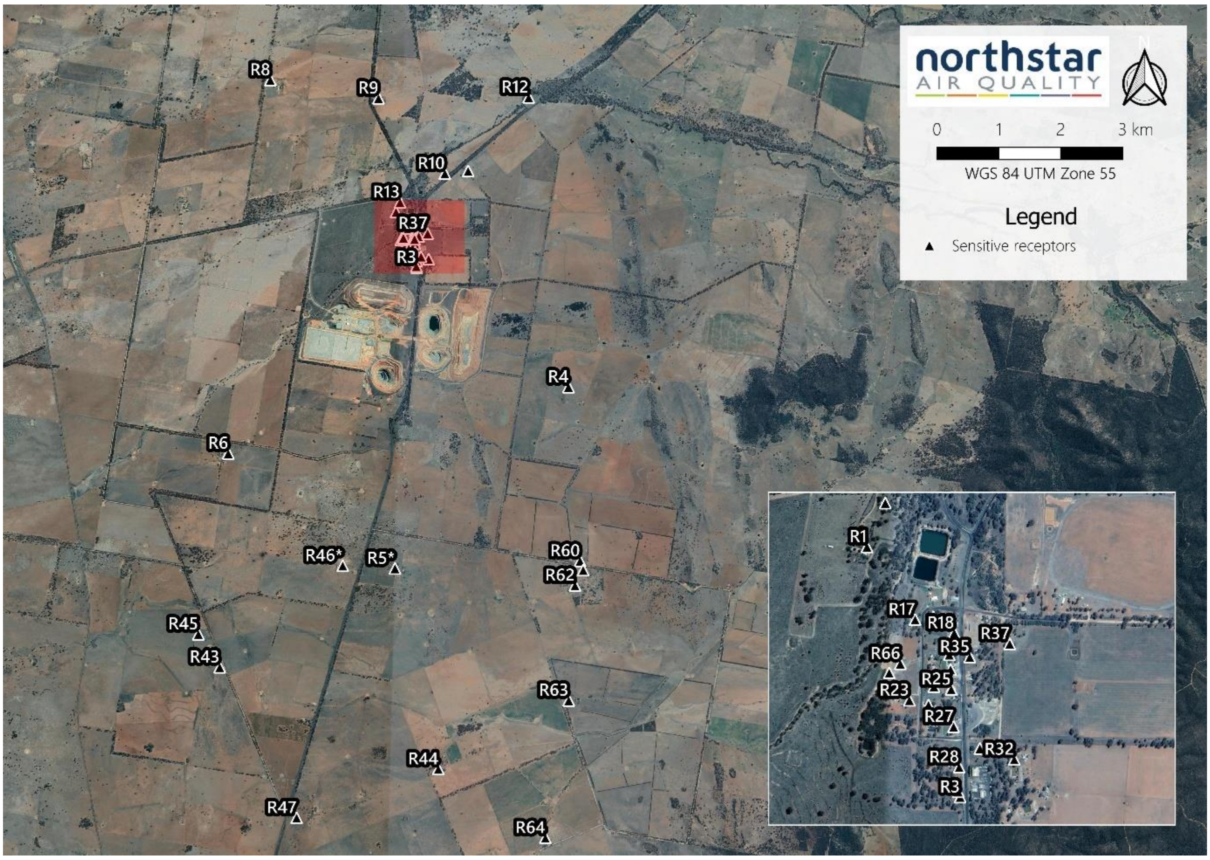
DDG 5 is located less proximate to the on-site mining activities (refer to **Figure 2** and **Figure 5**), and may be considered to be more representative of general background conditions surrounding the Mine site, particularly at receptors to the south of the mining activities. Excluding 2019, the measured dust deposition rates are less than 2.5 $g \cdot m^{-2} \cdot month^{-1}$ (at worst).

4.2 Surrounding Land Sensitivity

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

For consistency, this assessment has adopted the entire set of sensitive receptor locations as (PAEHolmes, 2011) (PEL, 2015) (PEL, 2016) and (ERM, 2020) (see **Section 5**). Those locations are presented in **Figure 8** and **Appendix B**. Note that receptors 5 and 46 are project related. Of note, receptor R6 is currently located approximately 1.8 km from the Mine boundary and should the Proposed Modification gain approval, would be located approximately 1.4 km from the updated boundary, and from RSF2.

Figure 8 Sensitive receptors surrounding the Mine

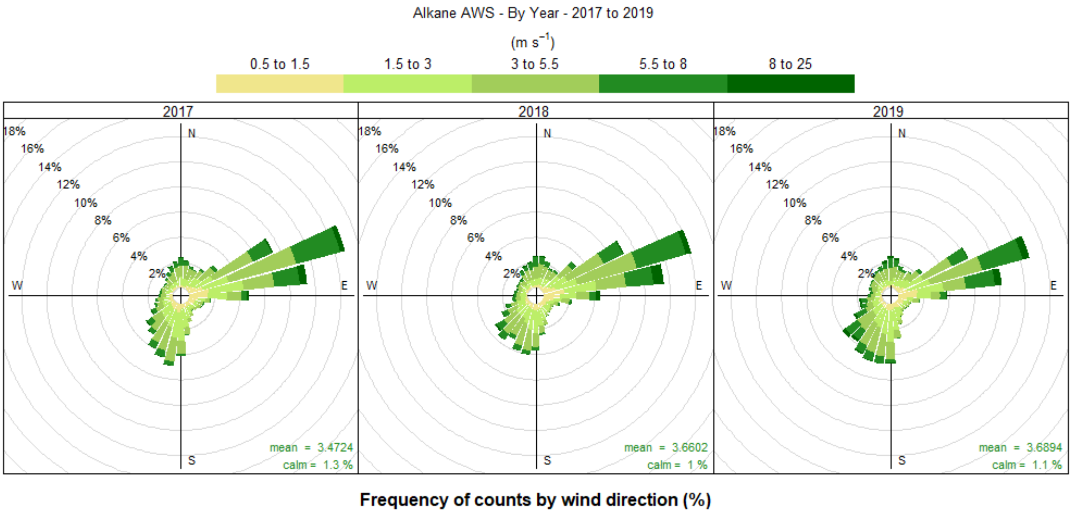


4.3 Meteorology

As previously discussed, meteorological parameters are measured at the Mine. Annual wind roses for the period 2017 to 2019 as measured at the Mine, are presented in **Figure 9**.

