APPENDIX 15

AIR DISCHARGE EFFECTS ASSESSMENT [AECOM]

Doug's Opua Boat Yard AQ Assessment
Doug's Opua Boat Yard
07-Oct-2019
Doc No. R002a

Doug's Opua Boat Yard - Air Quality Assessment - Slipway Reconstruction

Assessment of Air Emissions from Boat Yard Activities

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Assessment of Air Emissions from Boat Yard Activities

Client: Doug's Opua Boat Yard

ABN: N/A

Prepared by

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Abbreviations	Descriptions
AECOM	AECOM New Zealand Limited
AQNES	National Environmental Standards for Air Quality
AQG	Air Quality Guideline
AUP	Auckland Unitary Plan
AWS	Automatic Weather Station
CMA	Coastal Marine Area
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DOPY	Doug's Opua Boat Yard
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FNDC	Far North District Council
GPG	Good Practice Guide
GPG Dust	Good Practice Guide for Assessing and Managing Dust
GPG ID	Good Practice Guide for Assessing Discharges to Air from Industry
GPG ADM	Good Practice Guide for Atmospheric Dispersion Modelling
L	Litre
3D	Three Dimensional
m	Metre
m/s	Unit of Speed: meters per second
MfE	Ministry for the Environment
NASA	National Aeronautics and Space Administration
NES	National Environmental Standard for Air Quality
NRC	Northland Regional Council
NZAAQG	New Zealand Ambient Air Quality Guidelines
OEHHA REL	California Office of Environmental Health Hazard Assessment Reference Exposure Limits
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 µm
RAQT	Regional Air Quality Targets
TSP	Total Suspended Particulate
TWA	Time Weighted Average
SRTM-3	Shuttle Radar Topography Mission
US EPA RfC	US Environmental Protection Agency's Inhalation Reference Concentrations
UTM	Universal Transverse Mercator
WES	Workplace Exposure Standards
WHO	World Health Organisation
$\mu g/m^3$	Unit of Concentration: micrograms per cubic meter

1.0 Introduction

AECOM New Zealand Limited (AECOM) was engaged by Doug's Opua Boat Yard (DOBY) to assess the potential air quality effects associated with the proposed remediation and reconstruction of the slipway and ongoing operation of the boat yard.

DOBY is a fully commercial vessel maintenance facility for haul out, brokerage, chartering, marine construction, repair, servicing, victualling and surveying of all classes of vessel up to 25 metric tons of displacement.

The site has a range of resource consents issued by the Far North District Council (FNDC) and Northland Regional Council (NRC) to allow for the above activities. This suite of consents includes Air Discharge Permit CON20060791410 - 12 which authorises the discharge of contaminants to air in the coastal marine area from marine vessel construction, sale, repair, maintenance and associated activities. Prior to these consents expiring on 30 March 2018, DOBY applied for new consents, with this application currently before the Hight Court, awaiting resolution of an appeal.

During this process DOBY identified a range of site improvements to remediate and reconstruct the slipway and is seeking the necessary consents for these from FNDC and NRC.

AECOM has prepared the following air quality assessment to support this new application. The monitoring study used to inform the air quality assessment of the current air discharges from the site is also relevant to the new application and therefore has been reproduced in this report.

The assessment has been undertaken in accordance with the following Ministry for the Environment (MfE) Good Practice Guides (GPG):

- Good Practice Guide for Assessing and Managing Dust[1] (GPG Dust);
- Good Practice Guide for Assessing Discharges to Air from Industry[2] (GPG ID); and,
- Good Practice Guide for Atmospheric Dispersion Modelling[3] (GPG ADM).

[1] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016
[2] Ministry for the Environment, Good Practice Guide for Assessing Discharges to Air from Industry, 2008
[3] Ministry for the Environment, Good Practice Guide for Atmospheric Dispersion Modelling, 2004

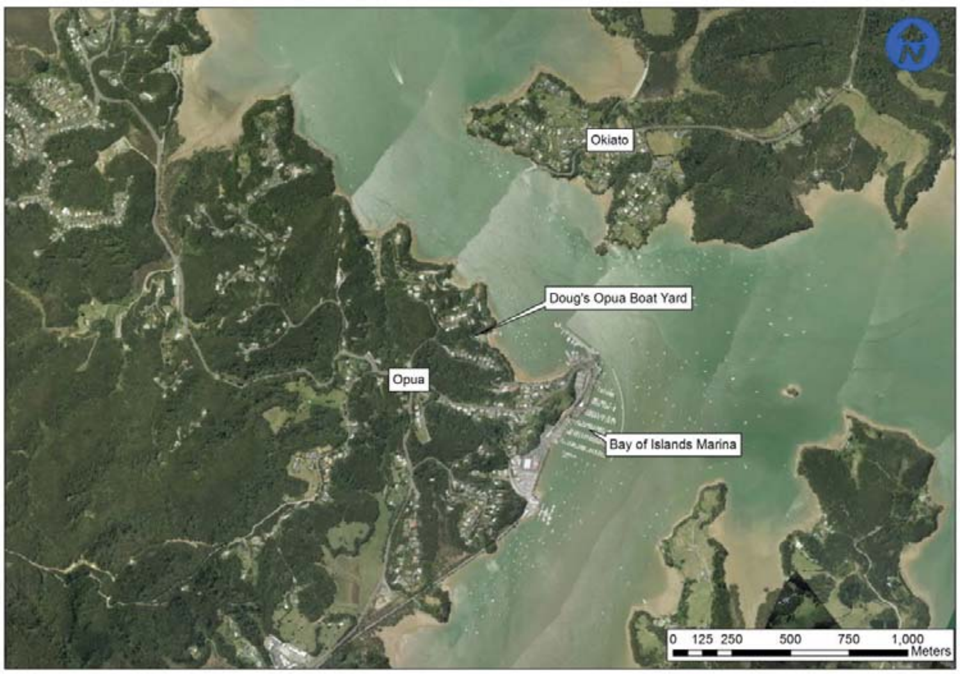
2.0 Location

DOBY is located off Richardson Street in Opua, Bay of Islands. The site is located within the Opua Town Basin at the southern-most end of the Veronica Channel and comprises approximately half of the small open bay and sandy beach directly west of the Opua Wharf and mooring area. The slipway extends to the east and is positioned at the northern side of the bay directly under a large bush covered bluff.

The landward site is completely surrounded by bush/rainforest and well below the level of the adjoining street. There are three residences that look onto the slipway and wharf in the Coastal Marine Area (CMA), but not the boat yard or the slipway located within the esplanade reserve.

The location of the site is shown in Figure 1.

Figure 1 Site Location



3.0 Description of Proposal

A detailed description of the proposal can be found in the Assessment of Environmental Effects Report[4]. However, a brief summary of the proposal is provided below.

Modified (replacement) activities

- Three working berths (alongside wharf).
- Removal and reconstruction of the existing wharf (fixed wharf, gangway, 30 x 300 SED timber piles, 4 x 406 PE sleeved steel piles, 1 x 300 SED timber pile for the boat pull).
- Earthworks associated with reconstruction of the existing slipway.
- Maintenance dredging.
- Stormwater discharges to the Coastal Marine Area.
- Discharges to land from boat maintenance activities.
- Discharges to air from boat maintenance activities.
- Occupy the CMA with various structures: Wharf, floating pontoons, piles, stormwater pipe(s) (attached to wharf), marina berths, slipway, signage, ladders, security and safety lighting, security gate, boat pull.
- Extension and modification to exclusive occupation area.

New activities

- Proposed erosion barrier.
- Capital dredging.
- Marina berths (two).

Activities which have the potential to generate air emissions include: earthworks associated with the reconstruction of the slipway; and, boat maintenance activities (discussed in Sections 4 to 11).

3.1 Effects from Construction Activities

There is the potential for dust from the minor earthworks associated with reprofiling the slipway which could cause nuisance effects if not appropriately mitigated. This activity is permitted under the operative Regional Air Quality Plan for Northland (Rule 9.1) providing that *"The discharge shall not result in any offensive or objectionable dust deposition, or any noxious or dangerous levels of airborne particulate matter, beyond the boundary of the subject property".*

AECOM considers that given the minor nature and short duration of this activity and providing that best practice mitigation measures are employed such as ensuring excavated material is kept damp, there is limited potential for dust nuisance effects. This activity has therefore not been considered any further in this report and the primary focus is on discharges from boat yard maintenance activities.

[4] Reyburn and Bryant, Assessment of Environmental Effects – Doug's Opua Boatyard, September 2019.

3.2 Changes to the Slipway which will have an impact on Air Quality

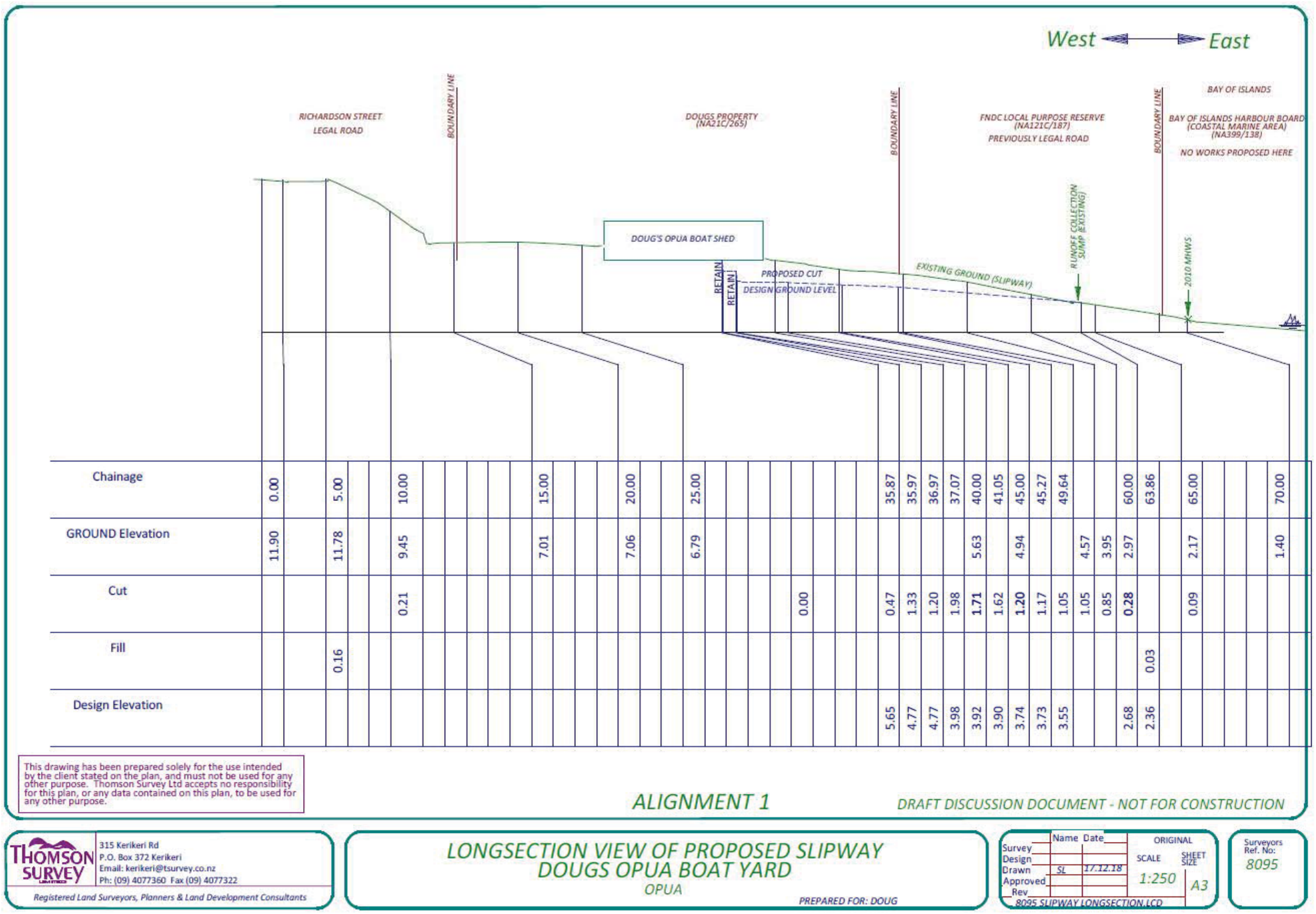
Figure 2 presents a site concept plan of the reconstructed slipway and Figure 3 presents a long section which shows the extend of the change in height of the working areas.
The reconstruction of the slipway will lower the working areas to between 1.5 and 2.0 m below the height of the reserve and surrounding areas. From an air quality perspective this change will influence how air discharges are dispersed in the local area as the retaining walls will essentially act as a screen reducing the potential for emissions to travel beyond the slipway. A deployable containment screen located adjacent to the walking track (refer to Figure 2) will be used to assist minimise the effects of spray drift from the boat yard.

