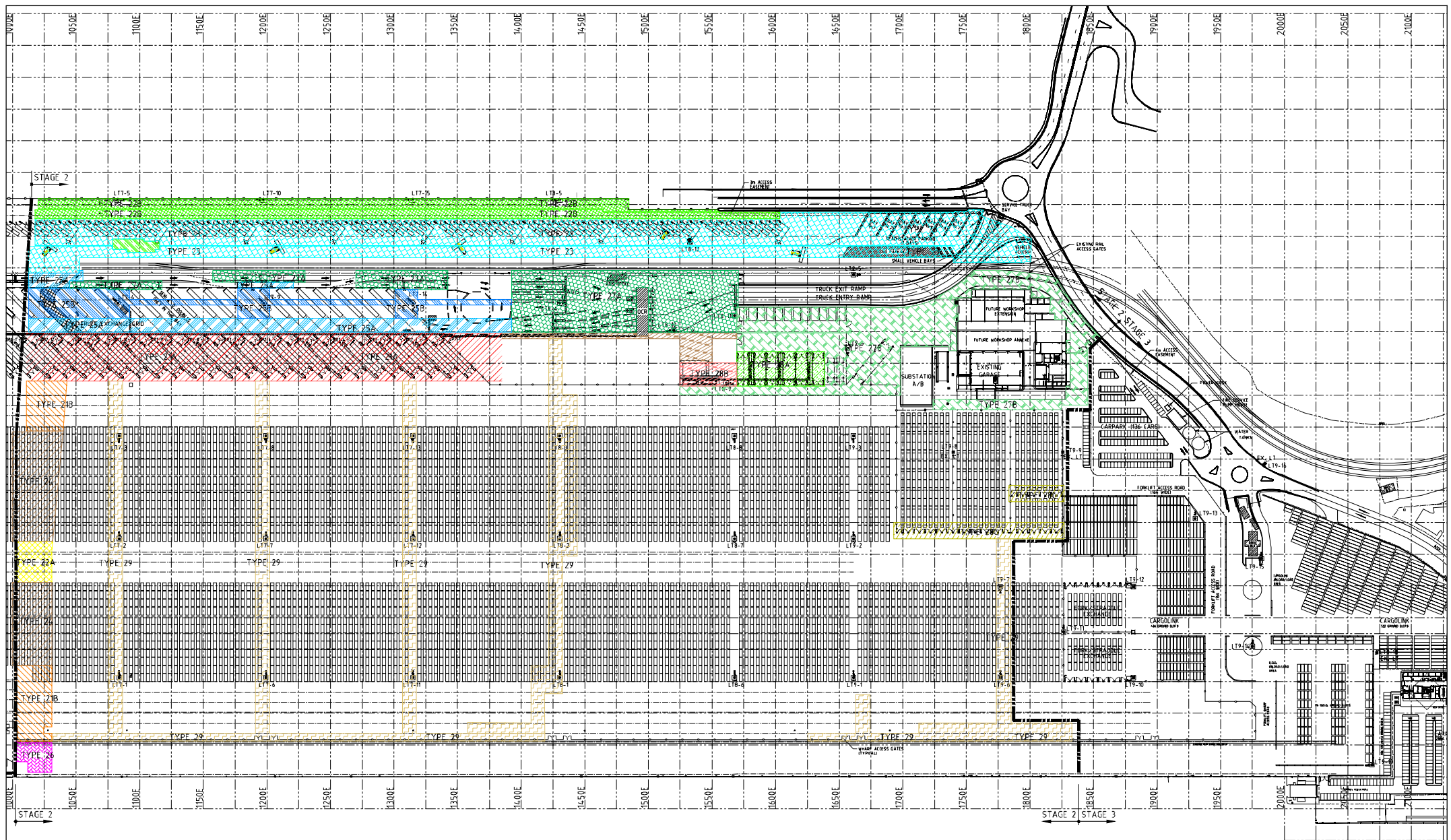




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REV	NO	DATE	DESCRIPTION	REV	NO	DATE	DESCRIPTION
1	1	12/01/2019	PRELIMINARY ISSUE				
2	2	12/01/2019	DETAILS				
3	3	12/01/2019	AMENDMENTS				

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DOCUMENT APPROVAL	CLIENT
DESIGN CONSULTING GROUP PTY LTD	PORT BOTANY Terminals PORT BOTANY CONTAINER TERMINAL PEPPERHAY ROAD PORT BOTANY NSW 2019

PORT BOTANY
 REDEVELOPMENT PROJECT
 PAVEMENT
 GENERAL ARRANGEMENT PLAN



CELLON CONSULTING GROUP PTY LTD
 CONSULTING ENGINEERS AND MANAGERS
 10/11-13/15 ADELAIDE ROAD, GLENDALE NSW 1511
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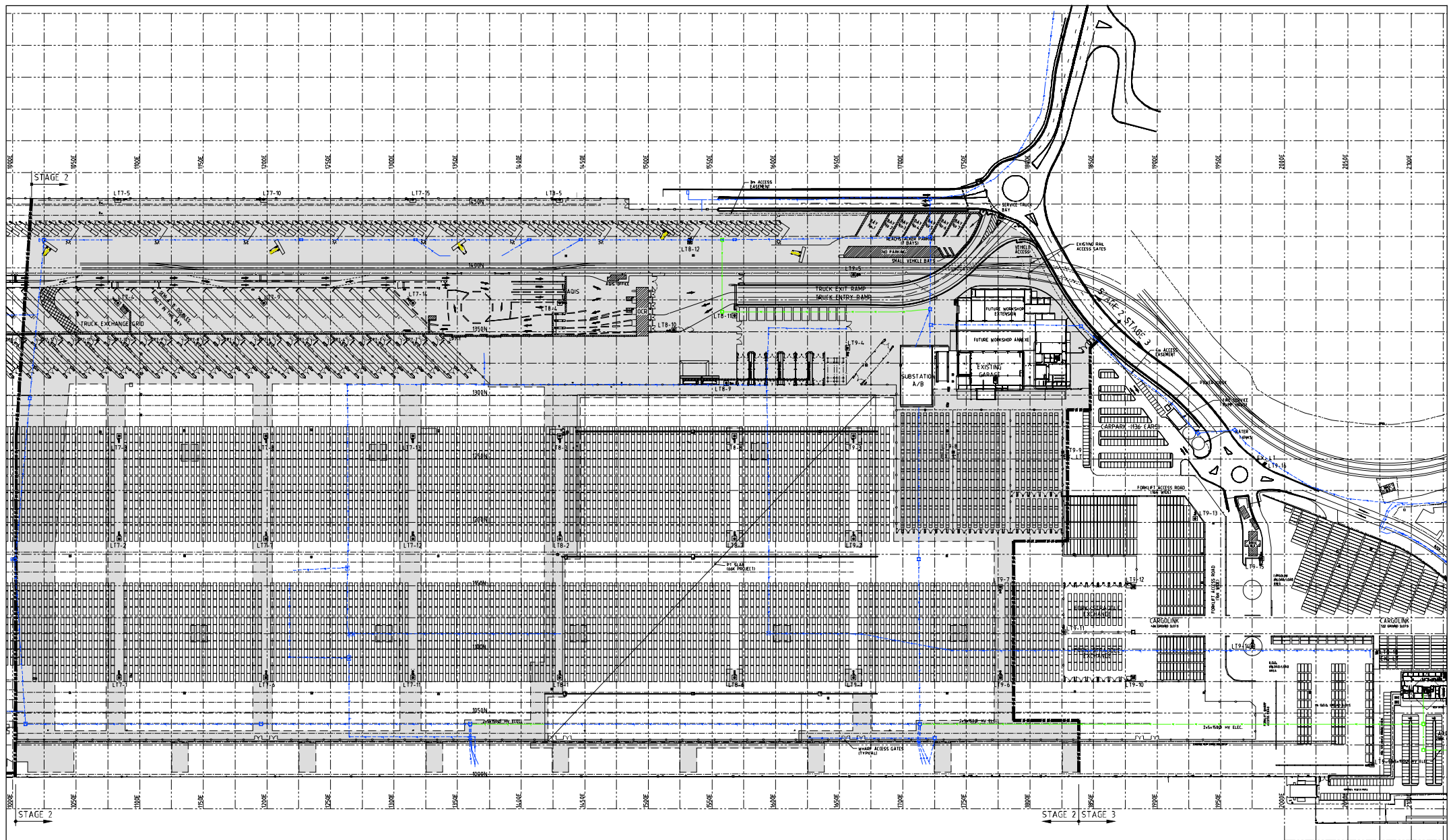
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	SIGNATURE	DATE
GILLEN CONSULTING GROUP PTY LTD		