Further discussion regarding the observed meteorology, meteorology adopted in previous AQIA for the Mine, and that adopted in the focussed quantitative assessment presented within this report, is provided in **Section 5**, **Section 6.2** and **Section 6.4.1**.

Figure 9 Alkane AWS wind-roses (2017-2019)

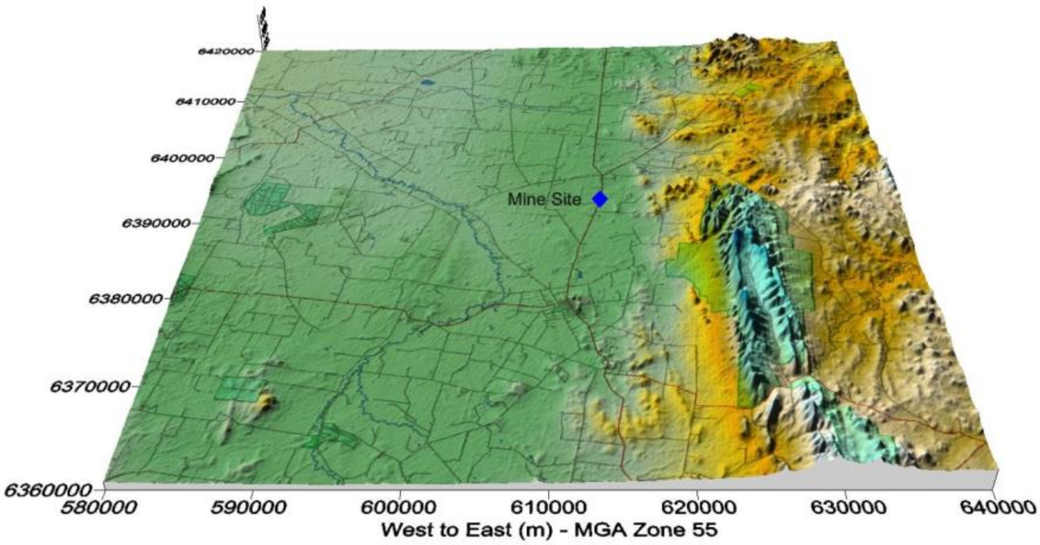


4.4 Topography

The elevation of the Mine site is between approximately 260 m and 270 m Australian Height Datum (AHD). The Mine is located within the catchment of the Bogan River. The Project is located west of the Herveys Range on the western slopes of the Great Diving Range. The highest point of the range is a number of unnamed peaks located to the east of Peak Hill, approximately 15 km to the southeast of the Mine Site, with elevations up to 775 AHD. The topography of the area, and the locations of surrounding receptors in relation to the Mine and surrounding topography was provided in (PAEHolmes, 2011) and is replicated in **Figure 10**.

Topography has been considered in the generation of the meteorological file used in modelling (refer **Section 6.4.1**).

Figure 10 Topography surrounding the Mine site



Source: (PAEHolmes, 2011)

5. PREVIOUS ASSESSMENTS OF AIR QUALITY

5.1 Tomingley Gold Project

An AQIA was performed to support the original EIS for the Tomingley Gold Project in 2011 (PAEHolmes, 2011). The AQIA quantified emissions associated with drilling, blasting, loading and hauling of waste rock and ore, emissions from processing activities, and wind erosion sources during three scenarios representative of operations at the end of year 1, 2 and 4. Dispersion modelling of those emissions was used to assess the impact that might arise from the project operations on a number of surrounding sensitive receptor locations, both with and without the effects of background air quality included.

The assessment criteria adopted for the project were those outlined in **Section 2.1**, although at that time, the annual average impact assessment criteria for PM_{10} was 30 µg·m^{-3}, and $PM_{2.5}$ criteria were not adopted in NSW.

PAEHolmes (2011) concluded that the annual average TSP, PM_{10} and deposited dust criteria were achieved in all modelled scenarios. A summary of the maximum incremental and cumulative impacts predicted in each of the three scenarios is presented in **Table 13**.

Table 13 Predicted incremental and cumulative annual average particulate (PAEHolmes, 2011)

Scenario	Annual average TSP µg·m^{-3}		Annual average PM_{10} µg·m^{-3}		Annual average dust deposition g·m^{-2}·month^{-1}	
	Maximum incremental	Maximum cumulative	Maximum incremental	Maximum cumulative	Maximum incremental	Maximum cumulative
Scenario 2 (Year 1)	6.0	57.0	5.0	25.0	0.2	2.2
Scenario 3 (Year 2)	6.0	57.0	5.0	25.0	0.2	2.2
Scenario 4 (Year 4)	4.0	55.0	3.0	23.0	0.3	2.3
Criterion	**90.0**		**30.0 (25.0)**		**4.0**	

Note: The criterion for annual average PM_{10} is presented as that applicable in 2011 (30 µg·m^{-3}), and presently (2020) (25 µg·m^{-3})

In relation to predicted maximum 24-hour PM_{10} impacts, PAEHolmes (2011) concluded that although the cumulative impact assessment criterion was exceeded at several receptor locations, the likelihood of these exceedances eventuating during any scenario modelled was low. This conclusion was reached through an assessment of the potential for the coincidence of background and incremental concentrations to result in exceedances of the relevant air quality criterion. Validation of modelled PM_{10} concentrations using measured data is not straightforward, as the cumulative impacts are generally driven by background concentrations which can be highly variable. Validation of modelled data is best performed through analysis of annual average concentrations.

A comparison of the modelling results presented in the original AQIA and those measured on-site is presented in **Section 6.1**.

