

# Stolthaven Bulk Liquids Fuel Storage Facility, Mayfield

Operational Noise Compliance Assessment (2018)

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## Operational Noise Compliance Assessment (2018)

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## 1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been engaged by Stolthaven Australia Pty Ltd (Stolthaven) to carry out noise compliance measurements for operations at the Stolthaven Bulk Liquids Fuel Storage Facility (the Facility) operated by Stolthaven at the Port of Newcastle, Mayfield, NSW.

Mayfield No. 7 Berth was recently commissioned and now services the Facility for the import and export of petroleum products.

The Facility has four approval/license documents that currently control its operations, these documents are:

- The NSW Environment Protection Authority (EPA) issued Environment Protection Licence No. 20193 (EPL 20193), License version date 14 September 2018;
- State Significant Development (SSD) 7065 – 15 December 2016;
- State Significant Development (SSD) 6664 – 16 April 2015 (as modified); and
- Mayfield Concept Approval (MCP) (Application 09\_0096) dated 16 July 2012 (latest modification 12 December 2014).

This acoustic assessment was conducted to determine compliance with the requirement in EPL 20193, SSD 6664 and SSD 7065 noting that the Facility is currently transitional between the two approvals.

As the Facility lies within the MCP approval area, it requires noise emissions from the site to be consistent with the environmental assessment requirements of the MCP Approval. Consistency with the MCP Approval requirements has also been addressed in this report.

Conditions L5.6, L5.7 and M9 of EPL 20193 outline the methods to determine compliance with the noise limits within in EPL 20193. Attended noise measurements were undertaken on 29 and 30 November 2018 at the closest nearby residential receiver locations in accordance with EPL 20193, Condition L5.6. During the attended measurements, it was not possible to directly measure the noise arising from operations at the Facility due to the influence from extraneous noise sources, i.e. existing industrial noise from other industrial areas unrelated to the Facility and traffic noise on Industrial Drive. In accordance with the EPA NSW Industrial Noise Policy (INP), an alternative method was employed to demonstrate the compliance noise levels. The compliance assessment was carried out using SoundPLAN noise modelling software.

This method of noise compliance assessment is in accordance of the Chapter 11 of the INP. In order to determine compliance of the Facility operational noise emissions with the required noise limits, 'reasonable' worst case operational scenarios were determined from 2018 historical data provided by Stolthaven, and noise levels based upon the attended noise measurements undertaken over the period of 29 to 30 November 2018 .

AECOM has been advised by Stolthaven that no noise complaints have been received to date in relation to noise from the operation of the Facility.

### 1.1 Mayfield No. 7 Berth Operations

Mayfield No. 7 Berth operated by Stolthaven was recently commissioned and now services the Facility for the import and export of petroleum products. Mayfield No. 7 Berth is classified as Complying Development under State Environmental Planning Policy (Three Ports) 2014 and a Complying Development Certificate (CDC 2016-00067), dated 5 March 2016, was issued by Newcastle City Council for this project. No noise assessment was required for the Complying Development therefore no noise level or operational criteria have been developed specifically for Mayfield No. 7 Berth.

#### 1.1.1 Environment Protection Licence 20193 Requirements

Prior to Mayfield No. 7 Berth commencing operations, the Facility was serviced by Mayfield No. 4 Berth. Operational activities associated with Mayfield No. 7 Berth are now included in the revised EPL

20193, License version date 14 September 2018. EPL 20193, Condition A2.2, Clause (c) specifies the following:

A2.2 *The premises, to which the licence applies, also includes the following:*

.....

*(c) The flexible pipeline whenever connecting the fixed pipeline at the Mayfield No. 7 Wharf (marked and shown as Points "96" and "97" on the Plan) and any vessel berthed at the Mayfield No. 7 Berth for the purpose of the import/export of petroleum products.*

However, discussions between Stolthaven and EPA (email dated 20 December 2018) indicates that shipping activities associated with Mayfield No. 7 Berth are not required to be included as part of this, and future year's, operational noise compliance assessments (2018). Shipping activities at Mayfield No. 7 Berth were not included in this assessment for the following reasons:

- The discharging vessel, berthed at Mayfield No. 7 Berth, does not sit within Stolthaven site premises;
- The original noise and vibration impact assessment to support the Environmental Impact Statement (EIS) for a State Significant Development (SSD) 7065 did not include shipping activities;
- Mayfield No. 4 Berth shipping operations have also not been included on previous noise monitoring assessments; and
- It was also noted the Noise monitoring equipment would not be permitted on the vessel due to safety reasons (equipment not intrinsically safe.)

### 1.1.2 Mayfield Concept Plan Approval Requirements

Under Condition 1.6 of the MCP approval, noise emissions associated with the berths, berthing or harbour operations (i.e. shipping activities) are excluded from contributing to the overall MCP noise emissions.

In addition, under Condition 1.14 of the MCP approval, Mayfield No. 7 Berth is excluded from the MCP area as it operates under an existing Complying Development Certificate (CDC 2016-00067), dated 5 March 2016. Note that the Complying Development Certificate does not specify any noise limits associated with operation of Mayfield No. 7 Berth.

Therefore, for the purpose of determining compliance with the MCP approval, operational noise associated with bulk fuel vessels berthed at Mayfield No. 7 Berth have not been included in this assessment.

### 1.1.3 State Significant Development (SSD) 6664 and 7065 Requirements

Similarly to the MCP approval requirements, noise emissions associated with vessels at Mayfield No. 7 Berth are excluded from SSD 6664 and SSD 7065 and therefore have not been included in this assessment.

In summary, as part of this noise compliance assessment, ship noise emissions associated with Mayfield No. 7 Berth operations have not been considered.

## 1.2 EPA Noise Policy for Industry

The *NSW Industrial Noise Policy* (EPA 2000) was withdrawn in November 2017 and replaced by the *Noise Policy for Industry* (EPA 2017) except as described in the EPA document *Implementation and transitional arrangements for the Noise Policy for Industry (2017)*, point 8, as presented below:

8. *The NSW Industrial Noise Policy (2000) will continue to apply where it is referenced in existing statutory instruments (such as consents and licences), except for the NSW Industrial Noise Policy Section 4 modifying factors, which will be transitioned to the Noise Policy for Industry (2017) Fact Sheet C through a NSW Industrial Noise Policy application note. This approach has been taken because the Noise Policy for Industry (2017) modification factor*

*approach reflects more recent understanding of the impact of tonal and low-frequency noise on the community.*

Therefore the NSW Industrial Noise Policy (2000) continues to apply to the operational for the purpose of assessing compliance.

### **1.3 Stolthaven Bulk Liquid Storage Terminal Description**

#### **1.3.1 Location**

The Facility is located on the former BHP steelworks site in Mayfield North, adjacent to the Hunter River, approximately 5 km north-west of Newcastle CBD. The site location falls within the MCP area, which is currently being redeveloped as an industrial precinct.