PATRICK Terminals
PORT BOTANY CONTAINER TERMINAL
PENRHYN ROAD
PORT BOTANY NSW 2019



PROJECT TITLE	PORT BOTANY REDEVELOPMENT PROJECT
DRAWING TITLE	STORMWATER GENERAL ARRANGEMENT PLAN

GILLON CONSULTING GROUP PTY LTD CONSULTING ENGINEERS AND MANAGERS CIVIL/STRUCTURAL/MARINE A.C.N. 078 008 181 LEVEL 1, 38 ARBUTHNOT ROAD, CHADSTONE 3166 TEL. (03) 9864 8232 FAX. (03) 9864 8244 Email: info@gillon.com.au Website: www.gillon.com.au			
DRAWING RSB	PROJECT NO. 0210020	DATE FEB. 2019	DRAWING NO. A2100 SK37
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 ———— EXISTING HV
 ———— PROPOSED HV

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REV	NO	DATE	DESCRIPTION	REV	NO	DATE	DESCRIPTION
1	1	15/02/23	PRELIMINARY ONLY				
2	2	15/02/23	DETAILS				
3	3	15/02/23	AMENDMENTS				

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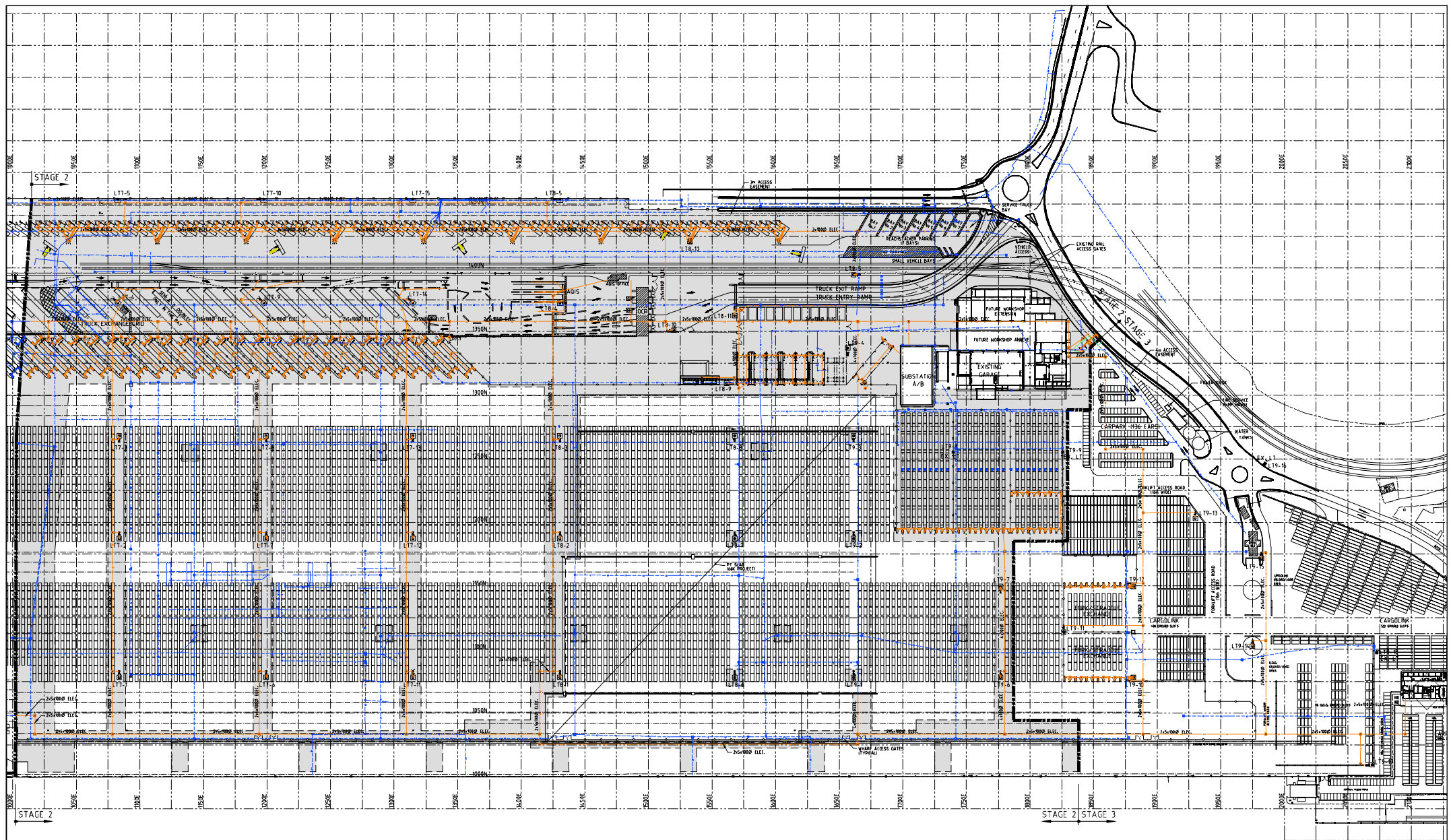
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PTV LTD		

