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Sent: Tue, 9 Jun 2026 17:04:04 +1000
To: "Development Assessment" <developmentassessment@townsville.qld.gov.au>; "javier.samanes@dilgp.qld.gov.au" <javier.samanes@dilgp.qld.gov.au>
Cc: "kellie.galletta@dsdip.qld.gov.au" <kellie.galletta@dsdip.qld.gov.au>; "rfiraq@urbis.com.au" <rfiraq@urbis.com.au>
Subject: 2604-52045 SRA application correspondence
Attachments: Attachment 5 - 2017 Acoustic Report.pdf, Attachment 5 - 2017 SWMP Report.pdf, GE83-N Representations about a referral agency response.pdf, 2604-52045 SRA - Change Other Response.pdf
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Lautaret Pty Ltd

West State Private Hospital

Acoustic Assessment Report

AAc/R01

Rev B | 13 February 2017

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

Queensland Government

SARA ref: 2604-52045 SRA

Date: 9 June 2026

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

Queensland Government

SARA ref: DEPC20/1007 (DEPC18/98)

Date: 30 October 2020

Job number 244765-00

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Document Verification

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			Prepared by	Checked by	Approved by
		Name	Cameron Hough	Simon Ham	Sandra Nilsen
		Signature			
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		Signature			
Rev B	13 Feb 2017	**Filename**	Report_AcousticAssessment_RevB.docx		
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		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

1 Introduction

Arup has been engaged by Lautaret Pty Ltd to conduct an acoustic assessment for the proposed West State Private Hospital, Townsville.

The development approval has also been referred to the Department of Infrastructure, Local Government and Planning for review, which requires an acoustic report to assess rail noise impacts on the development.

Arup has previously (April 2016) prepared an acoustic report for a previous version of the West State Private Hospital project. The space planning and location of the new-build component on site has subsequently been revised.

This revised report:

- Presents appropriate design criteria based on Townsville City Council and QLD Government policy, relevant Australian Standards and international guidelines (e.g. UK Department of Health)
- Assesses road traffic noise levels impacting the development
- Assesses current and future rail noise levels impacting the development
- Presents façade glazing performance requirements for each façade area to meet appropriate criteria internally within the development
- Presents indicative glazing constructions to meet the performance requirements.
- Provides recommended partition constructions to address internal sound insulation between functional areas of the West State Private Hospital.
- Provides preliminary recommendations for room acoustic treatment.

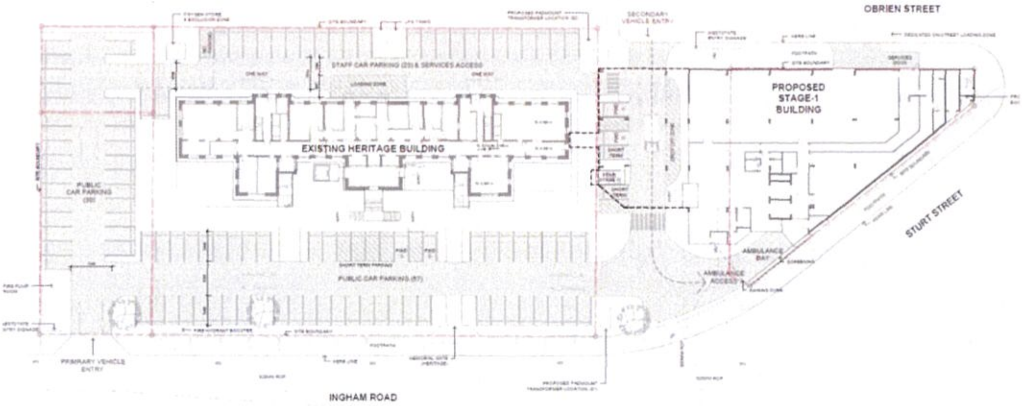
A glossary of acoustic terminology used in this report is presented in Appendix A.

1.1 Proposed Development

Stage 1 of the proposed development consists a mix of a new-build 5-storey hospital building with rooftop plant, and adaptive re-use of the former Townsville West State School main building.

A site plan showing the proposed new-build and refurbishment component of the development is given below in Figure 1.

Figure 1: Site Plan, West State Private Hospital, showing new-build component (right) and heritage refurbishment component (centre)



2 Site Description

The site is located at 39 Ingham Road and 763 Sturt Street, West End, Townsville. The existing site comprises of the former Townsville West State School main building and an undeveloped section of land between Sturt Street and O'Brien Street.

The site is surrounded by the following:

- To the north; new Townsville West State School and O'Brien Street.
- To the south; Ingham Road and the railway line.
- To the west; commercial tenancies fronting Ingham Road.
- To the east; Sturt Street.

2.1 Existing Noise Environment

The existing acoustic environment is a mixture of residential, community (education and places of worship) and commercial land usage, and is dominated by near-constant traffic noise along Ingham Road and Sturt Street, as well as general urban noise from surrounding properties.

Note that at present, it is likely that the total number of railway movements along the line to the south of the site is fewer than 15 movements per day, and rail noise does not significantly contribute to the overall $L_{Aeq,24hr}$ noise level. This would normally trigger treating the Ingham Road + North Coast Railway cumulatively as a 'Type 1' multi-modal corridor (i.e. against the criteria for State-controlled roads); however it must be noted that due to the recent (possibly temporary) closure of the nickel smelter at Townsville, freight movements on the North Coast Line are lower than usual and therefore current conditions are not necessarily representative of the likely maximum rail noise exposure of the site.

Therefore, for the purposes of the noise assessment for West State Private Hospital, it is considered most appropriate to assess against noise criteria for a Type 2 multi-modal corridor (>15 train movements per day) to account for potential future increases in the number of train movements.

Note that Ingham Road and Sturt Street, although significant for consideration of noise intrusion to the development, are not state-controlled roads and hence do not influence the selection of criteria for assessment.

2.2 Noise-Sensitive Receivers

The nearest noise-sensitive receivers to West State Private Hospital developmemt site are:

- residential properties on Lamington Street, to the north-west
- Townsville West State School and residential properties on Wilson Street, to the north
- St Mary's Church and Edmund Rice Education Flexible Learning Centre, located across Ingham Road to the south of the development

2.3 Measured Noise Levels

To quantify the existing noise environment, a noise survey was conducted on the site and surrounding areas. The noise survey consisted of a combination of unattended noise measurements using a noise logger and operator-attended measurements.

A noise logger (ARL Ngara noise logger, serial number 878107) was set up on the proposed development site approximately 5 m north of the Ingham Road footpath, as shown in Figure 2.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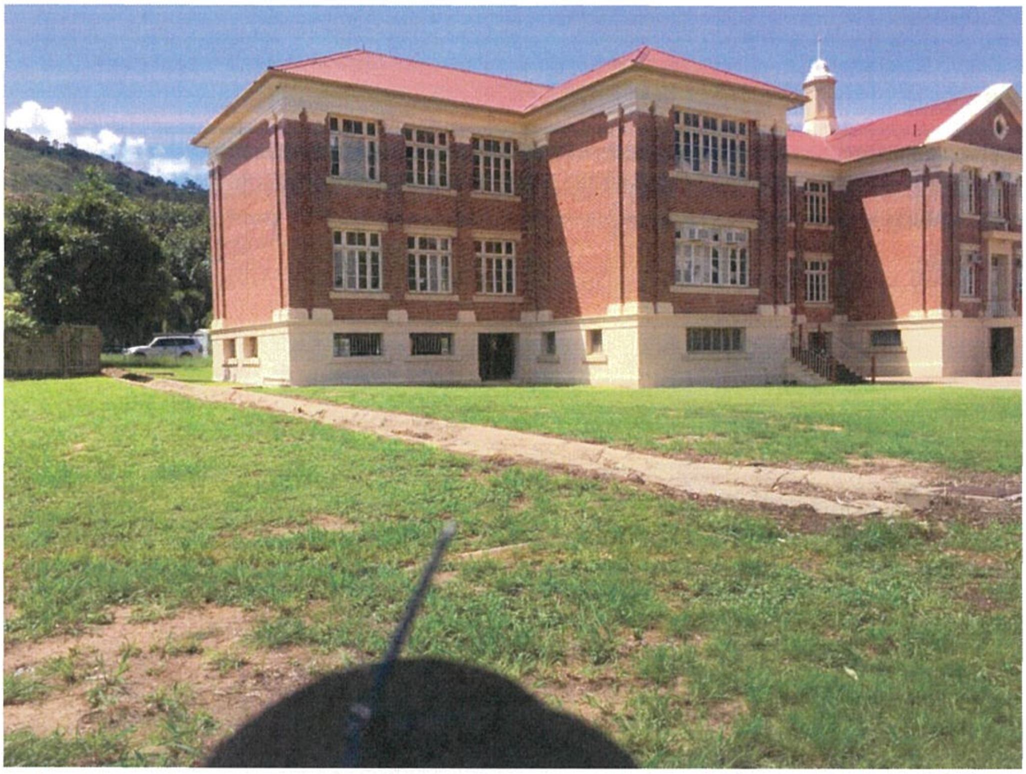


Figure 2 Noise Logger Location at proposed West State Private Hospital

The noise logger measured the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters over 15-minute intervals from 22 March 2016 to 24 March 2016.

Averaged noise levels from the noise logger are presented in Figure 3.

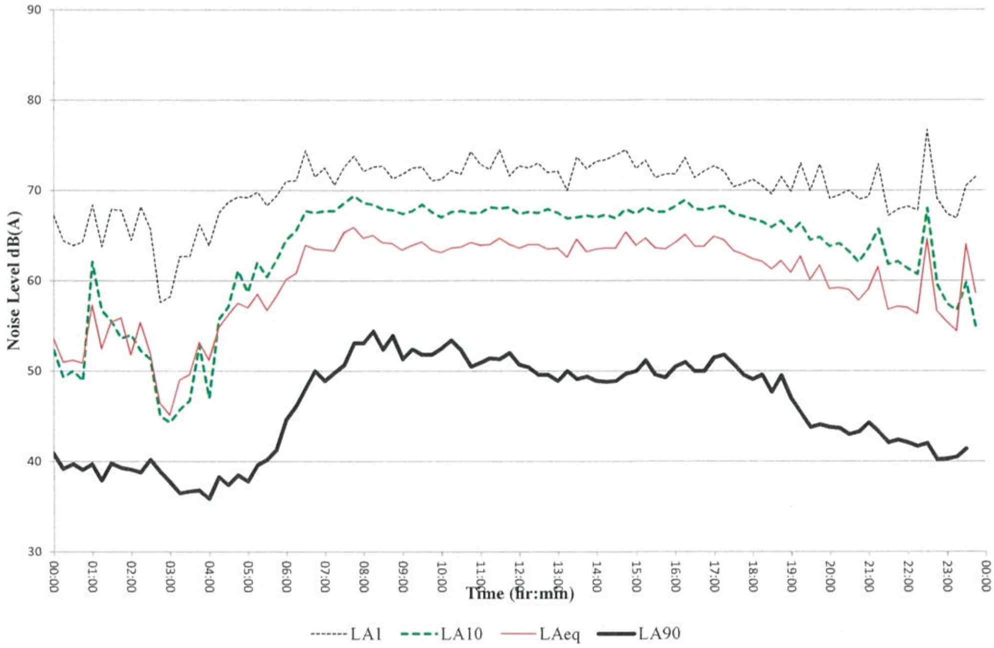


Figure 3 Average Noise Levels, Noise Logger, 22 March to 24 March 2016, dB re 20 μPa

To supplement the noise logger measurements, and to obtain traffic source levels for use in the façade design, attended measurements were taken by Matthew Tripodi of Arup on 22 March, 23 March and 24 March 2016, using a Brüel and Kjær Type 2270 sound level meter (S/N 3008107) and a PCB Piezotronics 393B12 accelerometer (S/N 27441). The accelerometer was mounted on a soil spike and firmly secured in the soil. The sound level meter was checked for calibration using a Brüel and Kjær Type 4231 calibrator before and after each measurement session. No significant drift in calibration occurred.

Simultaneous noise and vibration measurements were taken adjacent to the noise logger location, approximately 3 m away to avoid reflections from the operator affecting the measurements, as shown in Figure 4.

Figure 4 Attended Measurement Location, West State Private Hospital

The attended noise measurements are summarised in Table 1.

Table 1 Attended Measurements, West State Private Hospital, 22-24 March 2016

Comments	**Duration**	**Noise Measurements, dB re 20 µPa**			
		L_{A1}	L_{A10}	L_{Aeq}	L_{A90}
Average AM Peak Traffic Noise	10 mins, average of 12 measurements	73	68	65	53
Average PM Peak Traffic Noise	10 mins, average of 12 measurements	72	68	64	51
Spirit of Queensland Pass-By (northbound)	Pass-by, excluding horn	71	68	65	56
Spirit of Queensland Pass-By (southbound).	Pass-by, excluding horn	77	73	70	58
Diesel Engine pass-by (no wagons)	Pass-by, excluding horn	76	68	65	55
Average Heavy Vehicle Pass-By	Pass-by	73	72	67	60

The loudest single event (which will be used for façade design) is the southbound Spirit of Queensland pass-by, with a maximum noise level (free-field) of 77 dB(A) at the logger location. The southbound Spirit of Queensland is louder than the northbound because the train speed is higher running south compared to northbound where the train is accelerating away from a station stop.

A summary of the measured vibration levels is provided below in Figure 5 (rms vibration spectrum) and Figure 6 (peak vibration spectrum), with the Vibration Criterion (VC) curves overlaid for reference. Most medical equipment will operate satisfactorily with ambient vibration levels at or below the VC-C curve (", although some particularly-sensitive equipment may require VC-D to operate.

Figure 5: Measured RMS Vibration Velocity Spectra, West State Private Hospital

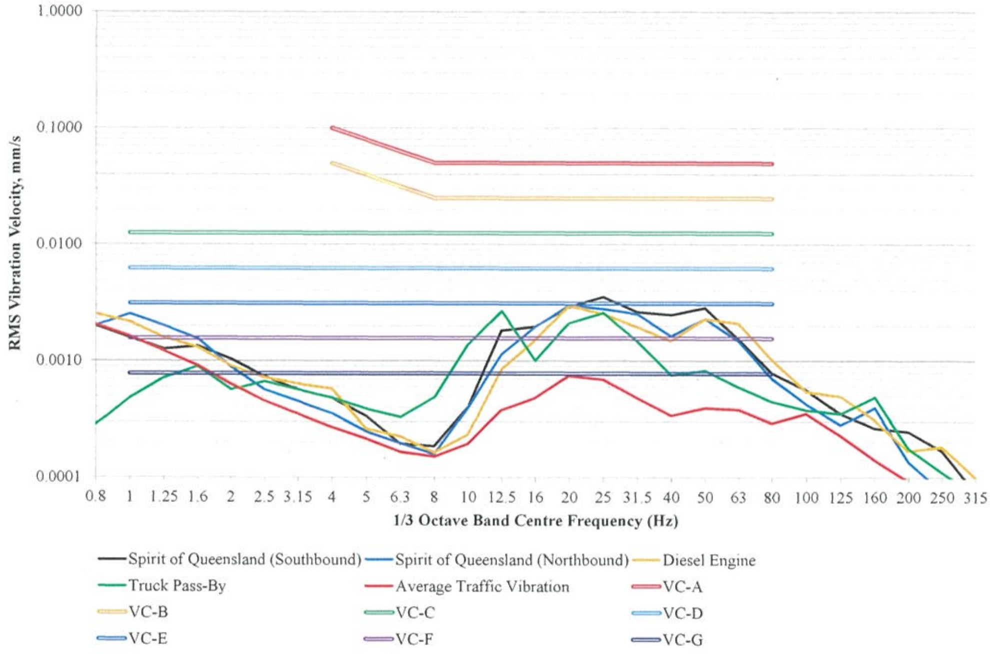
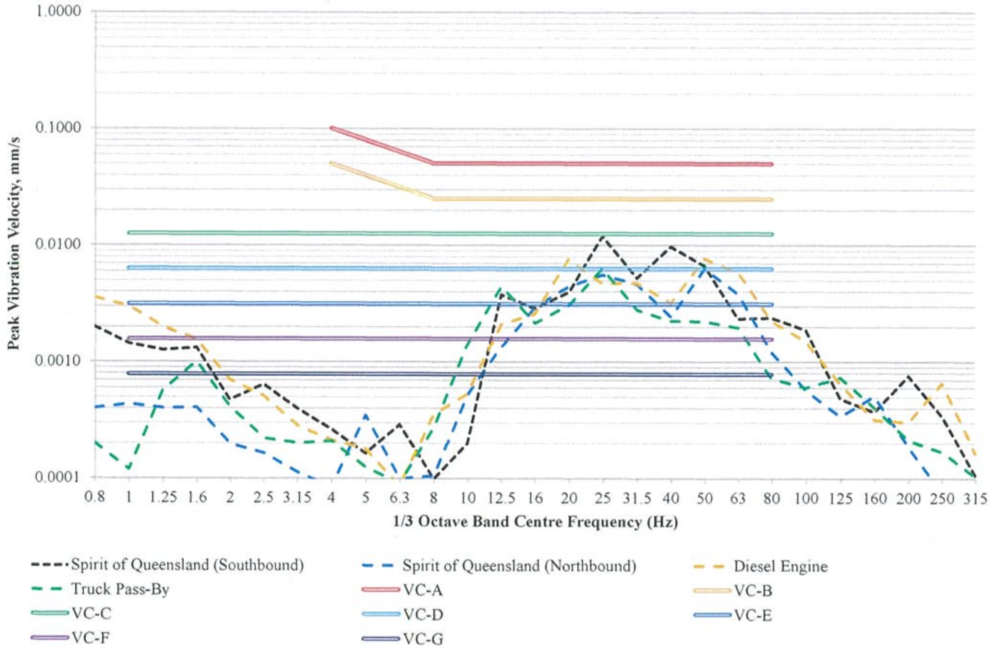


Figure 6: Measured Peak Vibration Velocity Spectra, West State Private Hospital



As can be seen from the measured vibration levels, ambient vibration in ground is likely to be at approximately VC-D, with occasional peaks to VC-C or VC-B. Based on the measured vibration levels, and with careful selection of equipment, appropriate location on site (e.g. away from the railway line at the northern end of site) and appropriate structural design of the building, adverse vibration impacts on medical equipment are not expected.

3 Performance Criteria

Ratings have been proposed for Acoustic Privacy, Noise Sensitivity and Noise Generation for each space in Table 2 below based on Arup's understanding of the client needs and the intended uses of the spaces and good practice guidance from Australian standards (particularly AS 2107 (2000) *Acoustics – Recommended design sound levels and reverberation times for building interiors*) and international guidelines (e.g. the UK Department of Health's *Acoustics: technical design manual 4032* and *Specialist Services Health Technical Memorandum 08-01: Acoustics* (HTM-08-01). Using these ratings and background design levels as provided in Table 3, the required level of sound insulation between functional spaces can be determined.