5.2 Modification 3 to PA 09_1055

PA 09_0155 was modified in November 2013 (MOD1) and in April 2015 (MOD2), which were considered not to materially impact upon air quality over and above that assessed in the original AQIA (PAEHolmes, 2011). A further modification application (MOD3) was submitted in November 2015 (PEL, 2015) which sought consent for the following:

- An additional cutback of the Caloma (Cal1) Open Cut;
- Establishment of the Caloma Two (Cal2) Open Cut;
- Construction of an alternative decline from the Cal1 Open Cut;
- Mining of additional underground resources below the Cal1 and Cal2 Open Cuts;
- Extension of Waste Rock Emplacement (WRE) 3;
- Backfill of the Wyoming Three (Wyo3) Open Cut with waste rock;
- Modifications to the Central Drainage Channel which diverts clean water runoff from the north through the Mine Site; and
- Minor modifications to soil management.

PEL (2015) quantified the additional emissions of TSP which would be anticipated should the above activities be approved. Emissions of TSP associated with MOD3 were calculated to increase by 10.9 % above those associated with Scenario 3 (Year 2) (see **Section 5.1**). It was concluded that an increase in TSP emissions of less than 20% would "*have a negligible impact on ground level particulate concentrations recorded at the assessed sensitive receptors*" (PEL, 2015). Furthermore PEL (2015) concluded that "*…it is anticipated that the air quality impacts resulting from MOD3 will be similar to those predicted in the original AQA*".

NSW EPA provided comments on the assessment and requested further information, including:

- a description of the temporal and spatial impacts of the proposed modification;
- a description of the on-site monitoring data and how it compared with predictions in the original AQIA (PAEHolmes, 2011); and

- details of additional management and mitigation measures to be implemented if required to ensure compliance with NSW EPA impact assessment criteria for particulates.

The additional information was provided in a Response to Submissions (PEL, 2016) which concluded that:

- activities associated with MOD3 would not be moving closer to receptors;
- the meteorological data used in the original AQIA included the more dominant wind conditions experienced at the site, as determined through on-site monitoring and was therefore representative;
- the annual average PM_{10} concentrations measured at the on-site PM_{10} monitor were close to those predicted in the original AQIA; and
- based on the annual average predictions, the model adopted as part of the original AQIA was considered to have performed well.

Modification 3 was approved in July 2016.

5.3 Tomingley Exploration Review of Environmental Factors

In March 2020, an air quality assessment was performed to support a Review of Environmental Factors (REF) associated with exploration activities related to the SAR deposits. ERM (2020) performed a discrete dispersion modelling exercise to quantify likely particulate matter impacts at surrounding receptors, associated with emissions from one ventilation shaft located to the south of the Mine.

Incremental impacts associated with emissions from the ventilation shaft were predicted to be minor, with annual average concentrations of TSP <0.2 $\mu g{\cdot}m^{-3}$, PM_{10} <0.1 $\mu g{\cdot}m^{-3}$, and $PM_{2.5}$ <0.1 $\mu g{\cdot}m^{-3}$, at all surrounding sensitive receptor locations. Annual average dust deposition was also predicted to be minor with deposition rates of <0.1 $g{\cdot}m^{-2}{\cdot}month^{-1}$ predicted.

Incremental maximum 24-hour PM_{10} and $PM_{2.5}$ concentrations were also predicted to be minor at all non-project related receptors, with increments being <1.6 $\mu g{\cdot}m^{-3}$, and <0.7 $\mu g{\cdot}m^{-3}$, respectively.

ERM (2020) concluded:

> ***"The results indicate that there are no sensitive receptors predicted to experience annual average PM concentrations or dust deposition rates above the relevant impact assessment criteria, either due to the Project alone or when including background concentrations.***
>
> ***When a contemporaneous assessment of 24-hour average PM_{10} is completed, combining background data with predicted project increment, one additional day of exceedance is observed at receptor R46. However, it is noted that receptor 46 is considered to be project-related.***
>
> ***Maximum predicted cumulative 24-hour average $PM_{2.5}$ concentrations are not predicted to exceed the EPA impact assessment criterion at any of the receptor locations.***
>
> ***Overall, this quantitative air quality assessment concludes that the operation of the proposed ventilation outlet is not anticipated to result in adverse air quality impacts under normal operating conditions."***

6. AIR QUALITY ASSESSMENT

This AQIA to support the Proposed Modification has been performed to demonstrate:

- that the results of the original AQIA compare well with air quality monitoring data collected at the Mine and those modelling results can be used as a reasonable basis for further assessment
- that the meteorological data adopted to support the original AQIA compare well with monitoring data collected at the Mine and the modelling performed is appropriate
- that the incremental change in emissions anticipated as a result of the Proposed Modification would not materially change the conclusions of the original AQIA
- that the spatial change in emissions sources associated with the Proposed Modification would not materially change the conclusions of the original AQIA

Issues previously raised by NSW EPA, upon review of the AQIA for MOD3, have been addressed where required as part of this AQIA.

6.1 Comparison of Model Results and Monitoring Data

As outlined in (PEL, 2016), the assessment of dispersion model performance is best achieved through the comparison of measured and predicted annual average concentrations rather than shorter term (24-hour) concentrations, which can be highly influenced by regional particulate events, limitations of dispersion modelling and the influence of short-term meteorological conditions and/or short-term activities being undertaken at the Mine site.

Discussion of annual average impacts is limited to the years 2014 to 2017, given that years 2018, 2019 and 2020 were highly impacted by regional drought and bushfire emergency events, which skew the annual average data (see also **Section 4.1**).

The original AQIA (see **Section 5.1**) predicted annual average TSP and PM_{10} concentrations and dust deposition rates as presented in **Table 13**. Measured ambient concentrations and deposition rates are presented in **Table 9**, **Table 11**, and **Table 12**. A distillation of those data is presented in **Table 14**, which shows that the modelled predictions compare well with measured concentrations. It is also noted that the air quality monitoring equipment is located in closer proximity to the Mine than any of the sensitive receptors, and therefore the concentrations of particulate experienced at the sensitive receptor locations would be lower than that presented in **Table 14**.

It can therefore be concluded that the modelling performed in 2011 is suitable to be used as a basis for further assessment.