PORT BOTANY
 PORT BOTANY CONTAINER TERMINAL
 PETERHIN ROAD
 PORT BOTANY NSW 2019



PROJECT TITLE
 PORT BOTANY
 REDEVELOPMENT PROJECT
DRAWING TITLE
 HV CONDUIT & PIT
 GENERAL ARRANGEMENT PLAN

BELLON CONSULTING GROUP PTY LTD
 CONSULTING ENGINEERS AND MANAGERS
 10/11-13/15 ANSON ROAD, COLSON STN 181
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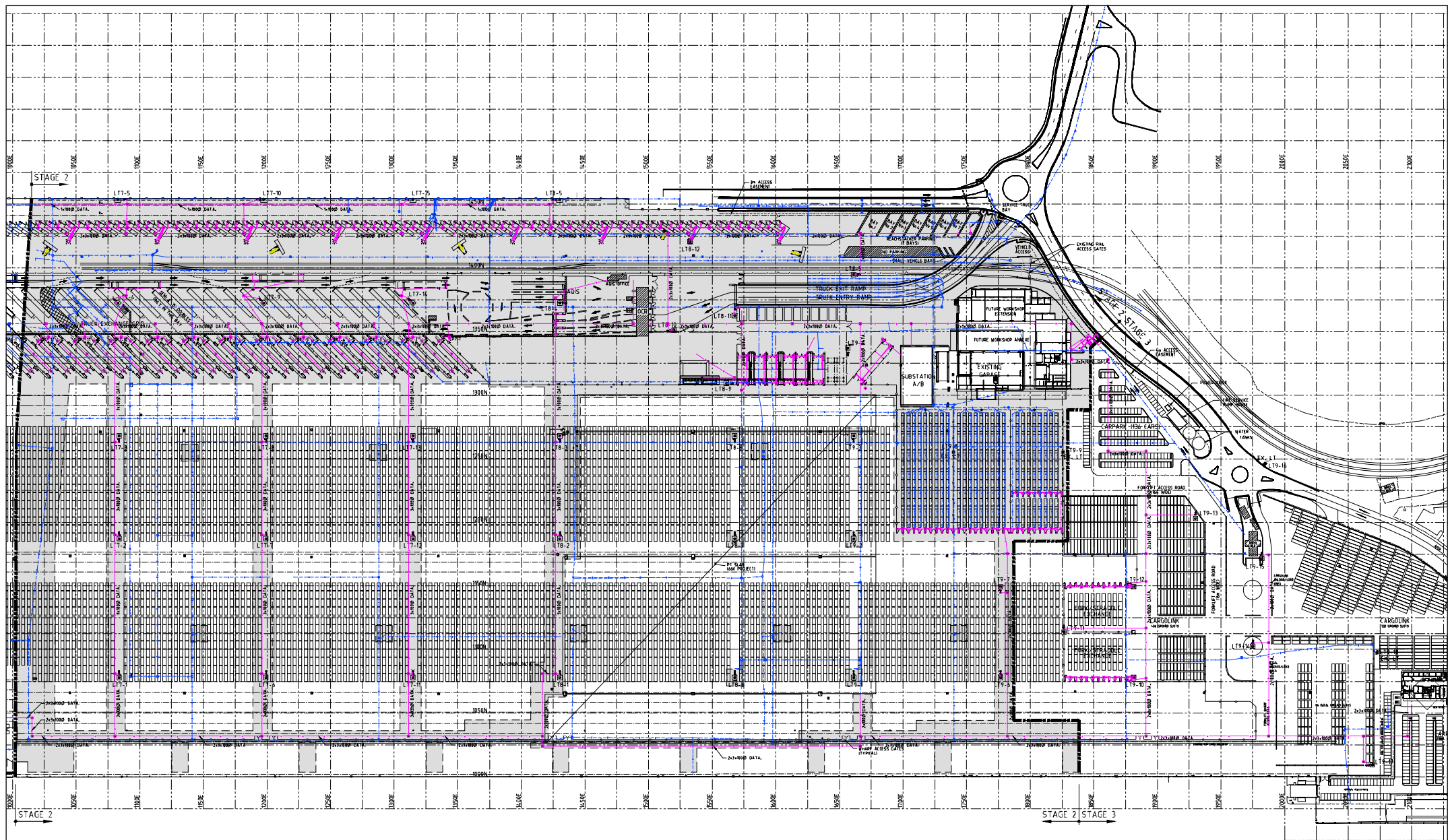
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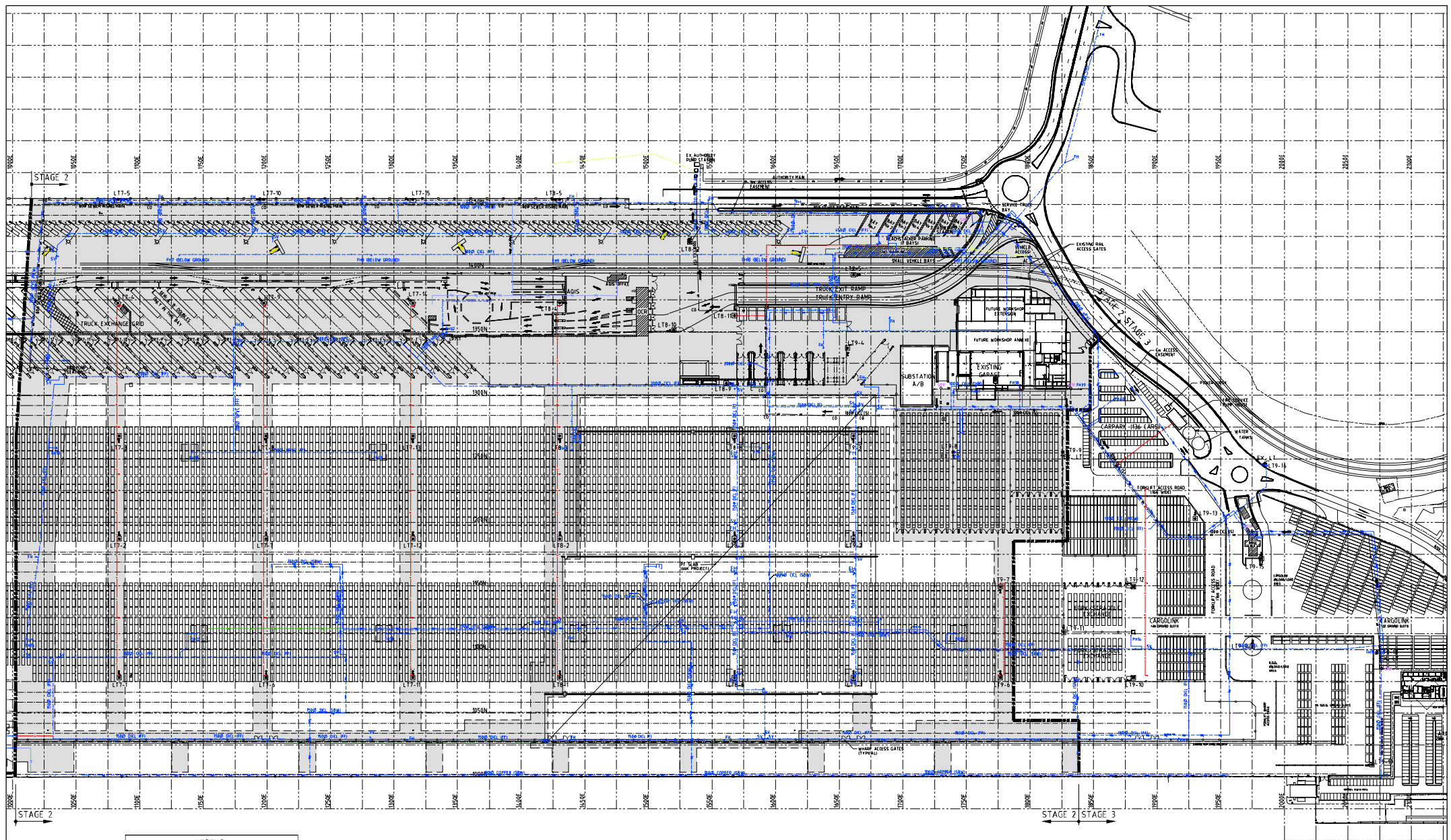
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PORT BOTANY CONTAINER TERMINAL
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Attachment D - Noise and vibration assessment



Patrick Stevedores Operations No. 2

Section 75W Modification - Port Botany Container Terminal
Project (DA-453-12-2002-i MOD 7)

Noise and Vibration Impact Assessment

May 2013

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Appendix A – Equipment for each construction task

Appendix B – Straddle carrier data sheets

Glossary and abbreviations

Term	Definition
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
ICNG	Interim Construction Noise Policy.
INP	Industrial Noise Policy.
LAeq(period)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
LA10(period)	The sound pressure level that is exceeded for 10% of the measurement period.
LA90(period)	The sound pressure level that is exceeded for 90% of the measurement period.
Noise sensitive receiver	An area or place potentially affected by noise which includes: • a residential dwelling • an educational institution, library, childcare centre or kindergarten • a hospital, surgery or other medical institution • an active (e.g. sports field, golf course) or passive (e.g. national park) recreational area • commercial or industrial premises • a place of worship.
Rating background level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
RNP	Road Noise Policy.

1. Introduction

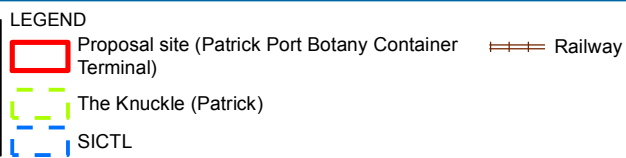
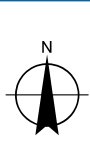
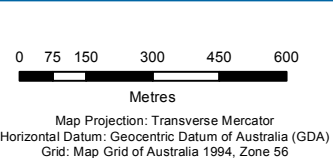
1.1 Purpose of this report

Patrick Stevedores Operations No. 2 (Patrick) proposes to modify its existing terminal located on the northern side of Brotherson Dock in Port Botany, New South Wales (NSW).

The noise and vibration impact assessment has been undertaken with consideration of the following:

- *Director General's requirements (DGRs) Patrick Stevedores Operations No. 2 - Patricks Container Terminal Proposed Modification for a Range of Demolition and Construction Works.*
- *Environmental Protection License (EPL) 6962.*
- *Industrial Noise Policy (INP) (EPA 2000).*
- *Interim Construction Noise Guideline (ICNG) (DECC July 2009).*
- *Assessing Vibration: A technical guideline (DEC 2006).*
- *Road Noise Policy (RNP) (DECCW 2011).*
- *Industrial Noise policy (INP) (EPA 2000).*

This report provides an assessment of the construction noise and vibration, operational noise from the development and the cumulative impact of construction noise from the adjacent Knuckle site and Ramp D. The site is shown in Figure 1.