The ratings are based on the following factors:

- **Acoustic privacy** refers to the degree to which activities in a functional space should be inaudible in adjacent areas.
  E.g. a consultation room used for sensitive medical discussions would require high acoustic privacy to prevent discussions being heard in adjacent rooms.
  - **Confidential** privacy means that raised speech in a room would be just audible but not intelligible in adjacent rooms, while normal speech would is unlikely to be audible
  - **Private** privacy means that normal speech would be audible but not intelligible in adjacent rooms.
  - **Not Private** privacy means that normal speech would be audible and intelligible in adjacent rooms
- **Noise sensitivity** refers to the degree to which a functional space will be disrupted by external noise levels (i.e. the expectation of 'quiet' in a space).
  E.g. a private room is highly sensitive to sleep disturbance from external noise intrusion
  - **Sensitive** means that a room should not normally experience audible noise from adjacent rooms
  - **Medium** sensitivity means that a room should not usually experience audible noise from adjacent rooms, but activities in adjacent rooms will occasionally be audible
  - **Not Sensitive** means that noise from other rooms does not affect the use of the room
- **Noise generation** refers to the likely level of noise associated with activities in a space.
  E.g. a retail/services space can have high noise generation but low/no noise sensitivity

The actual level of sound insulation between two spaces will depend on their adjacency to each other and the acoustic rating system in Table 2. For example, if a high noise generation space is located adjacent to a high noise sensitivity space this will require a higher performing acoustic separation to achieve the desired criteria.

3.1 Acoustic Quality Objectives

Table 2 Proposed Acoustic Privacy, Noise Sensitivity and Noise Generation ratings

Area	Acoustic Privacy	Noise Generation	Noise Sensitivity
Public/Patient Lounges Staff Lounges	Not Private	High	Not Sensitive
Maxillofacial Suite Cardiology Suite Operation/Procedure Rooms Anaesthetic Preparation Rooms Control Rooms	Private	Typical	Sensitive
Radiology	Private	High	Sensitive
Sterilising Supply Department Scrub Rooms Scope Reprocessing Area Pharmacy	Not Private	High	Not Sensitive
Consultation Rooms Interview Rooms	Confidential	Typical	Medium
Staff Support Clinical Support Pathology Services	Moderate	Typical	Medium
Day Unit Recovery Unit Recovery Suite	Moderate	Typical	Medium
Private Bedroom Isolation Room	Confidential	Typical	Medium
Open Plan Office Staff Education/Research	Not Private	Typical	Medium
Private Offices Meeting Rooms Boardroom	Private	Typical	Medium
Reception/Waiting Areas	Not Private	High	Not Sensitive
Retail/Service	Not Private	High	Not Sensitive
Plant	Not Private	Very High	Not Sensitive
Amenities	Moderate	Typical	Not Sensitive

3.2 Building Services Noise Levels

Recommended building services background noise levels are presented in terms of the quasi-steady L_{Aeq} noise level, as well as the Noise Rating (NR) curve is to assist in achieving a neutral background noise spectrum. In cases where the L_{Aeq} and the NR rating conflict, the NR rating should take precedence (i.e. services should be designed to meet a particular NR rating with compliance with the overall L_{Aeq} being secondary).

For spaces where increased acoustic privacy is required (e.g. reception areas where patients may be discussing medical details and multi-bed wards), services are recommended to be designed to the 'maximum' recommended levels from AS2107 in order to provide noise masking.

For other spaces where concentration is required (e.g. operating theatres) or where a quiet environment will assist recovery (private rooms) services should be designed to the 'satisfactory' levels.

Recommended background noise targets are presented in Table 3.

Table 3 Recommended Background Noise Targets, dB re 20 μPa

Area	L_{Aeq}, dB	NR
Staff or Patient Lounges Waiting Areas	45	40
Operation/Procedure Rooms Anaesthetic Induction Rooms Control Rooms	40	35
Diagnostic Imaging Sterilising Supply Department Scrub Rooms Cardiology / Maxillofacial	45	40
Specialist Consultation Rooms Interview Rooms	40	35
CEO Office Private Office Meeting Rooms	40	35
Staff Support Clinical Support	45	40
Private Bedroom	35	30
Day Unit Recovery Intensive Care	40	35
Open Plan Office Reception/Waiting Areas	45	40
Retail/Service	50	45
Amenities	55	50

3.3 Noise Ingress

There are typically three types of noise sources which are considered for noise ingress:

- Continuous noise sources (e.g. near-constant road noise)
- Intermittent noise sources (e.g. railway pass-bys)
- Rain noise on roof

For façade-located spaces, criteria have been developed to address these noise sources considering the recommendations of AS2107 and the UK Department of Health Guidelines, applicable QLD government policy (refer Section 3.3.1) and Townsville City Council development code requirements.

3.3.1 QLD Government Requirements

The QLD Environment Protection (Noise) Policy 2008 provides acoustic quality objectives for noise-sensitive land uses for "health and wellbeing", which are intended as "aspirational" long-term targets.

QLD DTMR's *Policy for Development on Land Affected By Environmental Emissions from Transport and Transport Infrastructure* (TMR Policy) 2013 and the QLD State Development Assessment Provisions Code 1.1 *Managing Noise and Vibration Impacts from Transport Corridors State Code* (SDAP) provides criteria for noise-sensitive developments located adjacent to transport noise corridors to control external noise impacts. These criteria are based in part on the objectives from the EPP(Noise).

Performance Outcome P07 of the SDAP code states *Development involving a hospital achieves acceptable noise levels for workers and patrons by mitigating adverse impacts on the development from noise generated by a railway with 15 or more passing trains per day or a type 2 multi-modal corridor.*

Acceptable Outcomes A07.1, A07.2 and A07.3 of the SDAP code provide performance criteria for healthcare buildings. These are equivalent to the performance criteria in the TMR Policy and therefore meeting the requirements of the TMR Policy will also meet the requirements of Acceptable Outcomes A07.

The TMR Policy sets out primary noise criteria for new sensitive development, which are external criteria, as well as secondary internal criteria. The Policy does not specify whether it is sufficient to just meet the primary criteria or whether both primary and secondary criteria must be met. On previous projects, TMR has clarified that since the external criteria are denoted as "primary" criteria, satisfying the external criteria is sufficient to demonstrate compliance with the Policy, and the secondary criteria are only applicable in cases where the primary criteria cannot be met.

For a development near a railway (or a multi-modal corridor that includes a railway with more than 15 movements per day), the Policy sets out the following primary criteria for healthcare usage:

- External 65 dB $L_{Aeq,1hr}$ (façade-corrected)
- External 87 dB $L_{Amax,single\ event}$ (façade corrected).

The following secondary (internal) criteria would apply:

- Sleeping Areas and Wards 45 dB $L_{Amax,single\ event}$
- Patient Care Areas 50 dB $L_{Amax,single\ event}$

3.3.2 Noise Ingress Criteria

Criteria for steady or quasi-steady noise sources such as road traffic noise have generally been based on not exceeding the recommended 'maximum' noise levels in AS 2107 during the loudest hour ($L_{Aeq,1hr}$), supplemented by the UK Department of Health guidance.

Criteria for maximum noise level have been based on the TMR Policy requirements, extrapolating for other usages based on the relative noise sensitivity of each space in AS2107, as well as the UK Department of Health guidance.

Rain noise criteria are only given for the top floor spaces within the new-build component of West State Private Hospital, since other floors will have a concrete slab above, and it is understood that the existing roof of the former Townsville West Public School building will be retained.

Table 4 Recommended noise ingress targets, dB re 20 μPa

Area	Continuous Noise	Maximum Noise	Rain Noise
	$L_{Aeq,1hr}$	$L_{Amax,fast}$	$L_{Aeq,1hr}$
Private Rooms Intensive Care Day Unit Recovery Area	35 dB	45 dB	40 dB
Operation/Procedure Rooms Anaesthetic Induction Rooms Control Rooms	40 dB	50 dB	-
Consultation Rooms	40 dB	50 dB	-
Office Areas	45 dB	55 dB	-
Diagnostic Imaging	45 dB	55 dB	-
Staff and Clinical Support Areas	45 dB	55 dB	-
Patient Lounges	45 dB	55 dB	-

3.4 Sound Insulation

Sound insulation performance targets for partitions have been specified based on the acoustic performance matrix in Table 2 for each space. Partition constructions to meet the required performance are given in Section 4.2.

The required sound insulation performance for acoustically-rated partitions and acoustically-rated areas of the façade is presented on marked-up drawings in Appendix B.

3.5 Room Acoustics

The reverberation time is a key (although not the only) parameter in quantifying the room acoustic of a space. It quantifies the decay rate of sound in a room and is controlled by the amount of sound absorption and the volume of a space.

Mid-Frequency and low-frequency[1] target reverberation times have been determined with reference to AS 2107 and from previous experience and are presented in Table 5.

These reverberation times apply to furnished but unoccupied spaces.

Note that some spaces have no requirement to control room acoustics and are excluded from Table 5.

Table 5 Recommended Reverberation Time Targets

Area	Low-Frequency Reverberation Time	Mid-Frequency Reverberation Time
Discharge Lounge Patient Lounges	0.6 to 1.0 s	0.6 to 0.8s
Maxillofacial Operation/Procedure Rooms Anaesthetic Induction Rooms Control Rooms	0.4 to 0.7 s	0.4 to 0.7 s
Diagnostic Imaging Sterilising Supply Department Scrub Rooms Scope Reprocessing Area	0.4 to 0.9 s	0.4 to 0.7 s
Consultation Rooms	0.4 to 0.8 s	0.4 to 0.6 s
Staff Support Clinical Support	0.6 to 1.0 s	0.6 to 0.8s
Day Unit Recovery	0.6 to 1.0 s	0.6 to 0.8s
Private Bedroom Isolation Room	0.4 to 0.6 s*	0.4 to 0.6 s*
Open Plan Office	0.6 to 1.0 s	0.6 to 0.8s
CEO Office	0.4 to 0.8 s	0.4 to 0.6 s
Reception/Waiting Areas	0.6 to 1.0 s	0.6 to 1.0 s

* Note that room furnishings in these rooms typically will achieve the acoustic targets without further acoustic treatment

[1] Mid-frequency reverberation times are the average of the 500 and 1k Hz octave band reverberation times. Low-frequency reverberation times are the average of the 125 Hz and 250 Hz octave band reverberation times.

3.6 Noise Egress Requirements

Townsville City Council does not specify noise criteria for environmental noise emission, and refers to the QLD Environmental Protection (Noise) Policy 2008 [EPP(Noise)] assessing environmental noise emission from the development (refer Section SC6.4.3.15 of the Townsville City Plan 2014).

The acoustic quality objectives in the EPP (Noise) are "intended… to be progressively achieved… over the long term". As such, these quality objectives represent aspirational noise targets rather than necessarily absolute noise emission criteria for the project. The objectives in Table 6 are presented for information.

Table 6: Environment Protection (Noise) Policy Acoustic Quality Objectives

Land Use	Time Period	Acoustic Quality Objective		
		$L_{Aeq,1hr}$	$L_{A10,1hr}$	$L_{A1,1hr}$
Residential (Outdoors)	Daytime and Evening	50	55	65
Residential (Indoors)	Daytime and Evening	35	40	45
	Night	30	35	40
Educational institution (indoors)	When in use	35	-	-
Commercial or retail activity (indoors)	When open for business	45	-	-

The EPP(Noise) defines criteria for "background noise creep", set based on whether the noise source in question is continuous or varying:

- For continuous sources, noise from the activity (L_{Aeq}) must not exceed 0 dB(A) above the ambient $L_{A90,T}$
- For varying sources, noise from the activity (L_{Aeq}) must not exceed 5 dB(A) above the ambient $L_{A90,T}$

These criteria apply "to the extent that it is reasonable" to control noise from the activity in question. Table 7 sets out the applicable environmental noise criteria for the development.

Table 7: Environmental Noise Criteria, EPP(Noise)

Noise Source	EPP(Noise) Limits, dB L_{Aeq}		
	Day	Evening	Night
Continuous Sources (e.g. mech plant)	49	42	38
Varying Sources (e.g. loading dock)	54	47	43

4 Acoustic Design

4.1 Building Envelope

Based on the site measurements and logger data, the following building envelope constructions are recommended in order to achieve the acoustic design criteria. In some cases more than one option is provided.

4.1.1 New-Build Roof

The new building roof will need to provide sufficient sound insulation against both external noise sources and rain noise.

The minimum roof slab thickness to control rain noise and vertical noise transfer from rooftop plant is 250 mm concrete, based on a design rainfall rate of 40 mm/h which is typically used for sensitive applications in tropical Australia.

Alternative roofing systems may also be considered however, lightweight roofs typically will all have a requirement to have additional mass layer below the lightweight outer skin to mitigate rain noise and provide sufficient airborne sound insulation.

4.1.2 Required Façade Acoustic Performance

Façade mark-ups showing the required façade performance for West State Private Hospital are provided in Appendix B.

Indicative façade constructions to meet the performance requirements are given below in Table 8. Acoustic performance of glazing can vary by ~1-2 R_w between different manufacturers; the actual façade construction required to meet the acoustic performance should be determined based on manufacturer's test data (i.e. the acoustic rating R_w+C_{tr} takes precedence over the indicative construction in selecting façade glazing).

Table 8 Façade Glazing Constructions

Required Façade Performance	Example Construction
R_w+C_{tr} 25	• 6 mm glazing (operable)
R_w+C_{tr} 30	• 6.38 mm laminated glazing (operable, high-performance seals)
R_w+C_{tr} 32	• 6.76 mm acoustic laminate glazing (operable, high-performance seals) • 10.38 mm laminated glazing (operable, high-performance seals) • 6mm glass |12 mm airgap |6.38mm laminate double glazing (fixed)
R_w+C_{tr} 34	• 10.76 mm laminate glazing (operable, high-performance seals) • 6mm glass |12 mm airgap |10 mm glass double glazing (fixed)

The predicted external and internal noise break-in levels based on these constructions are summarised in Section 4.1.3

4.1.3 Façade Noise Levels

The following noise levels are predicted on the external façades of the West State Private Hospital

Area	Façade-Corrected Noise Levels	SDAP A07.01 / TMR Policy Primary Criteria	Meets Primary Criteria?	Internal Noise Level	SDAP A07.2 / A07.3 / TMR Policy Secondary (Internal) Criteria	Meets Secondary Criteria?
Operating Theatre	63 dB $L_{Aeq,1hr}$ 74 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	Yes	37 dB $L_{Aeq,1hr}$ 46 dB $L_{Amax,fazt}$	50 dB $L_{Amax,fast}$	Yes
Recovery Unit (Sturt Street Façade)	**67 dB $L_{Aeq,1hr}$** 73 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	No	34 dB $L_{Aeq,1hr}$ 39 dB $L_{Amax,fast}$	50 dB $L_{Amax,fast}$	Yes
Private Bedrooms – Southern Façade (Ingham Road)	62 dB $L_{Aeq,1hr}$ 74 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	Yes	35 dB $L_{Aeq,1hr}$ 45 dB $L_{Amax,fast}$	45 dB $L_{Amax,fast}$	Yes
Private Bedrooms– Eastern Façade (Sturt Street)	**66 dB $L_{Aeq,1hr}$** 73 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	No	35 dB $L_{Aeq,1hr}$ 42 dB $L_{Amax,fast}$	45 dB $L_{Amax,fast}$	Yes
Consultation Rooms (New Build)	64 dB $L_{Aeq,1hr}$ 71 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	Yes	36 dB $L_{Aeq,1hr}$ 45 dB $L_{Amax,fast}$	50 dB $L_{Amax,fast}$	Yes
Consultation Rooms (Refurbishment)	62 dB $L_{Aeq,1hr}$ 74 dB $L_{Amax,fast}$	65 dB $L_{Aeq,1hr}$ 87 dB $L_{Amax,fast}$	Yes	39 dB $L_{Aeq,1hr}$ 49 dB $L_{Amax,fast}$	50 dB $L_{Amax,fast}$	Yes

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The Sturt Street façade of the new-building exceeds the external (primary) criteria of SDAP A07.01 and the TMR Policy. A performance-based solution is required for this façade to meet the internal (secondary) criteria of SDAP A07.02 and A07.03 and the TMR Policy for all areas.

All other façades of the building comply with the external (primary) criteria of the TMR Policy. The façade design for these façades has also been conducted to meet the internal (secondary) criteria of SDAP A07.02 and A07.03 and the TMR Policy for all areas.

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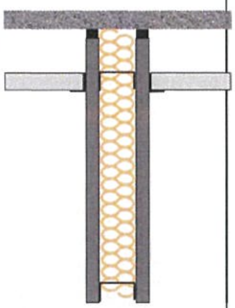
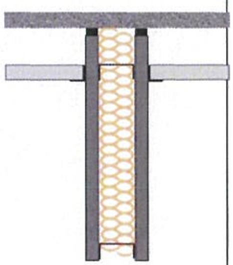
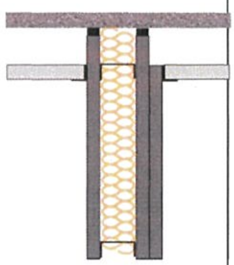
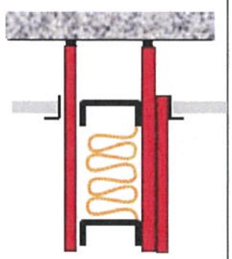
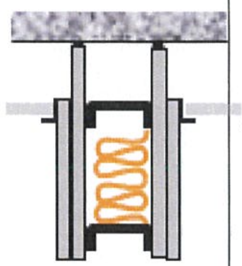
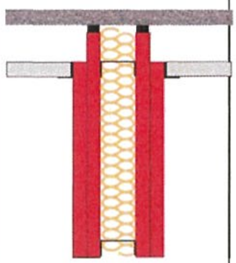
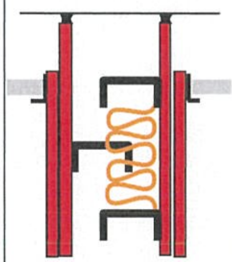
4.2 Internal Partitions

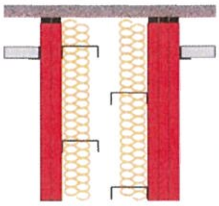
The internal partition constructions presented in Table 9 are designed to meet the acoustic quality objectives presented in Table 2. Refer to Appendix B for marked-up drawings showing partition ratings.