The reconstruction of the slipway will allow paint preparation and painting activities to be undertaken further up the slipway closer to the boat shed. This will provide a greater level of separation between these activities and people using the reserve or walkway.

Overall the changes proposed to the slipway are expected to have a positive impact on the local air quality.

Figure 2 Concept Plan – Reconstructed Slipway

Figure 3 Long Section – Reconstructed Slipway



Chainage	0.00	5.00	10.00	15.00	20.00	25.00		35.87	35.97	36.97	37.07	40.00	41.05	45.00	45.27	49.64			60.00	63.86	65.00	70.00
GROUND Elevation	11.90	11.78	9.45	7.01	7.06	6.79						5.63		4.94			4.57	3.95	2.97		2.17	1.40
Cut			0.21				0.00	0.47	1.33	1.20	1.98	1.71	1.62	1.20	1.17	1.05	1.05	0.85	0.28		0.09	
Fill		0.16																		0.03		
Design Elevation								5.65	4.77	4.77	3.98	3.92	3.90	3.74	3.73	3.55			2.68	2.36		

4.0 Air Discharge Sources

An AECOM staff member undertook site visits on 12 June 2018 and 2 April 2019 to identify activities that have the potential to generate air emissions. Based on these site visits and the findings of AECOM's assessments undertaken in 2000[5], AECOM considers there are four main activities that have the greatest potential to generate emissions. These are:

- Water blasting vessels;
- Sanding and grinding vessels;
- Antifouling vessels; and,
- Painting vessels.

Emissions from these sources are discussed in Sections 5 to 8 of this report.

[5] AECOM (formerly Woodward-Clyde), Boat Yard Emissions, 9 February and 28 September 2000.

5.0 Particulate Monitoring

To better understand the potential for particulate emissions from activities undertaken at the boat yard to cause effects, AECOM installed two E-BAM continuous particulate monitors, which were placed either side of the slipway. Monitoring was undertaken for a period of eight days and during this time four vessels were hauled out, with a range of typical maintenance activities undertaken on these vessels including; water blasting, scraping, grinding, application of antifouling, both sprayed on and rolled on, and polishing of topsides. The Applicant considers that this eight-day period of activity represents approximately 10% of the total amount of works undertaken at the boat yard in any given year.

The location of the monitors is presented in Figure 4 and the monitors are shown in Figure 5. The monitors were moved up and down the slipway depending on the location of the vessel being worked on, so as to be directly alongside the work being undertaken, and on the site boundary on the corners of Area A (refer Appendix A which shows the consented areas). Wind direction and wind speed measurements were also undertaken, in addition to particulate monitoring, to better understand conditions which could affect ambient particulate concentrations.

While these E-BAM's are not a USEPA Federal Equivalent Method (FEM) instrument; it uses the same measurement technique (beta attenuation) as the FEM methods and is considered appropriate for screening monitoring such as this study[6]. The E-BAM continuously measures the intensity of beta particles passing through a filter tape, this allows particulate concentrations to be measured and reported over a variety of averaging periods.

The measured particulate concentrations have been compared with the suggested trigger levels for total suspended particulate (TSP) provided by the Ministry for the Environment in the GPG Dust. The suggested trigger levels are presented in Table 1.

Given the close proximity of the particulate monitors, with respect to boat yard activities, the results of monitoring are considered to provide a worst-case assessment of air discharges from the site.

Due to the neighbouring landuse the receiving environment has been classified as 'moderate to high', and AECOM has conservatively used the 'high sensitivity' trigger values in its assessment.

The primary purpose of the 1-hour trigger value is to inform the operator that if this value is exceeded for large periods of time then there is the potential for the 24-hour average trigger to be exceeded. The 24-hour average trigger therefore provides a better indication of chronic nuisance effects, as it is the ongoing cumulative effect of particulate discharges which creates nuisance effects.

[6] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016.

Table 1 Suggested Trigger Levels for Total Suspended Particulate (TSP)

Trigger	Sensitivity of the Receiving Environment		
	High	Moderate	Low
Short Term (1 hour)	200 µg/m³	250 µg/m³	n/a
Daily (24 hours)	60 µg/m³	80 µg/m³	100 µg/m³

Figure 4 Particulate Monitoring Locations

Figure 5 Particulate Monitors (M1 and M2)

Table 2 presents the monitoring results. As the monitoring was only undertaken during periods of boat yard activity, AECOM has inferred 24-hour average concentrations. To calculate the 24-hour average values AECOM has assumed a background concentration of 20 µg/m³. This value represents the concentrations at times when no activities were being undertaken. This value is considered conservative as the average concentration measured by Monitors 1 and 2 while activities were being undertaken was 12 µg/m³ and 18 µg/m³, respectively.

Figures 12 to 19 in Appendix B present the particulate concentrations measured over the monitoring period.

The results of particulate monitoring are discussed further in the following sections of the report.

Table 2 Total Suspended Particulate (TSP) Monitoring Results

Day	Activities undertaken	Wind Direction	Average Wind Speed (m/s)	Wind Gust (m/s)	Maximum 1-hour Average TSP Concentration (µg/m³)			Inferred Average TSP 24-hour Concentration (µg/m³)		
					MfE Trigger Level	Monitor 1	Monitor 2	MfE Trigger Level	Monitor 1	Monitor 2
1 (12 June 2018)	Scraping and Grinding	N	0.5	3.1	**200**	43	123	**60**	18	22
2 (13 June 2018)	Spray Painting Antifouling	NW	0.3	4.3		No Result[7]	51		No Result	18
3 (14 June 2018)	Water blasting	NE moving thought to W	0.2	2.4		9	8		16	15
4 (15 June 2018)	Sanding and hand painting antifouling	ENE	0.4	1.9		6	13		17	16
5 (16 June 2018)	Water blasting, antifouling and topside repairs	ENE	1.7	4.5		7	5		16	16
6 (17 June 2018)	Sanding and Polishing topsides	NE	0.2	0.9		11	9		17	16
7 (18 June 2018)	Water blasting and cleaning	ENE	1.1	3.6		1	12		18	18
8 (19 June 2018)	Scraping and Grinding	ENE	0.2	2.1		392	313		32	38
Average	-	-	**0.6**	**2.9**		**67**	**67**		**19**	**20**

[7] On the second day of monitoring Monitor 1 did not provide any data as it was not powered on correctly. While the data collected on this day would have been useful, based on all the data collected, the two monitors produced similar results and therefore it is unlikely that concentrations at the location of Monitor 1 would have been significantly higher than those reported by Monitor 2.

6.0 Water Blasting Vessels

6.1 Description of Activity

Water blasting is undertaken as part of the first step in preparation for painting. The vessel is first hauled out of the water using a cradle which carries the vessel up the slipway on a track. The cradle is pulled up the slipway using an electric motor/worm drive assembly. This activity is usually undertaken at the location shown in Figure 6, designated as Area A.

Figure 6 Water Blasting Location

This activity has the potential to generate particulate discharges as material, such as sediments, barnacles and other sea crustaceans are removed from the underside of the vessel. These particles have the potential to cause nuisance effects, due to the deposition of this material on surfaces. The particles will either be discharged directly to air or will be encapsulated within large water droplets. Figure 7 shows a picture of a vessel being water blasted and prepared for antifouling.

This activity can occur two to three times per week and typically takes up to an hour to complete.

Figure 7 Picture of a vessel being Water Blasted

6.2 Proposed Mitigation Measures

A range of mitigation measures will be used to control the effects of spray drift from the water blaster, which include:

- Deploying a 2 m high screen across the walkway to reduce the potential for people on the walkway getting wetted;
- Consider using a mobile platform, where practicable, to ensure that the water blaster nozzle is kept below horizontal. This reduces the potential for spray to travel beyond the slipway.
- Installation of signs to notify the public that water blasting is taking place.

As mentioned previously the reconstruction of the slipway will lower the surface of the working areas. The retaining walls which will be constructed to the north and south of the slipway together with the screen, that will be deployed at near the intersection of the slipway and walking track, will reduce the amount of spray drifting on to the reserve and walkway. While it is difficult to determine how much of an improvement there could be, it is reasonable to expect that the majority of any the spray generated will be contained within the slipway, when working on the hulls up to a height of 1.5 m from the working surface (the height of the retaining walls).

6.3 Assessment of Effects from Water blasting Activities

This operation will generate a visible water plume with any particulate disturbed from the vessel likely to fall immediately to the ground or be contained within large water droplets which would also fall to the ground very near to the vessel. AECOM consider that it represents good practice to not undertake this activity during conditions where the wind is greater than 5 m/s (10 knots) or when the wind is not blowing up the slipway, i.e. when the wind is from the north, west or south.

6.3.1 Potential for Dust Nuisance

As mentioned in Section 5, AECOM undertook particulate monitoring over a period of eight days to assess emissions and determine the potential for nuisance effects to occur. Water blasting was undertaken on days 1, 3, 5 and 7 and during these occasions the maximum 1-hour average and 24-hour average concentrations were 12 µg/m³ and 18 µg/m³, respectively. These concentrations are well below the 1-hour average and 24-hour average trigger values of 200 µg/m³ and 60 µg/m³ respectively. While the period of monitoring provided calm to low wind speed conditions, given the close proximity of the particulate monitors with respect to activities, AECOM considers that the measured concentrations represent the worst-case conditions that could be experienced off-site, as it is reasonably expected that work will only be undertaken in winds less than 5 m/s or 10 knots.

Based on results of monitoring and the mitigation measures proposed AECOM considers that there is no potential for dust nuisance from this activity.

6.3.2 Potential for Health Effects from Spray Drift

In addition to particulates and water droplets containing particulate, the water blaster generates a very fine water mist that has the potential to travel beyond the site boundary. AECOM considers that providing that the water used by the water blaster has low levels of impurities including suspended solids, there is limited potential for this to cause health or nuisance effects. AECOM understands that the water used for water blasting is from a local spring, which would be unlikely to contain significant levels of impurities. To demonstrate that the water used for water blasting is free of contaminants DOBY staff sent a sample of the water to R.J.Hill Laboratories for testing[8] to determine if it complies with the New Zealand drinking-water standard[9]. A copy of this report is provided in Appendix C.

AECOM has reviewed the test report and considers that the water sample complies with the Drinking Water Standards for New Zealand 2005 (Ministry of Health, revised 2018). AECOM therefore considers that if people were to come in contact (i.e. skin) with this water it would pose no potential to cause health effects.

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[8] R.J Hill Laboratories test report dated 16 July 2018
[9] 'Drinking-water Standards for New Zealand 2005 (Revised 2008)', Ministry of Health

7.0 Sanding and grinding vessels

7.1 Description of Activity

Sanding and grinding is another step in the painting preparation process. After the vessels are hauled out of the water and water blasted, residual material is removed from the hull using scrapers, grinders and sanders. The activity can generate particulate that under normal circumstances will fall in the immediate vicinity of the boat cradle and is collected below in a bunded impermeable area – refer to Figure 8 which shows a picture of the keel being prepared for painting.

