

TOMAGO ALUMINIUM COMPANY
PTY LTD.

PRODUCTION CAPACITY INCREASE

575,000 TO 585,000 TONNES
SALEABLE METAL

PROJECT DESCRIPTION

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EXECUTIVE SUMMARY

In December 2009, approval was given to modify development consent DA no 392/80 to allow a production increase at Tomago Aluminium Company (TAC) from 530,000 tonnes/annum to 575,000 tonnes/annum.

With subsequent improvements in cell technology and energy efficiency, TAC has been able to marginally increase operating cell current from 245kA to 251 kA. The impact of this is expected to result in full year 2015 production of 581,000 tonnes/annum. To allow sufficient headroom in the development consent, TAC is seeking a modest increase of 10,000 tonnes/annum or 1.7% above the previous limit to a total of 585,000 tonnes/annum of saleable metal.

As part of the 2009 project an extensive Statement of Environment Effects (SEE) was prepared and submitted to the Department of Planning as part of the application. The proposed production increase of 1.7% % is not considered to be materially different to the consent granted in 2009 for the following reasons:

- No upgrades in plant or equipment are required.
- Air emissions of key pollutants of Fluoride and Sulphur Dioxide will remain within existing load limits stipulated in EPL 6163. Improvements in emissions reduction have seen unit emissions (kg F/ tonne Al) decrease over time.
- Air quality verification work completed in 2013 confirmed that the air quality modelling present in the AP2X SEE was conservative.
- Changes in traffic are minimal; 1 additional truck per day for raw materials and product transport.
- Noise, Water and Waste impacts will not change.
- Energy efficiency improvements will result in lower MWh/tonne, hence lower greenhouse emissions per tonne.

1 INTRODUCTION

Tomago Aluminium Company Pty Limited was founded in 1980 to build and manage, as agent for the participants, the Tomago Aluminium Smelter located 13 km North West of Newcastle. The joint venture participants sell aluminium produced at Tomago throughout the world.

Production of Aluminium began in September 1983, and the smelter reached full operating capacity in 1984 producing 220, 000 t/yr of liquid aluminium. DA no 392/80.

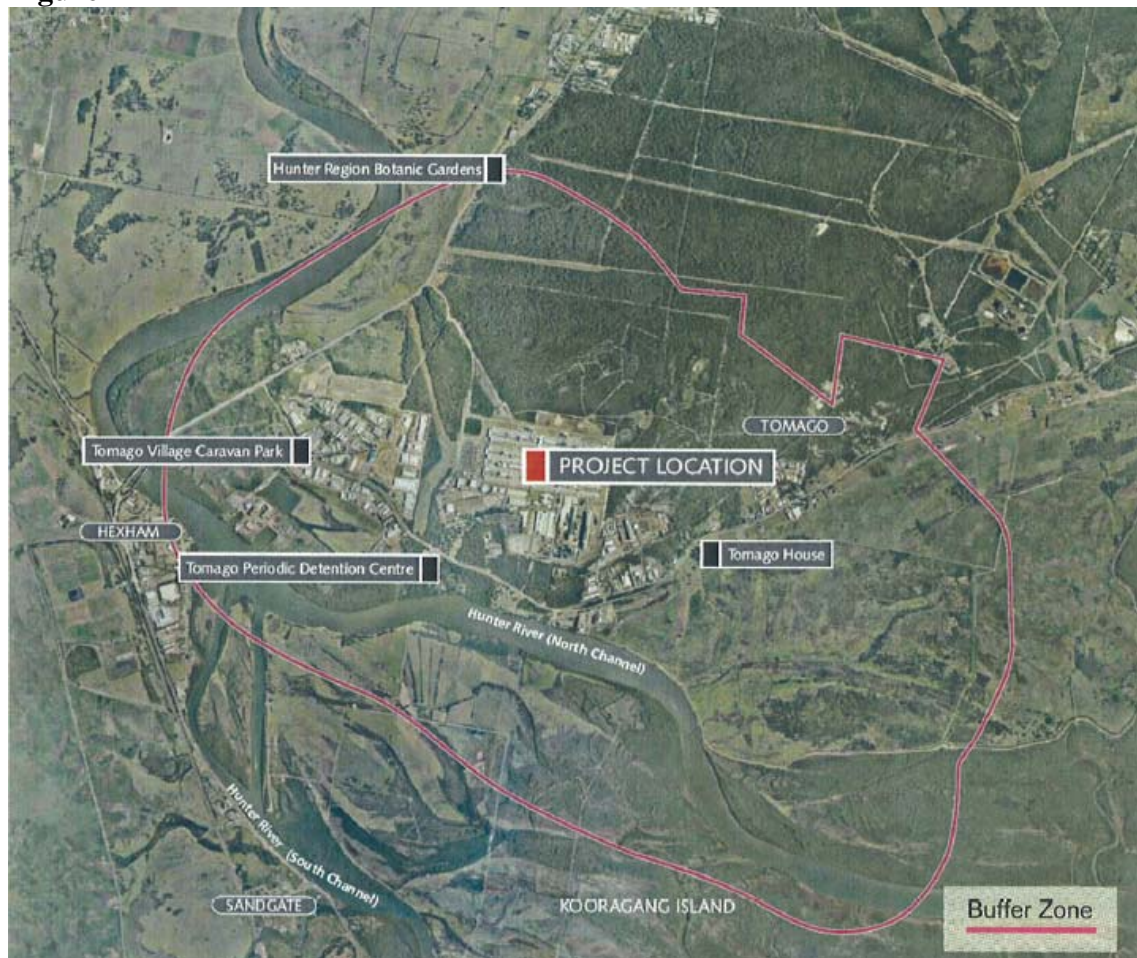
In 1991 development consent was granted to expand the existing plant capacity by building a new Potline No. 3, in conjunction with extending the existing Potlines No. 1 and No. 2. DA No 4908/90

In 1993, Potline No. 3 was commissioned and the plant operating capacity increased to 380,000 t/yr. In early 2002, Tomago Aluminium's participants decided to proceed with another major project, upgrading the smelter with a new pot design unknown as AP22 that allowed additional amperage to be applied to the potlines to produce additional metal. This project saw production capacity increase from 440,000 to 525,000 tonnes per annum and the operating amperage increase from 180kA to 225kA.

In 2009, approval was granted to increase liquid metal production to 575,000 tonnes per year. This expansion is known as the AP2X project. The expansion was similar to the AP22 Project and involved increasing the potline operating amperage to 245kA. The performance of the AP2X pot technology is meeting expectations and with new generation pot linings and subsequent amperage creep, TAC is now operating at an annualised rate of approximately 581,000 tonnes/annum.