Table 9 Typical internal partition constructions designed to meet sound insulation targets

Sound Insulation Performance	Wall Configurations	Wall Build-up	
D_w 25	Slab-to-ceiling (with unperforated ceiling) Slab-to-slab (with open-format ceiling)		**Lightweight** • 1 x 13 mm plasterboard (≥ 8.5 kg/m² per sheet) ≥ 64 mm stud 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 1 x 13 mm plasterboard (≥ 8.5 kg/m² per sheet) **Glazed** • 6 mm glazing
D_w 30	Slab-to-ceiling (with unperforated ceiling) Slab-to-slab (with open-format ceiling)		**Lightweight** • 1 x 13 mm plasterboard (≥ 8.5 kg/m² per sheet) ≥ 92 mm stud 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 1 x 13 mm plasterboard (≥ 8.5 kg/m² per sheet) **Masonry** 75 mm Hebel **Glazing** • 10.38 mm laminate glazing OR • 6.5 mm acoustic laminate

Sound Insulation Performance	Wall Configurations	Wall Build-up	
D_w 35	Slab-to-slab		**Lightweight** • 2 x 13 mm plasterboard (≥ 8.5 kg/m2 per sheet) ≥ 92 mm stud 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 1 x 13 mm plasterboard (≥ 8.5 kg/m2 per sheet) **Masonry** 100 mm Hebel **Glazing** • 12.5 mm acoustic laminate
D_w 40	Slab-to-slab	 	**Lightweight** • 2 x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) ≥ 92 mm stud 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 1x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) OR • 2 x 13 mm plasterboard (≥ 8.5 kg/m2 per sheet) ≥ 92 mm stud 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 2 x 13 mm plasterboard (≥ 8.5 kg/m2 per sheet) **Masonry** • 140 mm hollow concrete block OR 100 mm Hebel ≥ 64 mm stud 50 mm fibreglass (33 kg m^{-3}) in cavity 1 x 13 mm plasterboard (≥ 8.5 kg m^{-2} per sheet) **Glazing** • Not practicable with single glazing

Sound Insulation Performance	Wall Configurations	Wall Build-up	
D_w 45	Slab-to-slab		**Lightweight** • 2 x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) ≥ 92 mm stud (separate stud recommended if plumbing runs through cavity) 50 mm fibreglass (33 kg/m3) in cavity (or equivalent) 2x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) **Masonry** • 140 mm core-filled concrete block OR • 100 mm concrete **Glazing** • Not practicable without large airgap double glazing
D_w 50	Slab-to-slab		**Lightweight** • 2 x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) ≥ 150 mm cavity with staggered stud (separate stud if plumbing runs through wall cavity) 50 mm fibreglass (33 kg/m³) in cavity (or equivalent) 2x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) **Masonry** • 190 mm core-filled concrete block OR 150 mm concrete **Glazing** • Not practical

Sound Insulation Performance	Wall Configurations	Wall Build-up	
D_w 55	Slab-to-slab		**Lightweight** • 2 x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) ≥ 200 mm cavity with separate studs. Studs to be separated by ≥ 20 mm 50 mm fibreglass (33 kg/m³) in cavity (or equivalent) 3 x 16 mm high density plasterboard (≥ 13 kg/m² per sheet) **Masonry** • 150 mm concrete ≥ 64 mm stud with ≥ 20 mm separation from concrete 50 mm fibreglass (33 kg/m³) in cavity (or equivalent) 1x 13 mm plasterboard (≥ 8.5 kg/m² per sheet)

The following should be observed for the constructions presented in Table 9:

- All plasterboard joins should be taped and sealed.
- Where multiple layers of plasterboard are used joints shall be overlapped between layers, taped and sealed.
- Metal stud framing or furring channels should be installed at minimum 600 mm centres.
- Head and foot channels should be mechanically fixed to the ceiling slab and floor slab, and be fully sealed with a bead of non-hardening sealant beneath the channel.
- Edge joints to masonry walls or columns shall be close fitting, with a gap of maximum width 20 mm. The gaps should be filled with non-hardening sealant such as Selleys ProSeries FireBlock.
- Care with detailing will be required where the partitions meet the façade in order to maintain the sound insulation performance(e.g. cladding/packing of mullions) for higher-rated partitions.
  Acoustic treatment details for partition/façade interfaces will be developed during ongoing design
- Air transfer ducts/grilles should not be located across acoustically-rated constructions unless the transfer ducts are acoustically treated (e.g. lined bends, crosstalk attenuators etc as required to match the acoustic performance of the partitions).
- Service penetrations (such as GPO's, medical gas outlets, switches etc) should be staggered across wall studs. If back-to-back electrical penetrations are unavoidable, an appropriate acoustically rated backing box should be used.
- All building services penetrations through acoustically-rated partitions are to be appropriately sealed. Sealing details for services will be provided during ongoing design.

4.2.1 Doors

Doors will limit the overall sound insulation of a partition since they are generally of much lighter construction than the partition, and they are difficult to effectively seal. While high performance doors can be provided, it should be understood that they are likely to be heavy, more difficult to operate and relatively expensive.

Depending on the arrangement of the door, and the relationship of the room to other adjacent spaces, a door with a sound insulation performance less than the partition itself will typically be appropriate.

Nominal sound insulation performances of typical door constructions in correspondence with partition sound insulation targets are provided in the table below.

These performance requirements are indicative and apply for general situations where the door occupies a small (~20% or less) proportion of the overall partition area. In cases where the door occupies a significant proportion of the partition area, an increased door performance will be required in order to maintain the overall partition acoustic rating.

Note that higher-performance doors require properly-engaging acoustic seals. This may require coordination with infection control requirements and may necessitate a down-rating of the acoustic separation between spaces should infection control take precedence.

Undercuts beneath doors will essentially negate the acoustic performance of the door. The mechanical services design should not rely on air balance via door undercuts for any acoustically-sensitive rooms.

Indicative door constructions to achieve the sound insulation targets are presented in Table 10.

Table 10 Indicative door and framing constructions

Partition Rating	Nominal Door Rating	Typical Construction and Sealing Arrangement
Up to R_w+C_{tr} 30	R_w25	• Solid core (minimum 40 mm) or specialist acoustic glazed door, well fitted to effective frame • Strip seals to head, jambs, meeting stiles and threshold (can be sweep seal) • Vision panel (if required) to comprise 4 mm glass
R_w+ C_{tr} 35	R_w30	• Solid core (minimum 45 mm) or specialist acoustic glazed door, well fitted to effective frame • Compression seals to head, jambs, meeting stiles and threshold (can be drop seal) • Vision panel (if required) to comprise 6 mm glass
R_w+ C_{tr} 40	R_w35	• Solid core (minimum 45 mm), well fitted to effective solid frame • Double high-performance compression seals to head, jambs, meeting stiles and threshold (can be drop seal) • Vision panel (if required) to comprise 10.6 mm laminated glass
R_w+ C_{tr} 45	R_w40	• Proprietary acoustic rated doorset OR • Two back-to-back lobbied R_w25 doors with not less than 200 mm void between.
R_w+ C_{tr} 50	R_w45	• Proprietary acoustically-rated doorset OR • Two back-to-back lobbied R_w35 doors with not less than 200 mm void between.

4.2.2 Ceilings

In cases where partitions do not extend to the slab above, sound transfer between rooms via the ceiling void and along the ceiling tiles will limit the overall sound insulation between rooms. Therefore, floor-to-ceiling constructions are only acceptable for partitions requiring sound insulation ratings up to approximately D_w 30 (subject to the actual acoustic performance of the selected ceiling system; perforated ceiling systems are essentially acoustically transparent and cannot be used with floor-to-ceiling construction).

Even with a $<D_w$ 30 rated partition, care needs to be taken to ensure that a full airtight seal is achieved between the head of the partition and the underside of the ceiling. This will be further reviewed as design develops.

4.2.3 Floor/Ceiling Systems

Minimum slab/ceiling constructions to achieve the required vertical sound insulation performance are summarised in Table 11.

Table 11- Acoustic Slab/Ceiling Constructions

Space A (Upper)	Space B (Lower)	Slab/Ceiling Construction Requirement
Interview Rooms	Radiology	150mm concrete
Day Unit	Kitchen	150mm concrete
Operating Theatres Anaesthetic Preparation Rooms	Interview Rooms	150mm concrete
Recovery Area	Day Unit	200mm concrete
Rehab Suite	Operating Theatre	200mm concrete
Maxillofacial Cardiology	Operating Theatre	200 mm concrete
Private Rooms	Maxillofacial Cardiology	200 mm concrete
Private Rooms	Rehab Suite Recovery Bays	200 mm concrete
Plant	Private Rooms ICU	250 mm concrete

4.3 Room Acoustics

4.3.1 General Considerations

The location of acoustic finishes can have a significant impact on the room acoustic performance of a space.

- Breakout areas and nurse call areas can cause disturbance to surrounding patient areas.
  A highly-absorptive ceiling finish is recommended above these areas in conjunction with partial-height 'screens' (where practicable) to reduce the disturbance to surrounding areas.
- Due to hygiene and infection control requirements, acoustic treatment on walls is unlikely to be possible.
- Acoustic finishes for healthcare applications typically require specialist products.

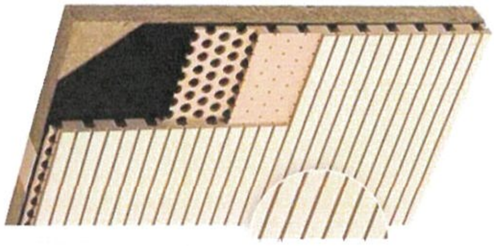
To meet the mid-frequency reverberation time targets presented in Section 3.5 acoustic finishes will be required for most functional spaces. The location and types of acoustic finishes will be determined during ongoing design.

Table 12 presents the minimum random incidence sound absorption co-efficient for typical products in a healthcare environment and Table 13 provides recommendations for suitable products.

Table 12 Minimum random incidence sound absorption coefficients for acoustic finishes

Description		**Minimum Recommended Random Incidence Absorption Coefficients, α Octave Band Centre Frequencies, Hz**					
	NRC	**125**	**250**	**500**	**1k**	**2k**	**4k**
Ceilings							
Acoustic Ceiling Tile	0.85	0.40	0.85	0.90	0.90	0.90	0.90
Perforated/Slotted Ceiling Panel	0.70	0.80	0.80	0.75	0.70	0.50	0.50
Floors							
Carpet Tile	0.20	0.05	0.05	0.10	0.20	0.50	0.50
Walls							
Wall acoustic panel	0.70	0.35	0.80	1.00	1.00	1.00	0.95

Table 13 Recommended types of acoustic finishes

	Descriptions and Minimum Requirements	
Ceilings		
Acoustic Ceiling Tile	Description:	Mineral ceiling tile (≥ 200 mm void behind) such as Ecophon Master A, Armstrong Ultima.
Perforated/ Slotted Ceiling Panel	Description:	Perforated metal, plasterboard, plywood, MDF or equivalent. 50 mm fibreglass backing (30-40 kg/m^3) and 200 mm cavity behind, not less than 15% open area such as Topakustik. 

Locations and extents of acoustic finishes will be developed with the Architect as design progresses.

4.4 Building Services Noise

Noise due to mechanical plant when combined with electrical and hydraulic services should meet the noise targets in Section 3.2.

The following should be considered in the design of the mechanical services systems:

- The selection of quiet equipment. This is the most important factor for achieving in-room noise levels for private rooms since there is very little scope for incorporating noise attenuation into FCU systems serving small rooms.
- Space planning of plant locations to be outside of and away from noise sensitive spaces.
- Careful aerodynamic design so that regenerated noise from bends and take-offs is low enough to ensure that the noise limits are met. This will include:
  a) Arrangement of duct routes for smooth airflow conditions in ductwork (minimising regenerated noise at bends, take-offs and transitions, etc)
  b) Designing the system to be as self-balancing as possible (thereby minimising the need for volume control devices)
  c) Controlling velocities in ducts to be adequately low. The lowest background noise levels for ducted systems in the project are 35 dB L_{Aeq} (for private rooms).
  Typically this would require in-duct air velocities in the order of no more than 3.0 m/s once the ductwork is inside the space.
  d) Selection of terminal units i.e. grilles and diffusers to comply with criteria (taking into account other building services noise sources).
- The need for duct-mounted attenuators on both the supply and extract systems.
- Mechanical services should not undermine the sound insulation. The following should be considered:
  a) Flexible ductwork should not pass through full height partitions.
  b) Cross talk attenuators (or additional acoustic treatment) if ductwork systems serve adjacent noise sensitive spaces.
  c) Avoiding cross talk via flexible ductwork in areas where high levels of sound insulation is required.
  d) Attenuation of air transfer paths in any sound insulating construction.
  e) Effective sealing of all ductwork/ pipework/ cable penetrations.
  f) Avoiding door undercuts or transfer grilles in any acoustically-rated partition
- Acoustic lagging for pipework located in occupied spaces to meet the criteria.
- Plant may need to be provided with appropriate anti-vibration mounts to meet vibration limits. Any plant equipment planned to be located on the roof should incorporate vibration isolation to reduce vibration entering the building structure which can result in structure borne noise

- Tonality and pulsating noise should not be present in any habitable spaces. Tonality is defined as occurring when a one -third octave band value is 5 dB higher than the arithmetic average of the decibel values in the adjoining third octave bands. Pulsing noise refers to any noise characteristic that is evidenced by fluctuations in noise level by more than ± 2 dB.
- The use of an electronic sound masking system should be considered for multi-bed wards or other large areas where services noise may not be even across the floor area, in order to provide noise masking to reduce disturbance from e.g. nurse call stations, patient alarms etc.

4.5 Environmental Noise

4.5.1 Building Services Plant/Equipment

Mechanical or electrical equipment from the development has not been selected at this stage of design.

During ongoing design of the development, mechanical and electrical equipment will be selected and provided with noise attenuation measures as required in order to meet the noise limits given in Table 7.

4.5.2 On-Site Traffic Movements

A screening calculation of noise impacts from the visitor and staff parking areas has been conducted to determine the likely scale of impacts (if any) from parking and pick up/drop off activities at the development.

Note that noise from emergency services vehicles is excluded from assessment under QLD noise criteria.

For vehicle movements within the parking areas, the Calculation of Road Traffic Noise (CoRTN) methodology that is used in QLD for road traffic noise on public roads is not applicable, because vehicle noise emission at very low speeds is dominated by engine noise rather than rolling noise, and CoRTN does not extend to speeds below 30 km/h. A different prediction method was adopted for on-site traffic movements using previous measured pass-by noise levels from cars at low speed (<20 km/h), with a 60-minute equivalent line source sound power level $L'_{w,eq,1hour}$ of 51 dB/m per vehicle.

This was scaled to an absolute "worst case" scenario of 100% turnover of vehicles within a parking area arriving/leaving over a 1-hour period. This scenario is considered unlikely to occur in practice and (if ever) would likely only occur during the Day time period.

The following overall source levels were obtained:

- Southern visitor parking and pick up/drop off areas (100% turnover of 57 spaces) $L'_{w,eq,1hour}$ 68 dB/m.
- Western visitor parking (100% turnover of 30 vehicles) $L'_{w,eq,1hour}$ 66 dB/m.
- Northern staff parking (100% turnover of 23 vehicles) $L'_{w,eq,1hour}$ 65 dB/m.

This sound power was distributed along line sources located within the internal circulation roads within the West State Private Hospital, with the sound power of each source line being weighted according to the number of car spaces along each road. Table 14 presents a summary of the predicted noise levels from traffic flows along the parking areas upon the nearest noise sensitive receivers.

Table 14: Predicted noise level from traffic flows along internal roads, West State Private Hospital, dB re 20 μPa

Receiver	Predicted Level $L_{Aeq,1hr}$	Time Period	Criteria	Meets Criteria?
Residential properties on Lamington Street	44 dB	Day	54 dB	✓
Townsville West State School Residential properties on Wilson Street	42 dB	Day	54 dB	✓
St Mary's Church Edmund Rice Education Learning Centre	40 dB	Day	54 dB	✓

Noise levels at all receivers are predicted to comply with the EPP(Noise) criteria for noise emission from West State Private Hospital.

4.5.3 Traffic Noise on External Roads

Due to the high existing traffic volumes on Ingham Road and Sturt Street, additional traffic noise impacts associated with the West State Private Hospital are anticipated to be negligible.

4.5.4 Loading/Unloading Activities

It is anticipated that loading/unloading activities would only occur during the Day and Evening time periods.

The source location has been assumed to be via the secondary vehicle entry off O'Brien Street.

Two components of noise from vehicle movements on site have been assessed:

- Vehicles accessing the loading dock
- Vehicles unloading within the loading dock.

Noise levels from vehicle movements on site have been predicted using previous Arup measurements of vehicles in loading docks (all noise levels measured at ~4.5 m distance):

- Accessing the loading dock: 56 dB $L_{Aeq(event)}$
- Unloading: 60 dB $L_{Aeq(event)}$

Using these source noise levels, noise levels from operation of the loading docks at the development have been predicted as presented in Table 15

Table 15: Predicted noise level from loading/unloading, West State Private Hospital, dB re 20 μPa

Receiver	Predicted Level $L_{Aeq,1hr}$	Time Period	Criteria	Meets Criteria?
Residential properties on Lamington Street	29-32 dB	Day	54 dB	✓
		Evening	47 dB	✓
		Night	43 dB	✓
Townsville West State School	33-37 dB	Day	54 dB	✓
St Mary's Church Edmund Rice Education Learning Centre	3-7 dB	Day	54 dB	✓

Noise levels at all receivers are predicted to comply with the EPP(Noise) criteria for noise emission from West State Private Hospital.

5 Summary

An acoustic assessment of the predicted noise impacts of the proposed West State Private Hospital has been conducted, assessing against relevant Townsville City Council and QLD Government policy, and deriving performance criteria for the proposed development against applicable Australian Standards and international good practice guidance.

An assessment of railway traffic noise impacts on the development has been conducted in accordance with DTMR's *Policy for Development on Land Affected By Environmental Emissions from Transport and Transport Infrastructure* (TMR Policy) 2013 and the QLD State Development Assessment Provisions Code 1.1 *Managing Noise and Vibration Impacts from Transport Corridors State Code* (SDAP).

The Sturt Street façade of the proposed new-build component of the hospital is predicted to experience traffic noise levels in excess of the primary (external) criteria from the TMR Policy. Accordingly, the building façade has been designed to meet the secondary (internal) criteria.

All other façades of the proposed West State Hospital are predicted to experience noise levels below the primary external criteria.

Internal sound insulation, background noise and room acoustic performance targets have been derived based on the guidance of AS2107 and UK Department of Health technical manuals, which represent international good practice in the design of healthcare facilities.

Noise impacts from operation of the proposed West State Private Hospital are predicted to be negligible compared to applicable impact criteria derived from the QLD Environmental Protection (Noise) Policy.

"A"

Appendix A

Acoustic Terminology

A1 Glossary of Acoustic Terminology

Absorption Coefficient, α

The amount of sound absorbed by a sample is characterised by the absorption coefficient, α. A perfect absorber (e.g. a sufficiently large opening in a room) from which no sound is reflected has an absorption coefficient of 1.00. There are two common methods for measuring sound absorption coefficients of a material.

One, the impedance tube method, is useful for readily obtaining results and only requires a small sample to be tested, but is limited in that it can only measure the *normal-incidence absorption coefficient* – i.e. the absorption coefficient for a single angle with sound propagating perpendicular to the material.

The other method, the reverberation chamber method, requires more extensive tests and a larger (~10 m^2) sample size, but obtains the *random-incidence absorption coefficient*- i.e. the effective absorption coefficient of the material averaged over all angles. The random-incidence absorption coefficient is required for detailed room acoustic calculations.
Note that the reverberation chamber method can legitimately measure coefficients greater than 1.0 due to "edge effects" such as diffraction or scattering from the edges of the sample. These edge effects are reduced by using a barrier around the sample or by using a larger sample.

Weighted absorption coefficient (α_w)

The weighted absorption coefficient, defined in ISO 11654 is a frequency-weighted single number absorption coefficient used to categorise the overall absorption effectiveness of a material.
Descriptors are used to indicate if the material absorbs strongly at high ("H"), mid ("M") and/or low ("L") frequencies – e.g. a material may be rated as α_W 0.85(LH), which indicates that it strongly absorbs at both low and high frequencies.
The weighted-absorption coefficient is also used to assign materials into five absorption classes (materials with very low absorption are not assigned a class): Class A has the highest absorption, with Class E having the lowest absorption.

Noise-reduction Coefficient (NRC)

The noise reduction coefficient (NRC) is the (arithmetical) average of the sound-absorption coefficients of a material at 250Hz, 500Hz, 1kHz and 2kHz. It is intended for use a single-number index of the sound absorbing efficiency of a material.

Ambient Noise Level

The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, birds, people talking and other nearby fans on other buildings.

Background Noise Level

The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.

Assessment Background Level (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.

Rating Background Level (RBL / min$L_{A90,1hour}$)

A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey. This parameter is denoted RBL in NSW, and min$L_{A90,1hour}$ in QLD.