Patrick Stevedores Operations No 2
Section 75W Modification
- Port Botany Container Terminal Project
(DA-453-12-2002-i MOD 7)

Job Number 21-21961
Revision 1
Date 22 Apr 2013

Site location

Figure 1

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1.2 Proposal description

The proposal would involve a range of demolition and construction works at the existing terminal as well as the replacement of manually-operated straddle carriers with automated straddle carriers. The key features of the proposal include:

- Removal of the temporary demountable administration building in the southeastern corner of the site and replacement with a permanent administration and control building. The new building would include a single-storey administration building and a control tower which would be approximately 43 metres in height.
- Construction of a new undercover maintenance building and workshop designed to accommodate the new automated straddle carriers.
- Removal of the existing optical character recognition (OCR) building and construction of a new OCR structure and traffic lanes at the entrance to the terminal.
- Construction of a new, single-storey demountable Australian Quarantine Inspection Service (AQIS) building adjacent to the new OCR structure.
- Relocation of the existing truck grids and weighbridges.
- Removal of an existing substation building.
- Construction of new straddle carrier parking and fuelling bays.
- Construction of two new car parks for visitors and employees.
- Pavement improvement works.
- Modernisation of terminal lighting including re-positioning of existing lights and installation of more energy efficient lighting within the container stacking yard.
- Replacement of the existing manually-operated straddle carriers with automated straddle carriers.

Other infrastructure and environmental improvements including installation of: gross pollutant traps, upgraded drainage and pumps, light poles, new water and sewerage services, boundary fencing and walls, weighbridge and associated equipment and landscaping works in accordance with the relevant statutory and port code requirements.

1.3 Limitations

This report has been prepared by GHD for Patrick Stevedores Operations No. 2 and may only be used and relied on by Patrick Stevedores Operations No. 2 for the purpose agreed between GHD and the Patrick Stevedores Operations No. 2.

GHD otherwise disclaims responsibility to any person other than Patrick Stevedores Operations No. 2 arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Existing environment

2.1 Sensitive receivers and land uses

Land uses surrounding the site consist of industrial, commercial, residential, recreational land uses and educational facilities.

Sensitive receivers (identified in Figure 2) which have the potential to be impacted by the proposed works include the following:

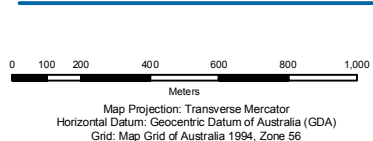
- Botany residential area approximately 750 m north of the proposed works.
- Matraville residential area approximately 700 m east of the proposed works.
- Port Phillip residential area approximately 1900 m south east of the proposed works.
- Banksmeadow Public School approximately 1300 m north of the proposed works.
- Matraville Public School approximately 1500 m north east of the proposed works.
- Sir Joseph Banks Park approximately 1000 m north of the proposed works.
- Botany Golf Course approximately 350 m north of the proposed works.
- Purcell Park approximately 700 m east of the proposed works.
- Womens Athletic Field approximately 1750 m south east of the proposed works.
- Yarra Bay Bicentennial Park approximately 1300 m south east of the proposed works.
- Yarra Recreation Reserve approximately 1600 m south east of the proposed works.
- Botany Cemetery approximately 1000 m south east of the proposed works.

2.2 Background noise levels

Table 2-1 presents a summary of the background and ambient noise levels in the vicinity of the proposed works. The measured noise levels have been provided by Patrick from the Parsons Brinckerhoff Report, *Patrick Stevedores Port Botany Container Terminal - Environmental Noise Compliance (September 2012)* which was prepared to assess compliance with the licensing conditions for the site. The background noise levels are typical of an industrial area with noise from traffic, industry and air traffic. The monitoring locations are identified in Figure 2.

Table 2-1 Summary of measured noise levels (September 2012)

Noise monitoring locations	Rating Background Level dB(A)			L _{Aeq(period)} dB(A)		
	Day	Evening	Night	Day	Evening	Night
	7 am to 6 pm	6 pm to 10 pm	7 am to 6 pm	7 am to 6 pm	6 pm to 10 pm	7 am to 6 pm
1424 Botany Road, Banksmeadow	51	50	45	60	57	56
80 Australia Avenue, Matraville	47	45	45	58	53	52
Military Road, Matraville	41	43	41	53	50	49



LEGEND

- Noise sensitive receivers
- Noise monitoring locations
- Site location (Patrick)
- The Knuckle (Patrick)
- SICTL



Patrick Stevedores Operations No 2
Section 75W Modification
- Port Botany Container Terminal Project
(DA-453-12-2002-i MOD 7)

Noise monitoring locations
and sensitive receivers

Job Number | 21-21961
Revision | 0
Date | 07 Mar 2013

Figure 2

3. Criteria

3.1 Director General's requirements

The DGRs to assess noise impacts are as follows:

"Noise impacts - an assessment of the construction and operational noise impacts of the development on adjoining land uses and sensitive receivers. The EA shall detail how the site will continue to meet its existing operational noise limits during the construction and operational phases. The EA shall consider the Interim Construction Noise Guidelines (DECC, 2009) and the NSW Industrial Noise Policy (EPA, 2000)."

3.2 Existing EPL conditions

The existing EPL conditions relating to noise at the site are summarised below. As required by the DGRs this assessment will determine if the EPL noise limits are still achievable for the proposed modification with regards to construction and operational noise emissions.

EPL 6962 Condition L6.1 prescribes the noise limits applicable to the premises. The DGRs specify that the existing operational noise limits should be complied with during the construction and operational phases of the proposal.

The EPL noise limits are defined in Table 3-1 and described below.

Table 3-1 Condition L6.1 –Noise limits, dB(A)

Location	Day		Evening		Night	
	L _{Aeq} (15min)	L _A (max)	L _{Aeq} (15min)	L _A (max)	L _{Aeq} (15min)	L _A (max)
Residential premises (from January 2009)	55	55	43	55	43	55

Note: Should the EPA consider that a lower noise level can be achieved, the EPA will further reduce the night-time noise limit to as close as possible to 40 dB(A).

- Condition L6.2. For the purpose of Condition L6.1:
 - Day is defined as the period from 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sundays and public holidays.
 - Evening is defined as the period from 6 pm to 10 pm.
 - Night is defined as the period from 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sundays and public holidays.
- Condition L6.3. Noise from the premises is to be measured or computed at the most affected point on or within the residential boundary or at the most affected point within 30 m of the dwelling (rural situations) where the dwelling is more than 30 m from boundary to determine compliance with condition L6.1.
- Condition L6.4. Noise from the premises is to be measured at 1 m from the dwelling façade to determine compliance with the L_{A(max)} noise limits in condition L6.1.
- Condition L6.5. The noise limits specified in condition L6.1 apply under the following meteorological conditions:
 - (a) wind speeds up to 3 m/s at 10 metres above ground level; and
 - (b) temperature inversion conditions of up to 3 °C/100m.
- Condition L6.6. Hours of operation: All construction work at the premises must only be conducted between 7 am to 6 pm Monday to Friday and Saturday 8 am to 2 pm.

3.3 Construction noise management levels

The DGRs imply that construction noise from the proposal should comply with the existing operational noise limits however the DGRs also state that the assessment should consider the ICNG which provides guidance for assessment of construction noise. The ICNG noise management levels would be used when they are more stringent than the existing operational noise limits and for sensitive land uses other than residential receivers.

The guideline recommends standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays.

The ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm.
- Works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.
- Works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours.

Table 3-2 and Table 3-3 detail the ICNG construction noise management levels at sensitive land uses and residences, respectively.

Table 3-2 Construction noise management levels at sensitive land uses

Land use	Management level, $L_{Aeq(15min)}$ (applies when the land use is being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dBA
Hospital wards and operating theatres	Internal noise level 45 dBA
Places of worship	Internal noise level 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dBA
Industrial premises	External noise level 75 dBA
Offices and retail outlets	External noise level 70 dBA

Table 3-3 Construction noise management levels at residences

Time of day	Management level L _{Aeq} (15min)	How to apply
Recommended standard hours: - Monday to Friday 7 am to 6 pm - Saturday 8 am to 1 pm - No work on Sundays or public holidays	Noise affected Rating background level + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured L_{Aeq}(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. - The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise Affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected Rating background level + 5 dBA	- A strong justification would typically be required for works outside the recommended standard hours. - The proponent should apply all feasible and reasonable work practices to meet the noise affected level. - Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

3.3.1 Construction noise criteria

The noise criteria for the proposed construction works during recommended standard hours are provided in Table 3-4 for each sensitive receiver area considering the lower of either the EPL noise limits or the ICNG, where applicable.