7.2 Proposed Mitigation Measures

A range of mitigation measures will be used to control the particulate emissions, these include:

- Grinders and sanders will be fitted with vacuum extraction to further control any potential for dust emissions.
- Sanding and grinding operations will only be conducted when the wind speed is between 0.5 m/s and 5 m/s (as an hourly average).

7.3 Assessment of Effects from Dust Discharges

7.3.1 Potential for Dust Nuisance

As mentioned in Section 5, AECOM undertook particulate monitoring over a period of eight days to assess emissions. A range of scraping, sanding and grinding activities were undertaken on days 1, 4, 6 and 8 and during these occasions the maximum 1-hour average and 24-hour average concentrations were 392 µg/m³ and 38 µg/m³, respectively. While the 1-hour trigger was exceeded on day 8, at other times the particulate concentration was well below the trigger value, with the average 1-hour maximum concentration being 67 µg/m³. The trigger was only exceeded for a single 1-hour period and given that sanding and grinding does not occur for long periods of time the 24-hour average is unlikely to ever be exceeded.

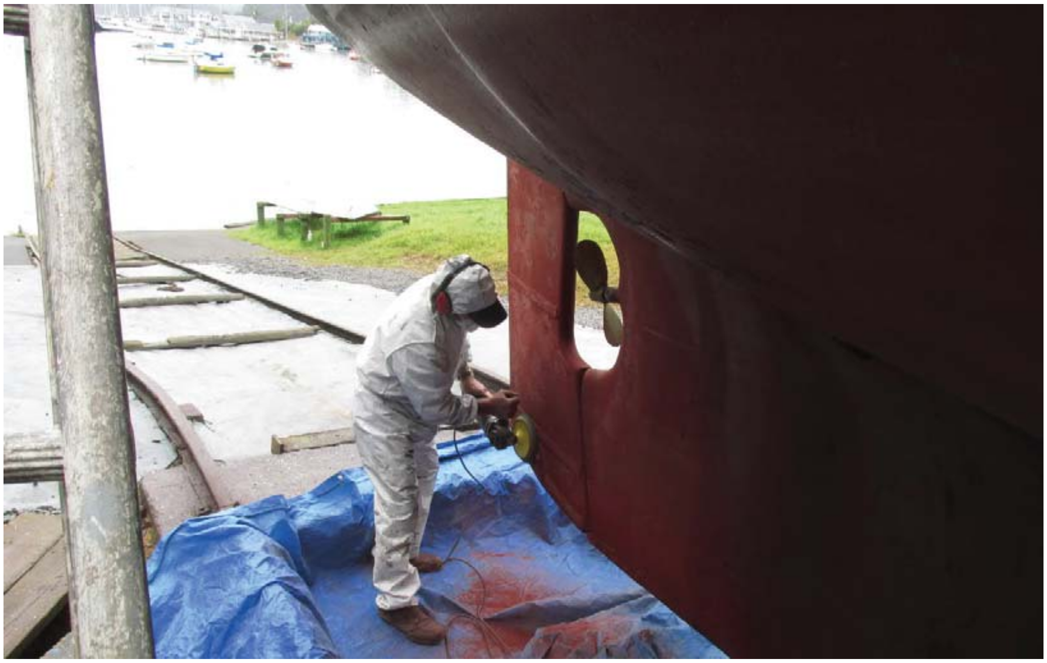
As previously mentioned, the 24-hour average trigger provides a better indication of chronic nuisance effects, as it is the ongoing cumulative effect of particulate discharges which creates nuisance effects, therefore concentrations slightly above the trigger value from time to time are unlikely to result in dust nuisance effects.

While the monitoring only occurred during calm to low wind speed conditions, given the close proximity of the particulate monitors with respect to activities, AECOM considers that the measured concentrations represent worse-case conditions that could be experienced off-site. Especially considering that this work should only be undertaken when winds are less than 5 m/s or 10 knots. During periods of high wind speed the potential for off-site particulate increases.

Similarly, to the effect that the reconstructed slipway will have on spray drift, the retaining walls to the north and south of the working area will reduce the potential for particulate emissions to travel beyond the slipway.

Given the relative infrequency of this activity, estimated to occur for 1 to 2 hours a day on up to 35 days of the year, AECOM considers that this activity has limited potential to cause nuisance at off-site locations and no potential for nuisance at the nearest residential locations.

Figure 8 Picture of a vessel being prepared for painting



7.3.2 Potential for Health Effects

Some of the dust that is generated during the paint preparation contains particulate matter with an aerodynamic dimeter of 10 µm or less (PM_{10}) which has the potential to cause health effects. PM_{10} is one of the main air pollutants in New Zealand, and because of this, there is a National Environmental Standard for Air Quality (NES)[10] of 50 µg/m³ as a 24-hour average. In New Zealand, the main sources of PM_{10} are combustion discharges from vehicles and home heating, although in coastal regions such as Opua, there will also be significant contributions from sea spray at times.

The PM_{10} standard is based on an exposure period of 24-hours as it is the prolonged exposure to this pollutant which can cause adverse effects. Based on the conservative assumption[11] that all of the TSP measured by the dust monitors is equivalent to PM_{10}, the highest 24-hour concentration was 38 µg/m³, which is below the standard.

AECOM therefore considers there to be limited potential for this activity to cause particulate related health effects, and any potential would be further reduced with the mitigation measures proposed, such as the use of vacuum attachments.

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[10] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality) Regulations, 2004 (NES)

[11] This is a conservative estimate of PM_{10} concentrations as the material measured is likely to contain coarser material which is not included within the PM_{10} size fraction.

8.0 Antifouling and Paint Emissions

To assess the potential effects associated with antifouling and paint emissions, AECOM has undertaken an atmospheric dispersion modelling assessment using the model CALPUFF (Version 7). CALPUFF has been used extensively in New Zealand and Australia and is a recommended model in the GPG ADM particularly for sites surrounded by complex terrain and where sea-breeze conditions are likely to occur. CALPUFF is a US EPA approved atmospheric dispersion model and is a recommended model in GPG ADM.

CALPUFF is a non-steady state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. In other words, the model can simulate the effects of time- and space-varying meteorological conditions on contaminant transport, transformation and removal.

The model was set up in accordance with the guidance contained in GPG ADM.

8.1 Assessment Criteria

8.1.1 Sources of Air Quality Assessment Criteria

The Ministry for the Environment's *GPG ID* recommends an order of priority when reviewing air quality assessment criteria. This order of priority is as follows:

- Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality) Regulations, 2004 (NES)[12];
- Ministry for the Environment, Ambient Air Quality Guidelines (2002 update) (NZAAQG)[13];
- Regional Air Quality Targets (RAQT); and,
- World Health Organisation air quality guideline (WHO AQG) Global Update 2005[14].

When there is no available New Zealand or WHO standards or guidelines, the GPG recommends that the ambient air quality criteria from other jurisdictions are to be used. These are as follow, in order of priority:

- California Office of Environmental Health Hazard Assessment Reference Exposure Limits (OEHHA REL)[15];
- US Environmental Protection Agency's Inhalation Reference Concentrations for Inhalation (US EPA RfC)[16];
- Texas Commission on Environmental Quality Effects Screening Level (TCEQ ESL)[17]
- New Zealand Worksafe -Workplace Exposure Standards (WES) Time Weighted Average (TWA) divided by 50 for low and moderately toxic hazardous air contaminants or divided by 100 for highly toxic bio-accumulative or carcinogenic hazardous air contaminants.

[12] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality), Regulations 2004
[13] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)
[14] Air quality Guidelines for Europe Second Edition, 2000
[15] California Office of Environmental Hazard Assessment http://www.oehha.ca.gov/air/allrels.html
[16] US EPA http://www.epa.gov
[17] Texas Commission on Environmental Quality Effects https://www.tceq.texas.gov/toxicology/esl/list_main.html

8.1.2 Summary of Assessment Criteria

Based on the guidance contained in the MfE GPG ID, AECOM has selected the appropriate health-effect based guidelines and these values are presented in Table 3.

Given that antifouling and painting typically only occurs for a maximum of 2 hours in any given day, predicted concentrations were compared with the 1-hour average assessment criteria.

Table 3 Summary of Relevant Air Quality Criteria

Pollutant	CAS Number	Threshold Concentration (µg/m³)	Assessment Criteria
1,2,4-trimethyl benzene	95-63-6	4,400	TCEQ ESL
1,3,5-trimethylbenzene	108-67-8	4,400	TCEQ ESL
2,4,6-tris[(dimethylamino)methyl]phenol	90-72-2	420	TCEQ ESL
2,4-pentanedione	123-54-6	830	TCEQ ESL
aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	136210-32-7	350	TCEQ ESL
bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	41556-26-7	100	TCEQ ESL
C18 fatty acid dimers/ polyethylenepolyamine polyamides	68410-23-1	1,000	TCEQ ESL
diethyl fumarate	623-91-6	400	TCEQ ESL
ethyl acetate	141-78-6	3,100	TCEQ ESL
ethyl Benzene	100-41-4	2,000	OEHHA REL
ethyl-3-ethoxypropionate	763-69-9	270	TCEQ ESL
ethylbenzene	100-41-4	2,000	OEHHA REL
hexamethylene diisocyanate	822-06-0	0.7	TCEQ ESL
hexamethylene diisocyanate polymer	28182-81-2	8.7	TCEQ ESL
Kerosene	8008-20-6	1,000	TCEQ ESL
methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	82919-37-7	100	TCEQ ESL
methyl ethyl ketone	78-93-3	18,000	TCEQ ESL
methyl isobutyl ketone	108-10-1	820	TCEQ ESL
naphtha petroleum, heavy, hydrodesulfurised	64742-95-6	4,400	TCEQ ESL
naphtha petroleum, light aromatic solvent	64742-95-6	4,400	TCEQ ESL
naphtha, petroleum, hydrodesulfurised heavy	64742-82-1	3,500	TCEQ ESL
n-butanol	71-36-3	610	TCEQ ESL
n-butyl acetate	123-86-4	11,000	TCEQ ESL
polyethylene glycol	25322-68-3	1,000	TCEQ ESL
propylene glycol monomethyl ether acetate, alpha-isomer	108-65-6	2,700	TCEQ ESL
propylene glycol monomethyl ether acetate, beta-isomer	70657-70-4	280	TCEQ ESL
solvent naphtha (petroleum), light aromatic	64742-95-6	4,400	TCEQ ESL
Tinuvin 1130	104810-47-1	120	TCEQ ESL
Tinuvin 213	104810-48-2	120	TCEQ ESL
toluene	108-88-3	37,000	OEHHA REL
xylene	1330-20-7	22,000	OEHHA REL

8.2 Identification of Sensitive Receptors

A desktop study was undertaken to identify discrete receptors deemed sensitive to changes in air quality as a result of discharges to air from the site. In the context of the assessment contained in this report, the term 'sensitive receptors' is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution. This type of receptor includes:

- residential properties;
- hospitals;
- schools;
- libraries; and,
- public outdoor locations (e.g. parks, reserves, beaches, sports fields).

For this project four residential locations and the reserve to the south have been identified near to the site, where it could reasonably be expected that people could be exposed to paint emissions for the duration of the assessment criteria averaging period which is typically 1 hour. These locations are shown in Figure 9.

Figure 9 Nearest Residential Receptor Locations

8.3 Model Parameters

The modelled parameters used in this assessment are presented in Table 4. The emission source has been characterised as a small volume source to approximate the dispersion of antifouling/paint over a relatively small area.

Table 4 Emission Data

Parameter	Units	Value
		Proposed Location
Source Coordinates (UTM) (x)	(m)	237,811
Source Coordinates (UTM) (y)	(m)	6,088,603
Base Elevation	(m)	27.4
Initial Sigma y	(m)	1.16
Initial Sigma z	(m)	0.7

8.4 Meteorological Modelling

The atmospheric dispersion model used in this assessment requires local meteorological data as an input to predict ground level concentrations of paint solvents. While some of the parameters required, such as wind speed, temperature and relative humidity can be obtained from local automatic weather stations (AWS), the model requires other meteorological parameters such as mixing height, vertical wind profile and temperature profile. These parameters are not typically measured by AWS and therefore for this project we undertook meteorological modelling using 'The Air Pollution Model' (TAPM) to predict the required meteorological parameters for the project domain. This data was then subsequently refined using CALMET, CALPUFF's, meteorological pre-processing module, which takes into consideration the influence of the local terrain and land use.