During operations, haulage ships will dock at the Mayfield No. 7 Berth and pump fuel into storage tanks to be held on site. Haulage trucks receive the fuels and transport it through an access road leading to the intersection of Industrial Drive and Ingall Street.

The nearest residential areas to the site are located to the south-west of the Facility at Mayfield, with the closest receivers in Crebert Street, approximately 900 m away. To the south east there are residential receivers located in Carrington, approximately 2 km away. To the south east there are the residential receivers located in Stockton, approximately 3 km away.

The Facility location and key sensitive receivers are shown in **Figure 1**.

#### **1.3.2 Operational Activities and Facilities**

Stolthaven has approval to operate the Facility to receive, store and dispatch diesel and biodiesel fuel. The Facility has been approved for an annual throughput of 1,300 ML of combustible fuels under SSD 6664 and 3,50ML of flammable and combustible fuels under SSD 7065, although flammable fuels are not yet stored on site. .

The Facility makes use of the newly commissioned Mayfield No. 7 Berth facility to receive diesel fuel, which are transferred to site using an above-ground, dedicated pipeline. Transportation of the fuel to customers is undertaken by road tankers. Transportation occurs 24 hours per day, seven days per week.

#### **1.3.3 Operational Noise Sources**

Operations at the site consist of the following activities:

- |                                      |                                  |
|--------------------------------------|----------------------------------|
| <b>Internal private access Roads</b> | • Moving trucks, idling trucks.  |
| <b>Industrial noise sources</b>      | • Fuel pumps; and                |
|                                      | • Haulage tanker trucks filling. |

Sound power levels of the different operations at the Facility were determined through on-site measurements conducted on 29 and 30 November 2018.

#### **1.3.4 Hours of Operation**

The operational hours for the Facility are Monday to Sunday, 24 hours per day.

#### **1.3.5 Nearby Sensitive Receiver Locations**

The locations of the Facility and nearby assessment receivers are shown in **Figure 1**. Provided in **Table 1** are the assessment receiver locations including the land use classification in accordance with the INP.



**Table 1 Assessment Receiver Locations**

EPL Receiver Number / Mayfield Concept Plan Receiver Location <sup>1</sup>	Address	Land use Classification	Associated Receiver Area
<b>Stolthaven EPL Receiver Number</b>			
R1/A	1 Arthur Street, Mayfield	Residence - Urban	Mayfield
R2	52 Arthur Street, Mayfield	Residence - Urban	Mayfield
R3/B	2 Crebert Street, Mayfield	Residence - Urban	Mayfield
R4	21 Crebert Street, Mayfield	Residence - Urban	Mayfield
R5	24 Crebert Street, Mayfield	Residence - Urban	Mayfield
R6	30 Crebert Street, Mayfield	Residence - Urban	Mayfield
R7	50 Crebert Street, Mayfield	Residence - Urban	Mayfield
R8	2 McNeil Close, Mayfield	Residence - Urban	Mayfield
<b>Mayfield Concept Plan Receiver Location</b>			
C	32 Elizabeth Street, Carrington	Residence - Suburban	Carrington
D	186 Fullerton Road, Stockton	Residence - Suburban	Stockton

**Notes:**

- Letters designate the Mayfield Concept Plan assessment receiver locations.



Figure 1 Site Location, Assessment Receiver Locations and Measurement Locations

## 1.4 Compliance Assessment Criteria

This section presents a summary of the noise monitoring requirements applicable to the operation of the Facility.

### 1.4.1 Environment Protection Licence 20193

Condition L5 *Noise limits* of the EPL 20193, License version date 14 September 2018, presents the noise limits that apply to the operation of the Facility.

Condition L5.1 specifies:

*Noise generated by the premises must not exceed the noise limits specified in the table below:*

**Table 2 Summary of Operational Noise Limits**

Receiver	Day	Evening	Night	
	L <sub>Aeq, 15min</sub>	L <sub>Aeq, 15min</sub>	L <sub>Aeq, 15min</sub>	L <sub>A1, 1min</sub>
R1 - 1 Arthur Street, Mayfield	35	35	35	45
R2 - 52 Arthur Street, Mayfield	35	35	35	48
R3 - 2 Crebert Street, Mayfield	41	41	41	49
R4 - 21 Crebert Street, Mayfield	40	40	40	47
R5 - 24 Crebert Street, Mayfield	42	42	42	51
R6 - 30 Crebert Street, Mayfield	41	41	41	50
R7 - 50 Crebert Street, Mayfield	35	35	35	50
R8 - 2 McNeil Close, Mayfield	35	35	35	48

Condition L5.2 specifies:

*Fire pumps at the premises must be designed and operated so that noise from routine testing or maintenance is not more than LAeq (15min) 53 dB(A) at the most affected residential or sensitive receiver. Routine testing or maintenance must only occur during the day time.*

Condition L5.5 specifies:

*The noise limits specified in conditions L5.1, L5.2 and L5.4 apply under all meteorological conditions except for any of the following:*

- (a) *Wind speeds greater than 3 metres/second at 10 metres above ground level; or*
- (b) *Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or*
- (c) *Stability category G temperature inversion conditions.*

#### 1.4.1.1 Sleep Disturbance Requirements

Condition L5.1 of the EPL 20193 presented sleep disturbance noise limits which are provided in **Table 2**.

#### 1.4.2 Conditions of Consent - State Significant Development (SSD) 6664 – As modified Amenity Noise Requirements – Mayfield Concept Plan (MCP)

A methodology to deal with cumulative noise from the entire MCP is currently in development and is yet to be finalised. As part of the most recent update, Minister for Planning's Project Approval (Application SSD 6664, dated 16 April 2015), two key conditions are relevant to this noise compliance assessment, these include Conditions 22 and 27, which specify:

**22.**

The Applicant shall, in consultation with the PON ensure that noise from operation of the Development:

- a. Fits within the Site Noise Model developed for the Mayfield Concept Plan;
- b. Does not exceed any noise quota provided by PON for the Development, in accordance with the Site Noise model for the Mayfield Concept Plan.

**27.**

The Applicant shall monitor noise from operation of the Development, to the satisfaction of the Secretary. The monitoring shall:

- a. Be undertaken annually, or to address genuine noise complaints that are related to the Development as determined by the Department or the EPA.;
- b. Be undertaken in accordance with the NSW Industrial Noise Policy; and
- c. Demonstrate compliance with the relevant noise goals constrained in the Mayfield Concept Plan, or any noise quota established by the PON for the Development.

Note: The monitoring requirements could be satisfied by the monitoring network require for the Mayfield Concept Plan once it is established.

The key part of the development of this cumulative noise management strategy is a focused upon the amenity (whole of period) noise levels. For any proposed development within the MCP area, the available noise criteria for the entire MCP area will be proportionally distributed amongst all future developments. When lodgement or notification of a new development is received by Port of Newcastle (PON), a noise allocation will be provided to the proposed development site that will become the cumulative amenity noise quota that they should meet. The overall MCP noise goals are presented in **Table 3**.