Table 14 Comparison of modelled and measured impacts

Parameter		Scenario		
		Scenario 2 (Year 1)	Scenario 3 (Year 3)	Scenario 4 (Year 4)
Annual average TSP µg·m^{-3}	Modelled maximum increment	6	6	4
	Modelled maximum cumulative	57	57	55
	Measured (cumulative)	38.6 to 60.0		
	Criterion	90		
Annual average PM_{10} µg·m^{-3}	Modelled maximum increment	5	5	3
	Modelled maximum cumulative	25	25	23
	Measured (cumulative)	18.2 to 20.0		
	Criterion	25		
Annual average dust deposition g·m^{-2}·month^{-1}	Modelled maximum increment	0.2	0.2	0.3
	Modelled maximum cumulative	2.2	2.2	2.3
	Measured (cumulative)	1.0 to 2.5		
	Criterion	4.0		

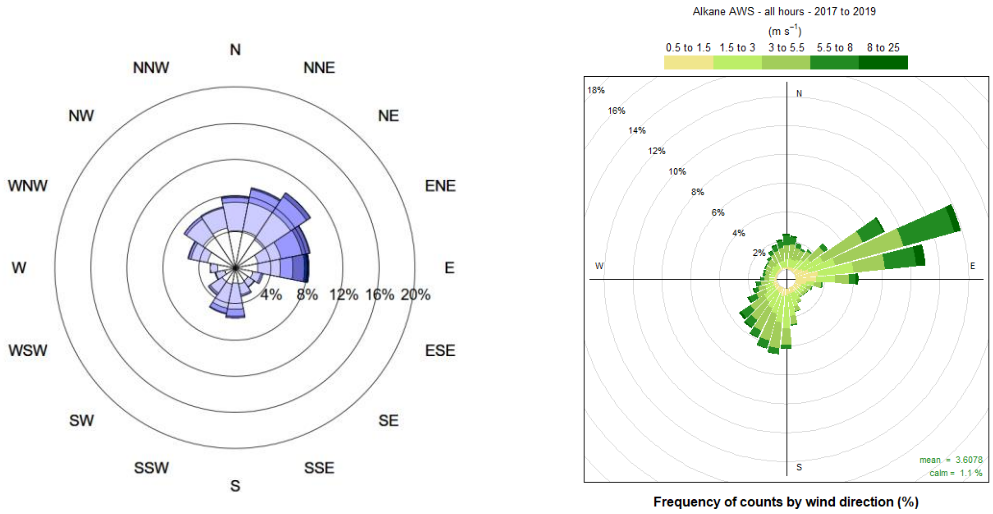
6.2 Comparison of Meteorological Data

As outlined in (PEL, 2016), the dispersion modelling for the original AQIA used 2003 meteorological data from the Peak Hill station (located approximately 15 km south of the Mine), integrated with site specific, synthetic meteorological data for the Tomingley site using TAPM. Since the performance of the original AQIA, on-site observations of meteorology have been collected by the Proponent. A comparison of the annual wind rose of data adopted in the original AQIA, and that collected at the Mine for the period 2017 to 2019 is presented in **Figure 11**.

As identified in (PEL, 2016), the meteorological data used in the original AQIA includes a much larger spread of winds from the entire north eastern sector as compared to site observations which show a larger influence of winds from the east northeast. This would act to transport particulate away from the receptors to the north of the Mine, and towards the more sparsely populated area to the west of the Mine. Winds from the south are shown to be well characterised in the meteorological data adopted in the original AQIA.

A caveat to the above is provided, as winds from the east northeast will act to transport particulate from the Mine towards receptor R6. This receptor is located to the southwest of the Mine and would be closer to site operations (i.e. RSF2) should the Proposed Modification be approved. Therefore, a level of quantitative assessment is warranted to characterise potential impacts at that location.

Figure 11 Comparison of modelled meteorology (PAEHolmes, 2011) and site observations



The following sections provide both a qualitative and quantitative assessment of the potential change in impacts which might be experienced at surrounding receptor locations, adopting site specific meteorological conditions, and a change in the location of emissions sources associated with the Proposed Modification.

6.3 Assessment of Incremental Change in Emissions

The MOD3 AQIA (PEL, 2015), (PEL, 2016) presented the likely incremental change in TSP emissions and provided a qualitative statement as to the potential for a material change in the conclusions of the original AQIA (PAEHolmes, 2011) to be experienced.

For consistency and to facilitate cross-study comparisons, potential emissions associated with RSF2 construction have been calculated adopting the same emission factors as those adopted in the original AQIA. These factors are still current, and are consistent with those adopted for other similar operations. Northstar has reviewed the factors adopted and considers them to be appropriate for further use within this current AQIA. A summary of the data adopted in the assessment is presented in **Table 15**.

Also included in the calculation of emissions are the emission controls as adopted within the original AQIA (PAEHolmes, 2011). These include the use of water carts on unpaved roads (75 % control), and the use of water carts during material scraper and bulldozing activities (50 % control). Once again, these factors have been reviewed by Northstar and they are considered to be suitable for use in this assessment.

The air quality management measures as outlined in **Section 2.3.3** would also be implemented during construction of the Proposed Modification. These include the modification of activities during adverse weather conditions (as defined in the AQMP (refer **Section 2.3.3**).

Table 15 Activity data associated with the Proposed Modification

Activity	Activity rate	Notes
Impoundment and embankment clearing and grubbing (scraper)	331 200 t	Scraper working on 540 000 m^2 to 300 mm depth (impoundment area) 150 000 m^2 to 300 mm depth (embankment area) Assumed soil density 1.6 $t{\cdot}m^3$
Impoundment and embankment clearing and grubbing (dozer)	360 hr	Assumed 1 month at 12 hrs per day operating at 75% efficiency
Trench excavation and backfill	162 304 t	Assumed 50 720 m^3 excavated and then backfilled Assumed soil density 1.6 $t{\cdot}m^3$
Embankment construction (Zone 1)	360 hr	Assumed 1 month at 12 hrs per day operating at 75% efficiency
Embankment construction (Zone 2)	360 hr	Assumed 1 month at 12 hrs per day operating at 75% efficiency
Embankment construction (Zone 3)	360 hr	Assumed 1 month at 12 hrs per day operating at 75% efficiency
Transport of material from WRE1	17 505 VKT	Assumed all required material required for Zone 3 and Zone 2 Filter from WRE1 234 000 m^3 (228 000 m^3 Zone 3, 6 000 m^3 Zone 2 Filter) Assumed material density 2.0 $t{\cdot}m^3$ Total 468 000 t in 90.9 t loads (5 148 one-way trips) 1.7 km one-way distance
Loading of material at WRE1	468 000 t	See above
Unloading of material at RSF2	468 000 t	See above
Wind erosion	54 ha	See above
Construction period	6 months	For Stage 1. Stage 2 assumed to occur in a different 12-month period and require less material movements and equipment.