Table 3-4 Construction noise criteria during standard hours dB(A)

Location	EPL noise limits to be applied to construction works as per the DGRs		ICNG noise management levels	Construction noise criteria	
	L _{Aeq} (15min)	L _A (max)	L _{Aeq} (15min)	L _{Aeq} (15min)	L _A (max)
Botany residential area	55	55	61	55	55
Matraville residential area	55	55	57	55	55
Port Phillip residential area	55	55	51 ¹	51	55
Banksmeadow Public School	-	-	55 ² (external)	55	-
Matraville Public School	-	-	55 ² (external)	55	-
Sir Joseph Banks Park (passive recreation)	-	-	60	60	-
Botany Golf Course (active recreation)	-	-	65	65	-
Purcell Park (passive recreation)	-	-	60	60	-
Womens Athletic Field (active recreation)	-	-	65	65	-
Yarra Bay Bicentennial Park (passive recreation)	-	-	60	60	-
Yarra Recreation Reserve (active recreation)	-	-	65	65	-
Botany Cemetery (passive recreation)	-	-	60	60	-

Note 1: Based on Military Road monitoring location

Note 2: Educational facility noise management levels for classrooms are based on internal noise levels therefore the external noise management level has been estimated based on a 10 dB reduction in external to internal noise levels.

3.4 Construction traffic criteria

The NSW Road Noise Policy (RNP) (DECCW 2011) provides traffic noise target levels for residential receivers in the vicinity of existing roads (Table 3-5).

The application notes¹ for the RNP state that “for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.”

If road traffic noise increases from the development and is within 2 dB(A) of current levels then the objectives on the RNP are met.

Table 3-5 –Traffic Noise Target Levels, $L_{Aeq(period)}$, dB(A)

Type of Development	Day 7 am – 10 pm	Night 10 pm – 7 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$

3.5 Construction vibration criteria

3.5.1 Human comfort

Vibration has been assessed based on the criteria in *Assessing Vibration: a technical guideline* (DEC February 2006). *British Standard (BS) 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* is recognised by the guideline as the preferred standard for assessing the ‘human comfort criteria’.

Typically, construction activities generate ground vibration of an intermittent nature. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table 3-6 for sensitive receivers.

Whilst the assessment of response to vibration in *BS 6472-1:1992* is based on vibration dose value and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak value, since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration*, as shown below in Table 3-7.

¹<http://www.environment.nsw.gov.au/noise/roadnoiseappnotes.htm> 12 December 2012

Table 3-6 Human comfort intermittent vibration limits (BS 6472-1992)

Receiver type	Period ¹	Intermittent vibration dose value (m/s ^{1.75})	
		Preferred value	Maximum value
Residential	Day	0.2	0.4
	Night	0.13	0.26
Educational institutes	When in use	0.4	0.8

Note 1: Day is between 7 am and 10 pm and night is between 10 pm and 7 am

Table 3-7 Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

3.5.2 Structural damage

Currently, there is no Australian Standard that sets criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures*. Table 3-8 presents guideline values for vibration.

Table 3-8 Guideline values for short term vibration on structures

Type of structure	Guideline values for velocity, (mm/s)		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹
Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example listed buildings under preservation order).	3	3 to 8	8 to 10

Note 1: At frequencies above 100 Hz the values given in this column may be used as minimum values.

3.6 Operational noise

The DGRs imply that operation noise from the proposal should comply with the existing operational noise limits.

4. Assessment of impacts

4.1 Construction noise impacts

4.1.1 Construction schedule and methodology

It is anticipated that the construction works would commence in the 4th quarter of 2013 and be conducted over 16 months. The proposed construction schedule is presented in Table 4-1. The construction program would be staged to ensure that the existing terminal remains operational during construction.

As the works would be undertaken in parallel with existing operations, detailed construction planning would be required.

The general construction approach would include the following key activities which may be undertaken simultaneously:

- Site preparation.
- Demolition works.
- Pavement works and installation of infrastructure.
- Building construction.

Table 4-1 Proposed construction schedule

Task	Month															
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16
Construction and refurbishment of maintenance building and workshop building and construction of car park																
Light pole installations																
Construction of OCR structure and associated traffic lanes																
Pavement works																
Construction of AQIS building																
Demolition of substation																
Installation of gross pollutant traps and improvements to stormwater drainage																
Installation of wharf and boundary fencing																
Relocation of truck grids, weighbridges and rail exchange grids																
Construction of new administration and control building, removal of demountable administration buildings, construction of car park and landscaping																
Construction of new straddle parking and refuelling facility																
Alignment of terminal roadways																
Delivery and assembly of automated straddle carriers																

4.1.2 Construction assessment methodology

The noise emissions from construction activities have been assessed at the surrounding potentially affected sensitive receivers. A quantitative assessment has been undertaken with consideration to the ICNG.

The magnitude of off-site noise impact associated with construction would be dependent upon a number of factors:

- The intensity and location of construction activities.
- The type of equipment used.
- Existing background noise levels.
- Intervening terrain and structures.
- The prevailing weather conditions.

The typical construction equipment likely to generate significant noise is shown in Table 4-2 with the corresponding noise level. Noise levels of construction equipment have been obtained from Australian Standard, AS 2436 – 2010 “*Guide to Noise Control on Construction, Maintenance and Demolition Sites*” unless otherwise specified. The construction modelling predictions assumed a ‘worst case’ sound power level with all equipment operating continuously over the construction site area. Construction machinery would likely move along the study area altering noise impacts with respect to individual receivers. During any given period, the machinery items to be used in the study area would operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time and certain types of construction machinery would be present in the study area for only brief periods during construction. Therefore noise predictions are considered conservative.

Based on the equipment sound power levels, noise levels were predicted at varying distances from the site using *ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors*. Propagation calculations take into account sound intensity losses due to hemispherical spreading, atmospheric absorption², ground absorption (0.5) and adverse meteorological conditions (moderate temperature inversion). Shielding objects, frequency content and terrain were ignored in the calculations.

The predictions consider the construction equipment used for each construction task as identified in Appendix A.

Table 4-2 Construction equipment sound power levels, dB(A)

Plant and equipment	Sound power level (typical)
Backhoe	104
Truck (average)	107
Concrete truck	108
Concrete truck	103
Mobile crane	104
Roller	108
Grader	110

² *ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors (1996)* based on a temperature of 20 °C and a humidity of 70 %.

Plant and equipment	Sound power level (typical)
Dozer	108
Bobcat	100
Excavator	107
Front end loader	113
Water cart	107
Piling rig (vibratory)	120

4.1.3 Predicted construction noise levels

A summary of the predicted noise levels for each month of construction at the potentially impacted sensitive receivers and land uses are shown in Table 4-3.

Construction activities during recommended standard construction hours are predicted to comply with the existing EPL noise limits and the ICNG construction noise management levels at all residential and sensitive receivers.

Since construction works are predicted to comply with the existing EPL noise limits, no specific construction mitigation treatments have been recommended.

4.1.4 Cumulative construction noise

Other works, which generate significant noise emissions, occurring simultaneously in the vicinity of the terminal would include the Knuckle construction (currently underway) and Ramp D works. These works need to be considered for cumulative noise impacts during construction. The construction schedule of the other works, which generate significant noise emissions, is presented in Table 4-4.

Cumulative noise impacts from the proposal and the neighbouring Ramp D and Knuckle projects are predicted to comply with the existing operational noise limits and the ICNG construction noise management levels at all residential and sensitive receivers.