**Table 3 MCP Overall Noise Goals**

Receiver	Project Specific Noise Goals, $L_{Aeq, period}$ dB(A)		
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
A – 1 Arthur Street, Mayfield	60	49	43
B – 2 Crebert Street, Mayfield	60	50	43
C – 32 Elizabeth Street, Carrington	57	44	45
D - 186 Fullerton Road, Stockton	55	37	37

#### 1.4.3 Stolthaven Stage 3 (SSD 7065) - Specific MCP Requirements

SSD 7065 Condition C30 (Table 3) and Condition C31, provide applicable operational noise limits. The noise limits under Condition C30 and C31 are the same as the noise limits in Condition L5 of EPL 20193, refer to **Table 3**.

PON is using a Cumulative Environmental Noise Management Tool (CENMT) that has been developed for the MCP to manage individual site noise requirements for projects within the MCP. It is noted that site specific noise quotas were not issued as part of the Stolthaven SSD 6664 MOD 1 submission. However, as part of Stolthaven Stage 3 (SSD 7065) Environmental Impact Statement, noise quotas were allocated to the Stolthaven Stage 3 development. In the absence of other noise quotas for the existing Facility, the noise quotas from the development consent for SSD 7065 have been referenced in this compliance assessment.

As part of SSD 7065, two key conditions are relevant to this noise compliance assessment, conditions C32 and C35, which specify:

**Mayfield Concept Plan Noise Quota**

C32. *The Applicant shall:*

- a) *Ensure noise from the Site does not exceed the noise quotas provided by the PON in accordance with the Site Noise Mode; and*
- b) *comply with the directions of the PON in relation to the management of noise from the Site.*

**Noise Monitoring**

C35. *The Applicant shall monitor noise from the Site. The monitoring shall:*

- a) *be undertaken annually, or to address genuine noise complaints related to the Site as determined by the Secretary, EPA or the PON; and*
- b) *be undertaken in accordance with the NSW Industrial Noise Policy and the Noise Verification Monitoring Plan, October 2015 or its latest version;*
- c) *demonstrate compliance with the noise limits in this consent and the noise quotas provided by PON in accordance with the Mayfield Concept Plan; and*
- d) *be reported annually to the Secretary, EPA and the PON.*

*Note: The monitoring requirements could be satisfied by the monitoring network required for the Mayfield Concept Plan once established*

Stolthaven Stage 3 (SSD\_7065) specific cumulative amenity noise quotas derived using the MCP CENMT are presented in **Table 4**. The quotas are based upon the project area presented in **Figure 2**.

For clarity, Stolthaven have been issued development consent SSD 7065 for the expansion of the existing terminal. When acted upon, SSD 7065 will supersede SSD 6664. To date however Stolthaven have not surrendered SSD 6664. Therefore SSD 6664 and SSD 7065 conditions of consent provides applicable conditions under which the Facility currently operates.

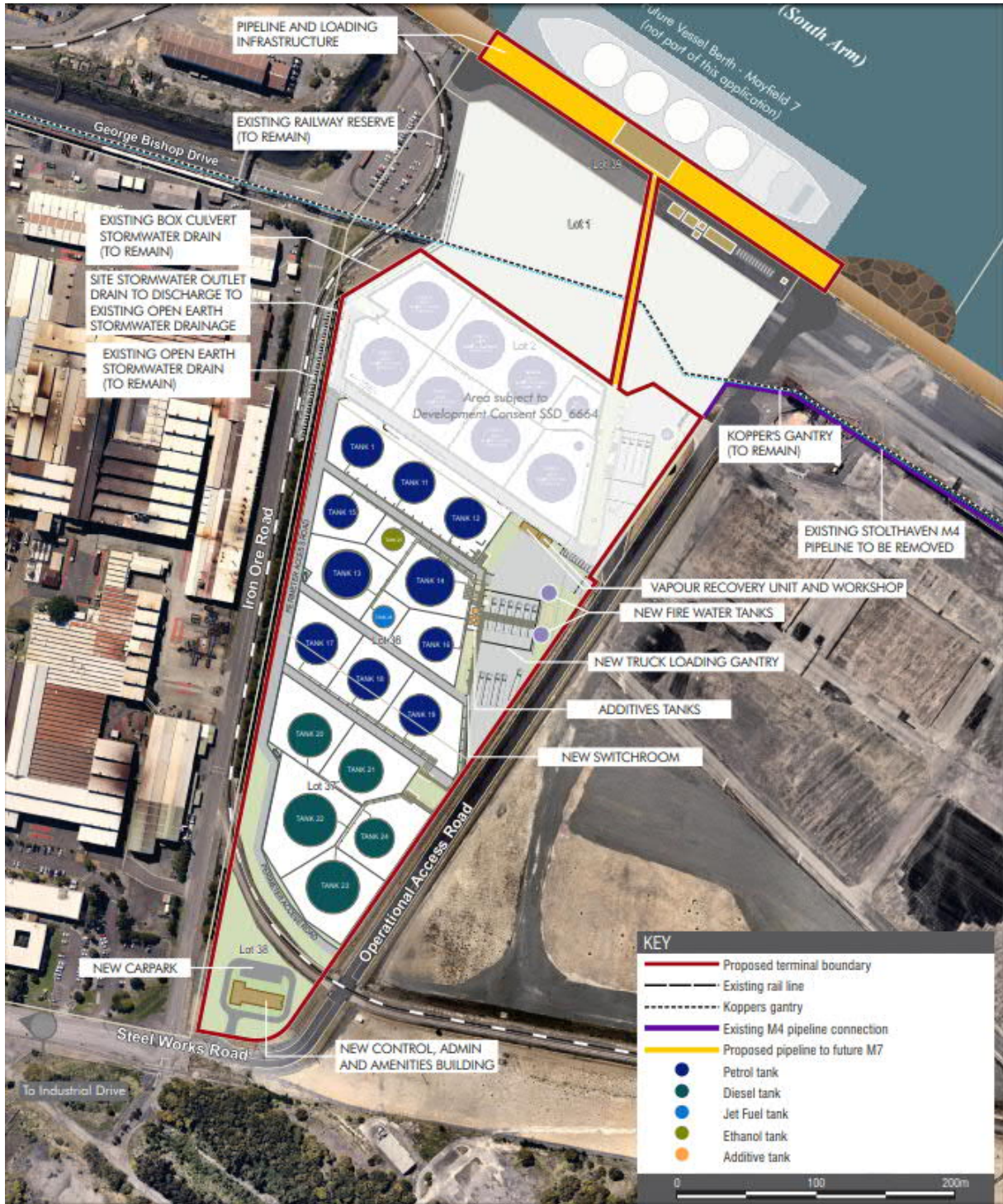


Figure 2 Site Operational Area for Derivation of MCP Noise Quota – Stolthaven Stage 3 (Not yet Constructed, Mayfield No. 7 Berth now operational)

**Table 4 Summary of MCP Noise Quotas for Noise Assessment for Stolthaven Stage 3 (SSD 7065)**

Receiver	Applicable Amenity Noise Quota, $L_{Aeq, period}$ dB(A)		
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
A – 1 Arthur Street, Mayfield	47	36	30
B – 2 Crebert Street, Mayfield	51	40	34
C – 32 Elizabeth Street, Carrington	42	30	25
D – 186 Fullerton Road, Stockton	39	28	22

**Notes:**

1. These cumulative amenity noise quota levels are subject to approval by PON and DP&E and have been included for assessment purposes.