Table 16 replicates the calculated TSP emissions information from (PAEHolmes, 2011), (PEL, 2015) and (PEL, 2016), with an additional column of data including the potential change in emissions associated with the Proposed Modification. It is demonstrated that the anticipated increase in annual TSP emissions associated with the Proposed Modification when compared to the original AQIA (Scenario 3, Year 3) is approximately 12.3 %. Based on the discussion provided in (PEL, 2015) and (PEL, 2016), incremental change in TSP emissions below 20 % is unlikely to result in a material change to the conclusions of the original AQIA.

Table 16 Comparison of TSP emissions

Activity	TSP Emissions (kg·yr^{-1})		
	Original AQIA	MOD 3	MOD 5
Waste - Drilling	66 050	37 170	37 170
Waste - Blasting	15 775	20	20
Waste - Excavator loading Waste to haul truck	3 977	1 649	1 649
Waste - Hauling from Caloma 1 OC to WRE3	69 137	22 745	22 745
Waste - Hauling from Wyoming 1 OC to WRE1	4 749	6 203	6 203
Waste - Hauling from Wyoming 3 OC to WRE2	15 922	310	310
Waste - Hauling from Caloma 2 OC to WRE3		5 686	5 686
Waste - Emplacing at WRE3	1 790	589	589
Waste - Emplacing at WRE1	676	883	883
Waste - Emplacing at WRE2	1 511	29	29
Waste- Emplacing at WRE3		147	147
Waste- Dozers on Waste	36 640	24 131	24 131
ORE- Drilling	928	700	700
ORE- Blasting	589		-
ORE - Dozers ripping/pushing/clean-up	109 963	282 439	282 439
ORE - Excavators/FELs loading open pit ore to trucks	106 550	105 955	105 955
ORE - Hauling open pit ore from Caloma 1 to ROM pad	12 352	9 748	9 748
ORE - Hauling open pit ore from Wyoming 1 to ROM pad	6 575	20 604	20 604
ORE- Hauling open pit ore from Wyoming 3 to ROM pad	5 689	266	266
ORE- Hauling open pit ore from Caloma 2 to ROM pad		2 437	2 437
ORE - Unloading ROM to ROM stockpiles	355	353	353
ORE- FEL unloading ROM from stockpiles to ROM bin	355	353	353
ORE- Primary Crushing	24 135	24 000	24 000
ORE - Conveying to Screen Building	46	46	46
ORE - Unloading ore from conveyor to Screen Building	355	353	353
ORE - Screening	1 508	1 500	1 500
ORE - Conveying oversized material to Crushing Building	46	46	46
ORE - Unloading oversized ore from conveyor to Crushing Building	101	101	101
ORE - Secondary Crushing	68 784	68 400	68 400
ORE - Conveying oversized material to Screen Building	46	46	46

Activity	TSP Emissions (kg·yr^{-1})		
	Original AQIA	MOD 3	MOD 5
ORE - Conveying undersized material to Surge Bin	27	27	27
ORE - Unloading undersized ore from conveyor to Surge Bin	5	5	5
ORE - Conveying undersized material from Surge Bin to ball mill	44	44	44
ORE - Unloading undersized ore from conveyor to ball mill	18	18	18
REHAB - Dozers on rehab	3 861	3 861	3 861
WE - Waste dump areas	223 730	230 901	230 901
WE - Residue Storage	51 824	51 824	51 824
WE - Open pit	198 677	225 663	225 663
WE - ROM stockpiles	1 402	27 349	27 349
Grading roads	86 264	86 264	86 264
Stage 1 RSF2 Construction (6 months) (A)	-	-	29 961
Total	**1 120 456**	**1 242 865**	**1 272 827**
Change (%) from original	**-**	**10.9**	**12.3**

Note: (A) Stage 1 construction assessed given that emissions would be greater than in Stage 2. Stage 1 and Stage 2 construction not anticipated to occur in the same calendar year and not concurrently.

It is noted that the location of emissions sources is proposed to change as a result of the Proposed Modification, and the additional emissions would be closer to a number of receptors to the south of the Mine. A focussed quantitative assessment has therefore been performed to assess the potential impacts at all surrounding receptors.

6.4 Assessment of Spatial Change in Emissions

Upon review of the AQIA presented to support MOD3 (PEL, 2015), (PEL, 2016), NSW EPA questioned whether that modification would result in any spatial changes in emissions. Although MOD3 did not result in any spatial change in emissions, the Proposed Modification presented within this assessment does.

In summary, the proposed RSF2 would be located to the south of the existing RSF1, require a change in the Mine boundary, and be located closer to receptors to the south. The closest receptor (R6) is currently located approximately 1.8 km to the southwest of the Mine site. Should the Proposed Modification gain approval, this distance would be reduced to approximately 1.4 km.

Given that activities associated with the Proposed Modification would be closer to certain receptors, a focussed dispersion modelling exercise has been performed to quantify any potential impacts.

6.4.1 Meteorological Modelling

Site representative meteorological data was generated using the CALMET meteorological model in a format suitable for use in the CALPUFF dispersion model.

In this study, CALMET has been run in no-observations (no-obs) mode using gridded prognostic data generated by The Air Pollution Model (TAPM, v 4.0.5), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The parameters used in TAPM and CALMET modelling are presented in **Table 17**. The year 2017 was adopted as it was shown to be representative of the period of available measurements, and was also selected when considering particulate matter distributions (as part of the AQIA for the TGE Project [to be submitted]).