Table 4-3 Predicted construction noise levels at surrounding receivers, dB(A)

Location	Criteria, L _{Aeq} (15min)	Month															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Botany residential area	55	43	51	53	53	53	53	53	53	53	53	51	51	51	51	51	32
Matrville residential area	55	42	50	52	52	52	52	52	52	52	52	50	50	50	50	50	31
Port Phillip residential area	51	33	41	42	42	42	43	42	42	42	42	41	41	40	40	40	21
Banksmeadow Public School	55	39	47	48	48	49	49	48	48	48	48	47	47	47	47	47	28
Matrville Public School	55	36	44	46	46	46	46	46	46	46	45	44	44	44	44	44	25
Sir Joseph Banks Park	60	42	50	51	51	52	52	51	51	51	51	50	50	50	50	50	31
Botany Golf Course	65	49	57	58	58	59	59	59	59	59	58	57	57	57	57	57	38
Purcell Park	60	42	51	52	52	52	53	52	52	52	52	51	51	50	50	50	31
Womens Athletic Field	65	33	41	42	42	43	43	43	43	43	42	41	41	41	41	41	22
Yarra Bay Bicentennial Park	60	37	45	46	46	47	47	46	46	46	46	45	45	45	45	45	26
Yarra Recreation Reserve	65	34	42	43	43	44	44	43	43	43	43	42	42	42	42	42	23
Botany Cemetery	60	39	47	49	49	49	49	49	49	49	49	47	47	47	47	47	28

Table 4-4 Construction schedule for adjacent works

Adjacent works	Month																			
	May-2013	June-2013	July-2013	Aug-2013	Sept-2013	Oct-2013	Nov-2013	Dec-2013	Jan-2014	Feb-2014	Mar-2014	April-2014	May-2014	June-2014	July-2014	Aug-2014	Sept-2014	Oct-2014	Nov-2014	Dec-2014
Stage 1 A Knuckle construction																				
Bulk earthworks																				
Pavements																				
Stage 2B Knuckle construction																				
Bulk earthworks																				
Pavements																				
Ramp D																				
Erection of temporary buildings																				
Demolition of RCOS building																				
Construction works																				
earthworks																				
piling																				
concrete works																				
pavement works																				

Table 4-5 Predicted cumulative construction noise levels from the proposal, Ramp-D and Knuckle works, dB(A)

Location	Criteria, L _{Aeq} (15min)	Sep 13	Oct 13	Nov 13	Dec 13	Jan 14
Botany residential area	55	51	54	54	54	54
Matraville residential area	55	46	51	52	52	52
Port Phillip residential area	51	37	42	42	42	43
Banksmeadow Public School	55	47	50	49	49	50
Matraville Public School	55	41	45	46	46	46
Sir Joseph Banks Park	60	52	54	53	53	53
Botany Golf Course	65	54	59	59	59	60
Purcell Park	60	46	51	52	52	53
Womens Athletic Field	65	37	42	43	43	43
Yarra Bay Bicentennial Park	60	41	46	47	47	47
Yarra Recreation Reserve	65	38	43	44	44	44
Botany Cemetery	60	43	48	49	49	49

4.1 Construction traffic noise

4.1.1 Existing traffic volumes

Traffic surveys were based on the Traffic Impact Assessment Report (GHD March 2013). The existing 2012 traffic data is summarised in Table 4-6 and the heavy vehicle percentage is shown in Table 4-7.

Table 4-6 Existing Traffic Volumes – 2012

Location	AM Peak Hour	PM Peak Hour
Penrhyn Road south of Foreshore Road	229	179
Foreshore Road west of Penrhyn Road	2642	2107
Botany Road north of Foreshore Road	1052	838
Botany Road east of Penrhyn Road	2839	2354
Penrhyn Road adjacent to site	109	40
Beauchamp Road north of Botany Road	1640	1587

Table 4-7 Heavy Vehicle Percentage – 2012

Location	HV %
Penrhyn Road south of Foreshore Road	55%
Foreshore Road west of Penrhyn Road	15%
Botany Road north of Foreshore Road	15%
Botany Road east of Penrhyn Road	15%
Penrhyn Road adjacent to site	62%
Beauchamp Road north of Botany Road	6%

4.1.2 Traffic generation and traffic routes

Patrick has advised that during periods of peak construction, up to 60 trucks may be expected to access the site per day. In order to provide a peak hour traffic impact assessment, it has been assumed that 20% of these trips would occur during the peak periods. The duration of the peak construction period is expected to be approximately four months. On average, the site is expected to generate in the order of 20 construction trucks per day.

The proposal would not result in changes to the operational capacity of the terminal and therefore heavy vehicles entering and exiting the site would not change as a result of the proposal. However the replacement of manually operated equipment with automated equipment would result in a reduction in the number of staff at the site by more than half; from 511 to 241. This would result in a decrease of light vehicle movements entering and exiting the site.

Construction traffic generation from the proposal is summarised in Table 4-8 and has been based on the Traffic Impact Assessment Report (GHD March 2013). Patrick have identified that 80% of construction traffic would access the site from Foreshore Road. Therefore, it is assumed that the remaining 20% is expected to access the site via Beauchamp Road and Botany Road.

Table 4-8 Construction traffic generation

Vehicle type	AM Peak hour traffic	PM Peak hour traffic	Total Vehicles Generation ¹
Heavy	12 (6 In / 6 Out)	12 (6 In / 6 Out)	120 (60 in / 60 out)
Light	30 In	30 Out	300 (150 in /150 out)

4.1.3 Predicted traffic noise impacts from the proposal

Based on the data in Section 4.1.2, the increase in traffic noise emissions from the proposal, along the preferred traffic routes are shown in Table 4-9. The traffic noise increases have been calculated using the *Calculation of Road Traffic Noise CoRTN* (UK Department of Transport) prediction method. Predictions have been based on the PM peak period.

The additional construction traffic generation from the proposal is predicted to increase road traffic noise emission levels by less than 2 dB(A) which is not considered significant by the RNP. Therefore, the construction road traffic noise levels from the proposal are predicted to comply with the noise criteria at sensitive receivers along the construction traffic routes.

Table 4-9 Predicted construction traffic noise levels (PM peak) from the proposal

Road	Existing traffic		Traffic generation		Noise emission level increase dB(A)
	Volume	hv%	Volume	hv%	
Foreshore Road (north of Botany Road)	2107	15%	34	29	0.1
Beauchamp Road (north of Botany Road)	1640	6%	8	29	0.1
Botany Road (east of Penrhyn Road)	2839	15%	8	29	<0.1

4.1.4 Cumulative traffic noise impacts

Based on the likely construction schedule, the worst case cumulative construction traffic scenario would occur during the period where construction of the proposal, Knuckle and Ramp D were being undertaken concurrently noting that the Knuckle works are already underway.

It is expected that the majority of the Knuckle site would be completed prior to the peak construction of the Patrick site. Construction of Ramp D is expected to generate up to 15 vehicles per hour additional during the construction period. As these works are comparatively minor, Patrick would commit to managing construction vehicles associated with this project outside of the AM and PM peak periods to avoid potential cumulative noise impacts.

The cumulative construction road traffic noise levels would not significantly exceed the noise levels predicted in Section 4.1.3 and be well below the 2 dB(A) increase criteria. Therefore cumulative traffic noise levels are predicted to comply with the noise criteria at sensitive receivers along the construction traffic routes.

4.2 Construction vibration impacts

Energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- The efficiency of the energy transfer mechanism of the equipment (i.e impulsive; reciprocating, rolling or rotating equipment).
- The frequency content.
- The impact medium stiffness.
- The type of wave (surface or body).
- The ground type and topography.

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. The *Construction Noise Strategy (Rail Projects) (TCA, 2011)* provides typical equipment safe working distances for cosmetic damage and human comfort.

For construction activities, the safe working distances for equipment that has the potential to generate vibration is shown in Table 4-10.

Table 4-10 Recommended safe working distances for vibration intensive plant

Plant item	Description	Safe work distance (m)	
		Building damage	Human comfort
Large vibratory roller	300 kN (>18 tonne)	25	100
Large hydraulic hammer	1600 kg (8 to 34 tonne excavator)	22	73

The proposed construction works on site should not be sufficient to generate vibration impact at any sensitive receiver outside of the proposal site as all sensitive receivers are well over 100 m from the works.

4.3 Operational noise impacts

Existing noise sources on the site include:

- Trucks.
- Ship unloading operations.
- Locomotives operations.
- Forklifts.
- Straddle carriers.

The proposed modification would not change any of the existing operations (with consideration to noise) except for the straddle carriers. The 37 existing manually operated straddle carriers would be replaced with 44 automated straddle carriers.

The automated straddle carriers would be fitted with noise reduction kits³ with sound attenuation material on the side and top plates of the power unit cover and acoustic louvers on the outlet ventilation system. The location of the straddle carriers is not proposed to significantly change from existing operations. The noise attenuation kit and noise source data sheets are provided in Appendix B. A comparison of the noise source data for the existing manually operated straddle carriers and the proposed automated straddle carriers is provided in Table 4-11.