Decibel

The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore a logarithmic scale, the decibel (dB) scale, is used to describe sound levels.

An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.

dB(A)

dB(A) denotes a single-number sound pressure level that includes a frequency weighting ("A-weighting") to reflect the subjective loudness of the sound level.

The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).

Some typical dB(A) levels are shown below.

Sound Pressure Level dB(A)	Example
130	Human threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside nightclub
90	Heavy trucks at 5 m
80	Kerbside of busy street
70	Loud stereo in living room
60	Office or restaurant with people present
50	Domestic fan heater at 1m
40	Living room (without TV, stereo, etc)
30	Background noise in a theatre
20	Remote rural area on still night
10	Acoustic laboratory test chamber
0	Threshold of hearing

L_1

The L_1 statistical level is often used to represent the maximum level of a sound level that varies with time.

Mathematically, the L_1 level is the sound level exceeded for 1% of the measurement duration. As an example, 87 dB $L_{A1,15min}$ is a sound level of 87 dB(A) or higher for 1% of the 15 minute measurement period.

L_{10}

The L_{10} statistical level is often used as the "average maximum" level of a sound level that varies with time.

Mathematically, the L_{10} level is the sound level exceeded for 10% of the measurement duration. L_{10} is often used for road traffic noise assessment. As an example, 63 dB $L_{A10,18hr}$ is a sound level of 63 dB(A) or higher for 10% of the 18 hour measurement period.

L_{90}

The L_{90} statistical level is often used as the "average minimum" or "background" level of a sound level that varies with time.

Mathematically, L_{90} is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB $L_{A90,15min}$ is a sound level of 45 dB(A) or higher for 90% of the 15 minute measurement period.

L_{eq}

The 'equivalent continuous sound level', L_{eq}, is used to describe the level of a time-varying sound or vibration measurement.

L_{eq} is often used as the "average" level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dB(A) weighting is applied, the level is denoted dB L_{Aeq}. Often the measurement duration is quoted, thus $L_{Aeq,15\ min}$ represents the dB(A) weighted energy-average level of a 15 minute measurement.

L_{max}

The L_{max} statistical level can be used to describe the "absolute maximum" level of a sound or vibration level that varies with time.

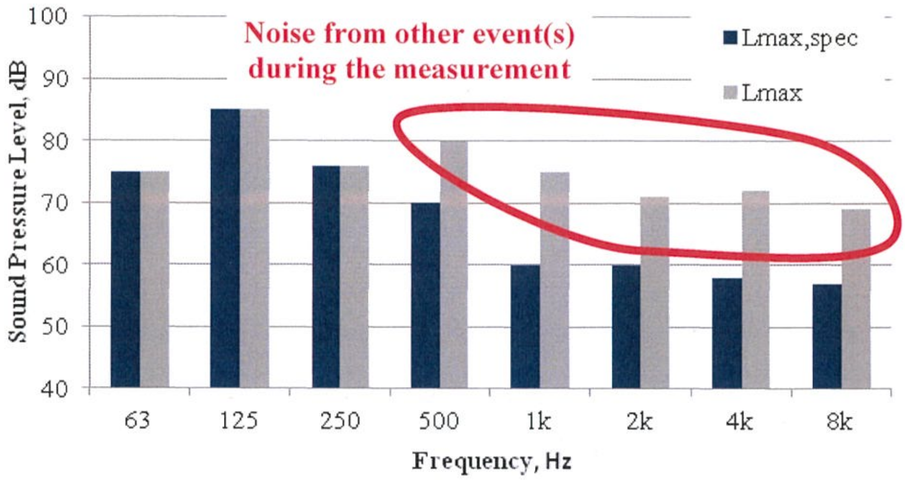
Mathematically, L_{max} is the highest value recorded during the measurement period. As an example, 94 dB L_{Amax} is a highest value of 94 dB(A) during the measurement period.

Since L_{max} is often caused by an instantaneous event, L_{max} levels often vary significantly between measurements.

$L_{max\ spec}$

$L_{max\ spec}$ is another representation of the highest noise or vibration levels during the measurement period.

$L_{max\ spec}$ is the spectrum of the event that caused the highest overall sound or vibration level during the measurement period is denoted by dB $L_{max\ spec}$. An example of the relationship between dB L_{max} and dB $L_{max\ spec}$ is shown below.



L_{max} (see definition above), when measured on an octave band or 1/3 octave band meter, is the spectrum obtained by recording the highest measured value in each band. However, the highest measured values in each band may occur at different times.

Hence, $L_{max\ spec}$ represents a real event, while L_{max} is often the mathematical addition of frequency band values from different times and often does not represent a real-world event.

Since $L_{max\ spec}$ is caused by an instantaneous event, $L_{max\ spec}$ levels often vary significantly between measurements.

Frequency

Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as "pitch". Sounds towards the lower end of the human hearing frequency range are perceived as "bass" or "low-pitched" and sounds with a higher frequency are perceived as "treble" or "high pitched".

Impact Sound Pressure Level

The technical parameter used to determine impact sound isolation of floors is the impact sound pressure level, L_i.

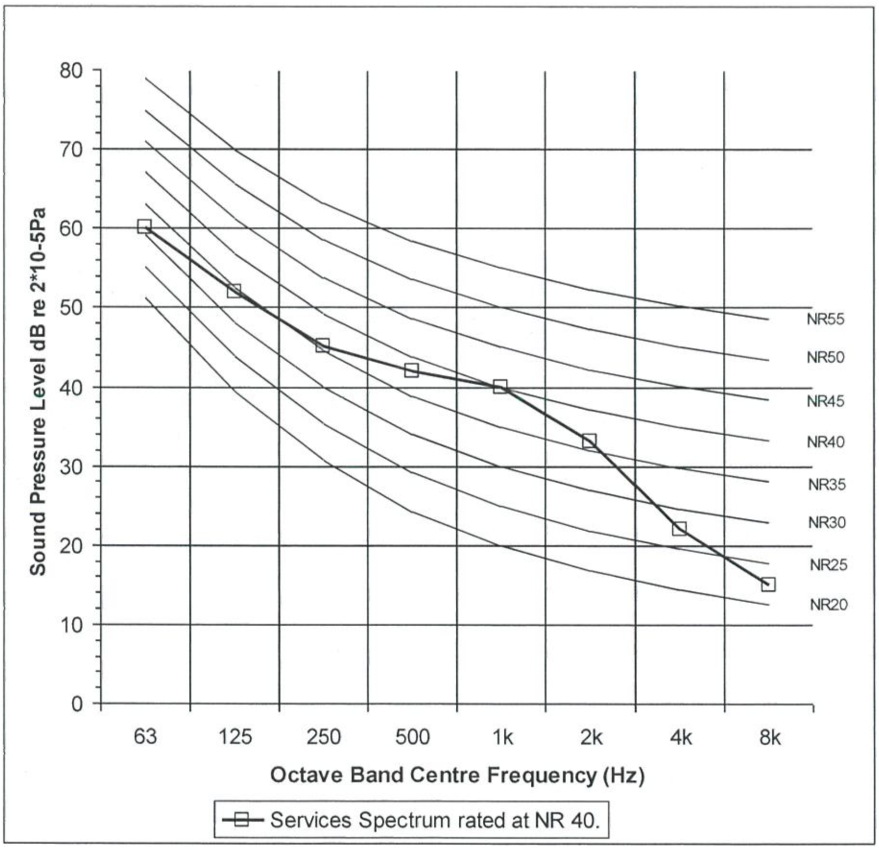
In the laboratory, the weighted normalised impact sound pressure level, $L_{n,w}$, is used to represent the impact sound isolation as a single figure.

On site, the weighted normalised apparent impact sound pressure level, $L'_{n,w}$, and the weighted standardised apparent impact sound pressure level, $L'_{n,Tw}$, are used to represent the impact sound isolation of a floor as a single figure.

These single weighted values are determined by comparing the spectral impact sound pressure levels (as defined in ISO 140-6 & ISO 140-7) with reference values outlined in AS/NZS ISO 717.2.

Noise Rating (NR) Curves

Noise rating (NR) curves are a set of internationally-agreed octave band sound pressure level curves, based on the concept of equal loudness. The curves are commonly used to define building services noise limits. The NR value of a noise is obtained by plotting the octave band spectrum on the set of standard curves. The highest value curve which is reached by the spectrum is the NR value. Shown below is a plant noise spectrum that is equivalent to NR 40.

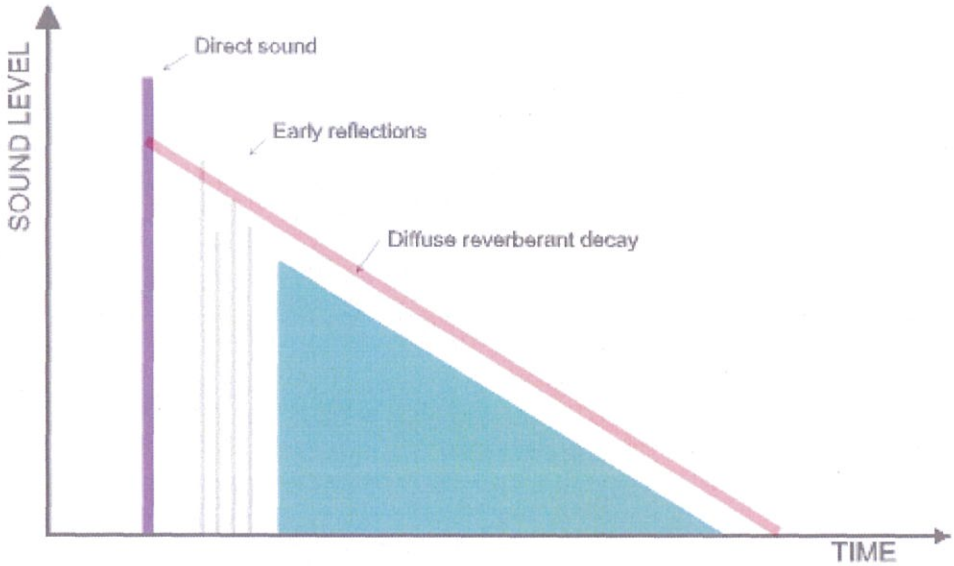


Reverberation Time (T_{60})

The time, in seconds, taken for a sound within a space to decay by 60 dB after the sound source has stopped is denoted at the reverberation time. The RT is an important indicator of the subjective acoustic within an auditorium. A large RT subjectively corresponds to an acoustically 'live' or 'boomy' space, while a small RT subjectively corresponds to an acoustically 'dead' or 'flat' space.

Examples of typical design reverberation times are provided below:

Mid-frequency Reverberation Time, s	Example
< 0.1	Anechoic
0.1 – 0.4	Call centres
0.4 – 0.6	Library
0.6 – 0.8	Offices / board rooms
0.8 – 1.0	Small auditorium for speech
1.0 – 1.2	Music studios
1.2 – 1.5	Chamber music venues
1.5 – 2.0	Orchestral music venues
2.0 – 3.0	Church
3.0 – 8.0	Cathedral



Sound Level Difference (D)

Sound level difference is used to quantify the sound insulation between two spaces, and is equal to the difference in sound level between the two rooms at a particular frequency (e.g. if the sound level in the source room is 100 dB and the sound level in the adjacent room is 75 dB, the sound level difference is 25 dB). The weighted sound level difference, D_w, (as defined in AS/NZS ISO 717.1) is commonly used to provide a single-number descriptor to describe the overall performance of a partition across a wider frequency range.

The terms used to describe the airborne sound insulation rating of a building element when tested on-site are the weighted normalised level difference ($D_{n,w}$), which corrects the measured sound level difference to a reference absorption area in the receiving room, or the weighted standardized level difference ($D_{nT,w}$), which corrects the measurements to a reference reverberation time in the receiving room. These single numbers are determined by comparing the spectral sound insulation test results (as defined in ISO 140-4) with reference values, as outlined in AS/NZS ISO 717.1.

Sound Power and Sound Pressure

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

Sound Reduction Index (R)

The sound reduction index (or transmission loss) of a building element is a measure of the loss of sound through the material, i.e. its sound attenuation properties. It is a property of the component, unlike the sound level difference, which is affected by the common area between the rooms and the acoustics of the receiving room. R is the ratio (expressed in decibels) of the sound energy transmitted through the building element to the sound energy incident on the building element for a particular frequency.

The weighted sound reduction index, R_w, is a single figure description of sound reduction index across a wider frequency range and is defined in BS EN ISO 717-1: 1997. R_w values are calculated from measurements in an acoustic laboratory. Sound insulation ratings derived from site measurements (which are invariably lower than the laboratory figures) are referred to as apparent sound reduction index (R'_w) ratings.

Spectrum Adaptation Terms (C and C_{tr})

The terms C and C_{tr} are spectrum adaptation terms (in dB) that are added to the R_w or D_w value of a partition in order to determine the overall sound insulation rating of a partition for various conditions. The overall performance of the partition is quoted as the sum of the Rw value and the spectrum adaptation terms, e.g. $D_w + C$ 55 dB; $R_w + C_{tr}$ 60 dB.

C is a spectrum adaptation term used to measure the performance of a partition for medium to high-frequency noise sources, such as speech.

C_{tr} is a spectrum adaptation term used to measure the performance of a partition for low-frequency noise sources such as traffic noise.

The values of C and C_{tr} are dependent on the construction of the partition. Because C and C_{tr} are (usually) negative quantities, they typically increase the Rw requirement of a partition (eg if C_{tr} is -6 dB, an R_w of 56 dB is required to achieve a rating of $R_w + C_{tr}$ 50 dB).

Vibration

Waves in a solid material are called "vibration", as opposed to similar waves in air, which are called "sound" or "noise". If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage.

A vibrating structure (eg a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structureborne vibration limits are sometimes set to control the noise level in a space.

Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for structureborne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s^2) or else using a decibel scale.

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Appendix B

Sound Insulation Requirements

B1 Sound Insulation Mark-Ups

Marked-up drawings showing the internal sound insulation and façade requirements are provided overpage.

Internal partition requirements are shown via a solid line, as per the following legend:

Partition Acoustic Rating	Mark-Up Colour
D_w 25	
D_w 30	
D_w 35	
D_w 40	
D_w 45	
D_w 50	
D_w 55	

Façade sound insulation requirements are indicated by dashed lines, as per the following legend:

Façade Acoustic Rating	Mark-Up Colour
$R_w + C_{tr}$ 25	
$R_w + C_{tr}$ 30	
$R_w + C_{tr}$ 32	
$R_w + C_{tr}$ 37	

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West State Private Hospital

Site Based Stormwater Management Plan

244765-ARUP-CI-REP-02

02 | 18 May 2017

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

Queensland Government

SARA ref: 2604-52045 SRA

Date: 9 June 2026

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

Queensland Government

SARA ref: DEPC20/1007 (DEPC18/98)

Date: 30 October 2020

Job number 244765-00

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Contents

Appendices

Appendix A

Concept Stormwater Layout

Appendix B

SPEL Product Details

1 Introduction

As part of the preliminary concept design works for West State Private Hospital a Site Based Stormwater Management Plan (SBSMP) has been prepared to support a Development Application (DA). The proposed development comprises a refurbishment of the existing heritage building with the addition of a new medical building and the provision of additional parking facilities.

The design of the development must give due consideration to the State Planning Policy (SPP) (April, 2016) and the Townsville City Council (TCC) stormwater quantity and quality requirements outlined in the Townsville City Plan.

This document presents the investigations that were undertaken to review the site at planning stage in terms of stormwater management, and reports on compliance with the design criteria outlined in Section 2 of this report.

2 Design criteria

The primary aim of a SBSMP is to ensure stormwater generated from developed catchments or sites causes minimal nuisance, danger and damage to people, adjacent properties and the surrounding environment.

In order to manage stormwater quantity and quality, the proposed development should meet the key design criteria outlined in Table 1.

Table 1: Legislation summary

Design Guideline/Authority	**Key Design Criteria**
Townsville City Council Development Manual Planning Scheme Policy (PSP)	Minimise the risk of causing environmental harm to receiving waters, damage to council infrastructure, and unnecessary financial burdens to council and the community.
Queensland Urban Drainage Manual (QUDM), 2013 (Provisional)	Stormwater Management Plans define the proposed management of stormwater quantity and quality, and the protection of receiving water features, such as the protection of existing waterways. Stormwater Management Plans should include consideration of issues such as: protection from flooding, measures to reduce changes to the volume and velocity of stormwater runoff, measures to minimise harm to receiving waters by stormwater, opportunities to prevent the initial contamination of stormwater and to remove introduced contaminants, and water conservation and recycling.
Environmental Protection Policy, 2009	Specific local Environmental Values (EVs) and/or Water Quality Objectives (WQOs) for Queensland catchments.
State Planning Policy (SPP), 2016	Maximum concentration based water quality objectives and minimum reduction targets in mean annual pollutant loads.

3 Existing site and drainage characteristics

3.1 General description

The proposed development site comprises a number of existing lots and a portion of road reserve that has been acquired for the project.

The site is bounded by residential lots to the west, Townsville West State School, Wilson Street and O'Brien Street to the north, Greenslade Street and Sturt Street to the east and Ingham Road to the south.

The site covers an area of 7944m² and encompasses 6 existing lots, including:

- Lot 707 on SP253232 (2 Wilson Street, West End);
- Lot 9 on T118290 (2 Wilson Street, West End);
- Lot 2 on SP234861 (2A Lamington Road, West End);
- Lot 1 on RP717784 (763 Sturt Street, West End);
- Lot 2 on T118434 (763 Sturt Street, West End); and
- Lot 5 on RP701541 (763 Sturt Street, West End).

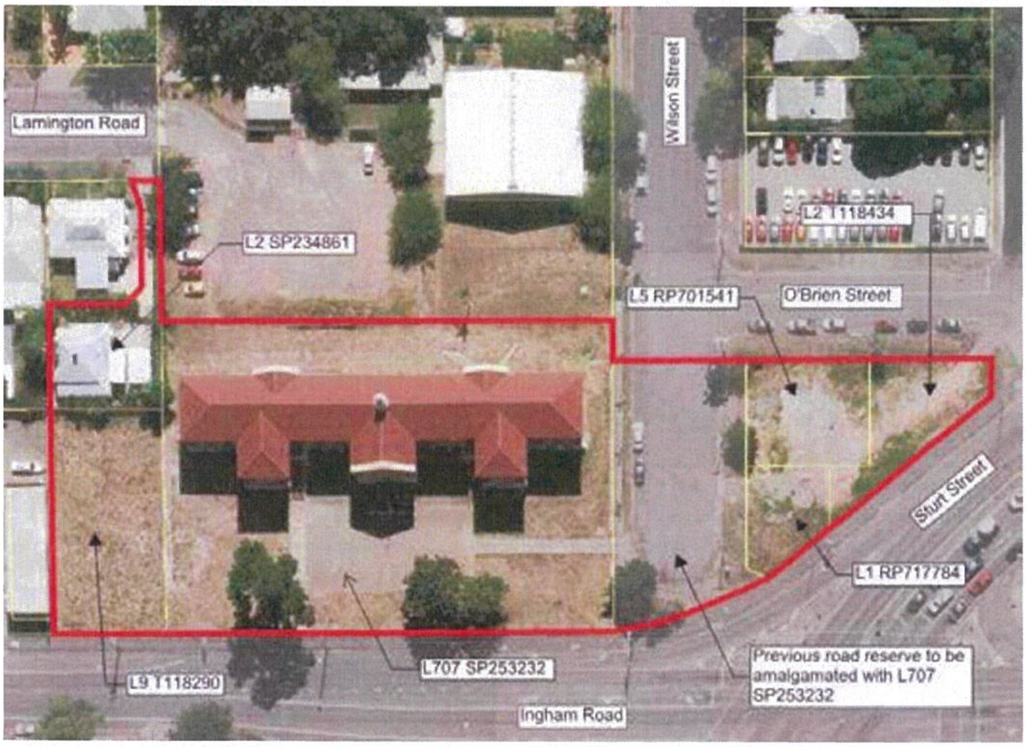

Figure 1: Site locality plan (Google Earth Pro 2015 with Queensland Globe data)

The proposed site is currently occupied by:

- An existing three storey heritage building with an adjacent car park previously part of Townsville West State School with driveway access from Wilson Street;

- A residential 'Queenslander' dwelling with driveway access from Lamington Road;
- The Wilson Street cul-de-sac; and
- Three vacant lots to the east of Wilson Street.