Table 17 Meteorological parameters adopted

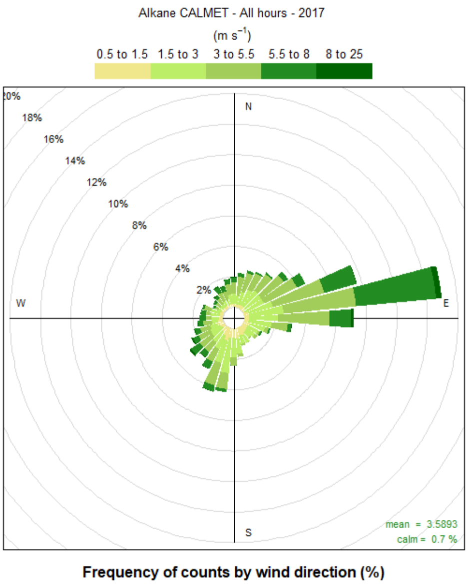
TAPM v 4.0.5	
Modelling period	1 January 2017 to 31 December 2017
Centre of analysis	614 191 mE, 6 394 250 mN (UTM Coordinates)
Number of grid points	25 × 25 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	-
CALMET	
Modelling period	1 January 2017 to 31 December 2017
South-West corner of analysis	604 500 mS, 6 383 000 mN (UTM Coordinates)
Meteorological grid domain (resolution)	20 km × 20 km (0.2 km)
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data assimilation	No-obs approach using TAPM – 3D.DAT file

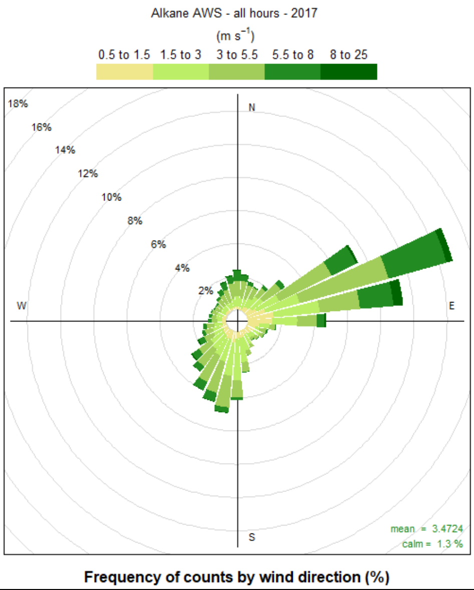
A comparison of the CALMET generated meteorological data, and that observed at the on-site AWS is presented in **Figure 12**.

These data generally compare well which provides confidence that the meteorological conditions modelled as part of this assessment are appropriate.

Figure 12 Modelled and observed meteorological data – 2017

CALMET generated windrose	Observational data





6.4.2 Emissions

The calculated emissions (TSP, PM_{10} and $PM_{2.5}$) associated with the Proposed Modification (see **Section 6.3**) have been modelled as an area source, covering the 540 000 m^2 of the RSF2 construction area. The construction period is anticipated to be six months in duration for both Stage 1 and Stage 2, and annual average impacts have been assessed assuming that those emissions (for Stage 1 construction) are 'smoothed' over the year, which is appropriate. In the assessment of 24-hour impacts, emissions have been adjusted (doubled), so that the construction period is effectively assumed to continue for the entire year which is appropriate as:

i. the coincidence of emissions and all meteorological conditions are assessed;

ii. emissions are appropriately high enough throughout the year; and,

iii. the modelling takes into consideration construction of Stage 1 and Stage 2 at any time during the year.

6.4.3 Modelling Results

Dispersion modelling has been performed using the CALPUFF model. Predicted incremental impacts at each of the identified sensitive receptor are presented in **Table 18**. The results indicate that annual average incremental concentrations at all receptors are anticipated to be insignificant with all annual average concentration <1.5 % of the relevant criteria. Short-term impacts are also demonstrated to be minor with 24-hour PM_{10} concentrations predicted to be ≤6 %, and $PM_{2.5}$ predicted to <3 % of the relevant criteria.

Table 18 Incremental model predictions of Proposed Modification

Receptor	Annual average µg·m^{-3}				Maximum 24-hour µg·m^{-3}	
	TSP	PM_{10}	$PM_{2.5}$	Dust Deposition	PM_{10}	$PM_{2.5}$
Criterion	**90**	**25**	**8**	**2**	**50**	**25**
Maximum	**0.5**	**0.2**	**<0.1**	**<0.1**	**3.0**	**0.7**
Max/Crit.	**0.6 %**	**0.8 %**	**<1.3 %**	**<5 %**	**6.0 %**	**2.8 %**
R1	0.3	0.1	<0.1	<0.1	2.5	0.5
R3	0.3	0.1	<0.1	<0.1	2.8	0.6
R4	0.1	<0.1	<0.1	<0.1	1.7	0.4
R5*	0.1	<0.1	<0.1	<0.1	1.0	0.2
R6	0.5	0.2	<0.1	<0.1	2.4	0.5
R8	0.1	<0.1	<0.1	<0.1	2.0	0.4
R9	0.2	0.1	<0.1	<0.1	1.9	0.4
R10	0.1	<0.1	<0.1	<0.1	1.6	0.3
R11	0.1	<0.1	<0.1	<0.1	1.3	0.3
R12	0.1	<0.1	<0.1	<0.1	0.7	0.2
R13	0.3	0.1	<0.1	<0.1	2.3	0.5
R16	0.2	0.1	<0.1	<0.1	2.5	0.5
R17	0.3	0.1	<0.1	<0.1	2.5	0.5
R18	0.2	0.1	<0.1	<0.1	2.5	0.6
R19	0.2	0.1	<0.1	<0.1	2.6	0.6
R21	0.2	0.1	<0.1	<0.1	2.7	0.6
R22	0.3	0.1	<0.1	<0.1	2.8	0.6
R23	0.3	0.1	<0.1	<0.1	3.0	0.7
R24	0.3	0.1	<0.1	<0.1	3.0	0.6
R25	0.2	0.1	<0.1	<0.1	2.8	0.6
R27	0.3	0.1	<0.1	<0.1	2.8	0.6
R28	0.3	0.1	<0.1	<0.1	2.8	0.6
R29	0.3	0.1	<0.1	<0.1	2.8	0.6
R32	0.2	0.1	<0.1	<0.1	2.2	0.5
R33	0.2	0.1	<0.1	<0.1	2.6	0.6
R35	0.2	0.1	<0.1	<0.1	2.6	0.6