With continued amperage creep to 252kA, annual production is expected to be 585,000 tonnes/annum. **Figure 1** shows an aerial image of the site, with nearby geographical features.

Figure 1



Existing development and operations

Aluminium is made in a series of large electrolytic cells known as pots. Pots are large rectangular steel cells, lined with insulating bricks and carbon blocks.

A potline is a series of pots connected electrically so that a direct current flows through one pot, then on to the next, and so on to the end of the line. Electricity is introduced to the pots via large carbon blocks known as anodes.

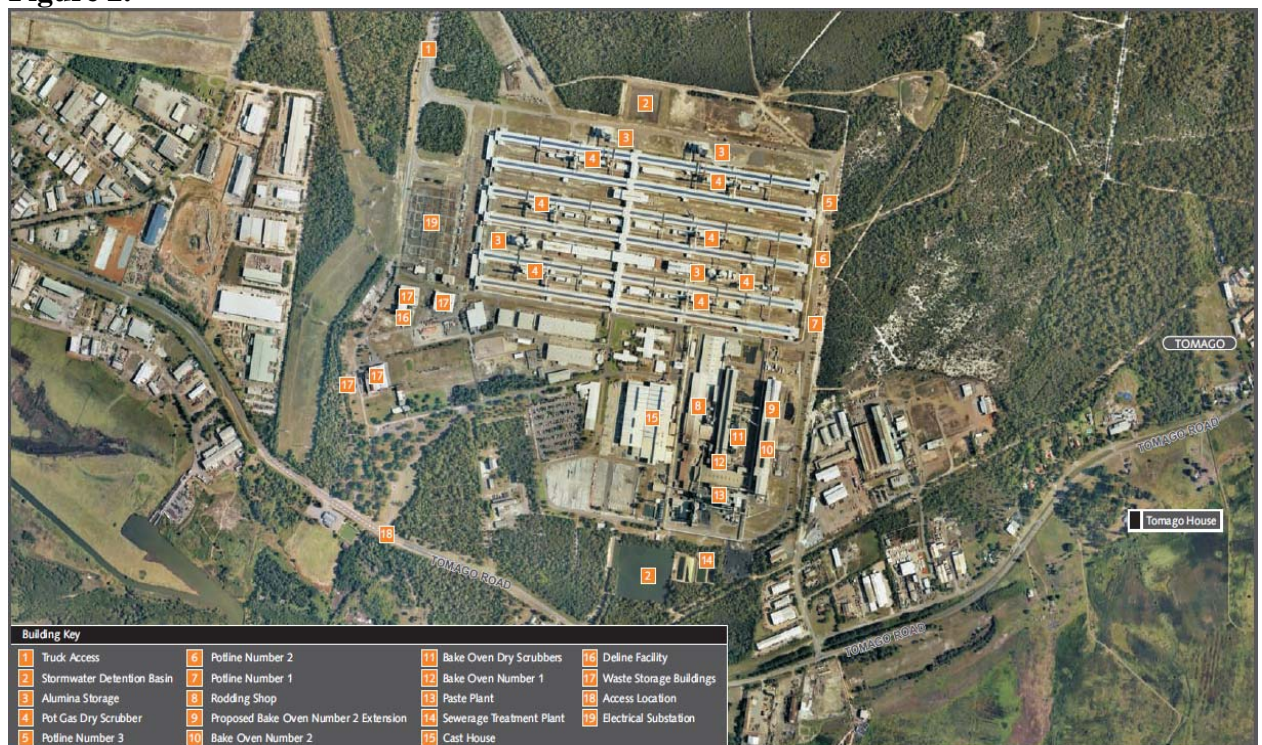
Inside the closed pot, alumina is dissolved in a bath of molten cryolite (sodium aluminium fluoride) and other materials.

As the electric current is passed through the bath it generates heat to keep the bath molten and causes the alumina to separate into aluminium and oxygen. As the oxygen is stripped from the alumina it combines with the carbon in the anodes, and they are consumed. Production of aluminium is directly related to cell current; increasing the cell current increases the rate of aluminium production.

Molten aluminium formed in the pots is periodically siphoned off into a ladle using a vacuum system and taken to the Cast Products Unit by special transporters.

Once at the Cast Products Unit, the molten metal is placed in large holding furnaces where the composition of the metal is determined and adjusted where necessary by the addition of alloying elements such as silicon, manganese, magnesium, copper and zinc. The molten metal is then cast into a variety of shapes and sizes to suit customer requirements. Figure 2 is a current aerial photo of the site, showing key components of the site layout.

Figure 2.



2 PROJECT DESCRIPTION

Following the AP2X project approval in 2009, the three potlines at Tomago Aluminium were projected to ramp up in cell current from 220 kA to 245 kA. With the inception of upgraded cell technology and energy efficiency improvements, the amperage through the three potlines is now projected to increase to 252 kA, resulting in the overall operating capacity increasing from 575,000 tonne/annum to 581,000 tonne/annum by December 2015 and 585,000 tonnes/annum by June 2016, a production increase of 1.7%. The existing plant infrastructure has the capability for the increased production with no capital works required. Details of specific production areas are detailed below.

Potlines

Potline operations have the potential to reach 585,000 tonne of liquid metal production without any capital investment. The additional tonnage is the result of amperage creep and the use of a more energy efficient cell lining.

Substation

The existing electrical substation has design capability to an amperage of 260kA. No capital investment is required.

Carbon

The current gross carbon requirement for the plant is 541kg/tonne of Aluminium. With improvements in anode quality and process control, the existing plant has the capability of supplying the required anodes without any capital modifications.

Cast Products

Casting of the additional liquid aluminium is envisaged to be managed by the existing ingot chains and current billet processes. The successful commissioning of Midal Cables, adjacent to TAC has seen 50,000 tonnes/annum of liquid metal delivered external to Casting, hence slightly lower volume is now being processed through Cast Products.