8.4.1 TAPM

TAPM is a prognostic model which is used to predict three-dimensional meteorological data, with no local data inputs required. TAPM Version 4 was developed in Australia by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The TAPM modelling domain was centred at Universal Transverse Mercator (UTM) 237,836 m E, 6,088,570 m N, (zone 60, south).

A three dimensional prognostic meteorological file was extracted from TAPM for the year 2017 and was used to generate the CALMET meteorological data input file.

8.4.2 CALMET

The CALMET modelling domain was centred at (UTM) 237,000 m E, 6,088,570 m N, (zone 60, south). A 33 km by 3 km Cartesian grid was used at a resolution of 150 m.

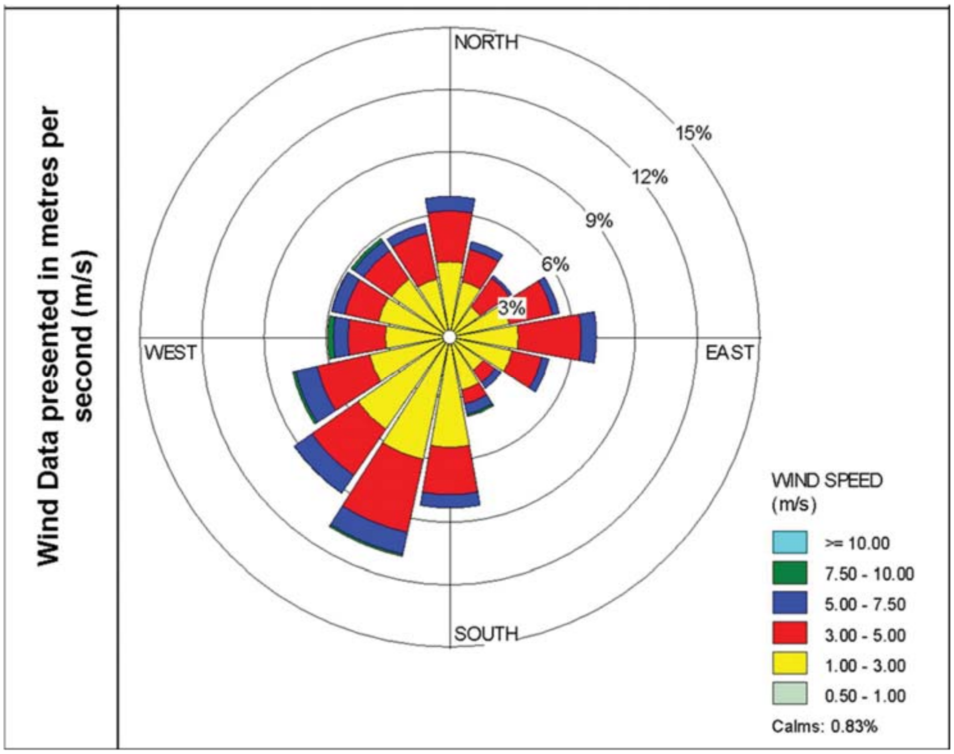
Geophysical (terrain and land use) data were input into the CALMET model at a resolution of 150m.

The surface elevation (terrain) data were taken from Lakes Environmental Software's website (www.webGIS.com), which was based on the Shuttle Radar Topography Mission (SRTM-3) digital elevation model data (Version 2) originally produced by the National Aeronautics and Space Administration (NASA). The land use data was extracted from the Global Land Cover Characterization database

Wind speed and wind direction data from the Russell Automatic Weather Station (AWS) was input into the model. Figure 10 presents a windrose of the CALMET data extracted from the model at the location of the project site.

AECOM has reviewed the CALMET model outputs and considers that the meteorological data developed is appropriate for an assessment of this type, however due to the very sheltered nature of the location on-site winds are likely to be lower in strength than modelled with a higher frequency of winds from the east. Notwithstanding this, there are enough low wind speed conditions in the meteorological dataset to provide a good indication of worst-case dispersive conditions.

Figure 10 CALMET Generated Wind Roses centred on the Project Site (2017)



8.5 Background Air Quality

AECOM has assumed that background solvent concentrations are zero given that there are no significant nearby sources of these compounds.

8.6 Model Assumptions

It has been assumed that the boat yard operational hours are between 8 am and 6 pm 365 days of the year. The model has been configured to assess emissions between these hours for all the days in the 2017 CALMET dataset. This is considered conservative as the painting activities typically only occur for 70 hours per year (35 boats x 2 hours per boat).

The 99.9%ile 1-hour average concentrations have been compared with the 1-hour average assessment criteria.

8.7 Antifouling Emissions

Antifouling paint is generally brushed onto vessels, however from time to time it is sprayed on. The amount used varies with the size of the vessel however it is generally applied up to a rate of 6.125 litres per hour, this includes the thinner which is mixed at up to 20% depending on how the antifouling is applied i.e. 5 L of antifouling to 1.125 L of thinner. The number of vessels painted with antifouling is approximately 30 to 35 per year. The boat yard currently uses either Altex or Awlcraft antifouling paint. These are copper and zinc (20-50% of the total paint component) in a solvent base.

The estimate of emissions has been based on the following conservative assumptions:

- That all of the volatile organics (VOC) will evaporate off from the product. This is a worst-case scenario as some of the compounds will bind with the copper/zinc solids.
- The maximum concentration of the VOCs listed in the Material Safety Datasheets (MSDS) has been used to estimate solvent concentrations.

Based on these assumptions the emissions presented in Table 5 have been used in this assessment. The effects from these emissions are assessed in Section 9.

Table 5 Antifouling Emissions

Manufacturer	Use	Compound	% of Total VOC	VOCs (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Coastal Copper Antifouling	Antifouling	n-butanol	20	251.5	4	0.056
Altex Coastal Copper Antifouling	Antifouling	xylene	20	251.5	4	0.056
Altex No.5 Antifouling	Antifouling	xylene	20	251.5	5	0.070
Altex No.5 Antifouling	Antifouling	n-butanol	20	251.5	5	0.070
Awlcraft Antifouling Blue	Antifouling	solvent naphtha (petroleum), light aromatic	25	348.0	5	0.121
Awlcraft Antifouling Blue	Antifouling	1,2,4-trimethylbenzene	10	348.0	5	0.048
Awlcraft Antifouling Blue	Antifouling	xylene	10	348.0	5	0.048
Awlcraft Antifouling Blue	Antifouling	1,3,5-trimethylbenzene	2.5	348.0	5	0.012
Awlcraft Antifouling Blue	Antifouling	ethyl Benzene	2.5	348.0	5	0.012
Altex Thinning Solvent #10	Thinner	xylene	80	869.4	1.125	0.217
Awlcraft International Thinner no. 3	Thinner	xylene	100	251.5	1.125	0.079
Awlcraft International Thinner no. 3	Thinner	ethyl Benzene	25	251.5	1.125	0.020

8.8 Painting Emissions

In addition to the application of antifouling, vessels are also painted with primers, undercoat and linear polyurethane and enamel top coat paints, typically manufactured by Altex. This occurs on average four times per year and up to 7.5 Litres of paint is used per vessel. This equates to a maximum of 30 L of paint per year. The majority of these products are two pot mixtures containing a resin and a base, typically mixed at a ratio of 1:4. The quantity of paint containing diisocyanate compounds used at the boat yard has been estimated to be a maximum of 15 L per year.

The estimate of emissions has been based on the following conservative assumptions:

- That all of the solvent will evaporate off from the product. This is conservative as some of the compounds will bind with the solids in the paint. The only exception to this is for paints with an diisocyanate component where, given the very low vapour pressure of diisocyanate compounds the amount evaporated has been assumed to be negligible. Emissions of diisocyanate compounds have instead been based on the proportion of overspray that is typically expected, which is 2%.
- The maximum concentration of the solvents listed (with the exception of diisocyanate compounds) in the MSDS has been used to estimate solvent concentrations.
- Some compounds identified in the MSDS have not been included in this assessment if they are expected to be bound to the painted surfaces or if they have very low vapour pressures i.e. they evaporate at a very slow rate that the above assumption that all of the VOC from the paint is discharged is overly conservative.

Based on these assumptions the emissions presented in Appendix D have been used in this assessment. The effects from these emissions are assessed in Section 9.

9.0 Atmospheric Dispersion Modelling Results – Antifouling and Paint Emissions

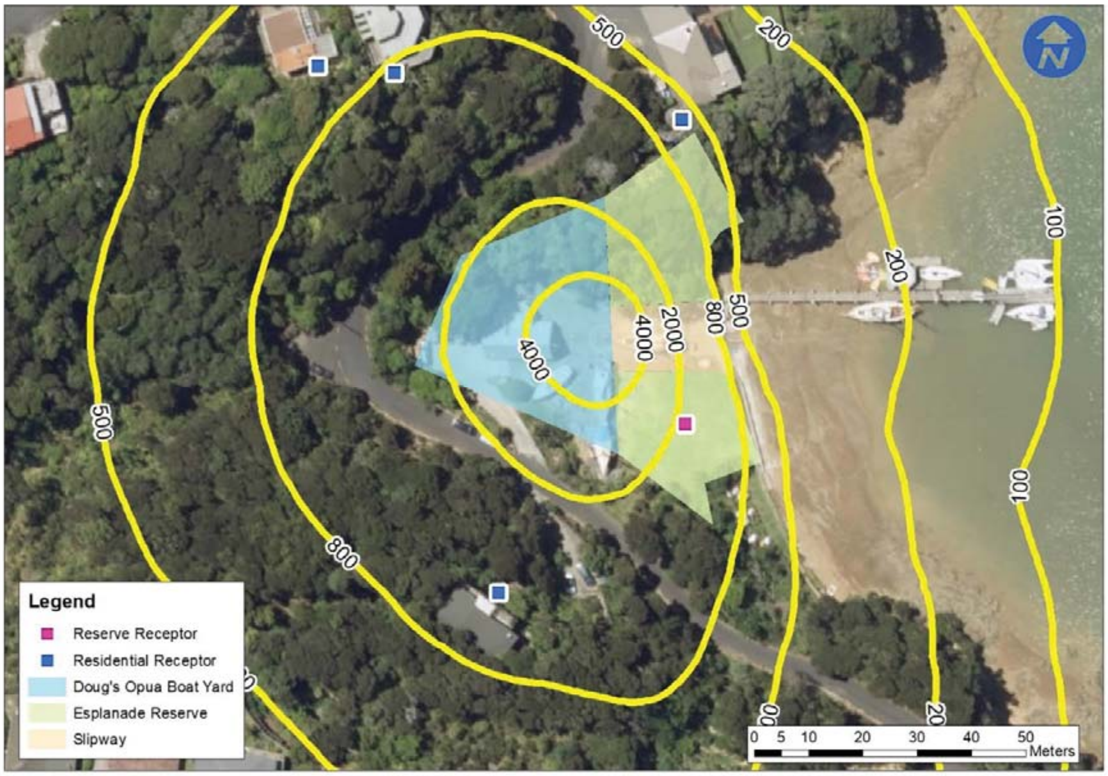
The predicted ground level ambient solvent concentrations are presented in Table 6. The predicted 99.9%ile concentrations of xylene, the solvent with the highest discharge rate, are presented as an isopleth plot in Figure 11.