These noise quotas apply under winds of up to 3 m/s (measured at 10 metres above the ground level) and Pasquill stability class from A to F.

Predicted amenity noise emission levels for assessment against the MCP requirements are provided in **Section 2.4.2**.

## 2.0 Measurement Methodology and Results

### 2.1 Compliance Measurements

#### 2.1.1 Meteorological Conditions

Meteorological results have been taken from the Stolthaven Terminal Automatic Weather Station (AWS) as required by EPL 20193 Condition M5.1.

Meteorological conditions during the representative assessment receiver attended measurement period have been reviewed for the noise monitoring period to determine the prevailing wind and temperature inversion conditions. The meteorological conditions experienced during noise compliance investigations is summarised as:

- During the night-time receiver measurement period at the Facility the equivalent average wind speed was a 1-4 m/s and generally from the NE, varying from NNE to E. The measurements were not impacted by the prevailing wind during the measurement periods;
- During the night-time period measurements, the temperature inversion conditions were generally Class D inversion, based upon calculations using the sigma-theta method referred to in Part E4 of Appendix E to the NSW INP;
- No rain occurred during any of the measurement periods; and
- The temperature during the night-time measurements ranged between 20°C - 21°C, and the cloud conditions were generally clear skies with a few scattered clouds during all periods.

#### 2.1.2 Instrumentation

Attended noise measurements were conducted using the equipment presented in **Table 5**.

**Table 5 Measurement Instruments**

Equipment	Serial Number
<b>Attended Noise Measurements</b>	
Brüel and Kjaer Type 2250	3009330

All instruments presented in **Table 5** are designated as Class 1 instruments. Each sound level meter was calibrated before and after the measurements using a calibrator (Rion NC-74 Serial Number 34283659) with a drift in calibration not exceeding  $\pm 0.5$  dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications".

All equipment used for this report has valid calibration certificates.

#### 2.1.3 Attended Measurement Results and Discussion

Attended noise measurements of typical operations were undertaken at the Facility in order to develop the noise model used for this noise compliance assessment.

The results of the attended measurements and site observations are presented in **Table 6**.

The receiver locations were selected as they are EPL 20193, SSD 7065 and MCP receiver locations or all other receiver locations are further away. As such, by achieving compliance at these locations, compliance will be achieved at all other receiver locations.

At all the measurement locations, except R6 (30 Crebert Street, Mayfield), the measured noise levels exceeded the noise limits.

However, it should be noted that noise from the Stolthaven Facility was not clearly distinguishable or quantifiable at any of the attended measurement receiver locations.



We have been informed that during the night-time attended measurements at nearby residential receivers the Facility was operating under normal conditions (i.e. including truck movements).

During the attended measurements it was not possible to quantify the noise contribution from the Facility from the other industrial sources in the surrounding area at all receiver locations. Thus it was not possible to determine the noise contribution through direct measurement. The INP provides guidance in Chapter 11 as to how to review the noise emissions of a site where the existing noise levels are already high.

Table 6 Attended Measurements at Assessment Receiver Locations on 29 to 30 November 2018

Location		Time of Measurement	Monitored Noise Levels			Comments
			L <sub>A1</sub> dB(A)	L <sub>Aeq</sub> dB(A)	L <sub>A90</sub> dB(A)	
R1/A	1 Arthur Street, Mayfield	29/11/2018 22:39:23	65	51	39	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from north (controls background). No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Trucks on industrial drive clearly audible. Car pass by on Crebert Street ~68 dB(A) OTHER: Cicadas. Average Wind – Calm, scattered clouds
R2	52 Arthur Street, Mayfield	29/11/2018 22:00:09	57	47	41	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from north (controls background). No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Traffic along industrial drive is dominant. Traffic passing along Crebert Street also audible. Truck engine braking on industrial drive ~ 60 dB(A) OTHER: Cicadas. Average Wind – Calm, scattered clouds
R3/B	2 Crebert Street, Mayfield	29/11/2018 23:20:23	68	58	37	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from the north but unable to determine if it is coming from the Stolthaven Facility. High frequency hum could be heard to the south-south east for a brief period of time, possibly rail noise. Intermittent traffic on Industrial Drive. Faint but audible horns to the north No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum Trucks engine braking ~ 78 dB(A), car pass bys ~60-70 dB(A) OTHER: Cicadas. Average Wind – Slight breeze, scattered clouds
R4/R5 <sup>1</sup>	21 Crebert Street, Mayfield	29/11/2018 23:38:27	72	60	38	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from the north east. High frequency hum could be heard very clearly from the east/south east, which changes in loudness throughout the measurement. Some horns heard from the east and south east. . No distinguishable noise sources in the direction of the Stolthaven Facility.

Location		Time of Measurement	Monitored Noise Levels			Comments
			L <sub>A1</sub> dB(A)	L <sub>Aeq</sub> dB(A)	L <sub>A90</sub> dB(A)	
						TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum. Truck passby's 79 dB(A) OTHER: Cicadas. Average Wind – Calm, scattered clouds
R6/R7 <sup>2</sup>	30 Crebert Street, Mayfield	29/11/2018 22:57:54	45	41	39	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum could be heard, but unable to determine where it is coming from.. Reverse siren could be faintly heard at one point, however it could not be determined from which direction it came from. No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum. OTHER: Cicadas. Average Wind – Calm, scattered clouds
R8	2 McNeil Close, Mayfield	29/11/2018 22:18:56	45	38	34	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from the north. No distinguishable noise sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Traffic noise can be faintly heard, mostly from the north with trucks clearly audible. OTHER: Cicadas. Average Wind – Calm, scattered clouds
C	32 Elizabeth Street, Carrington	30/11/2018 00:01:52	45	39	36	INDUSTRIAL CONTRIBUTION: Constant broadband industrial hum, cannot determine which direction it is from). Horns were audible. Rail was also audible from the north. A reverse siren was heard, however it could not be determined where it was from. No distinguishable sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Trucks driving down Parker Street audible with truck air brakes in Darling Street ~ 46 dB(A) OTHER: Cicadas. Average Wind – Calm, scattered clouds
D	186 Fullerton Road,	30/11/2018 00:36:57	69	56	46	INDUSTRIAL CONTRIBUTION: Strong constant broadband industrial hum from Kooragang Island (controls background). Occasional banging of metal from Kooragang Island. No distinguishable sources in the direction of the Stolthaven