Alumina Handling and Emission Control

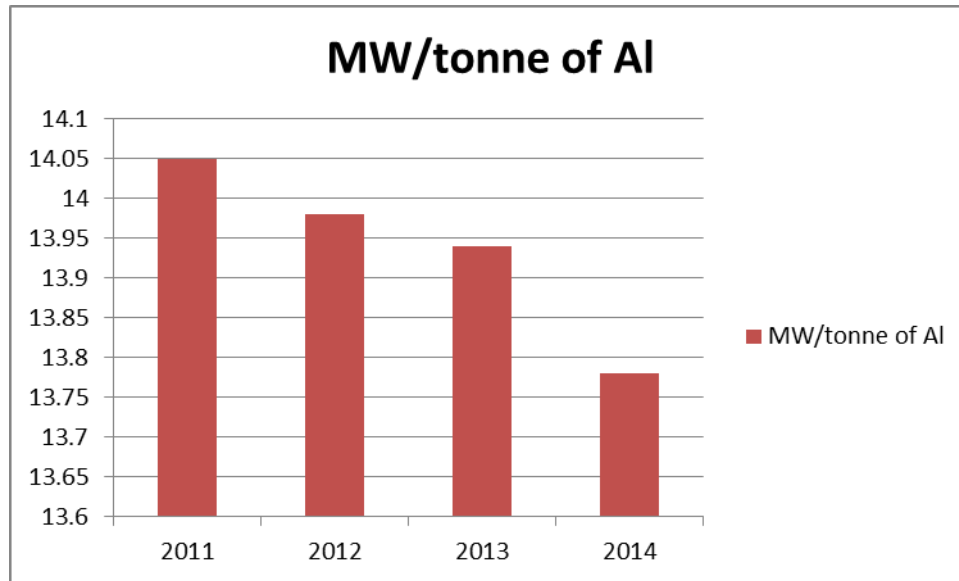
Pot cell emissions are collected and transported to a number of Gas Treatment Centres (GTCs) to minimise emissions to the environment. At each GTC, fresh alumina is injected into the stream of potline gases, which reacts with hydrogen fluoride in the gas stream. Once reacted, the fluoride and alumina mix is collected with other particulate emissions in the baghouses and recycled back into the potrooms. The scrubbing efficiency of the FTCs is greater than 99%.

The existing pneumatic alumina conveying systems, which transport alumina from the holding silos to the FTCs will not need to be upgraded as the design capacity has additional scope to handle the increased flow.

3 RESOURCES AND RAW MATERIALS

Energy Requirements

Electricity supply is under long term contracts with AGL. Electricity consumption is expected to continue to decrease per tonne of aluminium produced as a result of energy efficiency improvements related to the cell design (reduced heat losses), highlighted below.



Traffic and Transport Movements

The increase in production will result in the requirement of an additional 20,000 tonnes of alumina and 5,000 tonnes of petroleum coke being received at the Port of Newcastle and transported to the smelter site. This equates to one additional alumina truck per day and 1 additional petroleum coke delivery every two days. In regards to shipping, the additional tonnage equates to 1 additional alumina ship and 1 additional coke ship during a two year period. **Table 1** below details the current truck movements and the anticipated trucking movements at 585,000 tonne/annum based on the current trucking arrangement of deliveries of alumina on the weekend and petroleum coke on weekdays only.

The 2009 approval was based on anticipated trucking movements of 454 trucks per day.

Table 1 Anticipated Increase in truck movements

	Current truck movements	Anticipated increase
Alumina truck movements/ day	88	1
Coke truck movements/day	32	0.5
Aluminium Truck movements /day	55	1
Total	175	2.5

Staff

No additional staff are planned to be employed as a result of the proposed modifications. However, maintaining the internationally competitive position of the aluminium smelter will help underpin employment security of existing staff, contractors and service providers.

4 ENVIRONMENT IMPACT ASSESSMENT

Air quality

From an air quality perspective, the production increase is not expected to result in any additional impact. In the case of the key emissions of fluorides and sulphur dioxide, existing load limits of 298 tonnes for fluoride and 11,900 tonnes for sulphur dioxide established during the 2009 approval process will be respected and no increase in the load limit will be required.

Fluoride Emissions

A buffer zone was designated during the approval process for the third potline in 1991 to accommodate an annual emission equivalent of 298 tonnes of total fluoride per year. The establishment of the buffer zone was to assist in the management of land use around the smelter and to ensure incompatible activities such as dairy cattle grazing were controlled. Tomago Aluminium purchased land that was zoned as either rural or residential under the Development Consent condition. As production at the plant has increased, the 298 tonnes of total fluoride per year limit has been respected.

Improved emission performance has been achieved by improvements such as upgrading pot fume extraction systems and focusing on work practices.

Figure 5 displays the improvement in fluoride emission performance over the last 5 years against an increase in production of 32kt from 528kt to 560kt.

Figure 6 displays the fluoride emission rate performance (kilograms fluoride/tonne of aluminium) since 2010-2011 EPL licence year versus the emission rate target to achieve the annual load of 298 tonnes. The 2014 -2015 data is based on the current performance year to date (November 2014- July 2015). The 2015-2016 emission rate prediction is conservatively based on the average annual performance from 2010-2011 to 2013-14.