The surrounding land uses include retail, commercial, residential, and administrative and community uses.

Based on a review of contour data obtained from Council it is observed that the site has a gradual fall from the north-west and north-east corners to the south.

Surrounding services include reticulated water mains, electricity, gas, communications, stormwater drainage and sewerage. These have been identified through a Dial Before You Dig (DBYD) search and survey plans provided by TCC. It is assumed that there are service connections to the existing buildings on the site however the site survey does not identify existing underground conncections.

Refer to the Urban Infrastructure Assessment Report for further details and imagery of the existing site, topography, flooding conditions and existing services within and surrounding the site.

3.2 Existing Stormwater Drainage and Lawful Point of Discharge

Existing stormwater infrastructure exists within close proximity to and within the site along both Ingham Road and Wilson Street. TCC records indicate that there are existing stormwater kerb inlet pits collecting stormwater run-off along Wilson Street. These pits connect to a junction pit to the south of Wilson Street where stormwater is ultimately conveyed to a 900mm diameter reinforced concrete (RC) pipe crossing Ingham Road prior to outfall into the downstream stormwater network. Roof drainage from the existing residential dwelling is assumed to discharge as overland flow onto the site. It is assumed that the existing school building roof drainage connects underground into this network. The remainder of the site drains as overland flow from north to south.

Based on Arup's site inspection there is no evidence of rainwater harvesting or water treatment devices on the existing site.

Based on a review of Council records and observations made during site inspections it is understood that the lawful point of discharge for the site is the stormwater infrastructure on Wilson Street to the south of the site. It is assumed that the majority of the stormwater runoff from the site ultimately discharges into this stormwater network via a 375 mm diameter stormwater connection at the southern end of Wilson Street.

4 Stormwater Management

4.1 Requirements

4.1.1 Quantity

The TCC Stormwater Code stipulates that developments must provide a stormwater management system that safely conveys runoff, taking into account increased runoff due to any increase in impervious surfaces from development.

On the basis that there is a net increase in impermeable area, it is anticipated that the proposed development will increase the runoff from the site and therefore on site detention will be required.

4.1.2 Quality

The State Planning Policy (SPP) (2016) defines a set of Water Quality Objectives (WQOs) that must be achieved by a material change of use for urban purposes development applications that involve a land area greater than 2500m^2 that:

(1) Will result in an impervious area greater than 25% of the net developable area, or

(2) Will result in six or more dwellings.

The proposed development has an approximate site area of 7944m^2 with 82% of this area proposed to be impervious comprising buildings, external hardstanding areas and car parking. Therefore the proposed development triggers the requirements to meet the WQOs.

4.1.3 Proposed Development

The proposed development comprises the refurbishment of the existing West State school building and provision of a new building as part of the Townsville West State Private hospital development. Figure 2 below shows the proposed site layout for the development.

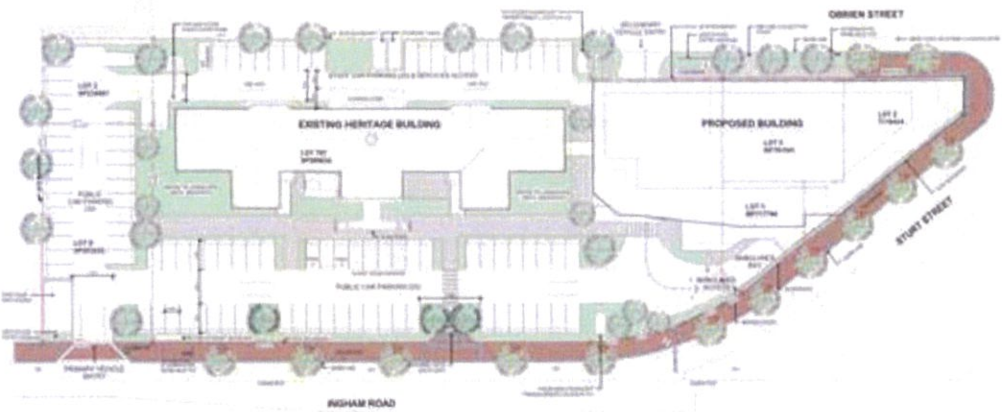

Figure 2 Proposed site plan

4.2 Opportunities and constraints

4.2.1 Opportunities

- The existing site does not include any water quality treatment devices. The proposed development provides the opportunity to incorporate water quality treatment devices to treat this run-off, and assist in improving the water quality of the downstream environment;
- Existing Council stormwater networks exist adjacent to the site in both Wilson Street and Ingham Road providing an outfall location in close proximity to the site;
- The use of proprietary stormwater quality treatment devices allow for easy maintenance, whilst allowing easy integration into the site layout; and
- An onsite detention tank can be constructed under the proposed car park/access road which will attenuate the increased flow rates.

4.2.2 Constraints

- The proposed development impacts the existing hydrology of the site, increasing the total impermeable urban area and subsequently increasing run-off and pollutant loading to receiving waters;
- Due to the extent of the proposed car park there is limited space available to incorporate treatment measures such as grass swales, bio-retention swales, bio-retention basins and wetlands;
- The site is located within the 1% and 2% AEP flood outline and therefore is susceptible to inundation from external sources; and
- The alignments and depths of existing underground services within the site are unknown and thus may conflict with the proposed stormwater strategy.

4.3 Stormwater drainage strategy

This section describes the route of stormwater flows generated by rainfall on the proposed development.

Water will be collected from the roof areas, access road and car park via a pit and underground pipe network. It will then be directed to an underground proprietary stormwater quality treatment device which will improve the quality of the stormwater before discharging to a detention storage tank to control the outflow from the site. The discharge from the tank will outfall to the Council stormwater network. Runoff from the car park will likely be contaminated for a range of reasons, as summarised in Table 2.

Table 2: Potential stormwater contaminants

Area	Contaminants
Car park	Oil or fuel spillage and gross pollutants

The sketch included in Appendix A illustrates a concept design for the proposed stormwater drainage strategy.

5 Water Quantity

5.1 Methodology

Peak flow rates produced from the 1 year to 100 year ARI events for existing and post-development site conditions were calculated.

5.2 Rational method analysis

5.2.1 Peak flow rate calculation

The Rational Method, which provides a simple means for the assessment of the peak flow rate for design storms, was used to determine the peak flow rates corresponding to the 100, 50, 20, 10, 5, 2 and 1 year ARI events draining from the proposed development site.

The site is currently comprised of the existing school building, residential dwelling, small car park area and two access driveways. The remainder of the site is open and well grassed.

The proposed site is largely impervious with small landscaped areas and will therefore result in an increase in volumetric discharge of stormwater runoff.

Table 3 summarises the catchment areas for the existing and proposed development, based on the assumptions previously outlined.

Table 3: Catchment areas summary

Characteristic	Pre-Development (existing)		Post-Development (proposed)	
Impervious (roofs, pavements etc.)	3067m^2	39%	6557m^2	82%
Pervious (landscaping etc.)	4877m^2	61%	1387m^2	18%

5.2.2 Rainfall intensity

Rainfall intensities for Townsville have been utilised in this study. The design parameters used in this assessment are listed in Table 4 and Table 5. Note that the design rainfall intensity corresponding to the 10 year 1 hour event for the site is 81.0mm/hr.

Table 4: Rainfall intensities and geographic parameters for Townsville

Storm Duration	2 year ARI (mm/hr)	50 year ARI (mm/hr)	Regional Parameters	
1 hr	53.7	110.5	G	0.06
12 hr	11.71	24.5	F2	3.93
72 hr	3.85	9.34	F50	17.10

Table 5: Design parameters

Parameter	Existing	Proposed
Time of Concentration (ToC)	14 minutes	5 minutes
Fraction impervious (f_i)	0.39	0.82
Coefficient of runoff (C10)	0.778	0.864

5.2.3 Results

Table 6 summarises the peak flow rates calculated for the existing development for various ARIs, while Table 7 shows the corresponding results for the proposed development.

Table 6: Peak flow rates (pre-development)

Fraction Impervious	Time of Concentration (min)	Area (ha)	ARI (years)	Runoff coefficient	Rainfall Intensity (mm/hr)	Q (m^3/s)
0.39	14	0.7944	100	0.934	242	0.499
			50	0.895	216	0.426
			20	0.817	182	0.328
			10	0.778	156	0.268
			5	0.739	137	0.223
			2	0.661	104	0.152
			1	0.622	80	0.110

Table 7: Peak flow rates (post-development)

Fraction Impervious	Time of Concentration (min)	Area (ha)	ARI (years)	Runoff coefficient	Rainfall Intensity (mm/hr)	Q (m^3/s)
0.82	5	0.7944	100	1.000	346	0.764
			50	1.000	308	0.680
			20	0.907	260	0.520
			10	0.864	223	0.425
			5	0.821	196	0.355
			2	0.734	149	0.241
			1	0.691	115	0.175

*Where the run-off coefficient is calculated to be greater than 1.0, a limiting value of 1.0 has been adopted in accordance with the recommendation of ARR (1998) for urban areas.

As shown in Table 8 below, the results demonstrate that there is an increase in peak flow for the post-development case.

Table 8: Comparison of peak flow rates

Scenarios	Q100	Q50	Q20	Q10	Q5	Q2	Q1
Post-development (m^3/s)	0.764	0.680	0.520	0.425	0.355	0.241	0.175
Pre-development (m^3/s)	0.499	0.426	0.328	0.268	0.223	0.152	0.110
Increase (m^3/s)	0.265	0.253	0.193	0.157	0.132	0.090	0.066
Increase (%)	53	59	59	59	59	59	60

5.3 Stormwater Detention

To ensure that the proposed development does not adversely impact adjacent properties and/or the Council stormwater network downstream from the site, stormwater runoff is to be attenuated within the site and discharged at flow rates not exceeding the flow rates calculated for the existing conditions.

Stormwater will be attenuated via a detention tank which is proposed to be installed below the car park pavement to minimise the impact on the architectural layout and spatial planning.

The conceptual volumetric size of the detention tank is 150m^3 based on preliminary sizing calculations as per the manual flow routing calculations for the storage equation in Chapter 5.5 of QUDM. The tank size is to be refined in the Detailed Design stage via hydraulic modelling.

6 Water Quality

6.1 Methodology

Runoff from the developed site requires treatment in order to ensure that the development has no detrimental impact on the water quality of downstream water courses in accordance with the SPP (2016).

The WQO's required under the SPP form the assessment criteria for stormwater quality management of the project.

6.2 Construction phase water quality management

In addition to the finished/operational phase of the development achieving the required WQO's, the construction phase should also be considered under stormwater quality management.

6.2.1 Construction phase pollutants of concern

Pollutants that are typically generated during the construction phase of a development have been identified by reviewing the Queensland Government Urban Stormwater Planning Guidelines. The various pollutants and their priority ratings are listed in Table 9 below.

Table 9: Water quality summary

Pollutant	Source	Priority
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts	High
Sediment	Unprotected exposed soils and stockpiles during earthworks and building	High
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas	High
Toxic materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (e.g. from tile works)	High
pH altering substances	Acid sulfate soils, cement slurry and washwaters	High

6.2.2 Construction phase performance criteria

The performance criteria are limited to those parameters that are directly linked to construction site management practices. These criteria are discharge standards, so they are applicable to runoff events or pumped discharges from development sites as identified in Table A of the SPP (2016). They have been summarised in

Table 10.

Table 10: Construction phase performance criteria

Issue		Construction Phase Stormwater Design Objectives
Drainage Control	Temporary Drainage Works	1. Design life and design storm for temporary drainage works: • Disturbed area open for <12 month - 1 in 2-year ARI event • Disturbed area open for 12-24 months - 1 in 5-year ARI event • Disturbed area open for > 24 months - 1 in 10-year ARI event 2. Design capacity excludes minimum 150mm freeboard. 3. Temporary culvert crossing – minimum 1 in 1-year ARI
Erosion Control	Erosion Control Measures	1. Minimise exposure of disturbed soils at any time 2. Divert water run-off from undisturbed areas around disturbed areas 3. Determine the erosion risk rating using local rainfall erosivity, rainfall depth, soil-loss rate or other acceptable methods 4. Implement erosion control methods corresponding to identified erosion risk rating

Issue		Construction Phase Stormwater Design Objectives
Sediment Control	Sediment control measures Design storm for sediment control basins Sediment basin dewatering	1. Determine appropriate sediment control measures using: • Potential soil loss rate, or • Monthly erosivity, or • Average monthly rainfall 2. Collect and drain stormwater from disturbed soils to sediment basin for design storm event: • Design storm for sediment basin sizing is 80th % five-day event or similar 3. Site discharge during sediment basin dewatering: • TSS < 50mg/l TSS, and • Turbidity not > 10% receiving water turbidity, and • pH between 6.5 and 8.5
Water Quality	Litter and other waste, hydrocarbons and other contaminants	1. Avoid wind-blow litter; remove gross pollutants 2. Ensure there is no visible oil or grease sheen on released waters 3. Dispose of waste containing contaminants at authorised facilities
Water stability and flood flow Management	Changes to the natural waterway hydraulics and hydrology	1. For peak flow for the 1-year and 100-year ARI event, use constructed sediment basins to attenuate the discharge rate of stormwater from the site

6.3 Operational phase stormwater management

6.3.1 Operational phase pollutants of concern

Pollutants that are typically generated during the operational phase of a development have also been identified by reviewing the Queensland Government Urban Stormwater Planning Guidelines. The various pollutants and their presence on site during the operational phase are summarised in Table 11.

Table 11: Operational phase performance criteria

Pollutant	Development
Litter	Yes
Sediment	Yes
Oxygen demanding substances (organic and chemical matter)	No
Nutrients (N&P)	Yes
Pathogens / Faecal Coliforms (bacteria and viruses)	No
Hydrocarbons (including oil and grease)	Yes
Heavy Metals (often associated with fine sediment)	No
Surfactants (e.g. detergents from car washing)	Yes
Organo-chlorines and organophosphates (e.g. pesticides, herbicides)	No
Thermal pollution (heat)	No
pH altering substances (other than Acid Sulfate Soils)	No

*Shading denotes the key pollutant to be targeted for trapping/treatment.

Water quality modelling will be based on typical export pollutant loading for commercial urban developments.

6.3.2 Water quality objectives

The WQOs for runoff during the operational phase of the site are derived from the SPP (2016), published by the Department of State Development, Infrastructure and Planning.

Table 12: Water quality objectives for Townsville

	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants >5mm
Reduction Target Objective	80%	65%	40%	90%

6.4 Water quality modelling

Mathematical modelling was undertaken to assess the stormwater treatment strategy for the proposed development during the operational phase. Modelling was undertaken using MUSIC version 6 software package. MUSIC has the capability to simulate discharge loads and concentrations of TN, TP and TSS.

6.4.1 Model assumptions

- Sources nodes and treatment nodes have been specified to represent the generation and treatment of stormwater under existing and developed conditions;
- The six minute rainfall data extending for 1980 – 1990 recorded for Townsville was used to set up the meteorological template in the model; and
- The time step selected for modelling the existing and developed scenarios was 6 minutes.

6.4.2 Input data

6.4.2.1 Meteorological data

A MUSIC meteorological template for West State Hospital was created using rainfall data for Townsville (Station No. 32040) from 1980 to 1990, obtained from BOM, using a 6 minute time-step. The mean annual rainfall for this period was 887mm.

Monthly average potential-evapotranspiration (PET) data for the region was obtained from BOM. MUSIC does not include in-built supplied data for Townsville and therefore the PET data is user-defined.

6.4.2.2 Rainfall run-off parameters

MUSIC modelling rainfall run-off parameters used for the proposed development are as documented in Table 13 below. These rainfall run-off parameters are as documented in Water by Design (WbD) MUSIC Modelling Guidelines (2010).

Table 13: MUSIC model runoff generation parameters (WbD, 2010)

MUSIC model parameter	Commercial
Rainfall threshold (mm)	1
Soil storage capacity (mm)	18
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity co-efficient (a)	243
Infiltration capacity co-efficient (b)	0.6
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily baseflow rate (%)	31
Daily deep seepage rate (%)	0

6.4.3 Pollutant source nodes and proposed treatment train

Table 14 identifies the catchment split for the determination of pollutant surface type modelled in MUSIC.

Table 14: Catchment delineation and pollutant sources

Catchment ID	Area (m²)	Surface Type	Fraction Impervious (%)
Roof	2,710	Tiles/tin	100
Car park, access road	3,847	Asphalt	100
Landscaping	1,387	Gardens/turf	10

Based on these values, a conceptual layout of the proposed treatment train modelled in MUSIC is shown below in Figure 3.

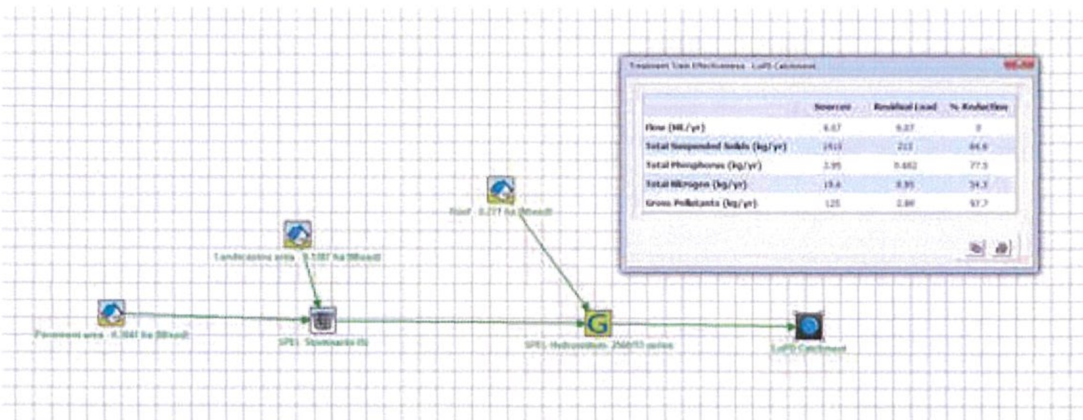

Figure 3: MUSIC model treatment train

The MUSIC model is based on the incorporation of proprietary stormwater quality treatment devices manufactured by SPEL Environmental Pty Ltd (SPEL).

6.4.4 Pollutant export parameters

The MUSIC model was set up using split catchment nodes for Urban Commercial roofs, roads and ground level areas as outlined in Table 14. The pollutant export parameters for each specific surface type utilised within the models are based on the recommendations of WbD MUSIC Modelling Guidelines Version 1.0 (2010) as summarised in Table 15 below.