The total sound power level of the proposed 44 automated straddle carriers is 117 dB(A) (at maximum revolutions). This is 10 dB(A) lower than the 37 existing manually operated straddle carriers which have a total sound power level of 127 dB(A).

The automated straddle carriers would not have reversing alarms fitted (which was a requirement for the existing manually operated straddle carriers). This would reduce potential for any sleep disturbance impacts associated with L_{Amax} noise levels generated by reversing alarms.

Since all other existing noise sources on the site would not change and the noise level from the automated straddle carriers would decrease by 10 dB(A), the overall noise levels from the site would also be anticipated to decrease.

³ Kalmar Straddle Carrier Modules ESC CH7043 RevA (26 May 2010)

Table 4-11 Straddle carrier noise emission comparison

Straddle	Noise Sound Power Level, dB(A)			Reversing alarms	Data source
	Idling, standing	Maximum revolutions, standing	Maximum revolutions, hoisting 40t load		
Existing straddle	99.5	112	-	Reversing alarm	Parsons Brinkerhoff Report, <i>Patrick Stevedores Port Botany Container Terminal – Environmental Noise Compliance (September 2012)</i>
Automated straddle carrier (SC1111) with noise reduction kit (CH7043)	93	101	104	No reversing alarm	Kalmar <i>Straddle Carrier Noise ESC W SC1111 Rev A</i>

Compliance noise monitoring of current operations is a requirement of the licensing condition and has been undertaken in September 2012. Details of the compliance noise monitoring is provided in the Parsons Brinkerhoff Report, *Patrick Stevedores Port Botany Container Terminal – Environmental Noise Compliance (September 2012)*.

The compliance monitoring report concludes the following,

“it was observed that operational noise was not audible at all four monitoring locations. Based on this observation, Patrick Port Botany Container Terminal operational noise is considered to comply with the EPL day, evening and night-time noise limits.

It is a finding of this compliance assessment that the current operation will comply with the established license limits at all locations during the day time, evening and night time periods.

Assessment of the measured residential noise levels indicated no annoying characteristics (tonality) were present. No sleep disturbance issues were present”.

Compliance monitoring indicates that current operations are not audible at the receiver locations, therefore, the cumulative effect of operational noise and construction noise should not significantly increase from the construction noise predictions in Section 4.1.

Since the compliance noise monitoring of existing operations indicates compliance with the EPL noise limits and the proposed modifications to the site are anticipated to decrease operational noise emissions then the proposal should comply with the existing EPL noise limits. Therefore, the modifications should be acceptable from an operational noise perspective and no additional mitigation treatments are required to be included in the EPL.

5. Conclusions

Construction activities from the proposal during standard construction hours are predicted to comply with the existing operational noise limits and the ICNG construction noise management levels at all residential and other sensitive receivers.

Cumulative construction noise impacts from the proposal and the neighbouring Ramp D and Knuckle projects are predicted to comply with the existing EPL noise limits and the ICNG construction noise management levels at all residential and other sensitive receivers.

The additional construction traffic generation is predicted to increase road traffic noise emission levels by less than 2 dB(A) which is not considered significant by the Road Noise Policy. Therefore the construction road traffic noise levels are predicted to comply with the noise criteria at sensitive receivers along the construction traffic routes for the proposal and considering cumulative impacts.

The works on site should not be sufficient to generate vibration impact at any sensitive receivers outside of the proposal site as all sensitive receivers are well over 100 m from the proposed works.

Operational noise impacts from the proposal are anticipated to decrease from current operations as the proposed automatic straddle carriers produce lower noise emissions and do not have reversing alarms fitted. Since the compliance noise monitoring of existing operations indicates current compliance with the EPL noise limits and the proposed modifications would decrease operational noise emissions, then the proposed modifications should comply with the existing EPL noise limits. Therefore the proposal should be acceptable from an operational noise perspective.

6. References

Assessing Vibration a Technical Guideline, Department of Environment and Conservation, February 2006

Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), BS 6472 – 1992, British Standards, 1992

Guide to noise and vibration control on construction, demolition and maintenance sites, AS 2436 - 2010, Australian Standards, 2010

Industrial Noise Policy, Environmental Protection Authority, January 2000

Interim Construction Noise Guideline, Department of Environment and Climate Change, July 2009

Road Noise Policy, Office of Environment and Heritage, March 2011

Structural Vibration Part 3: Effects of vibration on structures, DIN 4150-3 -1999, German Standards, 1999

Code of Practice Part 2 Vibration for noise and vibration on construction and open sites BS 5228.2 – 2009, British Standards, 2009

Environmental Protection Licence 6962, Environmental Protection Agency,

Patrick Stevedores Port Botany Container Terminal - Environmental Noise Compliance Parsons Brinckerhoff, September 2012

Appendices

Appendix A – Equipment for each construction task

Electrical works		Delivery and assembly of straddle carriers	Construction and refurbishment of maintenance and workshop building and carpark	Lighting installation	Construction of OCR structure and traffic lanes	Construction of control building	Pavement works	Construction of AQIS building	Demolition of substation	Water treatment plant improvements and drainage upgrades	Installation of wharf and boundary fencing	Relocation of truck grids, weighbridges and rail exchange grids	Construction of new administration building, removal of demountables and carpark	Construction of new straddle parking and refuelling facility	Alignment of terminal roadways	Removal of demountable administration buildings
< 40T Mobile Crane	< 40T Mobile Crane	Tip Truck	< 40T Mobile Crane	< 40T Mobile Crane	< 40T Mobile Crane	20T Pad Foot Roller	Concrete Truck	<20T Excavator	Back Hoe	Back Hoe	Back Hoe	Back Hoe	Back Hoe	Tip truck with trailer	Back Hoe	Tip truck with trailer
1	1	4	1	1	1	1	2	1	1	1	1	1	1	3	1	2
Back Hoe	< 15T Mobile Crane	Back Hoe	Boom lift	Back Hoe	< 15T Mobile Crane	20T Smooth Drum Roller	Tip Truck	Bobcat	Tip Truck	Concrete Truck	Tip Truck	Tip Truck	Concrete Truck	Tip Truck	Tip Truck	< 40T Mobile Crane
1	1	1	1	1	1	1	2	1	3	1	3	4	2	2	2	1
<20T Excavator	Boom lift	<40T Excavator	< 15T Mobile Crane	Tip Truck	Concrete Truck	20T Multi Tyre Roller	Back Hoe	Tip Truck	Concrete Truck	Bobcat	Concrete Truck	Concrete Truck	20T Smooth Drum Roller	Bobcat	< 15T Mobile Crane	
1	1	1	1	3	4	1	1	2	2	1	2	3	1	1	1	1
		20T Smooth Drum Roller		20T Pad Foot Roller	Concrete Pump	Grader	Bobcat	Back Hoe	< 15T Mobile Crane		< 40T Mobile Crane	Concrete Pump	20T Multi Tyre Roller	<20T Excavator	Bobcat	
		1		1	1	1	1	1	1		1	1	1	1	1	1
		Back Hoe		20T Smooth Drum Roller	Dozer	Dozer		< 15T Mobile Crane	<20T Excavator		Bobcat	< 40T Mobile Crane	Grader		<20T Excavator	
		1		1	1	1		1	1		1	1	1		1	1
		Concrete Truck			<40T Excavator	Tip truck with trailer			Front End Loader		<20T Excavator	20T Pad Foot	Front End Loader			

Electrical works		Delivery and assembly of straddle carriers	Construction and refurbishment of maintenance and workshop building and carpark	Lighting installation	Construction of OCR structure and traffic lanes	Construction of control building	Pavement works	Construction of AQIS building	Demolition of substation	Water treatment plant improvements and drainage upgrades	Installation of wharf and boundary fencing	Relocation of truck grids, weighbridges and rail exchange grids	Construction of new administration building, removal of demountables and carpark	Construction of new straddle parking and refueling facility	Alignment of terminal roadways	Removal of demountable administration buildings
													Roller			
		3			1	6				1		1	1	1		
		Concrete Pump			20T Multi Tyre Roller	Articulated Water Cart	Bobcat			Articulated Water Cart		Front End Loader	20T Smooth Drum Roller	Articulated Water Cart		
		1			1	1	1			1		1	1	1		
		Grader			Grader		Front End Loader						Grader			
		1			1		1						1			
		Bobcat			Articulated Water Cart		Articulated Water Cart						Bobcat			
		1			1		2						1			
		Articulated Water Cart			Concrete Truck								<40T Excavator			
		1			3								1			
					Concrete Pump								Front End Loader			
					1								1			
													Articulated Water Cart			
													1			