Figure 5: Total fluoride load and metal production over the last 5 years

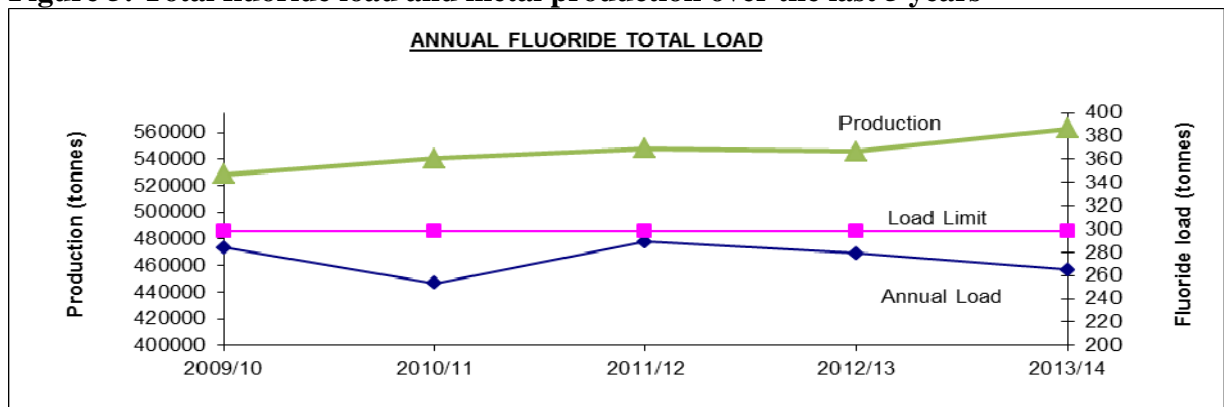
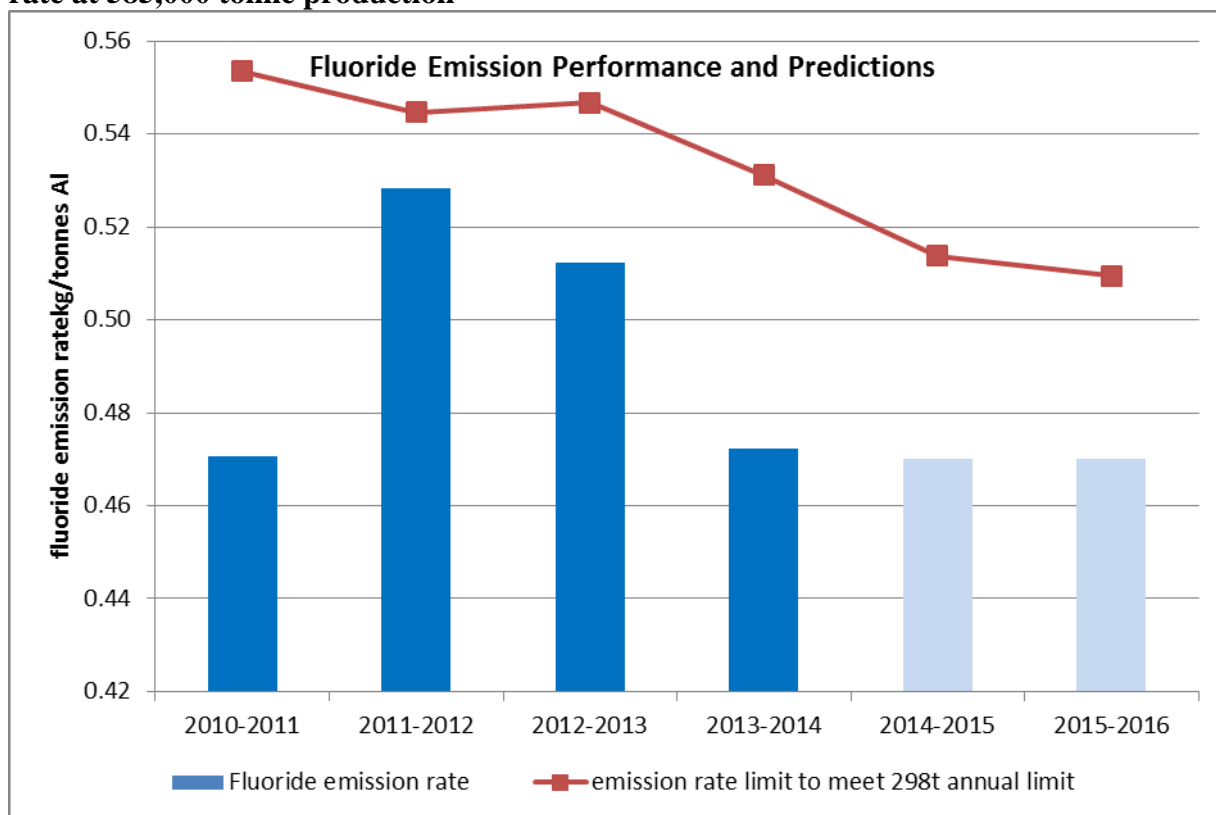


Figure 6: Fluoride emission rate performance and forecast fluoride emission rate at 585,000 tonne production



Sulphur Dioxide Emissions

Existing controls for sulphur dioxide currently rely on limiting the sulphur levels in petroleum coke and pitch used in the manufacture of the carbon anode. Sulphur dioxide is emitted during the baking and consumption of the anode. The annual sulphur dioxide limit of 11,900 tonnes is maintained through the purchase of petroleum coke that meets a targeted sulphur specification determined for the smelter to meet the annual sulphur dioxide target.

Figure 7 displays sulphur dioxide loads against the increase in production over the last 5 years.

Figure 8 displays the sulphur dioxide emission rate performance (kilograms sulphur dioxide/tonne of aluminium) since the 2010/2011 EPL licence year. The 2015-2016 emission rate prediction is based on the average annual performance over the last 5 years.

Figure 7: Total sulphur dioxide load and metal production over the last 5 years

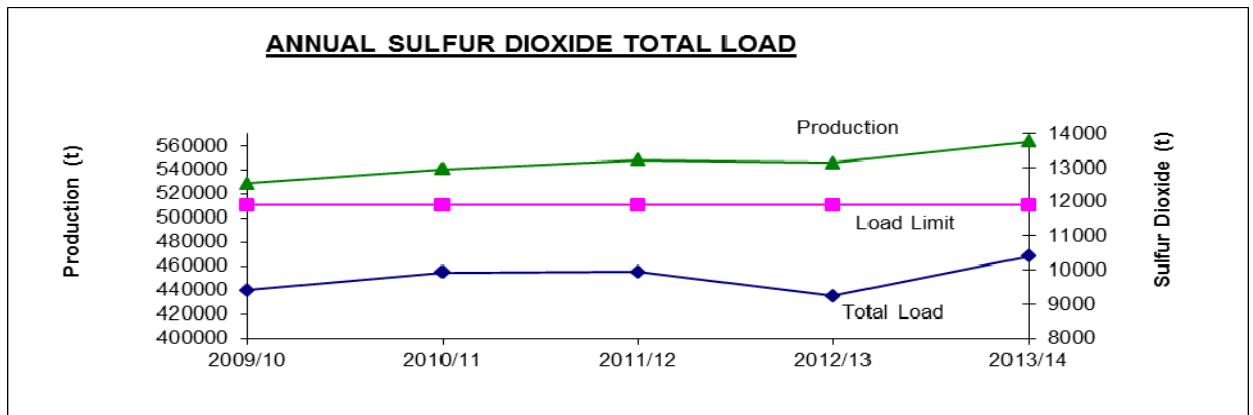
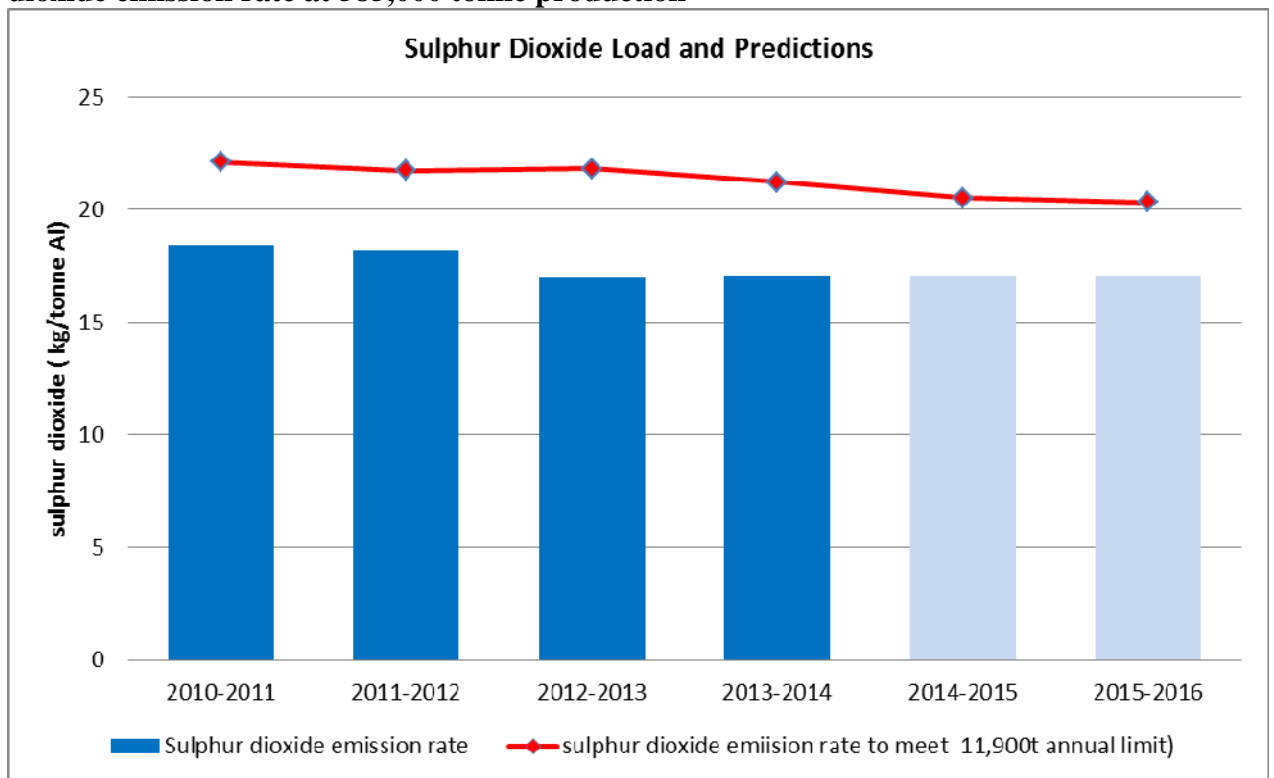