Table 15: Expected pollutant concentrations (WbD MUSIC Guidelines 2010)

Surface Type	Flow Type	Total Suspended Solids (TSS) (Log 10 mg/L)		Total Phosphorus (TP) (Log 10 mg/L)		Total Nitrogen (TN) (Log 10 mg/L)	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Commercial – Roof	Base Flow	N/A	N/A	N/A	N/A	N/A	N/A
	Storm Flow	1.30	0.38	-0.89	0.34	0.37	0.34
Commercial – Roads	Base Flow	0.78	0.39	-0.60	0.50	0.32	0.30
	Storm Flow	2.43	0.38	-0.30	0.34	0.37	0.34
Commercial – Ground Level	Base Flow	0.78	0.39	-0.60	0.50	0.32	0.30
	Storm Flow	2.16	0.38	-0.39	0.34	0.37	0.34

6.4.5 Treatment system parameters

As outlined in Section 6.4.3, the proposed stormwater treatment trains incorporates SPEL treatment devices. The following devices have been specified:

- 5 no. SPEL Stormsacks (Gross Pollutant Traps (GPTs)); and
- 1 no. SPEL Hydrosystem 2500/13 Series.

In order to demonstrate compliance with the SPP (2016), SPEL has modified the transform functions for a generic node within the MUSIC model to represent the SPEL Stormsack and SPEL Filter. The use of SPEL products is subject to approval by Council.

6.4.6 MUSIC modelling results

The results of the MUSIC modelling predict that the water treatment measures incorporated meet the WQOs set out in the SPP. The MUSIC modelling results for pollutant loads entering the downstream receiving waters are summarised in Table 16 below.

Table 16: MUSIC Modelling Pollutant Reductions

Pollutant	Reduction Achieved (%)	Water Quality Objective (%)	Objective Achieved (Yes/No)

Total Suspended Solids	84.9%	80	Yes
Total Phosphorous	77.5%	65	Yes
Total Nitrogen	54.3%	40	Yes
Gross Pollutants	97.7%	90	Yes

7 Maintenance requirements

7.1 General

During the operational life of the development the treatment devices will require regular simple maintenance in order to ensure its effective long term operation and to minimise lifecycle cost. This maintenance generally comprises:

- Removal of litter and debris;
- Periodic filter insert replacement;
- Sediment removal; and
- Unblocking inlets and outlets (system flushing).

For further details refer to SPEL product information provided in Appendix B.

7.2 Inspection frequency

Inspection frequency is as recommended by the manufacturer. Inspection frequency will depend in part on the manufacturers' recommendations for the type of proprietary product specified. SPEL recommend that maintenance of Stormsacks be undertaken approximately every three months.

For the Hydrosystem treatment device, it is generally recommended that two inspections should be scheduled per year following the installation of a new unit. These may be either minor maintenance activities (routine inspection, debris removal etc.) or major maintenance activates (sediment sampling, filter insert replacement etc.). Spel advises that filter cartridges require placement every five to seven years.

7.3 Access requirement for maintenance

For the concept design, it is proposed that both the treatment device and the detention tank are located beneath the pavement at the southern end of the access road. This will enable a maintenance vehicle to gain easy access. Traffic management of vehicles entering/exiting the development may be required whilst maintenance is being completed. Refer to the civil concept sketch in Appendix A for the proposed location of the treatment device.

8 Public access and safety

During minor storm events, water is directed 'offline' to the chosen treatment device to be treated prior to discharge. During major storm events, only a proportion of the stormwater will be treated; the remainder will be conveyed through a by-pass pipe directly to the outfall. This will also enable the device to be accessed offline during designated maintenance periods.

Covers to all chambers/inlets are to be lockable to prevent unauthorised access or displacement, which could pose a safety risk to the general public.

9 Conclusion

This SBSMP has been developed in accordance with the design guidelines and codes listed in Table 1, to manage the potential impacts of the proposed development. The plan has the following key outcomes:

- Best practice stormwater quality management using gross pollutant traps and stormwater treatment devices; and
- Install erosion and sediment control measures during construction phases to minimise soil erosion and control sediment discharge from site.

The implementation of the measures outlined above in the redevelopment of the West State Hospital site in Townsville will result in no worsening to stormwater quantity conditions and will provide significant improvement to the quality of the runoff discharged from the site. The proposed measures will also ensure that the quality of the discharged stormwater meets the pollutant reduction targets as previously identified.

10 References

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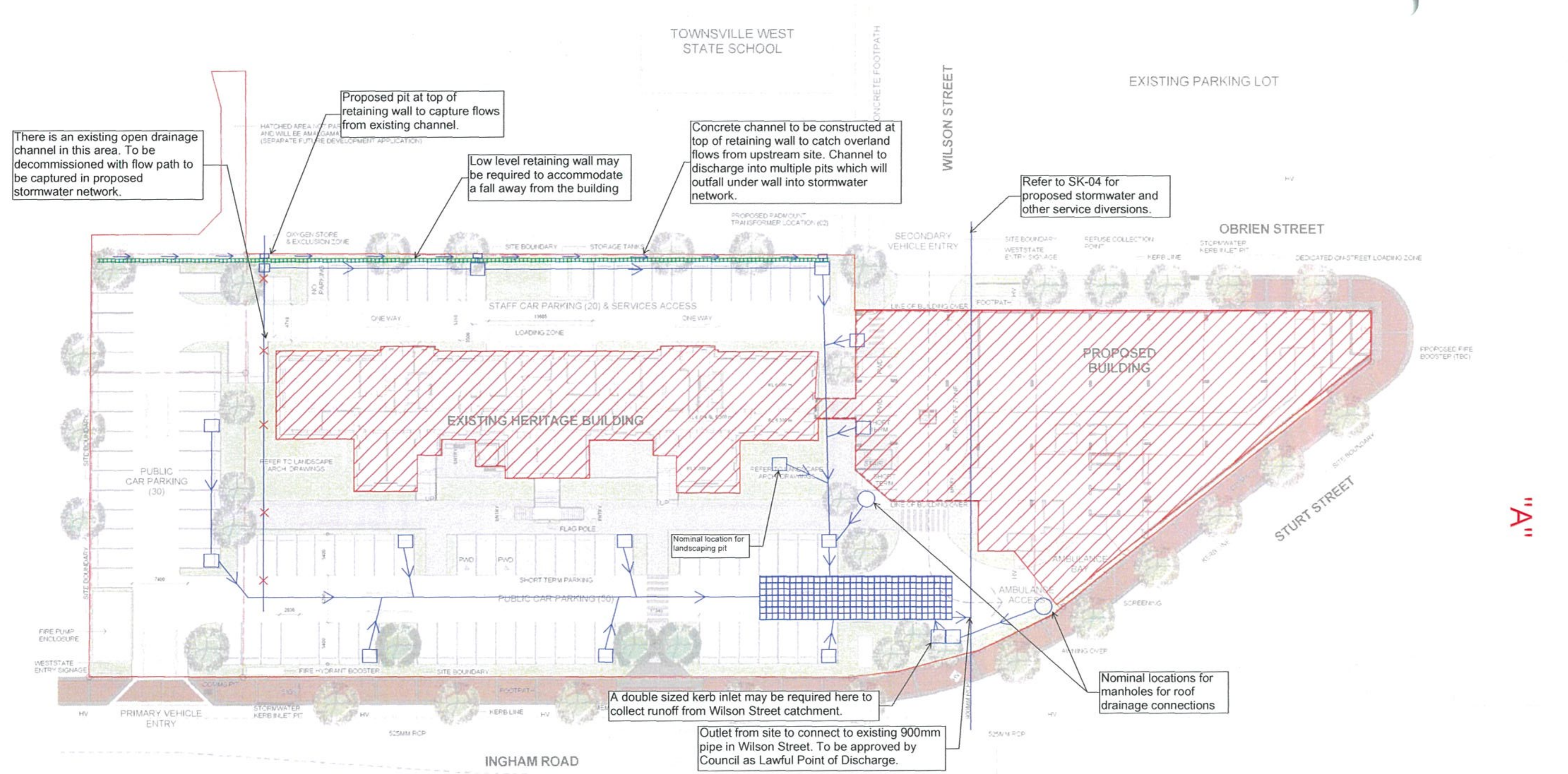
Appendix A

Concept Stormwater Layout



Legend:

- Approximate Site Boundary (to be confirmed by survey)
- Proposed roofed area, refer to architectural drawings
- Proposed Stormwater Pipe, 375mm RCP (maximum)
- Proposed Stormwater Pit, 600mm x 600mm (maximum), Trafficable Grate Load Class D
- Proposed Stormwater Manhole, 1050mm (maximum), Trafficable Lid Load Class D
- Proposed Stormwater Detention Tank and Treatment Device, Refer to notes for details
- Proposed concrete channel at top of retaining wall

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Notes:

1. Alignment and locations of proposed stormwater infrastructure to be coordinated with existing and new services to be installed (e.g. water and sewer connections).
2. Existing stormwater infrastructure (pipes and pits) within the site to be removed and disposed of. Existing roof drainage network to be modified by hydraulic engineer to connect into proposed civil network, and thus pass through the detention tank and treatment device.
3. Stormwater detention tank requires an approximate volume of 150m3. The shape/configuration of the tank to achieve this volume can be modified to suit site constraints (e.g. location of other services/landscaping). Refer to the Site Based Stormwater Management Plan for further details on stormwater detention and treatment requirements.

ARUP

Job title	Job no.	
West State Hospital, Townsville	244765	
Drawing title: Stormwater Drainage Layout		
Date: 18/05/17		
Status: Concept	Drawing no.: CI-SK-02	Rev.: 02

FOR INFORMATION ONLY

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Appendix B

SPEL Product Details

"A"

SPELFilter Hydrosystem

Environmentally aware and efficient.

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SPEL ENVIRONMENTAL
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The Technology

A specialist rainwater filter, designed for installation within load bearing shafts and chambers of concrete or plastic construction. The pre fitted plastic housing is safe and easy to fit at site.

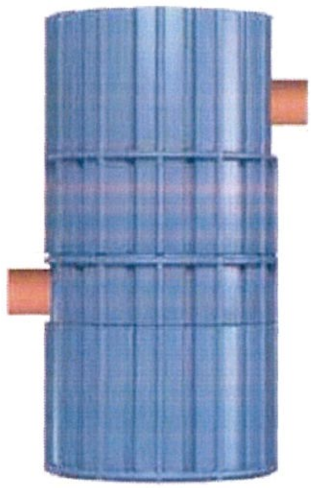
The Hydrosystem 1000 Filter uses an up-flow process. This means there is a minimal head drop between the inlet and the outlet. The cleaned water is of an outstanding water quality. The rainwater is treated within the unit by the following processes: sedimentation, filtration, adsorption and precipitation.

The initial treatment steps take place in the Dynamic Separator, where sedimentation of solid particles occurs within a radial flow regime, characterised by secondary flows.

A settling funnel to the silt trap chamber entrance ensures sediments are not remobilised. Above the separator are the filter inserts, covering the entire diameter of the unit's housing, where the second treatment step takes place.

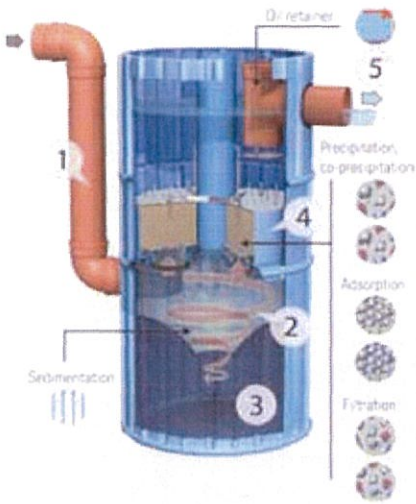
Water flows upwards through the removable filter element. As a result of both the upward flow within the filter element and the fact that the filter remains saturated, the rate of filter clogging by solids is both very limited and slow.

The filter inserts are easy to exchange.



How it works

1. The stormwater from the drained area is fed into the inlet, which is at the lower end of the shaft. A deflector plate sets up a radial flow.
2. Here, sedimentation of particles, especially the sand faction and above, takes place in the hydrodynamic separator. This is due to turbulent secondary flows within a radial laminar flow regime.
3. The settlable solids are collected via an opening in the silt trap chamber. This chamber is evacuated periodically, via the by-pass central tube at intervals.
4. Four filter elements are located within the filter shaft. As waters flow upwards the finer particles are filtered out, whilst the dissolved pollutants are precipitated and absorbed. The filter is easily backwashed, and if completely clogged or exhausted, is easily replaced.
5. Clean water above the filter elements passes to discharge via an oil trap assembly. In the event of major spill, free floating oils etc are retained here. Normal concentrations of dissolved oils are retained within the filter elements.



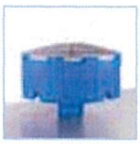
Technical Data

Stormwater filter complying with DIN 1989-2. Connections: DN 200; the various types of filter elements have different material structures.

Housing material: Polyethylene
Housing weight: 68 kg
Total weight: 220 to 350 kg depending on filter type
Packing unit SPEL Hydrosystem 1000: Pallet: 1 piece

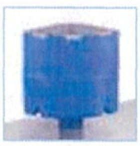
Accessories 1

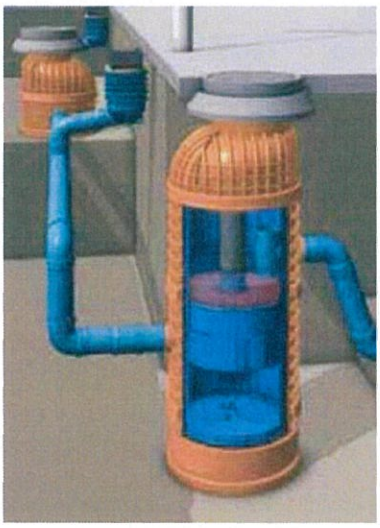
SPELFilter element
Weight per filter element:
34 kg (roof / traffic)



Accessories 2

SPELFilter element
Weight per filter element:
54 kg (heavy traffic)
66 kg (metal)





Example: Installation in a shaft made of plastic

Example:

The SPEL Hydrosystem 1000 traffic installed in a concrete shaft DN1000.

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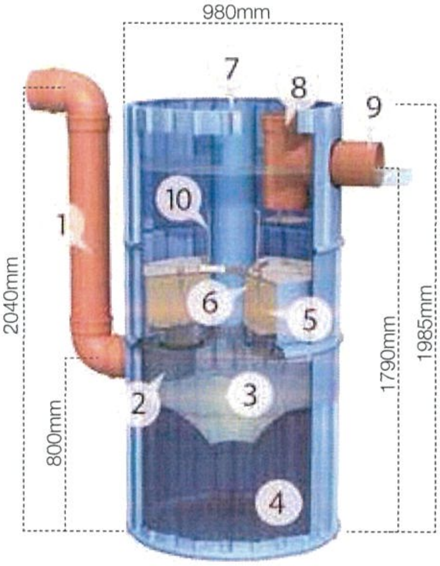
Product structure:

1. Stormwater inlet (DN 200)
2. Deflector plate
3. Hydrodynamic separator
4. Silt trap
5. Filter element
6. Extraction aid for filter element
7. Overflow and suction pipe
8. Oil trap
9. Outlet stormwater storage, soakaway system or surface waters
10. Buoyancy restraint for filter elements



The SPEL Hydrosystem is available with various filter types, depending on the usage of the connected area. The Roof type is used for roof areas that do not have a significant proportion of uncoated metals; the Metal type is employed for metal roof areas, and the Traffic type is used for slightly polluted traffic areas.

The Heavy Traffic type is employed for heavily polluted traffic areas and has been granted general technical approval (Z-84.2-4) by the German Institute for Structural Engineering (DIBt). The maximum areas that may be drained depend on the nature of the surfaces. These are given in the following table.

Type	**Nature of the surface to be drained**	**Weight of filter element / piece**	**Total Weight**
Heavy traffic with technical approval (Z-84.2-4)	Highly polluted traffic areas (car parks in front of supermarkets, main roads, HGV access roads)	54kg	300kg
Traffic	Slightly polluted traffic areas (side streets, staff car parks, yards)	34kg	220kg
Roof	Roofs without a significant proportion of uncoated metals (< 50m²)	34kg	220kg
Metal	Roofs made of uncoated metals (copper, zinc, lead)	66kg	350kg

Parameter	Unit	Non Metal Roof		Copper Roof		Zinc Roof		Parking lot, residential street		Main road Distributer		① Aims of LAWA	② Drinking Water	③ Seepage	④ SPEL Hydrosystem
		from	to	from	to	from	to	from	to	from	to	permissible limit	permissible limit	control value	aim
Phsico-chemical parameters												90 Percentile			
electrical conductivity	[uS/cm]	25	270	25	270	25	270	50	2400	110	2400	–	2500	–	< 1500
pH value	[–]	4.7	6.8	4,7	6,8	4,7	6,8	6,4	7,9	6,4	7,9	–	6,5 – 9,5	–	7,0 – 9,5
Nutrients															
phosphorous (P ges)	[mg/l]	0,06	0,50	0,06	0,50	0,06	0,50	0,09	0,30	0,23	0,34	–	–	–	0,20
ammonium (NH_4)	[mg/l]	0,1	6,2	0,1	6,2	0,1	6,2	0,0	0,9	0,5	2,3	–	0,5	–	0,3
nitrate (NO_3)	[mg/l]	0,1	4,7	0,1	4,7	0,1	4,7	0,0	16,0	0,0	16,0	–	50,0	–	–
Heavy Metals															
cadmium (Cd)	[µg/l]	0,2	2,5	0,2	1,0	0,5	2,0	0,2	1,7	0,3	13,0	1,0	5,0	5,0	< 1,0
zinc (Zn)	[µg/l]	24	4.880	24	877	1.731	43.674	15	1.420	120	2.000	500	–	500	< 500
copper (Cu)	[µg/l]	6	3.416	2.200	8.500	11	950	21	140	97	104	20	2000	50	< 50
lead (Pb)	[µg/l]	2	493	2	493	4	302	98	170	11	525	50	10	25	< 25
nickel (Ni)	[µg/l]	2	7	2	7	2	7	4	70	4	70	50	20	50	< 20
chromium (Cr)	[µg/l]	2	6	2	6	2	6	6	50	6	50	50	50	50	< 50
Organic Substances															
polynuclear aromatic hydrocarbons (PAK)	[ug/l]	0.4	0.6	0.4	0.6	0.4	0.6	0,2	17,1	0,2	17,1	–	0,1 6 compounds	0,2	< 0,2
petroleum-derived hydrocarbons (MKW)	[mg/l]	0,1	3,1	0,1	3,1	0,1	3,1	0,1	6,5	0,1	6,5	–	–	0,2	< 0,2

① Aims of the German working group on water issues of the Federal States and the Federal Government (LAWA) for surface water, usage as potable water (1998). ② Permessible of the German Drinking Water Ordinance (2001). ③ Control value for seepage of the German Federal Soil Protection Act an Ordinance (1999) according to § 8 1,2. ④ The aims of the system refer to average annual loads.