Location		Time of Measurement	Monitored Noise Levels			Comments
			L <sub>A1</sub> dB(A)	L <sub>Aeq</sub> dB(A)	L <sub>A90</sub> dB(A)	
	Stockton					Facility. TRAFFIC CONTRIBUTION: Local traffic on Fullerton Road with car passby ~ 74 dB(A) OTHER: Bats. Average Wind – Calm, scattered clouds
-	Mayfield East Public School (west side)	30/11/2018 09:50:57	70	59	47	INDUSTRIAL CONTRIBUTION: Industrial noise was not audible. No distinguishable sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Dominant noise from traffic movements on Ingall Street and Industrial Drive. OTHER: Cicadas, birds Average Wind – Calm, Clear Sky
-	Mayfield East Public School (north side)	30/11/2018 12:17:36	70	62	53	INDUSTRIAL CONTRIBUTION: Industrial noise was not audible. No distinguishable sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Dominant noise from traffic movements on Industrial Drive. OTHER: Cicadas, birds Average Wind – Calm, Clear Sky

**Notes:**

1. Attended noise measurements at Location R4 (21 Crebert Street, Mayfield), are representative of ambient noise conditions at locations R4 (21 Crebert Street, Mayfield) and R5 (24 Crebert Street, Mayfield).
2. Attended noise measurements at Location R6 (30 Crebert Street, Mayfield), are representative of ambient noise conditions at locations R6 (30 Crebert Street, Mayfield) and R7 (50 Crebert Street, Mayfield).

**Section 11.1.2 Notes on Noise Monitoring** of the INP states:

**Where existing noise levels are high**

*“When compliance is being measured it may be found that, in many cases, existing noise levels are higher than noise level from the source, making it difficult to separate out the source noise level. When this happens, it may not be feasible to measure compliance at the specified location, and other methods will be needed. In these cases, measurements may be taken closer to the source and then calculated back to the specified location.”*

Accordingly, on-site measurements of individual plant items and typical operations were undertaken on 29 and 30 November 2018 at the Facility.

It was noted during all measurements that the specific noise source being measured was the dominant noise source throughout the measurement period. Observations were made of the onsite operations, which have then been reviewed in conjunction with the Facility operational data to model ‘reasonable’ worst case operational scenarios over the assessment periods. These scenarios are described in **Section 2.2**.

The noise model was validated using the attended noise measurements, refer to **Section 2.3.2** for noise model calibration.

Key on-site attended measurement results are summarised in **Table 7**.

**Table 7 On-site Attended Measurements at the Facility on 29 and 30 November 2018**

Operation	Time of Measurement	Monitored Noise Levels				Comments
		$L_{A1(t)}$ , dB(A)	$L_{A10(t)}$ , dB(A)	$L_{Aeq(t)}$ , dB(A)	$L_{A90(t)}$ , dB(A)	
Truck pumping in Bay 2	11:57 AM	70	69	69	68	Truck pumping in Bay 2 measured at approximately 20 metres.
Truck idling	4:07 PM	74	70	69	68	Truck idling on access road about to depart site at 10 m
Truck arriving at site	4:12 PM	88	75	75	66	Truck pass-by and coming to a stop (truck arriving at entry gate with air brake discharge) at 10 m.
Truck leaving site	4:08 PM	74	73	71	68	Truck pass-by (accelerating down access road departing site) at 15 m from closest point of truck pass-by.
Pump operations (slow flow)	3:37 PM - 3:55 PM	85	84	82	80	Measurement of pump/motor in operation at 1.5 m
Pump operations (fast flow)	3:40 PM - 3:57 PM	81	79	78	76	Measurement of pump/motor in operation at 1.5 m
Compressor	10:47 AM	80	80	79	78	Compressor at 2 m.
Fire pump	10:36 AM	103	102	101	101	Fire pump at 2 m

## 2.2 Modelled Operational Scenarios

### 2.2.1 Observed Operations for Modelling

Based upon the attended measurements presented in **Table 7**, the movement logs for the Facility over the measurement period, and discussions with Stolthaven personnel, 'reasonable' worst case operational scenarios were established and modelled for the operations during the day, evening and night assessment periods, as required to satisfy the assessment periods under the following documents:

1. EPL 20193; and
2. The Minister for Planning's Project Approval (State Significant Development (SSD) 6664 – dated 16 April 2015) (Modification dated 28 September 2015).

### 2.2.2 Truck Operations

The following data on truck operations was obtained from a combination of site observations during the attended noise measurements, and from data provided by Stolthaven for the movements.

- Truck operations were typically B-Double trucks, and that a typical 'in-and-out' cycle time in the Facility was on median 30 minutes, with each tank filling cycle taking approximately 5-8 minutes;
- The average idling time for a truck from when it arrived to when it entered the Facility was approximately 1.5 minutes;
- There was typically a 5 to 6 minute gap between the pumping operations when switching between tanks;
- A maximum of trucks four trucks used the fuelling loading bays simultaneously;
- The pump source levels were based upon attended noise measurements. These have been included in the sound power levels presented in **Table 8**;
- Air-brake releases would occur when the trucks came to a complete stop at the truck gates and within the bays;
- Reversing beepers were not used on site. It is noted that truck can enter and exist in a forward movement and don't need to reverse;
- When the truck entered or exited the Facility a warning alarm at the gate would sound as the gate opened or closed;
- When a truck was loading typically a single pump/motor set would be serving the truck during the loading operations, and motors would operate based upon the load required in the linked bays; and
- Based on discussions with personnel onsite, it was noted that a maximum of four pumps and full load would operate at the same time typically with all four bays in operations.

### 2.2.3 Compressor Shed and Office Area Operations

- The main compressor would run for durations of around 5 minutes;
- An air-release valve that protruded from the southern façade of the compressor shed would operate rarely which is consistent with the previous year; and
- At the time the office plant was not in operation. The sound power level of some of the ventilation units was noted on the side of the units, and that unit types were also noted. As such, these were included in the modelling to take into account for periods where these are required for use.

### 2.2.4 Fire Pump Testing

- The fire pump is conservatively assumed to run for an entire 15 minute period;
- The testing occurs only during the day time as per Condition L5.2 of EPL 20193;
- It is assumed only one pump will be tested at a time; and

- The fire pump has a measured sound power level of 112 dB(A).

### 2.2.5 Assessment Noise Source Levels

The sound power level inputs presented in **Table 8** were used in the noise compliance modelling, and adjusted for duration and frequency of operations in accordance with the operations described in **Section 2.2.6**. The plant item sound power levels were determined from the attended noise measurements of typical operations made on site (**Table 7**). In order to determine compliance with the recommended noise limits, the predicted noise levels for each operational scenario were determined at each of the assessment locations. The results are presented in **Section 2.3**.