Figure 8: Sulphur Dioxide emission rate performance and forecast sulphur dioxide emission rate at 585,000 tonne production



As part of the negotiations for the development application for the production increase from 530,000tpa to 575,000tpa, the EPA negotiated the installation of three further ambient sulphur dioxide monitor to better understand sulphur dioxide emissions from the premises. After the installation of the new monitoring site Tomago Aluminium reported that the EPA 24 hour impact assessment criteria for sulphur dioxide was exceeded on some days during strong westerly winds at one of the newly established sites. As a result the EPA placed a Pollution Reduction Program on EPL 6163 to review air emission modelling and investigate feasible and reasonable technologies that can be implemented to reduce sulphur dioxide emissions from key areas of the smelter.

Following extensive dispersion and wind tunnel modelling it was concluded that under specific defined meteorological conditions of persistent strong wind from the northwest sector the newly established monitoring site would receive sulphur dioxide emissions from both the bake ovens and potline processes due to the orientation of the plant emission sources. Subsequent monitoring has confirmed a defined area of impact that will exceed the EPA 24 hour impact assessment criteria under persistent strong winds from the northwest sector when the wind persists for the 24 hour period. To address this issue Tomago Aluminium purchased the remaining residential property in the area of impact and demolished the existing Tomago Aluminium owned rental properties in the area. The EPA has removed the Pollution Reduction Plan from the current EPL.

Air modelling Verification

Following the 2009 approval, an air verification study was completed in 2013 that verified the air quality modelling presented in the 2009 Statement of Environment Effects. The stack parameters and emissions modelled for the SEE were compared against measured data and the EPL emission limits, while ambient pollutant concentrations were compared to the ground level concentrations predicted by the dispersion modelling presented in the SEE and the impact assessment criteria. The study highlighted.

Fluoride

- Fluoride emissions were all below the licence limit of 0.8kgF/tonne of aluminium produced, with a maximum fluoride emission rate of 0.59kgF/tonne of aluminium produced (March 2012).
- Exceedances of ambient fluoride concentrations were confined to the buffer zone with exceedances of the seven day criterion measured at Tomago Farm site and exceedances of the 90 day criteria recorded at the Tomago Road site.
- In the SEE, the maximum predicted concentration of fluoride at any receptor was 6.5ug/m³ for the 7 day averaging period and 1.6ug/m³ for the 90 day averaging period. The model over predicted the 7 day results by approximately 50% while underestimating the maximum 90 day concentrations.

Sulphur dioxide

- The modelled and measured emission rates and concentrations of sulphur dioxide from all sources were similar
- No exceedances of the 10 minute SO₂ criterion or annual criterion were recorded at any monitoring stations in 2012
- The maximum predicted cumulative concentration of 1 hour SO₂ at any discrete receptors was well above the concentrations measured during 2012
- The maximum predicted cumulative concentrations for a 24 hour averaging period was approximately half the maximum measured concentration in 2012.
- A single exceedance of 24 hour SO₂ was recorded at Tomago Road Farm site, which is acceptable under the NEPM.
- At School Drive site, single exceedances were recorded in 2012 during the months of April, May, July and August. These exceedances resulted in

additional investigations under a Pollution Reduction Plan as discussed above.

Other air pollutants

- The modelled and measured emission rate and concentrations of oxides of nitrogen (NO_x) for Bake Ovens No 1 FTC stack were quite similar, while measured data from Bake Ovens No 2 FTC stack were higher than the modelled data. Both sources had NO_x well below the EPL concentration limit
- The measured emission rates and concentrations of total solid particles (TSP) were typically well below the modelled levels.
- The measured emission rates and concentrations of PAH's were all below the modelled rates

The study highlights that a small increase in production of <2% and respecting the existing load limits for fluoride and sulphur dioxide, the modelling completed as part of the 2009 Statement of Environment Effects is still valid and no additional environmental impacts from air emissions can be expected.

Waste

Wastes generated at the TAC smelter as a result of the aluminium smelting process are classified in accordance with the Protection of Operations (Waste) Regulations.

The categorisation of aluminium smelter solid wastes and the manner in which they are either stored or disposed in NSW is also regulated by a Chemical Control Order (CCO) issued under the *Environmentally Hazardous Chemicals (EHC) act 1985*. The CCO was enacted in the 1980's when there were limited controls on waste movement and disposal in NSW.

The key smelter solid wastes include:

- Spent Pot lining (SPL)
- Dross
- Used refractory bricks
- Fluoridated waste.

The waste products are not expected to increase as a result of the production increasing of 1.7% to 585,000 tonnes. Incremental amperage creep does not alter the life of the pots or change the volume of waste material generated. Existing contracts are in place to manage Spent Pot Lining and Dross.