Stage 1 A Knuckle construction - Bulk earthworks	Stage 1 A Knuckle construction - Pavements	Stage 2B Knuckle construction - Bulk earthworks	Stage 2B Knuckle construction - Pavements	RAMP D - Erection of temp buildings	RAMP D - demolition of RCOS building	RAMP D - earthworks	RAMP D - piling	RAMP D - concrete works	RAMP D - Pavement works
Tip truck with trailer	Tip truck with trailer	Tip truck with trailer	Tip truck with trailer	Back Hoe	Tip truck with trailer	Back Hoe	Piling rig	Tip Truck	Tip truck with trailer
6	4	6	4	1	3	1	1	2	3
moxey truck	Concrete Truck	moxey truck	Concrete Truck	Tip Truck	< 40T Mobile Crane	Tip truck with trailer	Concrete Truck	Concrete Truck	12T Smooth Drum Roller
5	8	5	8	2	1	4	5	6	1
< 40T Mobile Crane	Concrete Pump	< 40T Mobile Crane	Concrete Pump	Concrete Truck	< 15T Mobile Crane	20T Pad Foot Roller	Concrete Pump	Concrete Pump	20T Smooth Drum Roller
1	1	1	1	2	1	1	1	1	1
20T Pad Foot Roller	20T Multi Tyre Roller	20T Pad Foot Roller	20T Multi Tyre Roller	< 40T Mobile Crane	Bobcat	20T Smooth Drum Roller	Tip truck with trailer	Bobcat	20T Multi Tyre Roller
2	1	2	1	1	2	1	2	1	1
12T Pad Foot Roller	20T Smooth Drum Roller	12T Pad Foot Roller	20T Smooth Drum Roller	Bobcat	<40T Excavator	Grader	Back Hoe		Bobcat
1	2	1	2	1	1	1	1		1
20T Smooth Drum Roller	Articulated Water Cart	20T Smooth Drum Roller	Articulated Water Cart	<20T Excavator	<20T Excavator	Dozer	< 40T Mobile Crane		Articulated Water Cart
1	1	1	1	1	1	1	1		1

Stage 1 A Knuckle construction - Bulk earthworks	Stage 1 A Knuckle construction - Pavements	Stage 2B Knuckle construction - Bulk earthworks	Stage 2B Knuckle construction - Pavements	RAMP D - Erection of temp buildings	RAMP D - demolition of RCOS building	RAMP D - earthworks	RAMP D - piling	RAMP D - concrete works	RAMP D - Pavement works
Grader		Grader			Front End Loader	<40T Excavator	<20T Excavator		
1		1			1	1	1		
Dozer		Dozer			Back Hoe	Front End Loader	Articulated Water Cart		
2		2			1	1	1		
Bobcat		Bobcat				Articulated Water Cart			
1		1				1			
<40T Excavator		<40T Excavator							
2		2							
Front End Loader		Front End Loader							
2		2							
Moxey watercart		Moxey watercart							
2		2							

Appendix B – Straddle carrier data sheets

CH7043 Noise reduction kit for power unit

Technical data:

- Sound damping material on the side and top plates of the power unit cover
 - 20 mm foamed plastic with black imitation leather surface
- Sound trap at the outlet opening of the power unit ventilating air
 - Steel plate construction with sound damping material

Customer benefits:

- reduced noise level around the yard as well in the driver's cabin



SC 1111 NOISE LEVEL OF KALMAR EDRIVE® ESC W STRADDLE CARRIER WITH CUMMINS QSM11 VSG ENGINE AND COVER CH7043 ON POWER UNIT

Noise in cabin

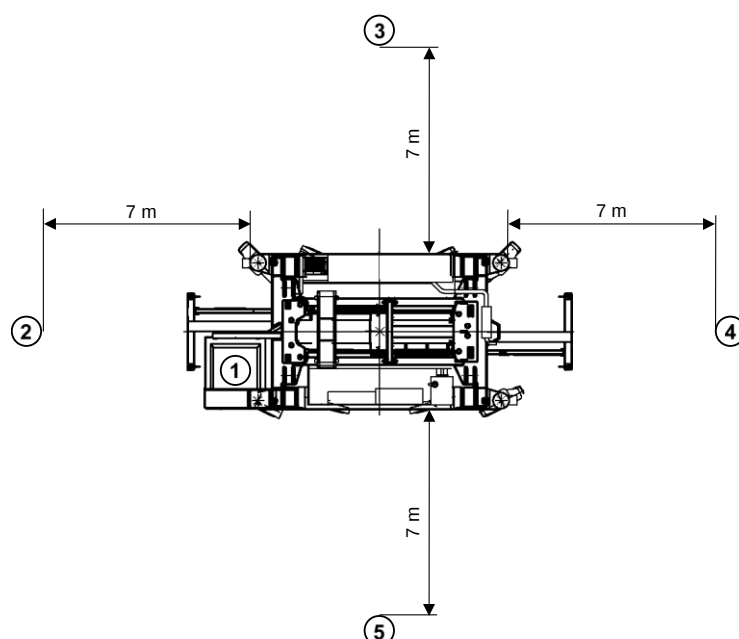
Measuring point at operator's head location, ventilation fan at low speed and air conditioning off.

Load case	Point	Noise level L_{Aeq} [dB]
Idling, standing	1	55
Max. rpm, standing	1	60
Max. rpm, hoisting without load, standing	1	62
Max. rpm, hoisting 40 T load, standing	1	65

Noise at ground level

Measuring point at 7 m distance from machine and 1.2 m above ground.

Load case	Noise level L_{Aeq} [dB]			
	Front Point 2	Right Point 3	Rear Point 4	Left Point 5
Idling, standing	64	65	63	66
Max. rpm, standing	72	73	72	74
Max. rpm, hoisting without load, standing	73	74	75	78
Max. rpm, hoisting 40 T load, standing	74	75	76	79



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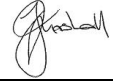
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B	E Milton	E Smith		G Marshall		13/03/13

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Attachment E - Traffic impact assesment



Patrick Stevedores Operations No 2
Section 75W Modification - Port Botany Container Terminal
Project (DA-453-12-2002-i MOD 7)
Traffic Impact Assessment

April 2013

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1. Introduction

1.1 Overview

Patrick Stevedores Operations No. 2 (Patrick) proposes to modify the configuration of its container terminal by undertaking a range of demolition and construction activities. The works would be contained within the existing terminal site located on the northern side of Brotherson Dock in Port Botany, New South Wales (NSW).

Road access to the development site is provided via Penrhyn Road. Penrhyn Road forms the southern arm of the Foreshore Road and Botany Road intersection, as shown in Figure 1. The demolition and construction activities (referred to as the proposal) require approval from the NSW Minister for Planning and Infrastructure in the form of a Section 75W Modification to the *Patrick Stevedores Port Botany Container Terminal Project* (DA-453-12-2002-i) under the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Study scope

This traffic impact assessment report discusses the following:

- Existing conditions – a review of existing road features, adjacent developments, traffic volumes, pedestrian facilities.
- The proposal – a review of additional traffic generated from the proposal and proposed access/egress arrangements during the construction and operational phase of the proposal.
- Construction impact – assessment the performance of the existing intersections (queues, delays, level of service, safety) during the construction phase of the proposal.
- Operation impact – a review of the operational phase of the proposal.

This report also provides a cumulative impact assessment of the construction and operation of the adjacent 'Knuckle' site (which is in the future to be operated by Patrick) and the construction of Ramp D (which will provide a fourth arm of the recently constructed grade separated Penrhyn Road roundabout). The cumulative impact assessment also considers the operation of the adjacent SICTL site. It is noted that the SICTL site is currently under construction, and that construction traffic associated with the site is accounted for in the traffic survey data undertaken in 2012 for the proposal. The Knuckle, Ramp D and SICTL were approved under the Sydney Ports Corporation (SPC) Port Botany Expansion (2003).

This traffic impact assessment has been prepared in accordance with the Roads and Maritime Services (RMS) *Guide to Traffic Generating Developments* procedure manual, where applicable.