Modelling was undertaken using SoundPLAN noise modelling software. In total two intrusive (reasonable 'worst' 15-minute period) operational scenarios were modelled, in addition to day, evening and night-time amenity (whole of period) scenarios. The assessment of each scenario considers a 'reasonable' worst case operational period. The assumptions made for modelling purposes with regards to the equipment operating and the duration and frequency of operation are described in **Section 2.2.6**.

The predicted noise levels for both worst case wind or from worst case temperature inversion scenarios as required by the project approval conditions, in addition to the neutral scenarios are presented **Section 2.3**.

**Table 8 Facility Plant Items Sound Power Levels**

Plant Item/Operation	Sound Power Level, $L_{Aeq}$ , dB(A)
Trucks approaching/leaving site - Accelerating	88 dB(A)/m <sup>1</sup>
Trucks approaching/leaving site – Using main access road	81 dB(A)/m <sup>1</sup>
Trucks idling at site	94
Truck airbrake event	104
Fuel Pump/Motor (Bay 1/2)	89 <sup>1</sup>
Fuel Pump/Motor (Bay 3/4)	97 <sup>1</sup>
Entrance gate/ exit gate alarm	95 <sup>1</sup>
Office plant (individual item) – 5 items	68 <sup>2</sup>
Office plant (individual item) – 2 items	75 <sup>2</sup>
Compressor	84
Compressor shed air release valve	101 <sup>1</sup>

**Notes:**

1. Based on previous year.
2. Based on manufacturer data.

**Table 9 Facility Plant Items Sound Power Levels for Peak Events**

Plant Item/Operation	Sound Power Level, $L_{A1\ 1\ min}$ , dB(A)
Trucks approaching/leaving site - Accelerating	108
Truck airbrake event	120
Entrance gate/ exit gate alarm	100
Compressor shed air release valve	101 <sup>1</sup>

**Notes:**

1. Based upon previous years' measurements.

## 2.2.6 Reasonable Worst Case Intrusiveness Scenarios (15 minute period)

The following are the modelled reasonable worst case intrusiveness scenarios (15 minute period). Two key sets of operations which generate noise emissions represent the sites worst case noise emissions, which are the worst case pumping operations, and then the worst case truck movements approaching or leaving the site. The make-up of these scenarios has been determined from an analysis of the movement data over the measurement period.

Both worst case periods occurred during the night-time measurement period, and so this has been used to assess against the day, evening and night periods. Noting the only difference will be the office noise contribution from the office based mechanical services, which generate negligible contribution to the overall noise impacts from the site operations.

**Table 10 Worst Case 15 Minute Intrusive Assessment Scenarios**

Activity	Worst case on-site activities 15 minute assessment period (10:22 pm - 10:37 pm 22 November 2016)	Worst case truck movements 15 minute assessment period (4:11 am - 4:26 am 23 November 2016)
<b>Leaving</b>	Two trucks move down the approach road at approximately 40 km/h departing site. (Bays 1 & 4)	Two trucks move down the approach road at approximately 40 km/h departing site. (Bays 2 & 3).
<b>Arriving</b>	Two trucks move down the approach road at approximately 40 km/h and arrive at the site, stop with airbrake release, and idle for 1 minute at the entrance gate of the Facility (Bays 1 & 4).	Two trucks move down the approach road at approximately 40 km/h and arrive at the site, stop with airbrake release, and idle for 1 minute at the entrance gate of the Facility (Bays 1 & 4).
<b>Pumping</b>	Four B-Double trucks pumping in the facility. <ol style="list-style-type: none"> <li>Bay 1 – One truck pumping for 9 minutes, then 2<sup>nd</sup> truck pumping for 2 minutes during period with 4 minute change over.</li> <li>Bay 2 – Pumping for 10 minutes</li> <li>Bay 3 – Pumping for 10 minutes each during period (Bay 3) with 3 minute tank switch break.</li> <li>Bay 4 – Pumping for 9 minutes with break.</li> </ol>	Four B-Double trucks pumping in the facility. <ol style="list-style-type: none"> <li>Bay 1 – Pumping for 10 minutes</li> <li>Bay 2 – Pumping for 6 minutes</li> <li>Bay 3 – Pumping for 6 minutes</li> <li>Bay 4 – Pumping for 6 minutes</li> </ol>
	Consideration for the onsite speed and the usage of airbrakes at the Facility has been included in the modelling.	
	The operation of the entrance gate is associated with each truck movement through the Facility.	
<b>Other</b>	Compressor shed operating with gas discharge during period.	
<b>Office Plant</b>	Office plant is not operating as the office building is not operating during the night period.	

## 2.2.7 Reasonable Worst Case Amenity Scenarios

The following are the modelled whole of period scenarios based upon on-site observations. All noise sources in the model were assumed to operate as per the points below.

- Each truck using the Facility is a B-Double;
- One motor/pumps combination is used to fill each tank;
- Each B-Double tank takes 6 minutes to fill (i.e. 12 minutes per B-Double truck);
- Each truck idles for a total of 1 minute on site at gate;



5. Air-break releases occur when the trucks arrived on-site and stopped prior to swiping in at the gate, and also when they stopped after moving into the bays;
6. Trucks move down the approach road at approximately 40 km/h and arrive at the site;
7. The operation of the entrance and exit gate is associated with each truck movement through the Facility;
8. Consideration for the onsite speed and the usage of airbrakes at the Facility has been included in the modelling;
9. Usage of the pump/motors is distributed throughout available pumps as per the operational usage;
10. Compressor shed operating with gas discharge operating throughout period;
11. Office plant are operating throughout the day and evening periods, 5 condenser units were noted on the south-western façade of the office building and are assumed the operation during the day and evening periods when the office could be occupied; and
12. In consultation with Stolthaven, reasonable worst-case truck movements have been determined for 2018. These movements are consistent with movements in 2017. The approach has been based upon the top 10% of movements through the facility during each of the day, evening or night assessment periods. The source noise levels have been based upon the on-site measured noise levels.

Presented in **Table 11** are the truck numbers modelled to represent the reasonable worst case truck throughput during 2018.

**Table 11 Reasonable Worst Case Trucks through the Facility - 2018**

Reasonable Worst Case Trucks through the Facility	Day (7am - 6pm)	Evening (6pm - 10pm)	Night (10pm - 7am)
Truck movements (either to or from the facility)	83	28	55
Trucks in each period	41	14	28

## 2.3 Modelling Methodology

### 2.3.1 General Modelling Assumptions

Noise levels due to the operational activities shown in **Section 2.2** have been predicted to nearby noise sensitive receivers using SoundPLAN 7.3 noise modelling software. The base model has been based upon the current version of the *MCP Master SoundPLAN model*.