100 percent of the used refractory bricks are recycled under a current exemption under part 6 of the Protection of the Environment Operations (Waste) Regulation.

Noise

The existing acoustic environment around the site consists mainly of industrial noise from industrial land uses which include warehousing facilities, various metal fabrication works, a gas storage facility and an aluminium cable manufacturing facility.

Previous noise modelling conducted for the AP22 Project SEE (April 2001) indicated that noise levels would be similar to those in the previous Potline No 3 EIS study (1990). As part of the AP2X (2009) regular noise monitoring was conducted at the TAC electrical substation to assess if the amperage increase impacted on the noise generated from the substation. A summary of the noise monitoring results as the amperage increased from 225 kA to 245 kA is presented in **Table 2** and **Table 3** below. No increase in noise levels was detected. **Figure 9** details the substation noise monitoring sites.

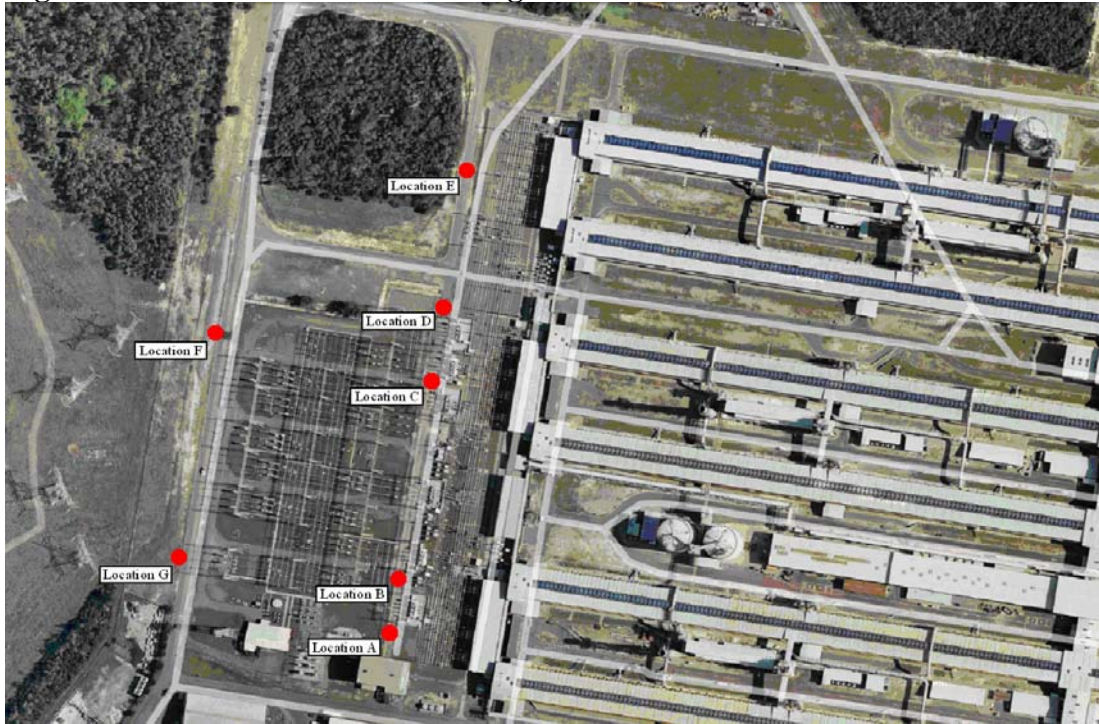
Table 2 Sound Pressure Levels (L_{A90} dB)

Location	06/04/10	19/07/10	28/03/11	09/03/12	16/10/12	02/12/13	26/9/14	Overall Change
A	76	78	78	76	76	74	77	1
B	76	75	75	75	75	75	72	-4
C	75	76	75	73	75	76	75	Nil
D	70	70	69	69	69	71	66	-4
E	67	68	67	66	65	68	66	-1
F	60	61	63	56	56	60	59	-1
G	58	59	63	58	56	60	59	1

Table 3 Sound intensity Levels (L_{Aeq} dB)

Location	06/04/10	19/07/10	28/03/11	09/03/12	16/10/12	02/12/13	26/9/14	Overall Change
A	81	80	80	79	80	76	79	-2
B	78	78	76	77	75	77	75	-3
C	78	79	75	74	77	77	76	-2
D	72	71	70	70	71	72	67	-5
E	69	70	70	69	67	71	68	-1
F	64	64	65	60	60	62	61	-3
G	62	63	66	61	60	62	61	-1

Figure 9: Substation noise monitoring locations



TAC currently undertakes attended Noise Monitoring at three locations surrounding the site, Old Punt Road (rear of Tomago Caravan Park), Tomago Detention Centre and 47 School Drive on a six monthly basis. The monitoring locations are detailed in **Figure 10**. The monitoring data is presented in **Table 4** below.

Figure 10: Environment Noise Monitoring Sites



Table 4: Environment Noise Monitoring Data

	Noise Goal (night)	Old Punt Road (L1)				Detention Centre (L2)				School Drive (L3)			
		1997 - 1999	2013	2014	Apr 2015	1997 - 1999	2013	2014	Apr 2015	1997 - 1999	2013	2014	Apr 2015
L _{A90} (dB)	45	48	46	50	45	51	49	52	47	44	40	38	46
L _{A10} (dB)		60	51	52	49	61	51	52	48	51	44	46	52
L _{Aeq} (dB)	50	58	50	51	48	63	50	52	47	56	42	42	49
L _{Aeq} (dB) TAC attrib.				46	IA			52	46			33	42

Note : IA = Inaudible

The land use criteria around the Tomago Aluminium Smelter has changed significantly over the last 15 years to be now largely dominated by industrial facilities, noise levels measured at the monitoring sites are conservatively compared to night time urban / industrial interface amenity criteria of 50 L_{Aeq} dB(a) detailed in Table 2.1 of the NSW Industrial Noise Policy and EPA recommended maximum acceptable background noise level (L_{A90}) of 45dB(A) at night.

Whilst some measured levels are above the recommended amenity levels, the L_{Aeq} levels are generally trending down when compared to the 1997-1999 levels. No noise complaints have been received by the Tomago Aluminium smelter in the last ten years.