Table 6 Predicted VOC Concentrations

Pollutant	Threshold Concentration (µg/m³)	99.9 % ile 1-hour Average Predicted Concentration (µg/m³)	
		Existing Slipway	
		Nearest Residence	Within the Reserve
1,2,4-trimethyl benzene	4,400	237	416
1,3,5-trimethylbenzene	4,400	59	104
2,4,6-tris[(dimethylamino)methyl]phenol	420	42	74
2,4-pentanedione	830	78	137
aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	350	30	52
bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	100	2	4
C18 fatty acid dimers/ polyethylenepolyamine polyamides	1,000	41	72
diethyl fumarate	400	1	1
ethyl acetate	3,100	78	137
ethyl Benzene	2,000	96	169
ethyl-3-ethoxypropionate	270	78	137
hexamethylene diisocyanate	0.7	0.028	0.049
hexamethylene diisocyanate polymer*	8.7	7	12
Kerosene	1,000	80	140
methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	100	1	2
methyl ethyl ketone	18,000	320	561
methyl isobutyl ketone	820	131	229
naphtha petroleum, light aromatic solvent	4,400	56	98
naphtha, petroleum, hydrodesulfurised heavy	3,500	159	280
n-butanol	610	342	601
n-butyl acetate	11,000	148	260
polyethylene glycol	1,000	1	1
propylene glycol monomethyl ether acetate, alpha-isome	2,700	422	741
propylene glycol monomethyl ether acetate, beta-isomer	280	0.2	0.4
solvent naphtha (petroleum), light aromatic	4,400	592	1,039
Tinuvin 1130	120	1	3
Tinuvin 213	120	3	6
Toluene	37,000	64	112
Xylene	22,000	1,065	1,869

*Guideline has the potential to be exceeded during certain meteorological conditions.

Figure 11 Predicted 99.9%ile 1-hour average xylene concentrations (µg/m³)



9.1.1 Proposed Mitigation Measures

9.1.1.1 Limit use of Hexamethylene diisocyanate paint

Hexamethylene diisocyanate is primarily associated with the resin component for two types of paint; Altex Elite Pro-Spray Polyurethane and Altex Polyurethane Undercoat. The applicant has advised that these paint products are seldom used; typically up to four times a year for a period of two hours on a given day (maximum annual paint usage is 15 L).

To minimise any potential for off-site effects associated with the use of these products, AECOM considers that any resource consent should limit the use of these products to periods of time when the wind is blowing up the slipway (northeast through to a south-southeast direction).

Based on AECOM understanding of the local meteorology, winds from these directions are relatively common. This is due to a combination of the regional prevailing wind flows and the unique topography surrounding the site. It is therefore considered that this recommended resource consent condition would not significantly limit the ability of the applicant to undertake painting activities.

9.1.1.2 Use of an Exclusion Zone

The Environmental Protection Agency (EPA)[18] has outlined a number of control measures to minimise the effects from antifouling application. These include the requirement to post signs at every entrance point to warn people that the application of antifouling is taking place.

In terms of the use of paint containing hexamethylene diisocyanate, AECOM has not been able to identify the extent of a suitable exclusion zone from NRC and FNDC documents. However, based on the controls set out in the Auckland Unitary Plan (AUP) Standard (E14.6.1.4), an exclusion zone of 15 m is considered appropriate. The controls provided in the AUP Standard were designed to minimise the effects of spray application of surface coatings containing diisocyanates.

The AUP Standard also requires the activity to be at least 30 m from sensitive receptors such as residential dwellings, with no more than 18 L per day of paint containing diisocyanates or organic plasticisers applied in a continuous application at a single location.

The nearest residential dwelling is approximately 35 m from the area used to paint vessels and the amount of paint used per day has been estimated to be less than 7.5 L. The activity would therefore comply with the requirements of the AUP Standard.

AECOM recommends that while painting is being undertaken signage shall be placed on the edge of the reserve and at the bottom of the slipway notifying the public that painting of vessels is taking place and that they should keep clear.

---

[18] Environmental Protection Agency. Decision on the Application for reassessment of Antifouling Paints (APP201051). 26 June 2013

9.2 Assessment of Health Effects from Antifouling/Painting

AECOM has assessed the potential effects from paint emissions and has found that the off-site concentrations, for the majority of the VOCs associated with the paints commonly used at the boat yard, are below the relevant health-effects based air quality assessment criteria. The only exception being that the guideline for hexamethylene diisocyanate has the potential to be exceeded at off-site locations.

Providing that painting using hexamethylene diisocyanate products is only undertaken during periods when the wind is blowing up the slipway (northeast through to a south-southeast direction), AECOM considers that there is limited potential for health-effects from boat yard activities to occur at the nearby residential receptor locations or the reserve to the south.

9.2.1 Effect of Changes to the Slipway

In terms of the changes associated with the reconstruction of the slipway, some minor reduction in concentrations could be expected within the reserve and on the walkway due to boats being worked on closer to the boat shed and further from the reserve and walkway.

10.0 Proposed Resource Consent Conditions

The following presents a set of proposed resource consent conditions that AECOM considers would be appropriate at controlling air discharges from boat yard activities.

Discharge Contaminants to Air in the Coastal Marine Area

1. The discharges to air authorised by this consent applies only to the 'Discharge to Air and Offensive Odour Boundary' area below Mean High Water Springs identified on the attached Northland Regional Council Plan Number 3231D.
2. The preparation or smoothing of vessel hulls including removal or smoothing of antifouling shall not be undertaken in the consent area. The preparation or smoothing of vessel or facility superstructure using a sanding device shall not be undertaken unless a dust collection apparatus that is operating effectively is attached to the device.

Discharge Contaminants to Air from Land

1. The discharges to air authorised by this consent applies only to the 'Discharge to Air and Offensive Odour Boundary' area landward of Mean High Water Springs identified on the attached Northland Regional Council Plan Number 3231D. This consent does not authorise dry abrasive blasting activities.
2. The preparation or smoothing of vessel hulls or superstructure including removal or smoothing of antifouling using a sanding or grinding device shall only be undertaken using an appropriate dust collection system that is operating effectively.
3. A permanent weather station capable of measuring wind speed and direction at a height of 6 m shall be installed on the boat yard site.
4. Sanding and grinding operations shall only be conducted when the wind speed is between 0.5 m/s and 5 m/s (as an hourly average). The application of antifouling and paint shall only be undertaken when the windspeed is greater than 0.5 m/s and when apparent wind on the slipway is from the northeast to south (wind is blowing up the slipway through an angle of 45 to 170 degrees).
5. All spray application of antifouling paint shall comply with Environmental Protection Agency rules including setting up of a controlled work area around the vessel concerned.
6. An exclusion zone shall be setup around vessels being painted commensurate with the edge of the slipway and walking track. Temporary signage shall be placed on the edge of the reserve and at the bottom of the slipway notifying the public that painting of vessels is taking place. The signage shall be designated to comply with the requirements of the Environmental Protection Agency rules.
7. Temporary screens shall be erected between the blasting area and the walking track at all times during high pressure water blasting to mitigate effects of spray drift.
8. All equipment used to avoid or mitigate any adverse effects on the environment from emissions to air shall be maintained in good working order.
9. The Consent Holder's operations shall not give rise to any offensive or objectionable dust, overspray, or odour at or beyond the 'Discharge to Air and Offensive Odour Boundary' as identified on the attached Northland Regional Council Plan Number 3231D.
10. The maximum daily paint application rate for all paints, excluding those which contain diisocyanate compounds, shall be restricted to no more than 30 L/day.
11. The Consent Holder shall, on a daily basis, keep records of all occasions when water blasting and spray coating activities are undertaken. These records shall be made available to the council's assigned monitoring officer on written request and shall include the:
    a. Item(s) being spray coated;
    b. Location at which spray coating occurred;
    c. Date and time (Hours) of operation each day, including a record of the

   d. wind speed and direction at the commencement and conclusion of works on each day;
   e. Number of spray coating units being used; and
   f. Types and volumes of coating materials being applied.

12. The maximum daily paint application rate for all paints, excluding those which contain diisocyanate compounds, shall be restricted to no more than 30 L/day.
13. The use of diisocyanate based paints shall be restricted and limited to no more than 15 L/ year.
14. Diisocyanate painting shall only be undertaken when the wind is from the northeast through to south southeast direction (i.e. 45° to 170°). The consent holder shall advise the councils assigned monitoring officer, in writing, when diisocyanate painting is to occur at least 24-hour beforehand on each occasion.

11.0 Conclusions

AECOM has assessed the potential effects associated with air discharges from activities at DOBY This included assessing the potential for dust nuisance from water blasting, sanding and grinding activities and VOC emissions from the application of antifouling and paints.

AECOM assessment has concluded, based on an eight-day particulate monitoring study, that there is unlikely to be any nuisance effects from water blasting, sanding or grinding activities.

To assess the potential effects from VOC emissions associated with the application of antifouling and paint, AECOM undertook an atmospheric dispersion modelling assessment using the model CALPUFF. As part of this assessment AECOM developed meteorology for the local environment that was incorporated into the computer model. The modelling assessment conservatively assumed that all of the VOC associated with the antifouling and paint are discharge to atmosphere and that painting occurred between 8 am and 6 pm for all the hours of the modelled year (2017) i.e. 3,650 hours in the year, this compares with the typical boat yard throughput which is in the order of 70 to 80 hours of paint application per year.

The results of atmospheric dispersion modelling determined that VOC concentrations at nearby residences and at the reserve to the south, locations where it can be reasonable expected that people would be for significant periods of time, were typically below accepted international air quality assessment criteria designed to protect human health. Concentrations of hexamethylene diisocyanate have the potential to exceed health-effect assessment criteria within the reserve, therefore it is recommended that the use of paints containing this compound are limited and only used when the wind is blowing up the slipway.

The change proposed to the slipway are likely to have a positive influence on air quality, with the reprofiling of the slipway creating physical barriers to the north and south of boat yard activities which will reduce the potential for discharges to travel beyond the slipway.

Overall, AECOM considers that there is limited potential for VOC from the application of antifouling and painting to cause human health effects, particularly given the limited duration that this activity takes place.

12.0 Limitations

AECOM New Zealand (AECOM) has prepared this Assessment of Effects report on discharges to air in accordance with the usual care and thoroughness of the consulting profession for Doug's Opua Boat Yard for use in a statutory process from the Auckland Council under the Resource Management Act 1991 for activities undertaken at 1 Richardson Street, Opua, Bay of Islands.

Except as specifically stated in this section, AECOM does not authorise the use of this Report by any third party except as provided for by the Resource Management Act 1991.