The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

Noting that the closest receptors in the vicinity of the proposed Facility are at least 500 m from the site, the CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation. Whilst the General Prediction Method algorithm more accurately predicts at closer receiver locations, and was used for modelled receiver locations less than 100 m, as part of the model validation.

The modelling includes:

- Ground topography;
- Buildings and structures;
- All sources behave as point, or moving point sources;
- Ground Absorption; and

- Representative operational noise sources as required.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

### 2.3.2 Model Validation

The noise model outputs were compared with attended measurement results. Measurements at locations further than this were not possible, as the existing industrial noise levels were in the region of 50 dB(A) during the night period and in the region of 55 dB(A) during the day from sources to the north, and at locations further away it was not possible to quantify noise directly from the Facility.

Validation of the worst case on-site pumping activities was undertaken, and is presented below in **Table 12**. Comparisons have been made against noise measurements for known operational activities (e.g. operational pumps (including duration), occupied bays, and pumping was the dominate activity taking place).

**Table 12 Comparison Between Measured and Modelled Noise Levels**

Activity	Measured Noise Levels (L <sub>Aeq</sub> , dB(A))	Predicted Noise Levels (L <sub>Aeq</sub> , dB(A))	Difference, dB
Trucks idling at entry gate	75	74	1
Compressor operation	66	66	0

The differences identified in **Table 12** are within the accuracy of the modelling algorithm and considered suitable for this assessment. The results from the validation of the model show that the model is suitable for determining the compliance noise levels for this assessment.

## 2.4 Noise Compliance Assessment

Provided in **Table 13** to **Table 14** are the predicted noise levels present at each of the assessment locations during each of the reasonable worst case operational scenarios. The predicted noise levels identify that each operational scenario is compliant with the applicable noise criteria.

Observed meteorological conditions on the day of the measurements are presented in **Section 2.1.1**, however, as required by the EPL 20193 and the MCP noise verification requirements, adverse meteorological conditions should be assessed for each period. Previous assessments have identified that the 3 m/s source to receiver wind meteorological condition predictions to be consistently between 0 dB(A) to 1 dB(A) higher than temperature inversion predictions. As such this report has limited the assessment of adverse conditions to the more conservative 3 m/s source to receiver wind meteorological condition.

### 2.4.1 Environment Protection Licence 20193, SSD 6664 and SSD 7065

#### 2.4.1.1 Intrusiveness Noise Assessment (15 minute period)

**Table 13** and **Table 14** present predicted noise level results for the reasonable worst case intrusiveness scenario (15 minute period) for neutral and adverse weather conditions respectively. The modelling scenarios are presented in **Section 2.2**.

Table 13 Predicted Intrusive Noise Levels – Neutral Weather

Receiver	EPL 20193 and SSD 7065 Noise Limits, $L_{Aeq,15min}$ dB(A) <sup>1</sup>	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Compliance	
			Exceedance	Yes/No
<b>Worst Case – Truck Movements</b>				
R1	35	26	-	Yes
R2	35	28	-	Yes
R3	41	32	-	Yes
R4	40	31	-	Yes
R5	42	33	-	Yes
R6	41	33	-	Yes
R7	35	28	-	Yes
R8	35	28	-	Yes
<b>Worst Case – Site Operations</b>				
R1	35	26	-	Yes
R2	35	28	-	Yes
R3	41	32	-	Yes
R4	40	32	-	Yes
R5	42	33	-	Yes
R6	41	33	-	Yes
R7	35	28	-	Yes
R8	35	28	-	Yes

**Notes:**

- Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).

Table 14 Predicted Intrusive Noise Levels – Adverse Weather

Receiver	EPL 20193 and SSD 7065 Noise Limits, $L_{Aeq,15min}$ dB(A) <sup>1</sup>	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Compliance	
			Exceedance	Yes/No
<b>Worst Case – Truck Movements</b>				
R1	35	30	-	Yes
R2	35	32	-	Yes
R3	41	36	-	Yes
R4	40	36	-	Yes
R5	42	37	-	Yes
R6	41	36	-	Yes
R7	35	32	-	Yes
R8	35	32	-	Yes
<b>Worst Case – Site Operations</b>				
R1	35	30	-	Yes

Receiver	EPL 20193 and SSD 7065 Noise Limits, $L_{Aeq,15min}$ dB(A) <sup>1</sup>	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Compliance	
			Exceedance	Yes/No
<b>Worst Case – Truck Movements</b>				
R2	35	32	-	Yes
R3	41	37	-	Yes
R4	40	36	-	Yes
R5	42	37	-	Yes
R6	41	36	-	Yes
R7	35	32	-	Yes
R8	35	32	-	Yes

**Notes:**

- Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).
- Adverse weather considers the worst case of 3 m/s source to receiver wind and temperature inversions.

The Facility's predicted operational noise levels, **Table 13** and **Table 14** results, indicate that under neutral and adverse weather conditions, the Facility comply with EPL 20193 and SSD 7065 noise limits at all assessment locations.

#### 2.4.1.2 Sleep Disturbance Noise Assessment

The following are the predicted modelled results to determine noise compliance against the EPL 20193 and SSD 7065 sleep disturbance noise limits. The sound power levels for the maximum noise events at the Facility are included in **Table 9**.

**Table 15 Predicted Sleep Disturbance Noise Levels, Night-time Period**

Receiver	EPL 20193 and SSD 7065 Noise Limits, $L_{A1, 1 min}$ dB(A)	Predicted Noise Level, $L_{A1, 1 min}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather <sup>1</sup>	
R1	45	40	44	Yes
R2	48	45	48	Yes
R3	49	45	48	Yes
R4	47	43	47	Yes
R5	51	48	51	Yes
R6	50	49	50	Yes
R7	50	43	47	Yes
R8	48	45	48	Yes

**Notes:**

- Adverse weather considers the worst case of 3 m/s source to receiver wind and temperature inversions.

The  $L_{A1, 1min}$  night-time site operation assessment indicates that the predicted noise levels at all receiver locations comply with the EPL 20193 and SSD 7065 sleep disturbance noise limits during both neutral and adverse weather conditions.

### 2.4.1.3 Fire Pump Testing Noise Assessment

Table 16 presents the modelled results for the fire pump testing operational scenario.

Table 16 Predicted Fire Pump Testing Noise Levels, Day-time Period

Receiver	EPL 20193 and SSD 7065 Noise Limits, $L_{Aeq,15min}$ , dB(A)	Predicted Noise Level $L_{Aeq,15min}$ , dB(A)		Compliance
		Neutral Weather	Adverse Weather <sup>1</sup>	
R1	53	8	13	Yes
R2	53	5	10	Yes
R3	53	19	24	Yes
R4	53	33	38	Yes
R5	53	15	20	Yes
R6	53	13	18	Yes
R7	53	10	15	Yes
R8	53	3	9	Yes

1. Adverse weather considers the worst case of 3 m/s source to receiver wind and temperature inversions.

The fire pump testing operational noise assessment indicates that the predicted noise levels at all receiver locations comply with the EPL 20193 and SSD 7065 noise limits during both neutral and adverse weather conditions.