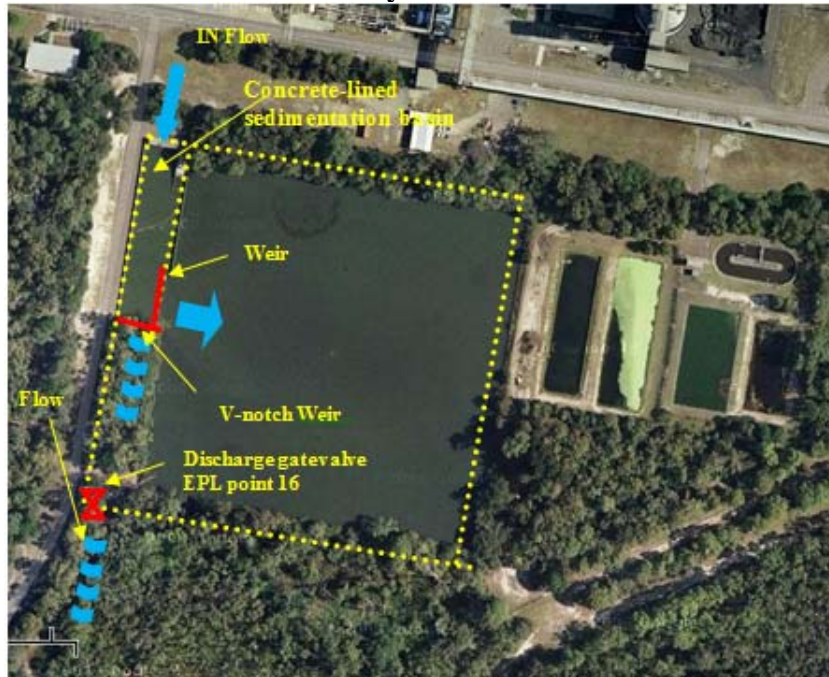
No increase in noise is expected to occur as a result of the amperage increase require to increase production by <2 %.

Water Quality

Stormwater

The management of stormwater at the TAC smelter is not expected to be modified from the current arrangements as a result of the proposed production capacity increase. The surface water management arrangements as described in the SEE (April 2001) for AP22 project are still applicable. These are summarised below. Stormwater runoff is directed to a separate collection pond, which accepts the first flush of a one in 10 year storm event. Subsequent stormwater runoff that contains lower fluoride concentrations is discharged directly to the Hunter River, detailed in **Figure 11**. The process of stormwater discharge is controlled by the conditions of the EPL 6163 for the smelter. The first flush collection is later discharged at a controlled rate (4320 kilolitres/day) via EPL discharge point 16, after the quality of the water has been verified. This ensures that fluoride levels entering the river are within approved limit of less than 40mg/l.

Figure 11: Stormwater Retention System



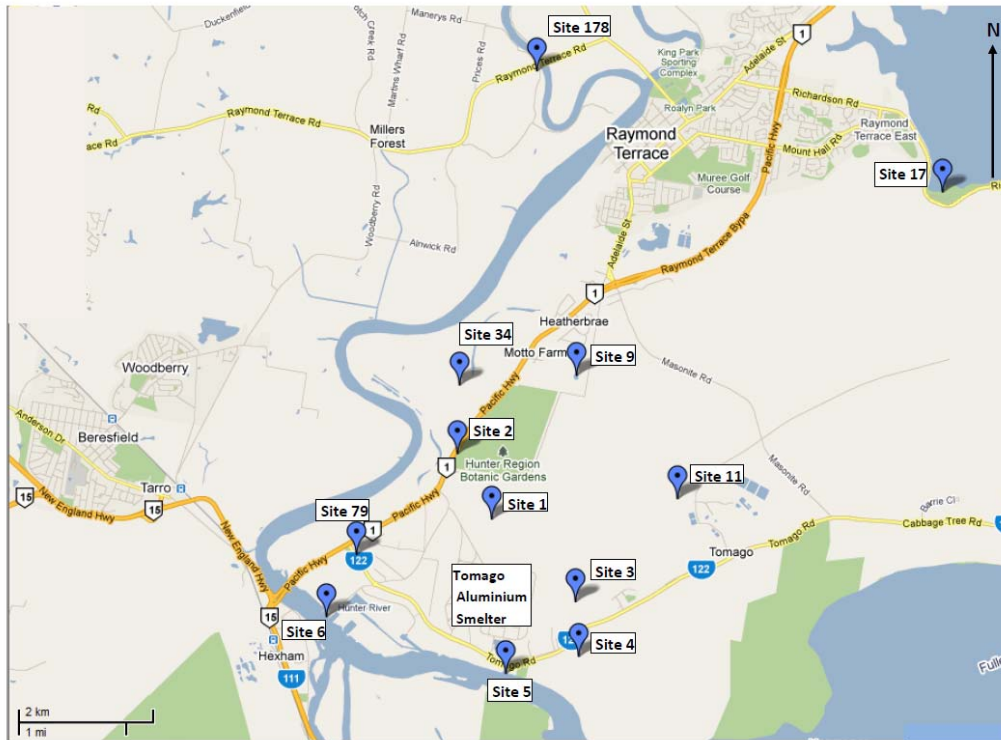
Surface Water

The current EPL 6163 requires TAC to monitor the fluoride, pH and conductivity levels of surface waters within 16.6 km of the smelter. The Potline No. 3 EIS (July 1990), AP22 project SEE (April 2001) and the AP2X project May 2009) reviewed the monitoring data. Both the EIS and SEE reviews concluded that the only surface water monitoring location that showed an increased fluoride level was a temporal pond approximately 0.5km north of the smelter (site 1). This site is subject to regular drying out, influencing the results. The capacity increase approved in 2009 anticipated that the production increase will have little effect. This is confirmed by surface water monitoring data from 2005-2014 presented in **table 5** below. The location of the monitoring sites is detailed in **Figure 12**.

TABLE 5 SURFACE WATER MONITORING IN THE VICINITY OF TOMAGO ALUMINIUM SMELTER FOR 2005 – 2014
(All results expressed as milligrams of fluoride per litre of water)

SITE	Average 2005-2009	2010	2011	2012	2013	2014
1	3.5	3.1	3.4	2.3	3.9	4.0
2	0.71	0.53	0.57	0.54	0.61	0.53
3	1.5	1.9	2.3	2.4	1.5	2.6
4	1.0	0.64	1.1	0.97	1.4	1.3
5	0.91	0.76	0.68	0.76	1.0	1.2
6	0.70	0.61	0.42	0.58	0.71	1.0
7	0.56	0.93	0.74	0.68	0.91	3.6
9	0.17	0.21	0.20	0.24	0.58	0.34
11	0.29	0.26	0.24	0.32	0.76	0.35
17	0.17	0.21	0.19	0.19	0.23	0.20
34	0.11	0.13	0.11	0.13	0.14	0.15
178	0.95	1.0	0.89	1.1	0.87	0.82

Figure 12: Surface water monitoring sites



Groundwater

The current EPL 6163 requires TAC to monitor the fluoride, pH and conductivity levels of groundwater within 16.5km of the smelter. The groundwater monitoring results for 2010-2014 are provided in **Table 5**.