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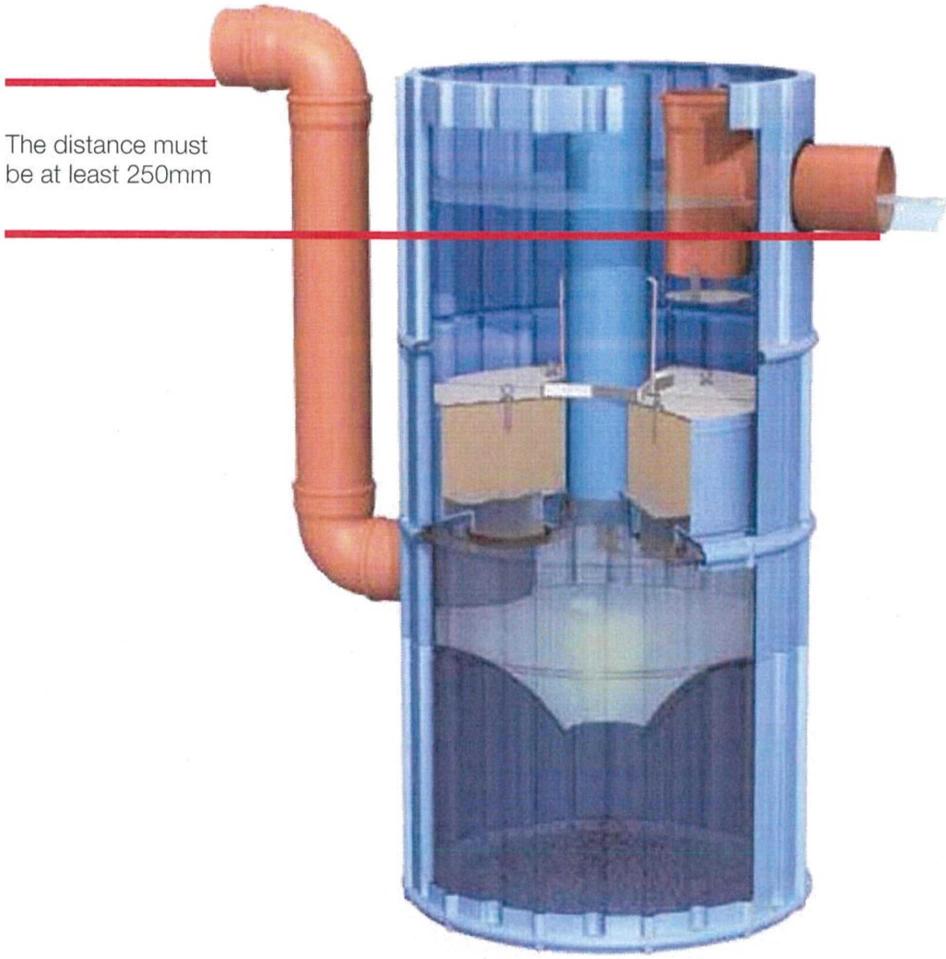
Installation

CAUTION! Important information, please observe.



The following is to be checked before installation:

The filter must be installed with a so-called fall. This means that the incoming pipe (stormwater inlet) is led downwards just ahead of the shaft and can be connected to the lower connection as described.

The difference in invert between the incoming pipe and the outlet to discharge must be at least 250mm.

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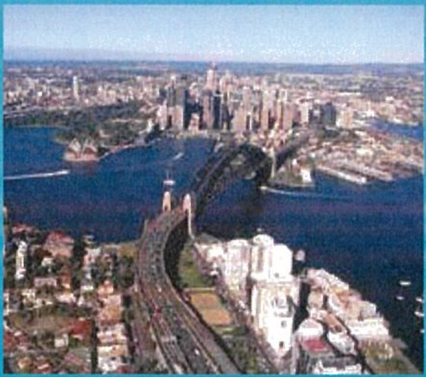

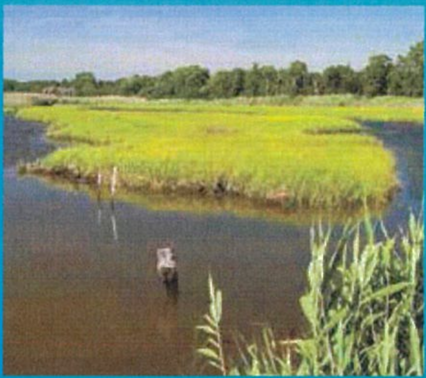

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SPELFilter Hydrosystem 1.0

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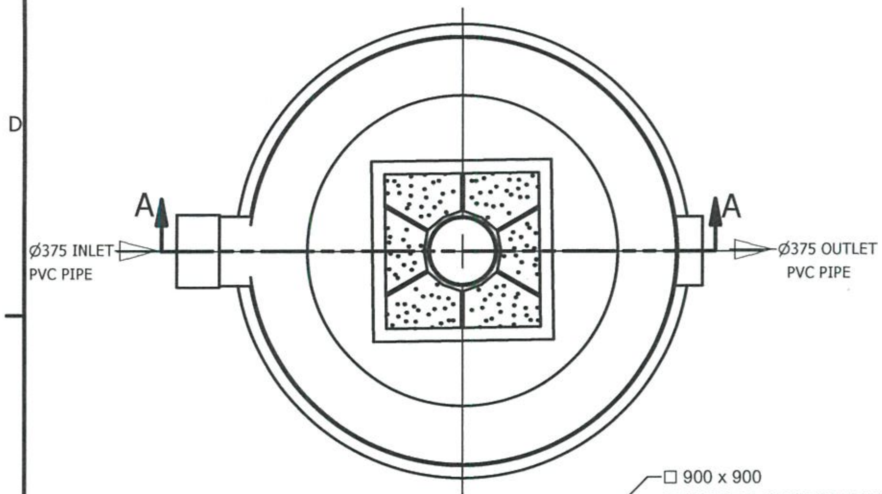
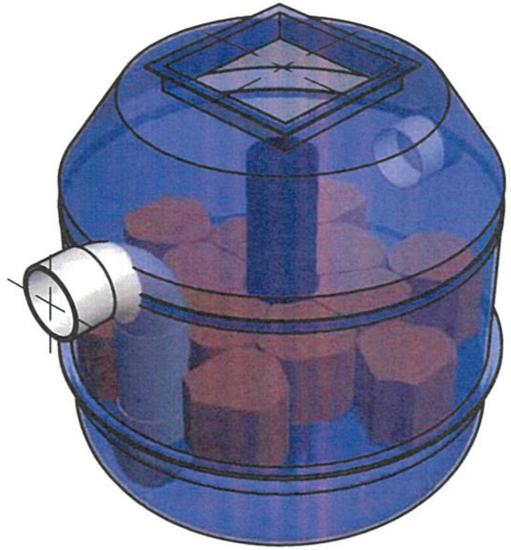
REVISION HISTORY				
REV	DESCRIPTION	DESIGNER	DATE	CHECKED BY
1	INITIAL DESIGN	M.M.	22/10/2014	

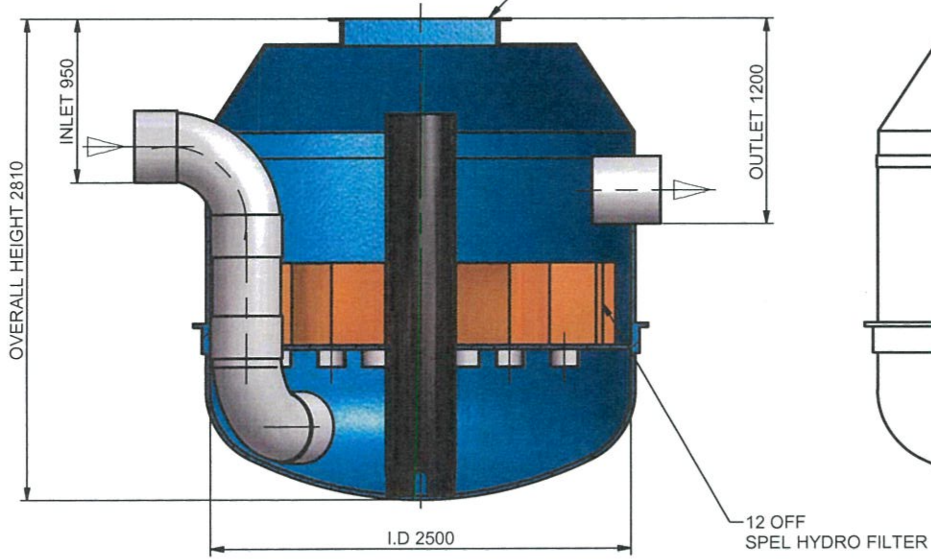


PLAN VIEW

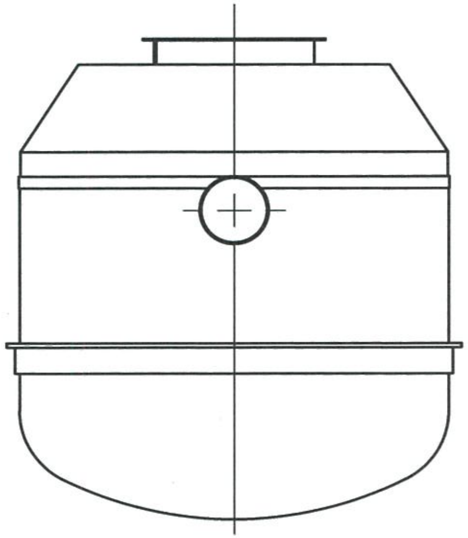
Site Level Confirmation	
Finished Surface Level (FSL)	RL:
Access Cover Thickness	mm
Inlet Invert Level	RL:
Outlet Invert Level	RL:
Company:	
Name:	
Date:	



ISOMETRIC VIEW



SECTION A-A



SIDE VIEW
OUTLET

APPROVED................ ☐
NAME.............................
SIGNED...........................
DATE........../........../.........

ISSUE FOR APPROVAL
NOT FOR CONSTRUCTION

D:\Vault Working Folder\Designs\SPEL PRODUCTS\HYDROSYSTEM\2500 - SERIES\SP14-HY9630-P.idw

TOLERANCE: ALL DIMENSIONS 10mm UNLESS OTHERWISE STATED.

CLIENT:

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DISTRIBUTOR :

Drawn	Date
M.M.	22/10/2014
Check	Date
Verified	Date
Approved	Date
Request No. D20768	

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PROJECT : STANDARD DRAWING
PROJECT :

TITLE SPEL HYDROSYSTEM 2500
HS.2500.FG.375
FRP TANK 2500 DIA.- 12 FILTER CARTRIDGES
GENERAL ARRANGEMENT

SCALE N.T.S	SIZE A3	SHEET 1	REV 1
CUSTOMER CODE :	DWG No. SP14-HY9630-P		

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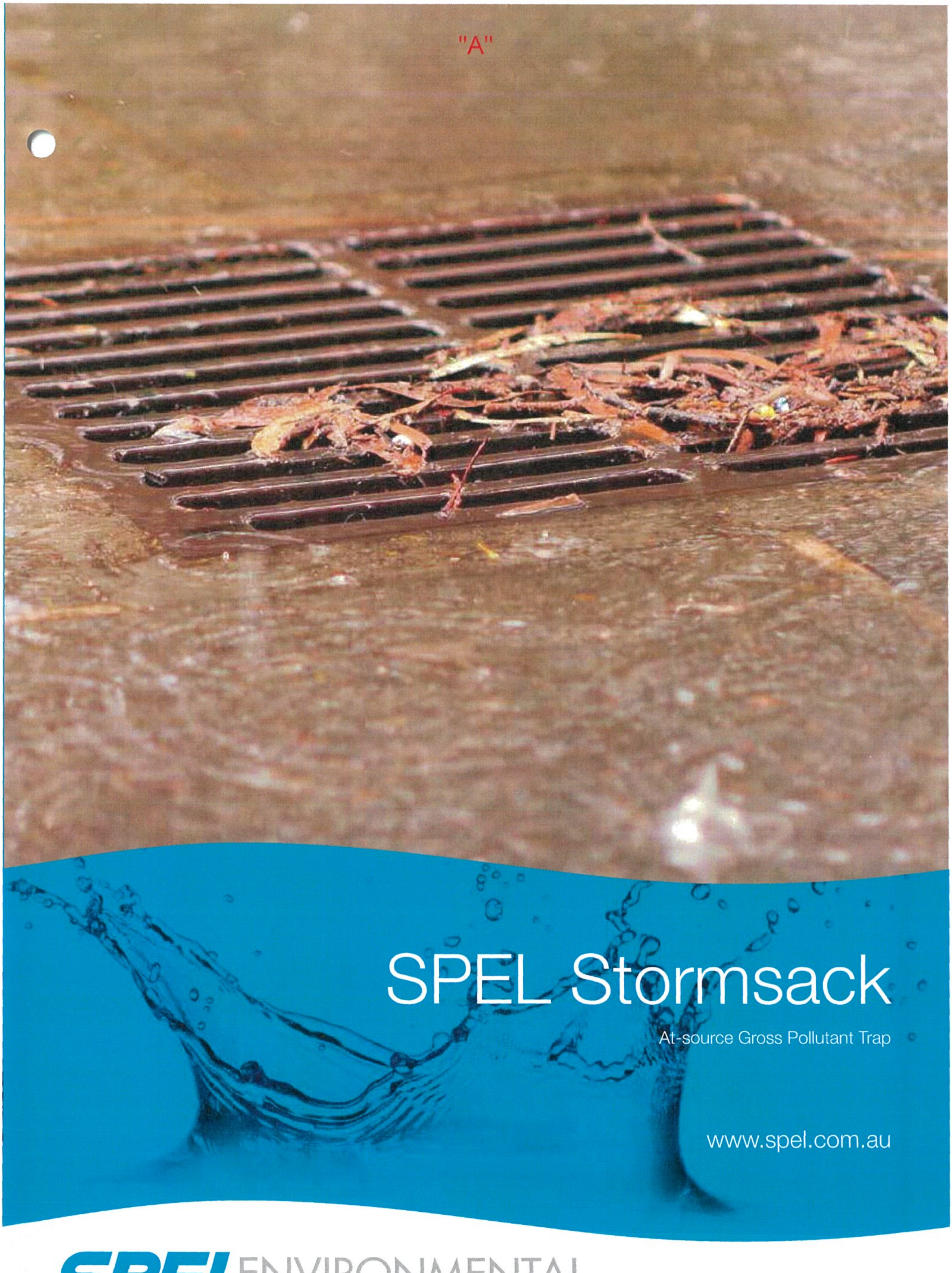

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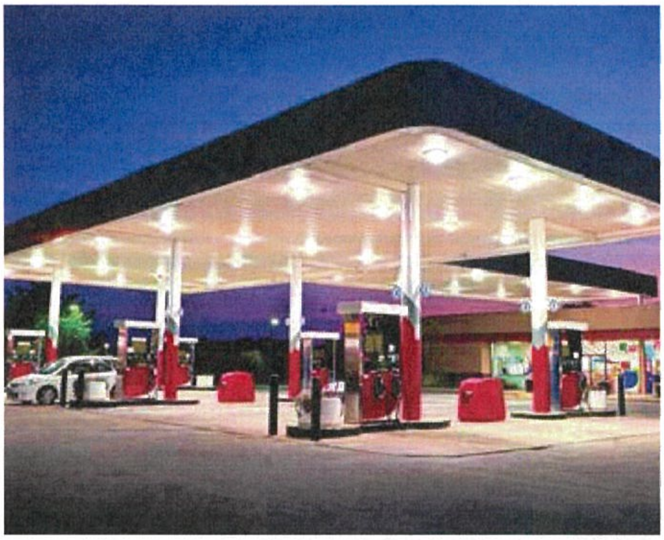
Stormwater Treatment



An all too common issue with today's highly impervious landscape is how to meet stormwater regulations with limited budgets and tight space constraints.

SPEL StormSack filtration solutions are highly engineered water quality devices that are deployed directly in the stormwater sewer system to capture contaminants close the surface for ease of maintenance. Easily retrofitted into new or existing structures, SPEL StormSack filtration technology is a decentralized approach to stormwater treatment that essentially repurposes traditional site infrastructure and customizes it to meet specific site water quality goals. In this way, it satisfies important objectives of today's LID (Low Impact Development) criteria.

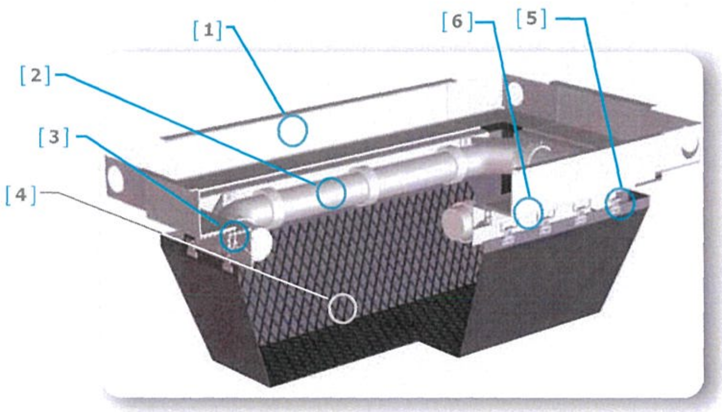
From an operations perspective, catch basins with SPEL Stormsack filters are also easier and quicker to clean out because pollutants are trapped just under the grate.

StormSack

The SPEL StormSack is specifically designed for the capture of gross pollutants: sediment, litter, and oil and grease. Ideally suited for municipal storm drain retrofits, the SPEL StormSack's unique design allows maintenance to be performed using conventional vacuum suction equipment.

Application	Regulatory Issue	Target Pollutants
Council Storm Drain Retrofits	At-source litter capture	Sediment, Litter, O&G
Commercial/Retail/Residential	Stormwater Compliance	Sediment, Litter, O&G
Litter Prone Urban Areas	Cost effective litter control	Litter ≥ 5 mm
Scrap Metal/Solid Waste/Oil Storage/Etc	Industrial Multi-Sector General Permit	Gross Pollutants, O&G
Part of Treatment Train	Council Stormwater Quality Improvement Targets	Sediment, Litter, O&G
Construction Sediment/Erosion	Sediment Control Plan	Sediment/Erosion Control

Features	
1.	Durable, aluminum frame construction has 15 year service life
2.	Integral oil boom effectively captures oil and grease from spills
3.	Patented dovetailed flange – allows 12cm of length/width field adjustment
4.	Polypropylene netting protects sack from suction hose during maintenance
5.	Steel clip with locking tab holds replaceable filter sack in place
6.	Baffled bypass traps floatables



Standard SPEL Stormsack to suit Pit Sizes
450x450mm
600x600mm
900x600mm
900x900mm

Custom sizes (i.e. 1200x900mm) can be manufactured on short lead times

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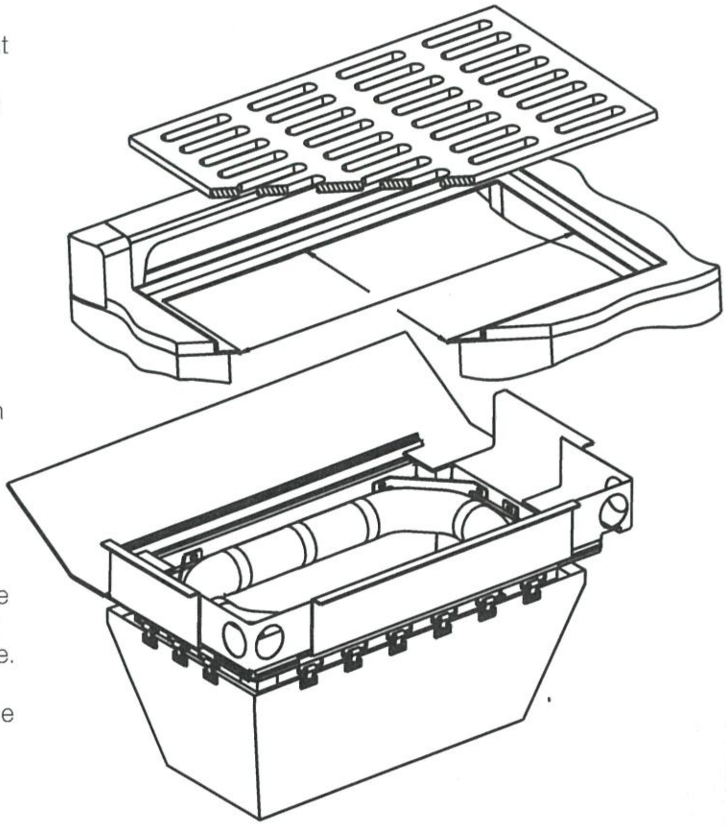
Specifications & Details

General Description

This technology is a post developed stormwater treatment system. The SPEL StormSack provides effective filtration of solid pollutants and debris typical of urban runoff, while utilising the existing or new storm drain infrastructure. The StormSack is designed to rest on the flanges of conventional catch basin frames and is engineered for most hydraulic and cold climate conditions.