Receptor	Annual average µg·m^{-3}				Maximum 24-hour µg·m^{-3}	
	TSP	PM_{10}	$PM_{2.5}$	Dust Deposition	PM_{10}	$PM_{2.5}$
R37	0.2	0.1	<0.1	<0.1	2.3	0.5
R40	0.2	0.1	<0.1	<0.1	2.7	0.6
R43	0.1	<0.1	<0.1	<0.1	0.8	0.2
R44	<0.1	<0.1	<0.1	<0.1	0.4	0.1
R45	0.1	<0.1	<0.1	<0.1	1.3	0.3
R46*	0.1	<0.1	<0.1	<0.1	1.3	0.3
R47	<0.1	<0.1	<0.1	<0.1	0.6	0.1
R60	<0.1	<0.1	<0.1	<0.1	0.8	0.2
R61	<0.1	<0.1	<0.1	<0.1	0.8	0.2
R62	<0.1	<0.1	<0.1	<0.1	0.9	0.2
R63	<0.1	<0.1	<0.1	<0.1	0.2	0.1
R64	<0.1	<0.1	<0.1	<0.1	0.3	0.1
R65	0.3	0.1	<0.1	<0.1	2.8	0.6
R66	0.3	0.1	<0.1	<0.1	2.7	0.6

In relation to potential cumulative impacts, the incremental contributions associated with the proposed modification as presented above have been added to site-specific monitoring data. The site-specific monitoring data already includes the influence of currently approved activities and the addition of an increment associated with proposed activities is appropriate.

Air quality monitoring data from 2017 has been adopted (commensurate with the meteorological year selected for modelling). Data from the year 2017 is also appropriate for use in the cumulative assessment as it represents Mine activities (i.e. waste movements, ore mining and ore milling) at their maximum (cumulative) rates over the production period (see **Table 7** and **Figure 3**). No cumulative assessment of $PM_{2.5}$ has been provided given that there is no site-specific data available. However, given the low incremental contribution from the Proposed Modification, this is considered to be a low risk.

The cumulative assessment of annual average model predictions is presented in **Table 19** and demonstrates that all criteria are anticipated to be achieved.

Table 19 Cumulative annual average model predictions of Proposed Modification

Receptor	Annual average µg·m^{-3}		
	TSP	PM_{10}	Dust Deposition (background from DDG5)
Criterion	**90**	**25**	**4**
Maximum	**47.3**	**20.1**	**<1.8**
Max/Crit.	**52.5 %**	**80.4 %**	**<45 %**
R1	47.1	20.0	<1.8
R3	47.1	20.0	<1.8
R4	46.9	19.9	<1.8
R5*	46.9	19.9	<1.8
R6	47.3	20.1	<1.8
R8	46.9	19.9	<1.8
R9	47.0	20.0	<1.8
R10	46.9	19.9	<1.8
R11	46.9	19.9	<1.8
R12	46.9	19.9	<1.8
R13	47.1	20.0	<1.8
R16	47.0	20.0	<1.8
R17	47.1	20.0	<1.8
R18	47.0	20.0	<1.8
R19	47.0	20.0	<1.8
R21	47.0	20.0	<1.8
R22	47.1	20.0	<1.8
R23	47.1	20.0	<1.8
R24	47.1	20.0	<1.8
R25	47.0	20.0	<1.8
R27	47.1	20.0	<1.8
R28	47.1	20.0	<1.8
R29	47.1	20.0	<1.8
R32	47.0	20.0	<1.8
R33	47.0	20.0	<1.8
R35	47.0	20.0	<1.8

Receptor	Annual average µg·m^{-3}		
	TSP	PM_{10}	Dust Deposition (background from DDG5)
R37	47.0	20.0	<1.8
R40	47.0	20.0	<1.8
R43	46.9	19.9	<1.8
R44	46.8	19.9	<1.8
R45	46.9	19.9	<1.8
R46*	46.9	19.9	<1.8
R47	46.8	19.9	<1.8
R60	46.8	19.9	<1.8
R61	46.8	19.9	<1.8
R62	46.8	19.9	<1.8
R63	46.8	19.9	<1.8
R64	46.8	19.9	<1.8
R65	47.1	20.0	<1.8
R66	47.1	20.0	<1.8

In relation to short-term (24-hour) PM_{10} impacts, the existing air quality as measured at the Mine in 2017 includes five exceedances of the air quality criterion, and these have been demonstrated to be associated with:

> "*Exceedances measured in February due to extreme heat and dry conditions. Other exceedances due to local meteorological conditions (Tomingley Gold Operations Pty Ltd, 2018).* "

Contemporaneous addition of the background PM_{10} concentration as measured at the Mine and the incremental impacts predicted as a result of the Proposed Modification indicate that the number of exceedances anticipated to occur during the modification remains as five at all modelled receptors, with the exception of R23 located in Tomingley village, to the north of the Mine. At this location, a background PM_{10} concentration of 48.51 µg·m^{-3} and a project increment of 1.53 µg·m^{-3} act to result in a marginal exceedance of the assessment criterion (of <0.1 µg·m^{-3}). Given the magnitude of the exceedance, it is likely that the management measures outlined in the AQMP which cannot be fully quantified in a dispersion modelling assessment, such as the modification of activities in 'adverse' weather conditions, would be sufficient to ensure that this exceedance would not occur in reality. Proactive management measures for 'adverse' weather conditions are currently included in the AQMP (refer **Section 2.3.3**).

At the closest receptor to the Proposed Modification (R6), five exceedances of the 24-hour PM_{10} criterion are anticipated with or without the Proposed Modification being approved. The dispersion modelling assessment demonstrates that the spatial change in emissions would not cause any adverse impacts at this location. As previously discussed (see **Section 4.1.1**) , the five exceedances of the 24-hour PM_{10} criterion are attributable to non-mining activities.