### 2.4.2 Mayfield Concept Plan Noise Quotas

#### 2.4.2.1 Amenity Noise Assessment

Table 17 presents the modelled results for whole of period amenity operating scenarios.

Table 17 Predicted Amenity Noise Levels

Receiver	MCP Noise Quota $L_{Aeq, period}$ dB(A) <sup>1</sup>	Predicted Noise Level $L_{Aeq, period}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather <sup>2</sup>	
<b>Daytime</b>				
A	47	21	25	Yes
B	51	28	33	Yes
C	42	13	18	Yes
D	39	12	18	Yes
<b>Evening</b>				
A	36	23	28	Yes
B	40	31	35	Yes
C	30	18	23	Yes
D	28	18	24	Yes
<b>Night-time</b>				
A	30	19	24	Yes
B	34	27	32	Yes
C	25	13	18	Yes
D	22	12	18	Yes

**Notes:**

- Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).
- Adverse weather considers the worst case of 3 m/s source to receiver wind and temperature inversions.

### 3.0 Conclusion

AECOM Australia Pty Ltd (AECOM) was commissioned by Stolthaven Australia Pty Ltd (Stolthaven) to undertake a compliance noise assessment of operations at the Stolthaven Bulk Liquids Fuel Storage Facility (the Facility) operated by Stolthaven at the Port of Newcastle, Mayfield, NSW.

This acoustic assessment was conducted to determine compliance with the following site operational approvals and requirements:

- The NSW Environment Protection Authority (EPA) issued Environment Protection Licence No. 20193 (EPL 20193), License version date 14 September 2018;
- State Significant Development (SSD) 7065 – 15 December 2016;
- State Significant Development (SSD) 6664 – 16 April 2015 (as modified); and
- Mayfield Concept Approval (MCP) (Application 09\_0096) dated 16 July 2012 (latest modification 12 December 2014).

As the Facility lies within the Mayfield Concept Plan approval area, it requires noise emissions from the site to be consistent with the environmental assessment requirements of the Mayfield Concept Plan Approval, as stated in the approval SSD 6664 and SSD 7065, which have been demonstrated in this report.

Attended noise measurements were undertaken on 29 and 30 November 2018 at the closest nearby residential receiver locations. During the attended measurements, it was not possible to directly quantify the impacts of noise arising from operations at the Facility due to the influence from extraneous noise sources, i.e. existing industrial noise from other industrial areas unrelated to the Facility and traffic noise on Industrial Drive, or the noise impacts are significantly below the measured existing noise levels. As such, an alternative method was required in order to demonstrate compliance with the project approval requirements.

The compliance assessment was carried out using SoundPLAN noise modelling software, calibrated based upon attended noise measurements.

This method of noise compliance assessment is in accordance of the Chapter 11 of the EPA NSW Industrial Noise Policy (INP). In order to determine compliance of the Facility operational noise emissions with the required noise limits, 'reasonable' worst case operational scenarios where determined from 2018 historical data provided by Stolthaven, and noise levels based upon the site attended noise measurements undertaken over the measurement period.

Daytime, evening and night-time noise emissions were predicted to each of the required assessment locations and compared against the site noise limits for all scenarios. The Project approval requires that the noise emissions be assessed under worst case prevailing wind and temperature inversion conditions.

Results of the noise compliance modelling showed that the operation of the facility complies with the noise limits stated in EPL 20193, SSD 6664 and SSD 7065 in addition to the project specific noise goals in the MCP for all outlined receivers.

# Appendix A

## Acoustic Terminology

## Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology that may have been used in this report.

<i>Sound power level</i>	The total sound emitted by a source																						
<i>Sound pressure level</i>	The amount of sound at a specified point																						
<i>Decibel [dB]</i>	The measurement unit of sound																						
<i>A Weighted decibels [dB(A)]</i>	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
<i>Decibel scale</i>	<p>The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:</p> <table> <tr> <td>0dB(A)</td> <td>Threshold of human hearing</td> </tr> <tr> <td>30dB(A)</td> <td>A quiet country park</td> </tr> <tr> <td>40dB(A)</td> <td>Whisper in a library</td> </tr> <tr> <td>50dB(A)</td> <td>Open office space</td> </tr> <tr> <td>70dB(A)</td> <td>Inside a car on a freeway</td> </tr> <tr> <td>80dB(A)</td> <td>Outboard motor</td> </tr> <tr> <td>90dB(A)</td> <td>Heavy truck pass-by</td> </tr> <tr> <td>100dB(A)</td> <td>Jackhammer/Subway train</td> </tr> <tr> <td>110 dB(A)</td> <td>Rock Concert</td> </tr> <tr> <td>115dB(A)</td> <td>Limit of sound permitted in industry</td> </tr> <tr> <td>120dB(A)</td> <td>747 take off at 250 metres</td> </tr> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/Subway train	110 dB(A)	Rock Concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 take off at 250 metres
0dB(A)	Threshold of human hearing																						
30dB(A)	A quiet country park																						
40dB(A)	Whisper in a library																						
50dB(A)	Open office space																						
70dB(A)	Inside a car on a freeway																						
80dB(A)	Outboard motor																						
90dB(A)	Heavy truck pass-by																						
100dB(A)	Jackhammer/Subway train																						
110 dB(A)	Rock Concert																						
115dB(A)	Limit of sound permitted in industry																						
120dB(A)	747 take off at 250 metres																						
<i>Frequency [f]</i>	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
<i>Equivalent continuous sound level [L<sub>eq</sub>]</i>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
<i>L<sub>max</sub></i>	The maximum sound pressure level measured over the measurement period																						
<i>L<sub>min</sub></i>	The minimum sound pressure level measured over the measurement period																						
<i>L<sub>10</sub></i>	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L <sub>10</sub> .																						



<i>L<sub>90</sub></i>	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L <sub>90</sub> .
<i>Ambient noise</i>	The all-encompassing noise at a point composed of sound from all sources near and far.
<i>Background noise</i>	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L <sub>90</sub> sound pressure level is used to quantify background noise.
<i>Traffic noise</i>	The total noise resulting from road traffic. The L <sub>eq</sub> sound pressure level is used to quantify traffic noise.
<i>Day</i>	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
<i>Evening</i>	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
<i>Night</i>	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
<i>Assessment background level [ABL]</i>	The overall background level for each day, evening and night period for <b>each day</b> of the noise monitoring.
<i>Rating background level [RBL]</i>	The overall background level for each day, evening and night period for the <b>entire length</b> of noise monitoring.
<i>Weighted sound reduction index [R<sub>w</sub>]</i>	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.

\*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 “Acoustics – Glossary of terms and related symbols”, the EPA’s NSW Industrial Noise Policy, Noise Policy for Industry and the EPA’s NSW Road Noise Policy.