Installation And Maintenance

Installation procedures shall include removing the storm grate, cleaning the ledge of debris and solids, measuring catch basin clear opening and adjusting flanges to rest on grate support ledge. Install SPEL StormSack with splash guard under curb opening so the adjustable flanges are resting on the grate support ledge. Install corner filler pieces. Reinstall storm grate directly on support flanges [rise shall be no more than 1/8 inch (3 mm)].

Maintenance: Typically the SPEL StormSack is serviceable from the street level, and therefore maintenance does not require confined space entry into the catch basin structure. The unit is designed to be maintained in place with a vacuum hose attached to a sweeper or a vactor truck. The oil boom is also designed to easily be replaced from the street level. Use only SPEL replaceable parts.

Products

Material and Design

A. Adjustable Flange and Deflector: Aluminum Alloy 6063-T6
B. Splash Guard: neoprene rubber
C. Stormsack: woven polypropylene geotextile with US Mesh 20
D. Corner Filler: Aluminum Allow 5052-H32
E. Lifting Tabs: Aluminum Allow 5052-H32
F. Replaceable Oil Boom: polypropylene 3 inch (76 mm) diameter
G. Mesh Liner: HDPE, diamond configuration
H. Support Hardware: CRES 300 Series

Typical Performance Characteristics

A. Debris capacity: 8.5cu. ft. (0.24 m3)
B. Filtered flow rate: 7.3 cfs (207 lps)
C. Primary baffled bypass flow rate: 4.2cfs (119 lps)
D. Secondary bypass flow rate: 0.4 cfs (10 lps)
E. Total bypass flow rate: 4.6 cfs (130 lps)
F. Oil boom sorption capacity: 376 oz (11 L)

Recommended minimum clearance from bottom of SPEL StormSack to inside bottom of vault is 2 inches (50 mm) Typical frame adjustability range of 5 inches (127 mm) in each direction.

Benefits

- Low cost gross pollutant capture
- Quick & easy installation
- Simple maintenance
- At source capture
- Adjusts to custom pit sizes

Field Performance

The SPEL Stormsack was introduced to the Australian market in 2012 and field testing is underway at several locations in South-east Queensland. Laboratory testing has shown capture of 99.99% of gross pollutants up to the bypass flow rate.* Further results will be provided as they become available.

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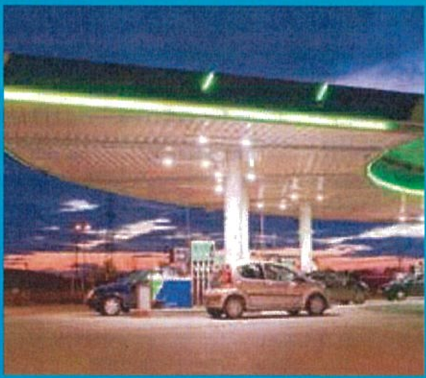

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0033 SPEL StormSack 2.0

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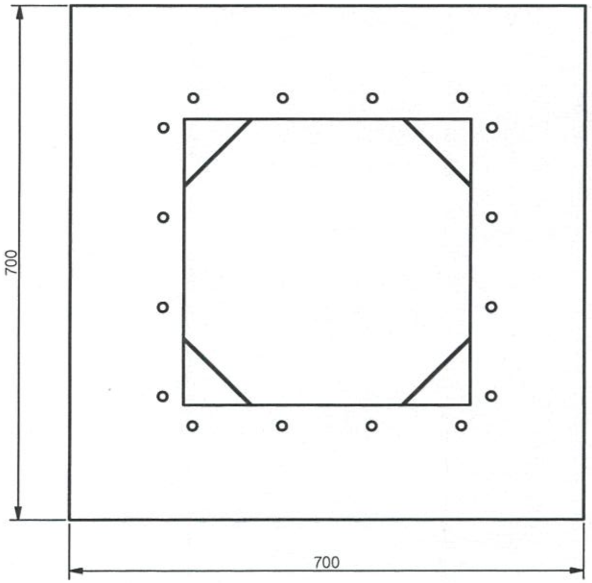
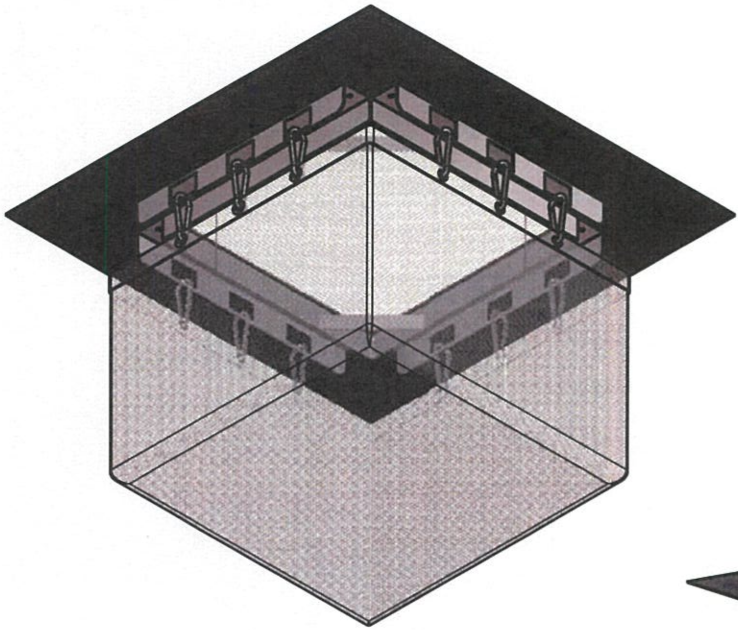
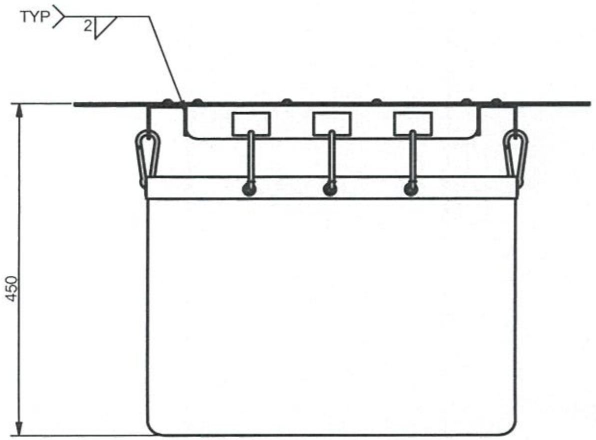
REVISION HISTORY				
REV	DESCRIPTION	DESIGNER	DATE	CHECKED BY
1	INITIAL RELEASE	M.M	25/03/2015	



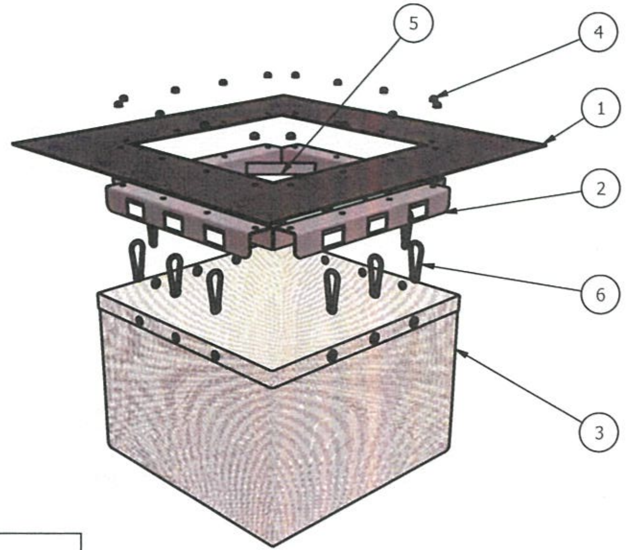
PLAN VIEW



ISOMETRIC VIEW
BOTTOM VIEW



ELEVATION VIEW



ISOMETRIC VIEW
EXPLOSION

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	PLASTIC SHEETING	HDPE
2	4	SHEET METAL BENDING	STAINLESS STEEL 304
3	1	TEXTILE FABRIC & MESH LINER	HDPE
4	16	BLIND RIVIT 7 DIA.	STAINLESS STEEL 304
5	4	CORNER ESTIFFENER - FLAT BAR 25 x 2 - 141 LG	STAINLESS STEEL 304
6	12	CARABINER CLIP 6	ALUMINIUM

"A"

CLIENT:

150

DISTRIBUTOR

Drawn	Date
M.M	25/03/2015
CHECKED BY	Date
Verified	Date
Approved	Date
Customer Code :	

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS
100 Silverwater Road Silverwater NSW 2128
PH: 1300 773 500 | E: sales@spel.com.au
www.spel.com.au

TITLE
SPEL STOMSACK
FRAME 600 x 600
BASKET MOUNTING ASSEMBLY DRAWING

REQUEST No.	SIZE	SHEET	REV
D20194	A3	1	1
SCALE	DWG No.		
N.T.S	SP15-BB4610-S		

Development Assessment Rules—Representations about a referral agency response

The following provisions are those set out in sections 28 and 30 of the Development Assessment Rules[1] regarding **representations about a referral agency response**

Part 6: Changes to the application and referral agency responses

28 Concurrence agency changes its response or gives a late response

28.1. Despite part 2, a concurrence agency may, after its referral agency assessment period and any further period agreed ends, change its referral agency response or give a late referral agency response before the application is decided, subject to section 28.2 and 28.3.

28.2. A concurrence agency may change its referral agency response at any time before the application is decided if—

(a) the change is in response to a change which the assessment manager is satisfied is a change under section 26.1; or

(b) the Minister has given the concurrence agency a direction under section 99 of the Act; or

(c) the applicant has given written agreement to the change to the referral agency response.[2]

28.3. A concurrence agency may give a late referral agency response before the application is decided, if the applicant has given written agreement to the late referral agency response.

28.4. If a concurrence agency proposes to change its referral agency response under section 28.2(a), the concurrence agency must—

(a) give notice of its intention to change its referral agency response to the assessment manager and a copy to the applicant within 5 days of receiving notice of the change under section 25.1; and

(b) the concurrence agency has 10 days from the day of giving notice under paragraph (a), or a further period agreed between the applicant and the concurrence agency, to give an amended referral agency response to the assessment manager and a copy to the applicant.

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1 Pursuant to Section 68 of the *Planning Act 2016*

2 In the instance an applicant has made representations to the concurrence agency under section 30, and the concurrence agency agrees to make the change included in the representations, section 28.2(c) is taken to have been satisfied.

Part 7: Miscellaneous

30 Representations about a referral agency response

30.1. An applicant may make representations to a concurrence agency at any time before the application is decided, about changing a matter in the referral agency response.[3]

[3] An applicant may elect, under section 32, to stop the assessment manager's decision period in which to take this action. If a concurrence agency wishes to amend their response in relation to representations made under this section, they must do so in accordance with section 28.

Department of
State Development,
Infrastructure and Planning

Our reference: 2604-52045 SRA
Your reference: MCU26/0030
Applicants reference: P0064451

9 June 2026

The Chief Executive Officer
Townsville City Council
PO Box 1268
Townsville Qld 4810
developmentassessment@townsville.qld.gov.au

Attention: Kate Wilkes

Dear Sir/Madam

SARA referral agency response – Change (Other) - 37 Ingham Road, West End

(Referral agency response given under section 56 of the *Planning Act 2016*)

The development application described below was confirmed as properly referred by the State Assessment and Referral Agency (SARA) on 7 July 2025.

Response

Outcome:	Referral agency response – with conditions
Date of response:	9 June 2026
Conditions:	The conditions in **Attachment 1** must be attached to any development approval
Advice:	Advice to the applicant is in **Attachment 2**
Reasons:	The reasons for the referral agency response are in **Attachment 3**

Development details

Description:	Development permit	Change (Other) to Development Approval associated with MI17/0007 Development Permit - Material Change of Use (Hospital, Health Care Services, Shop and Food and Drink Outlet) to increase the number of approved hospital beds from 22 to 50 within the existing built form.

North and North West regional office
Level 4, 445 Flinders Street, Townsville
PO Box 5666, Townsville QLD 4810

SARA role:	Referral agency
SARA trigger:	Schedule 10, Part 9, Division 4, Subdivision 2, Table 4, Item 1 Material change of use of premises near a state transport corridor or that is a future state transport corridor
SARA reference:	2604-52045 SRA
Assessment manager:	Townsville City Council
Street address:	37 Ingham Road, West End (Townsville City)
Real property description:	Lot 707 on SP327134
Applicant name:	CHPF South Bunbury Pty Ltd C/- Urbis Ltd
Applicant contact details:	Level 32, 300 George Street Brisbane QLD 4000 rfiraq@urbis.com.au
Human Rights Act 2019 considerations:	A consideration of the Human Rights Act 2019 sections 15 to 35 has been undertaken as part of this response. It has been determined that this response does not limit human rights.

Representations

An applicant may make representations to a concurrence agency, at any time before the application is decided, about changing a matter in the referral agency response (s.30 Development Assessment Rules). Copies of the relevant provisions are in **Attachment 4**.

A copy of this response has been sent to the applicant for their information.

For further information please contact Kellie Galletta, Principal Planning Officer, North and North-West Queensland, on 07 4037 3224 or via email NQSARA@dsdilgp.qld.gov.au who will be pleased to assist.

Yours sincerely

Carl Porter
A/ Manager Planning

cc CHPF South Bunbury Pty Ltd C/- Urbis Ltd, rfiraq@urbis.com.au

enc Attachment 1 - Referral agency conditions
Attachment 2 - Advice to the applicant
Attachment 3 - Reasons for referral agency response
Attachment 4 - Representations about a referral agency response provisions
Attachment 5 - Documents referred to in conditions

Attachment 1—Referral agency conditions

(Under section 56(1)(b)(i) of the *Planning Act 2016* the following conditions must be attached to any development approval relating to this application) (Copies of the documents referenced below are found at Attachment 5)

No.	Conditions of Development Approval	Condition timing
Material Change of Use		
Schedule 10, Part 9, Division 4, Subdivision 2, Table 4, Item 1 - Material change of use of premises near a state transport corridor or that is a future state transport corridor that - The chief executive administering the *Planning Act 2016* nominates the Director-General of Department of Transport and Main Roads to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following condition(s):		
1.	The development must be generally in accordance with Chapter 4 Acoustic Design of the Lautaret Pty Ltd West State Private Hospital Acoustic Assessment Report, prepared by ARUP Pty Ltd, dated 13 February 2017, reference AAc/R01, revision B. In particular, the following acoustic treatments regarding: (a) the new-build roof (Section 4.1.1)) (b) façade (Section 4.1.2) (c) internal partitions (Section 4.2) (d) doors (Section 4.2.1) (e) ceilings (Section 4.2.2) (f) floor/ceiling systems (Section 4.2.3) (g) general acoustic finishes (Section 4.3.1).	Prior to the commencement of use and to be maintained at all times
2.	(a) The development must be in accordance with the Lautaret West State Private Hospital Site Based Stormwater Management Plan, prepared by ARUP Pty Ltd, dated 18 May 2017, reference 244765 ARUP-CI-REP-02 and revision 02, in particular: i. section 3.2 - Existing Stormwater Drainage and lawful Point of Discharge ii. section 5.3 - Stormwater Detention iii. Stormwater Drainage Layout prepared by ARUP dated I7 February 2017 Drawing Number CI-SK- 02 and revision 01 (b) RPEQ certification with supporting documentation must be provided to the Program Delivery and Operations Unit, Department of Transport and Main Roads, North Queensland Region (North.Queensland. IDAS@tmr.qld.gov.au), confirming that the development has been designed and constructed in accordance with part (a) of this condition.	(a) At all times (b) Prior to the commencement of use

Attachment 2—Advice to the applicant

General advice	
1.	Terms and phrases used in this document are defined in the *Planning Act 2016*, its regulation or the State Development Assessment Provisions (SDAP) (version 3.6). If a word remains undefined it has its ordinary meaning.
2.	**Public Passenger Transport Infrastructure**
	The hospital expansion is likely to increase demand for access by wheelchair accessible taxis, an important public passenger service for patients with disabilities. These vehicles need access to drop-off/pick-up facilities that are parallel to the kerb (refer to Chapter 7 'Taxi Facilities' of the Department of Transport and Main Roads' Public Transport Infrastructure Manual (PTIM) 2015). To ensure these vehicles can safely and efficiently service the hospital, the 'short term drop off' bay shown on the Proposed Ground Floor Set Out Plan, prepared by Health Architects, dated 08.09.2023, reference A021, revision P would need to be modified to comply with Australian Standard *AS2890.6:2022 - Parking facilities Part 6: Off-street parking for people with disabilities* (section 2.5.2 'Parallel parking spaces' and figures 2.10 - 2.12). The Department of Transport and Main Roads' Public Transport Infrastructure Manual (PTIM) 2015 can be accessed online at https://www.publications.qld.gov.au/dataset/public-transport-infrastructure-manual

Attachment 3—Reasons for referral agency response

(Given under section 56(7) of the *Planning Act 2016*)

The reasons for the SARA's decision are:
The proposed development has been assessed against and complies with State code 2: Development in a railway environment (v3.6), where relevant.

Specifically, the development:

- does not result in an increase in the likelihood or frequency of accidents, fatalities or serious injury for users of a railway;
- does not adversely impact the structural integrity or physical condition of railways, rail transport infrastructure or other rail infrastructure within a railway corridor;
- does not compromise the operating performance of railway corridors;
- does not adversely impact the state's ability to plan, construct, maintain, upgrade or operate railway corridors, future railway corridors and associated rail transport infrastructure or other rail infrastructure;
- does not significantly increase the cost to the state to plan, construct, maintain, upgrade or operate railway corridors, future railway corridors, rail transport infrastructure or other rail infrastructure;
- does not compromise pedestrian or cycle access to public passenger transport infrastructure or active transport infrastructure associated with railways; and
- protects the community from significant adverse impacts resulting from environmental emissions generated by a railway.

Material used in the assessment of the application:

- the development application material and submitted plans
- *Planning Act 2016*
- Planning Regulation 2017
- the SDAP (version 3.2 and 3.6), as published by SARA
- the Development Assessment Rules
- SARA DA Mapping system
- section 58 of the *Human Rights Act 2019*

Attachment 4—Representations about a referral agency response provisions

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