Nor does AECOM accept any liability for any loss, damage, cost or expenses suffered by any third party using this report for any purpose other than that stated above.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

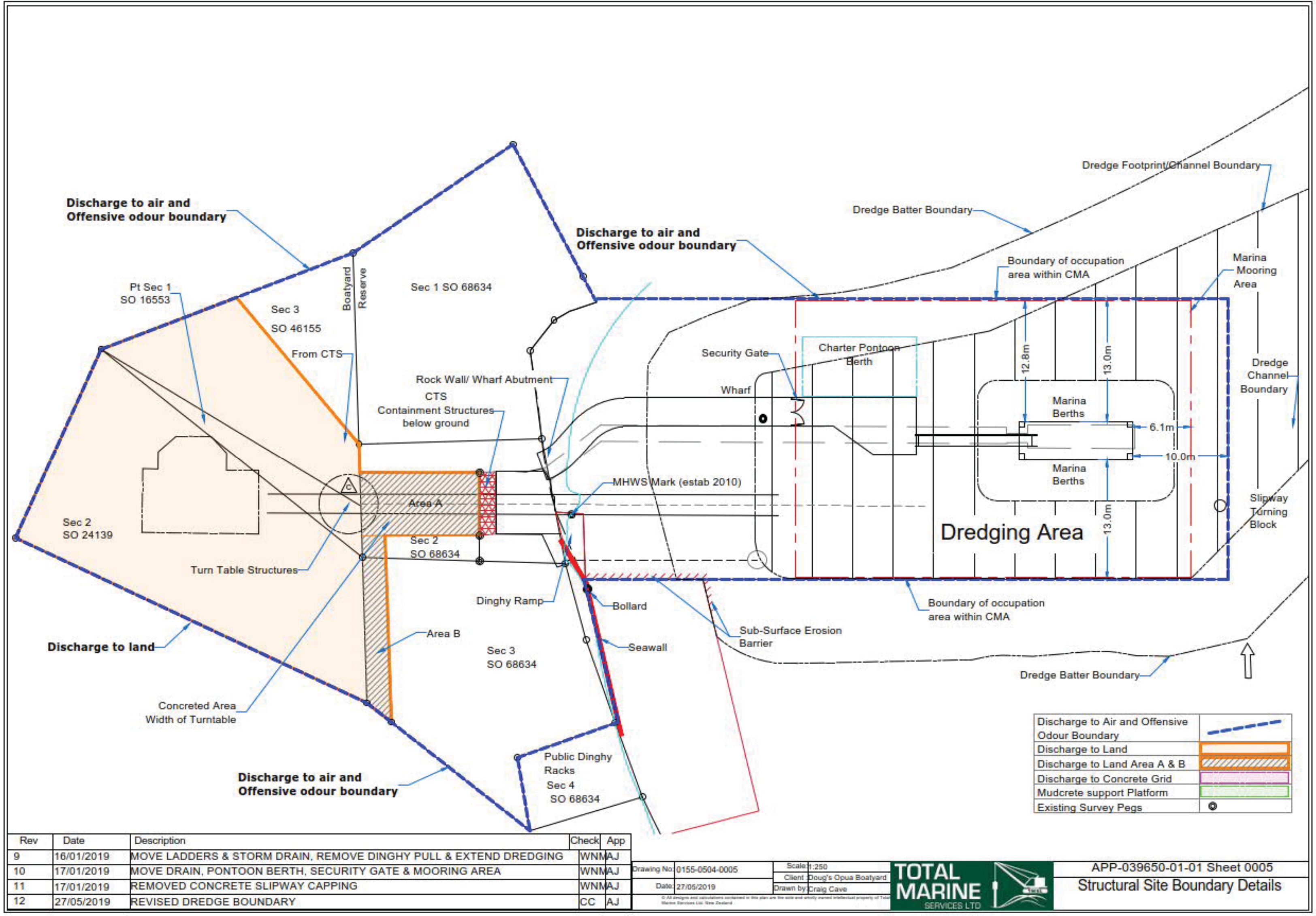
It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated June 2018.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in this Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared during May 2019 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

Appendix A

Resource Consent Plan



Rev	Date	Description	Check	App
9	16/01/2019	MOVE LADDERS & STORM DRAIN, REMOVE DINGHY PULL & EXTEND DREDGING	WNM	AJ
10	17/01/2019	MOVE DRAIN, PONTOON BERTH, SECURITY GATE & MOORING AREA	WNM	AJ
11	17/01/2019	REMOVED CONCRETE SLIPWAY CAPPING	WNM	AJ
12	27/05/2019	REVISED DREDGE BOUNDARY	CC	AJ

Appendix B

Particulate Monitoring Results

Figure 12 Particulate Monitoring Day 1 (12 June 2018) – Water blasting Scraping and Grinding

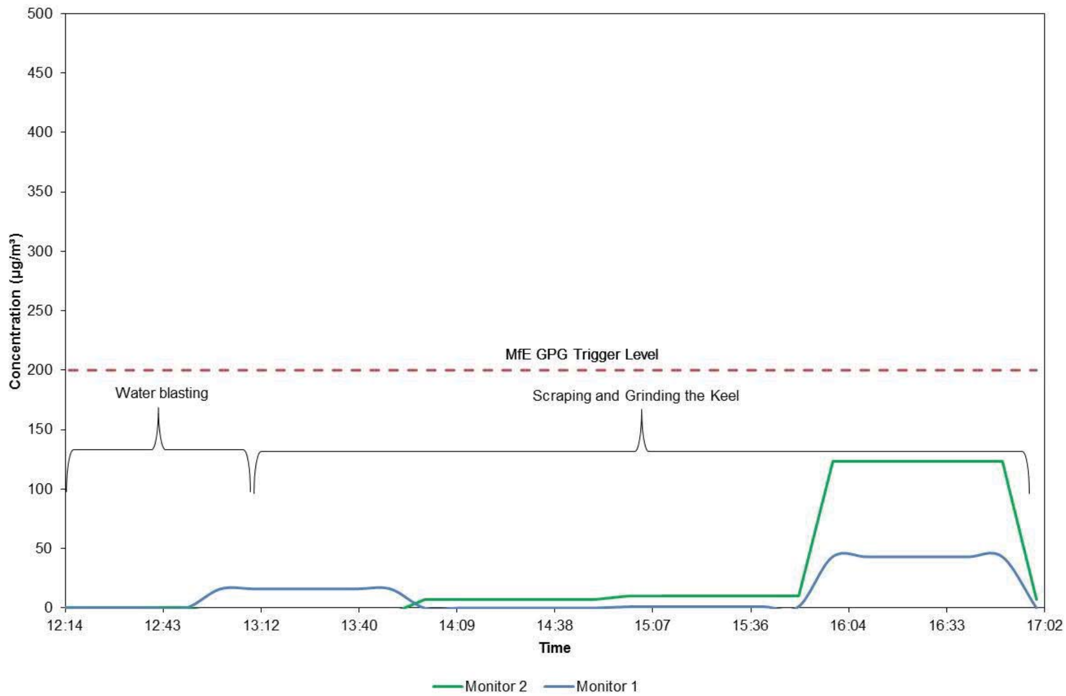


Figure 13 Particulate Monitoring Day 2 (13 June 2018) – Spray Painting Antifouling

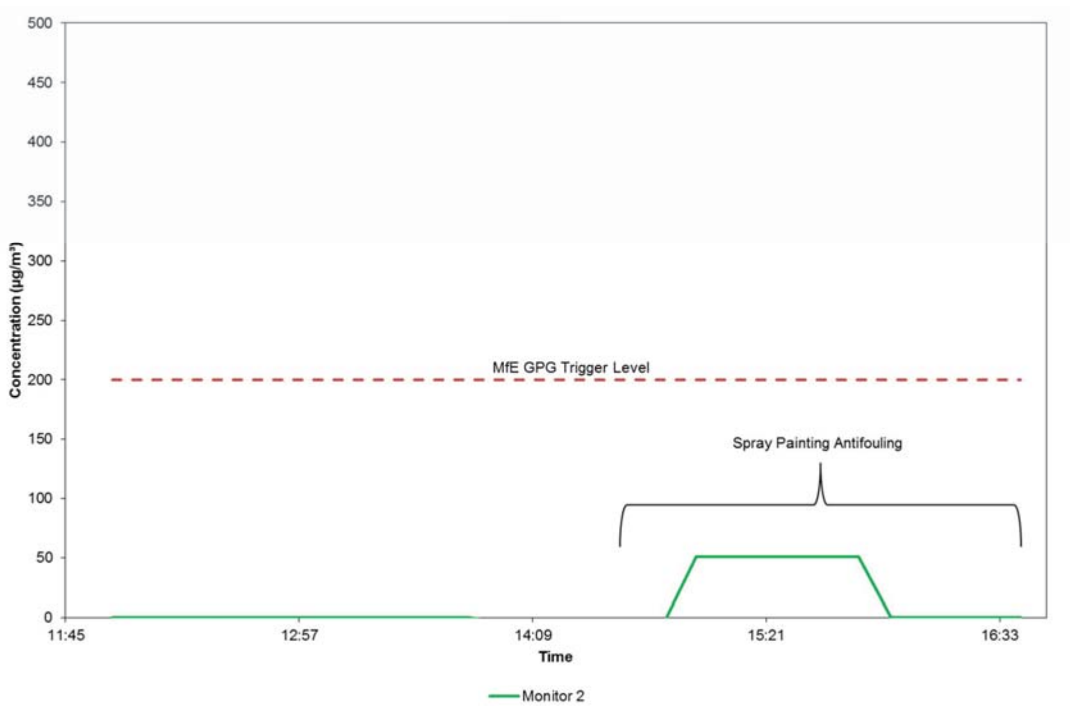


Figure 14 Particulate Monitoring Day 3 (14 June 2018) – Water blasting

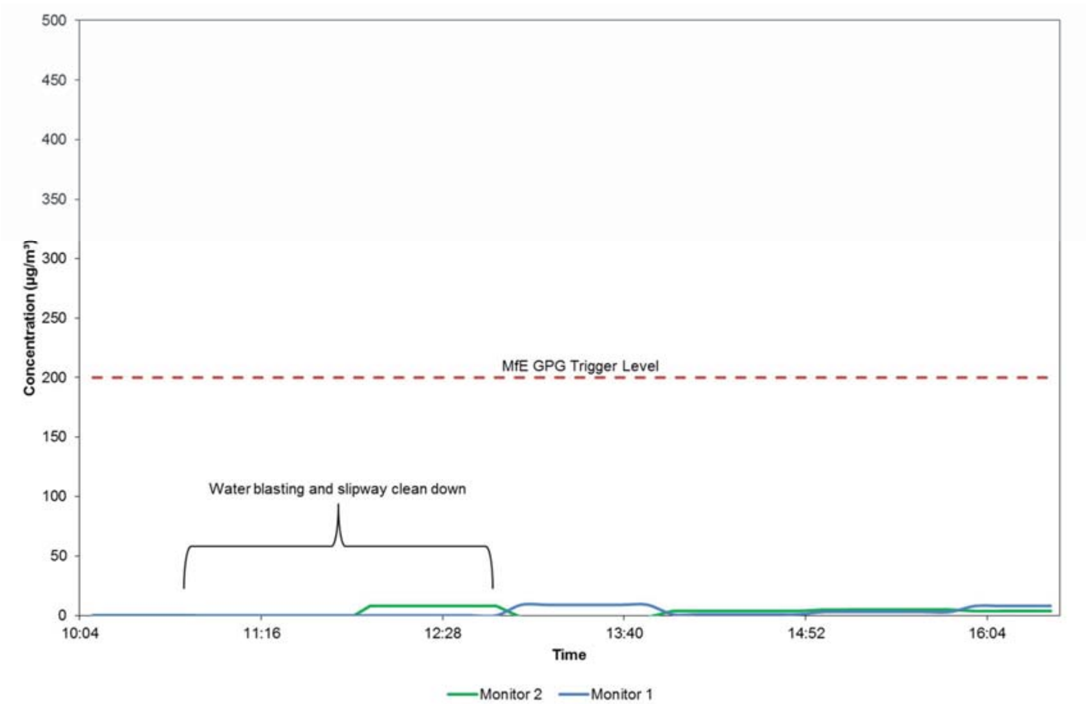


Figure 15 Particulate Monitoring Day 4 (15 June 2018) – Sanding and hand painting antifouling