TABLE 6 GROUNDWATER MONITORING IN THE VICINITY OF TOMAGO ALUMINIUM SMELTER FOR 2010-2014

(All results expressed as milligrams of fluoride per litre of water)

Bore Group	2010	2011	2012	2013	2014
Hunter Water Bores	<0.1	<0.1	0.3	<0.1	<0.1
Northern Boundary Bores	2.3	1.4	1.6	2.1	1.7
Eastern Boundary Bores	5.0	5.2	5.9	5.7	6.7
Southern Boundary Bores	13	12	11	10	10
Southern Off-Site Bores	0.3	0.3	0.3	0.3	0.3

South-Western Boundary Bores	2.6	2.5	2.2	2.0	2.2
Western Boundary Bores	4.9	5.5	9.6	9.7	9.4

The Hunter Water bores are generally situated in the Tomago Sand beds Area as displayed in **Figure 13**, The concentrations levels of fluoride are presented in **Table 5** and highlight that fluoride concentrations are at background levels and indicate there has been no impact on the regional Tomago Sand beds groundwater reserve has resulted from the operation of the smelter.

The groundwater sites sampled by Tomago Aluminium are largely located within the smelter site and to the south of the smelter, the sampling locations are displayed in **Figure 14**. The groundwater flow direction on the smelter site is to the south east towards the Hunter River. An increase in the western boundary bores was observed in 2012 but concentrations remained stable in 2013 and 2014. During 2010-2014 groundwater monitoring sites on the southern boundary (close to the first flush stormwater Basin) have displayed elevated but stable fluoride concentrations. Tomago Aluminium commissioned Coffey Environments Australia in 2012 to undertake an assessment of the significance of fluoride recorded in groundwater within the vicinity of the southern stormwater pond. The contaminant fate and transport modelling concluded:

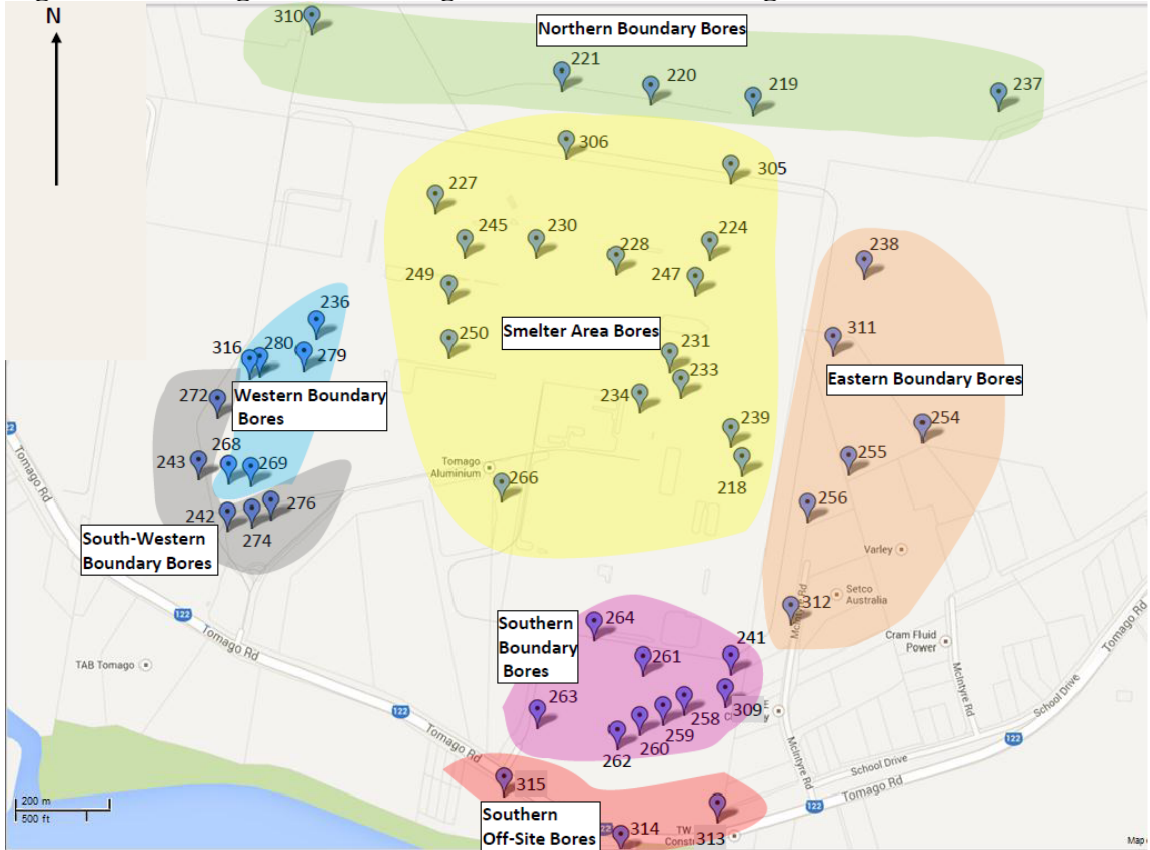
- The migration of fluoride contaminated groundwater will result in only marginal increases in fluoride levels at the groundwater/river interface. When the effects of adsorption are considered within the modelling based on reference and field data derived from pond sediment, the modelling predicts that the fluoride plume would not break through at the groundwater/river interface within the next 100 years.
- An appraisal of the net flow of the Hunter River indicates the river would provide significant dilution potential. In the context of the marginal increase in fluoride concentrations predicted to discharge into the river, it is assessed that the increase in fluoride levels within the river would not be detectable.

Fluoride concentration in groundwater is not expected to increase as a result of the marginal production increase.

Figure 13: Hunter Water groundwater monitoring sites



Figure 14: Tomago Aluminium groundwater monitoring sites



5. CONCLUSIONS

Presented in this document is a description of the proposed production capacity increase at Tomago Aluminium Company. This project is envisaged to result in an incremental increase of total operating capacity from the existing 575,000 tonnes/year to 585,000 tonnes/year of saleable metal, an increase less than 2 %.

The project is based on an incremental increase of the total amperage through each of the three potlines from the current level.

The main air pollutants associated with aluminium smelting, namely fluoride and sulphur dioxide will remain below the existing load limits.

Based on the small material increase in proposed tonnage, the verification and ongoing monitoring conducted as part of the Environment Protection Licence 6163 and the development consent conditions from the AP2X (2009) approval no additional environmental impact is expected.