The assessment presented confirms that the minor incremental change in emissions anticipated as a result of the Proposed Modification (a 12.3 % increase in TSP emissions when compared to the original AQIA) would not materially change the conclusions of that original AQIA.

7. MITIGATION AND MONITORING

7.1 Air Quality Mitigation

Should the Proposed Modification be approved, the AQMP would be reviewed to take into account the Proposed Modification. During the construction of the Proposed Modification, the Proponent would act to ensure that the requirements of the AQMP, as revised, are fully implemented. Details of those measures can be seen in **Section 2.3.2**. All relevant sections of the AQMP would be adhered to during construction of RSF2, including (but not limited to) the triggers and corrective actions as required (section 8.3 of the AQMP), and the ongoing implementation of real time dust management (section 8.2 of the AQMP).

No additional management or mitigation measures have been identified as part of the AQIA or are recommended.

7.2 Monitoring

Monitoring of meteorology and air quality will continue at the Mine during the Proposed Modification. The use of real time dust management as outlined in the AQMP will ensure that any impacts associated with the Proposed Modification (and all other mining activities) would be minimised.

The monitoring program, as implemented, is suitable for identifying and measuring the extent of any air quality impacts from the Proposed Modification and no additional monitoring is recommended.

8. CONCLUSION

R.W. Corkery & Co. Pty Limited (RWC) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Tomingley Gold Operations Pty Ltd (the Proponent) to support the application to modify development consent PA 09_0155 for the Tomingley Gold Mine (the Proposed Modification).

An assessment of potential incremental changes in the emissions profile of the Mine during construction of RSF2 indicate that the incremental change in emissions is likely to be <13 % (TSP) when compared to the original AQIA (PAEHolmes, 2011). In an air quality assessment associated with MOD3 for the Mine, PEL (2015, 2016) concluded that any increase in TSP emissions up to 20 % of that assumed in the original AQIA would not be likely to result in a material change in the conclusions of that assessment. Given that the Proposed Modification would result in a change in the locations of emissions sources, a focussed dispersion modelling assessment has been performed to confirm that assumption.

The results of a dispersion modelling exercise confirm that the Proposed Modification would have minimal/insignificant impacts on surrounding receptor locations, when considering annual average air quality criteria. Even including suitable background air quality concentrations as measured within the Mine site, the annual air quality criteria are all easily achieved.

In relation to short-term (24-hour) impacts, the Proposed Modification is likely to result in minor impacts at all surrounding receptors. Inclusion of background air quality concentrations indicates that one additional, but marginal, exceedance may occur at a location in Tomingley village. However, given the magnitude of that exceedance (< 0.1 $\mu g \cdot m^{-3}$), it is not likely to result in any measurable change at that receptor. The modelling exercise included a range of emissions controls currently outlined within the AQMP for the Mine. Although a number of those measures could not be included in the modelling assessment, including the modification of activities in 'adverse' weather conditions, it is considered that the marginal exceedance predicted would be managed so as to not occur.

At the receptor closest to the Proposed Modification (R6) and at all other surrounding receptors, no additional exceedances of the air quality criteria are predicted to occur which indicate that the level of emissions controls, and the scale of activities proposed is appropriate and can be managed to not result in any adverse impacts at those locations.

9. REFERENCES

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APPENDIX A

Report Units and Common Abbreviations

Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

- 50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and,
- 0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

Table A1 Common Abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
AHD	Australian height datum
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AWS	automatic weather station
BoM	Bureau of Meteorology
°C	degrees Celsius
CO	carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EETM	emission estimation technique manual
EPA	Environmental Protection Authority
FEL	front end loader
GDA	Geocentric Datum of Australia
GIS	geographical information system
K	kelvin (-273°C = 0 K, ±1°C = ±1 K)
kW	kilowatt
MGA	Map Grid of Australia
$mg \cdot m^{-3}$	milligram per cubic metre of air
$mg \cdot Nm^{-3}$	Milligram per normalised cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
OEH	NSW Office of Environment and Heritage (now defunct)
PM	particulate matter

Abbreviation	Term
PM_{10}	particulate matter with an aerodynamic diameter of 10 µm or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 µm or less
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEE	Statement of Environmental Effects
TAPM	The Air Pollution Model
TPM	total particulate matter
TSP	total suspended particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	vehicle kilometres travelled

APPENDIX B

Sensitive Receptors

Discrete sensitive receptor locations used in the study

ID	Location (m, UTM 55)	
	Eastings	Northings
R1	614 364.3	6 396 179.0
R3	614 698.3	6 395 282.0
R4	617 152.6	6 393 349.0
R5*	614 347.7	6 390 416.0
R6	611 653.1	6 392 276.0
R8	612 333	6 398 313.0
R9	614 081.2	6 398 019.0
R10	615 154.2	6 396 801.0
R11	615 530.5	6 396 843.0
R12	616 509.2	6 398 034.0
R13	614 430.1	6 396 336.0
R16	614 602.4	6 395 928.0
R17	614 536.9	6 395 918.0
R18	614 677.0	6 395 870.0
R19	614 676.6	6 395 820.0
R21	614 659.2	6 395 792.0
R22	614 604.3	6 395 678.0
R23	614 516.3	6 395 629.0
R24	614 584.7	6 395 612.0
R25	614 666.2	6 395 668.0
R27	614 674.8	6 395 534.0
R28	614 694.6	6 395 389.0
R29	614 691.6	6 395 301.0
R32	614 892.1	6 395 417.0
R33	614 768.9	6 395 456.0
R35	614 732.7	6 395 784.0
R37	614 875.7	6 395 831.0
R40	614 663.9	6 395 739.0
R43	611 515.0	6 388 819.0
R44	615 048.4	6 387 172.0
R45	611 169.6	6 389 354.0
R46*	613 503.9	6 390 460.0
R47	612 757.8	6 386 383.0
R60	617 339.1	6 390 536.0
R61	617 390.2	6 390 389.0
R62	617 258.0	6 390 140.0
R63	6171 56.4	6 388 282.0
R64	616 778.9	6 386 059.0
R65	614 444.0	6 395 727.0

ID	Location (m, UTM 55)	
	Eastings	Northings
R66	614 483.8	6 395 760.0