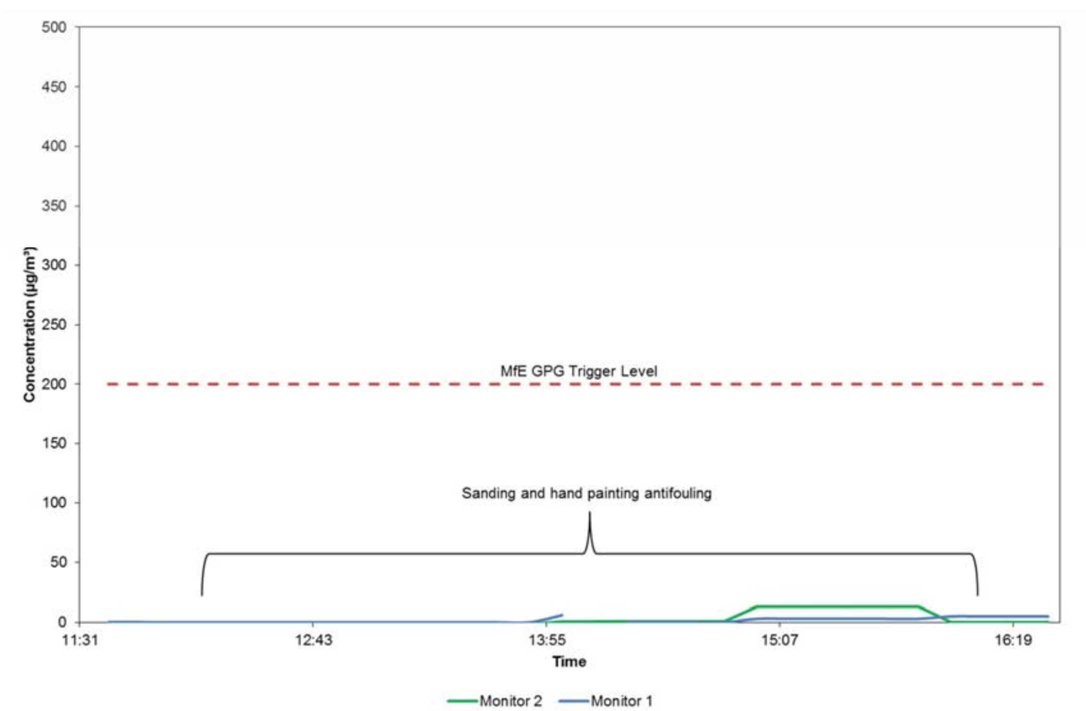


Figure 16 Particulate Monitoring Day 5 (16 June 2018) – Water blasting, antifouling and topside repairs

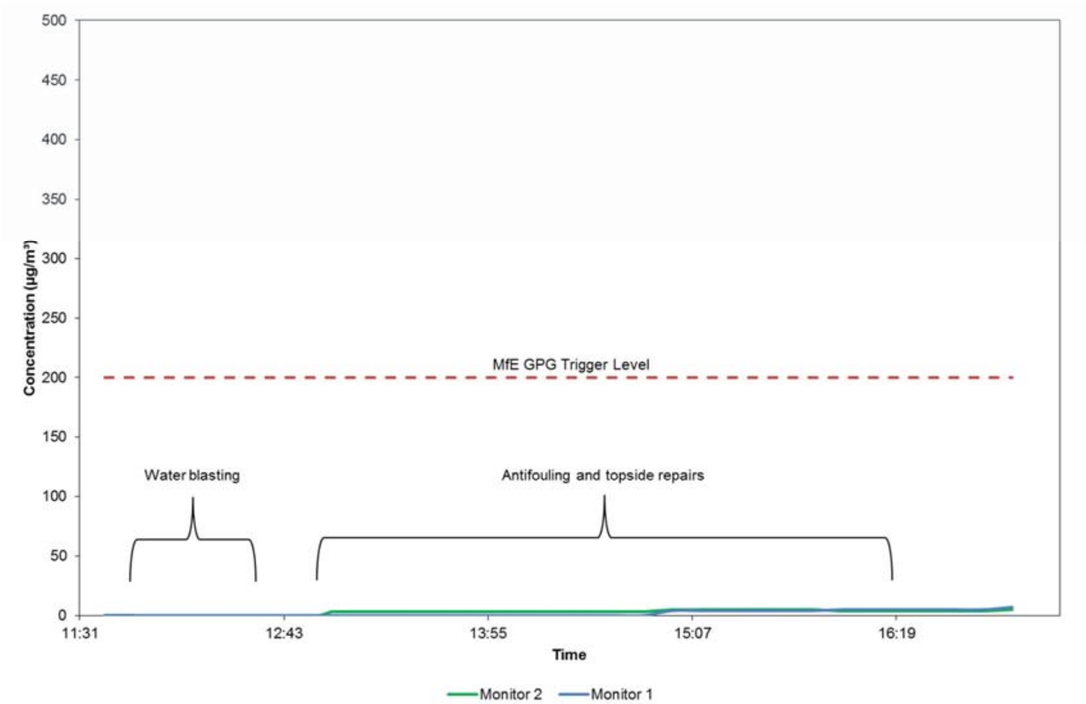


Figure 17 Particulate Monitoring Day 6 (17 June 2018) – Sanding and Polishing topsides

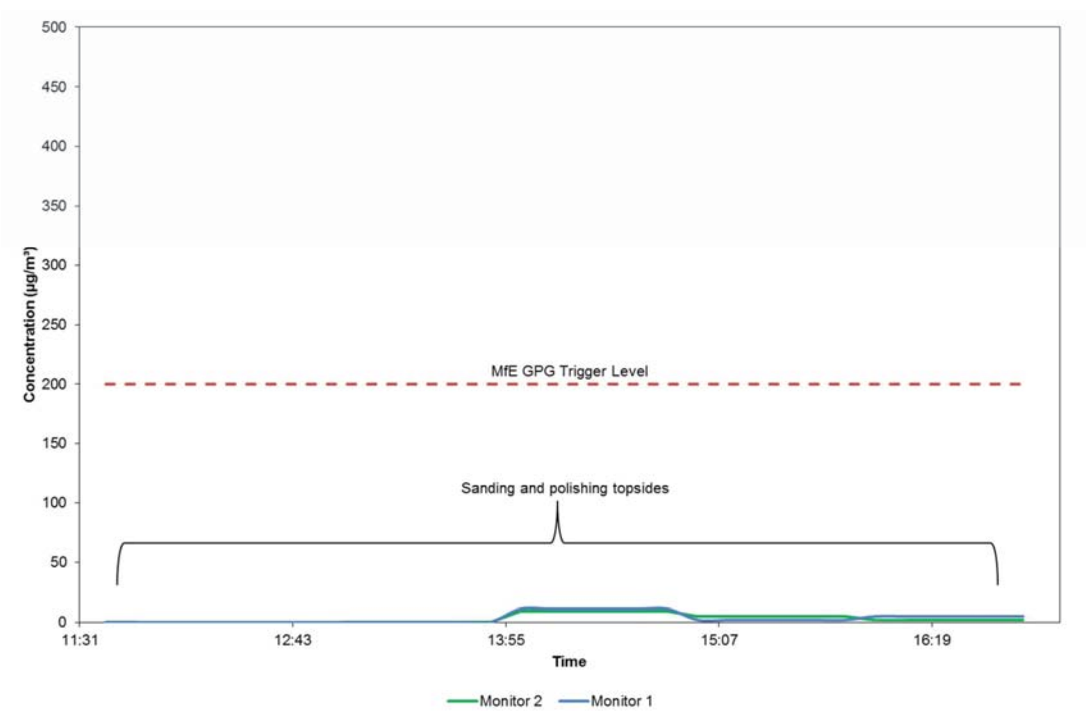


Figure 18 Particulate Monitoring Day 7 (18 June 2018) – Water blasting and cleaning

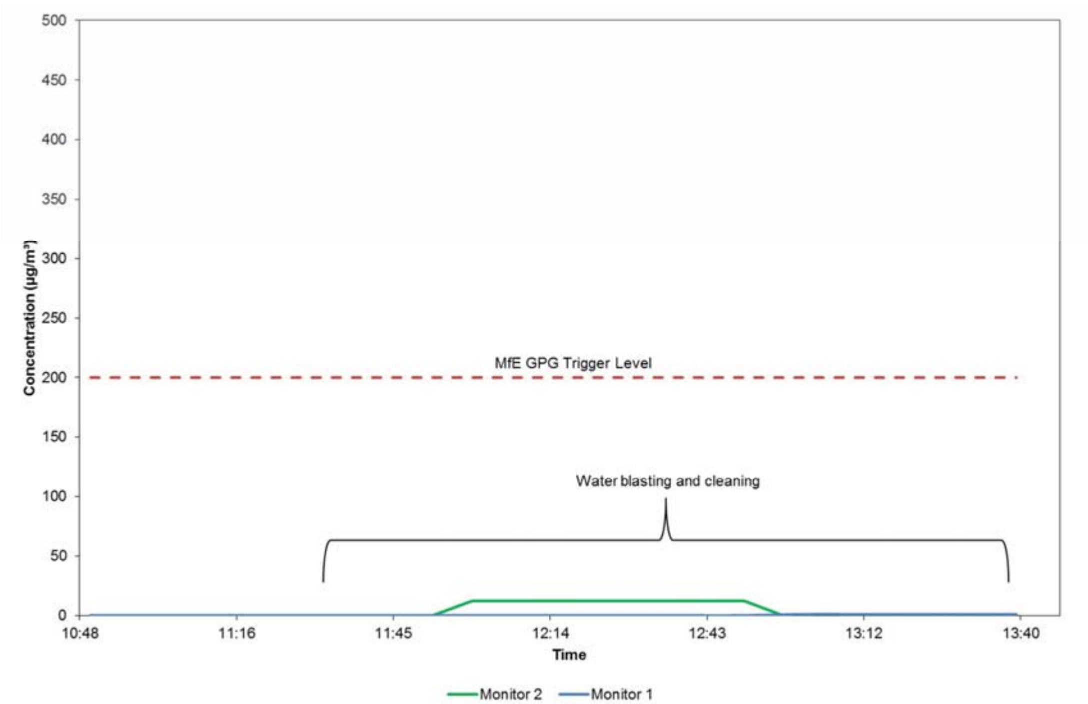
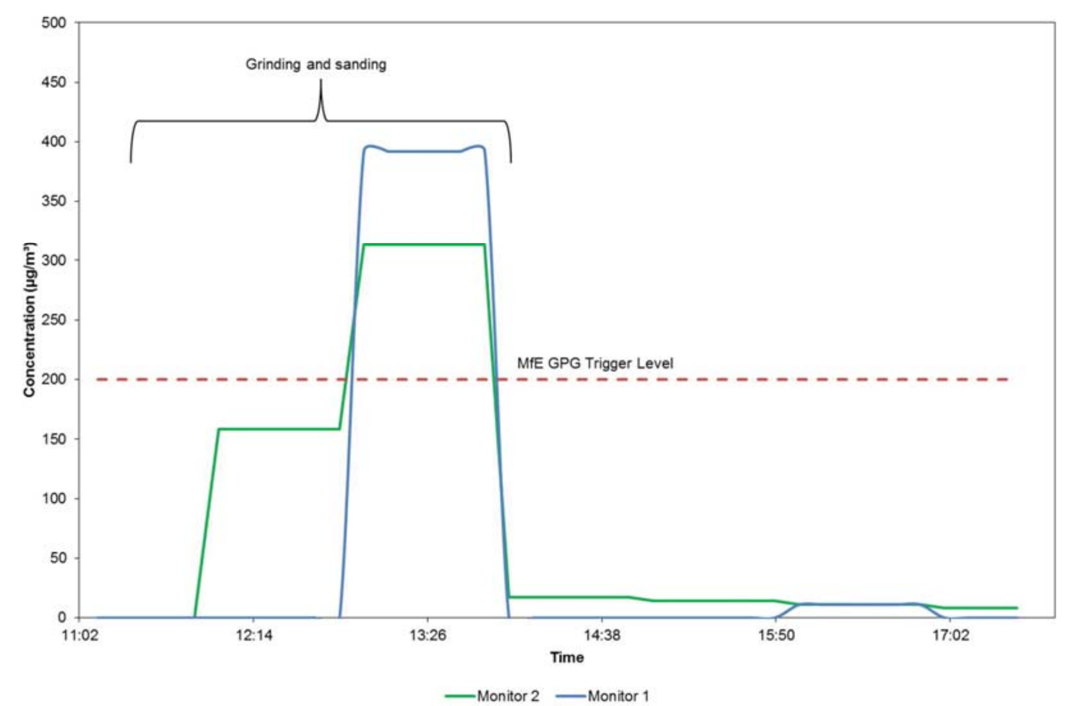


Figure 19 Particulate Monitoring Day 8 (19 June 2018) – Scraping and Grinding



Appendix C

Water Quality Test Results

AECOM Imagine it. Delivered.

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12 March 2019

Peter Stacey
Team Leader - Air Quality
AECOM NZ Ltd
8 Mahuhu Crescent
Auckland 1140

Dear Peter

Doug's Opua Boat Yard, 1 Richardson Street, Opua 0200 - Drinking Water Results

1.0 Introduction and results

As requested I have reviewed the spring water samples from Doug's Opua Boat Yard, 1 Richardson Street, Opua 0200 taken on the 10th July 2018 and sent for testing at Hills Laboratory. Results were compared against the Drinking-water Standards for New Zealand 2005 (Ministry of Health, revised 2018) and are presented in Table 1 below. The Certificate of Analysis from Hills Laboratory is provided in Appendix A.

Table 1 Spring water sample results from Doug's Opua Boat Yard compared with Drinking-water Standards (revised 2018)

	Lab result	Guidance value[1]	Maximum Acceptance values (MAV)[2]
Escherichia coli (MPN/100ml)	< 1*		< 1
pH (pH Units)	7.5	7.0 -8.5	
Total Alkalinity (g/m3 as CaCO3)	20		
Free Carbon Dioxide (g/m3 at 25°C)	1.3		
Total Hardness (g/m3 as CaCO3)	18.9	<200	
Electrical Conductivity (EC) (mS/m)	20.5		
Electrical Conductivity (EC) (µS/cm)	205		
Approx Total Dissolved Salts (g/m3)	137	<1000	
Total Boron (g/m3)	0.025		1.4
Total Calcium (g/m3)	2.3		
Total Copper (g/m3)	0.0108	<1	2
Total Iron (g/m3)	0.026	<0.2	
Total Magnesium (g/m3)	3.2		
Total Manganese (g/m3)	0.00119	<0.04 (Staining) <0.10 (Taste)	0.4
Total Potassium (g/m3)	2.1		
Total Sodium (g/m3)	29	<200	
Total Zinc (g/m3)	0.0137	<1.5	
Chloride (g/m3)	35	<250	
Nitrate-N (g/m3)	1.85		11.3
Sulphate (g/m3)	6.1	<250	

[1] Guideline Values are the limits for aesthetic determinants that, if exceeded, may render the water unattractive to consumers.

[2] The Maximum Acceptable Values (MAV) have been defined by the Ministry of Health for parameters of health significance and should not be exceeded.

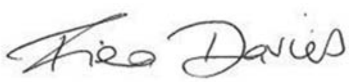
***** Hills laboratories state that the sample did not meet the temperature requirements for the lab testing. The sample was received at 13degrees C, which is above the recommended 10degrees C. Usually higher temperatures favours bacteria growth. Given the result was less than 1 MPN/100 ml the sample result is considered below the MAV for E. coli.

2.0 Conclusion

It is considered that the results of the sampling are compliant with the Drinking Water Standards for New Zealand 2005 (Ministry of Health, revised 2018). All of the parameters tested were below the MAV or within the Guideline Value range.

In my opinion, based on this analysis, if people were to come in contact (i.e. skin) with this water it would pose no potential to cause health effects.

Yours sincerely,



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Appendix A. Hills Laboratory – Certificate of Analysis

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Hamilton 3240 New Zealand

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Certificate of Analysis

Client:	Dougs Opua Boat Yard	**Lab No:**	2013451 DWAPv1
Contact:	Doug Schmuck	**Date Received:**	11-Jul-2018
	C/- Dougs Opua Boat Yard	**Date Reported:**	16-Jul-2018
	1 Richardson Street	**Quote No:**	
	Opua 0200	**Order No:**	
		Client Reference:	
		Submitted By:	Doug Schmuck

Sample Type: Aqueous

	Sample Name:	DOBY 10-Jul-2018 1:00 pm	**Guideline Value**	**Maximum Acceptable Values (MAV)**
	Lab Number:	2013451.1		
Routine Water + E.coli profile Kit				
Escherichia coli*	MPN / 100mL	< 1 #1	-	< 1
Routine Water Profile				
pH	pH Units	7.5	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$	20	-	-
Free Carbon Dioxide	g/m³ at 25°C	1.3	-	-
Total Hardness	g/m³ as $CaCO_3$	18.9	< 200	-
Electrical Conductivity (EC)	mS/m	20.5	-	-
Electrical Conductivity (EC)	µS/cm	205	-	-
Approx Total Dissolved Salts	g/m³	137	< 1000	-
Total Boron	g/m³	0.025	-	1.4
Total Calcium	g/m³	2.3	-	-
Total Copper	g/m³	0.0108	< 1	2
Total Iron	g/m³	0.026	< 0.2	-
Total Magnesium	g/m³	3.2	-	-
Total Manganese	g/m³	0.00119	< 0.04 (Staining) < 0.10 (Taste)	0.4
Total Potassium	g/m³	2.1	-	-
Total Sodium	g/m³	29	< 200	-
Total Zinc	g/m³	0.0137	< 1.5	-
Chloride	g/m³	35	< 250	-
Nitrate-N	g/m³	1.85	-	11.3
Sulphate	g/m³	6.1	< 250	-

Note: The Guideline Values and Maximum Acceptable Values (MAV) are taken from the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2008)', Ministry of Health. Copies of this publication are available from http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008

The Maximum Acceptable Values (MAVs) have been defined by the Ministry of Health for parameters of health significance and should not be exceeded. The Guideline Values are the limits for aesthetic determinands that, if exceeded, may render the water unattractive to consumers.

Note that the units g/m³ are the same as mg/L and ppm.

Analyst's Comments

#1 The samples do not meet the requirements of the NZDWS - samples were greater than 10 °C on receipt in the lab (13 °C). As such, please interpret these microbiological results with caution. Samples must be kept at less than 10 °C (but not frozen).

Routine Water Assessment for Sample No 2013451.1 - DOBY 10-Jul-2018 1:00 pm

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

The pH of this water is within the NZ Drinking Water Guidelines, the ideal range being 7.0 to 8.0.

Hardness/Total Dissolved Salts Assessment
The water contains a low amount of dissolved solids and would be regarded as being very soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The Drinking-water Standards for New Zealand 2005 (Revised 2008) suggests a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was detected in this water but at such a low level to not be of concern.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a low level.
Manganese was found in this water at a low level.
Treatment to remove iron and/or manganese should not be necessary.

Bacteriological Tests
The NZ Drinking Water Standards state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present. Results obtained for Total Coliforms are only significant if the sample has not also been tested for E coli.

Escherichia coli was not detected in this sample.

Final Assessment
All parameters tested for meet the guidelines laid down in the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2008)' published by the Ministry of Health for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	1
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22nd ed. 2012.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D 22nd ed. 2012.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22nd ed. 2012.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1
Escherichia coli*	MPN count using Colilert , Incubated at 35°C for 24 hours. APHA 9223 B (2004), 22nd ed. 2012.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Appendix D

Paint Emission Calculations

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Epoxy Barrier Undercoat Part A	Undercoat	bisphenol A/ bisphenol A diglycidyl ether polym	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	n-butanol	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	xylene	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	ethylbenzene	10	250.07	2	0.014
Altex Epoxy Barrier Undercoat Part B	Undercoat	xylene	70	616.9	0.5	0.060
Altex Epoxy Barrier Undercoat Part B	Undercoat	ethylbenzene	20	616.9	0.5	0.017
Altex Epoxy Barrier Undercoat Part B	Undercoat	2,4,6-tris[(dimethylamino)methyl]phenol	10	616.9	0.5	0.009
Altex Epoxy Barrier Undercoat Part B	Undercoat	n-butanol	10	616.9	0.5	0.009
Altex Polyurethane Undercoat Part A	Undercoat	2,4-pentanedione	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	ethyl acetate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	ethyl-3-ethoxypropionate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	methyl isobutyl ketone	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	n-butyl acetate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	propylene glycol monomethyl ether acetate, alpha-isome	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	xylene	10	287.49	2	0.016
Altex Polyurethane Undercoat Part B	Undercoat	propylene glycol monomethyl ether acetate, alpha-isome	60	1034.62	0.5	0.086
Altex Polyurethane Undercoat Part B	Undercoat	naphtha petroleum, heavy, hydrodesulfurised	10	1034.62	0.5	0.014
Altex Polyurethane Undercoat Part B	Undercoat	n-butyl acetate	10	1034.62	0.5	0.014
Altex Polyurethane Undercoat Part B	Undercoat	hexamethylene diisocyanate polymer	50	1034.62	0.5	0.001*Based on 2% overspray
Altex Polyurethane Undercoat Part B	Undercoat	hexamethylene diisocyanate	0.2	1034.62	0.5	0.0001*Based on 2% overspray
Altex Surfacer Undercoat	Undercoat	kerosene	10	205.35	2	0.011

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Surfacer Undercoat	Undercoat	naphtha petroleum, light aromatic solvent	10	205.35	2	0.011
Altex Surfacer Undercoat	Undercoat	naphtha, petroleum, hydrodesulfurised heavy	10	205.35	2	0.011
Altex Surfacer Undercoat	Undercoat	xylene	10	205.35	2	0.011
Altex Epoxy Primer Part A	Primer	bisphenol A/ bisphenol A diglycidyl ether polymer	30	240	2	0.040
Altex Epoxy Primer Part A	Primer	methyl isobutyl ketone	20	240	2	0.027
Altex Epoxy Primer Part A	Primer	zinc phosphate	20	240	2	0.027
Altex Epoxy Primer Part A	Primer	n-butanol	10	240	2	0.013
Altex Epoxy Primer Part A	Primer	xylene	10	240	2	0.013
Altex Epoxy Primer Part A	Primer	ethylbenzene	5	240	2	0.007
Altex Epoxy Primer Part A	Primer	propylene glycol monomethyl ether acetate, alpha-isome	1	240	2	0.001
Altex Epoxy Primer Part B	Primer	xylene	30	302.28	0.5	0.013
Altex Epoxy Primer Part B	Primer	n-butanol	10	302.28	0.5	0.004
Altex Epoxy Primer Part B	Primer	C18 fatty acid dimers/ polyethylenepolyamine polyamides	20	302.28	0	0.000
Altex Multi Purpose Primer	Primer	1,2,4-trimethyl benzene	20	262.22	2	0.029
Altex Multi Purpose Primer	Primer	solvent naphtha (petroleum), light aromatic	10	262.22	2	0.015
Altex Multi Purpose Primer	Primer	xylene	10	262.22	2	0.015
Altex Multi Purpose Primer	Primer	ethylbenzene	5	262.22	2	0.007
Altex Multi Purpose Primer	Primer	naphtha petroleum, heavy, hydrodesulfurised	1	262.22	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	titanium dioxide	29.12	291.36	2	0.047

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	n-butyl acetate	18.65	291.36	2	0.030
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	propylene glycol monomethyl ether acetate, alpha-isomer	7.67	291.36	2	0.012
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	silica amorphous	4	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	3.72	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	xylene	3.52	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	aluminium hydroxide	3.28	291.36	2	0.005
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	2,4-pentanedione	1.4	291.36	2	0.002
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	ethylbenzene	0.88	291.36	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	Tinuvin 213	0.42	291.36	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	0.28	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	quaternium 18-hectorite	0.2	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	Tinuvin 1130	0.18	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	0.12	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	polyethylene glycol	0.09	291.36	2	0.000

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	diethyl fumarate	0.08	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	propylene glycol monomethyl ether acetate, beta-isomer	0.03	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	hexamethylene diisocyanate polymer	40	939.37	0.5	0.001*Based on 2% overspray
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	methyl ethyl ketone	50	939.37	0.5	0.065
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	hexamethylene diisocyanate	0.1	939.37	0.5	0.0001 *Based on 2% overspray
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	propylene glycol monomethyl ether acetate, alpha-isomer	20	939.37	0.5	0.026
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	ethyl acetate	10	939.37	0.5	0.013
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	toluene	10	939.37	0.5	0.013
Altex Regatta Gloss Enamel	Enamel	naphtha, petroleum, hydrodesulfurised heavy	20	292.73	2	0.033
Altex Regatta Gloss Enamel	Enamel	kerosene	10	292.73	2	0.016
Altex Regatta Gloss Enamel	Enamel	xylene	10	292.73	2	0.016