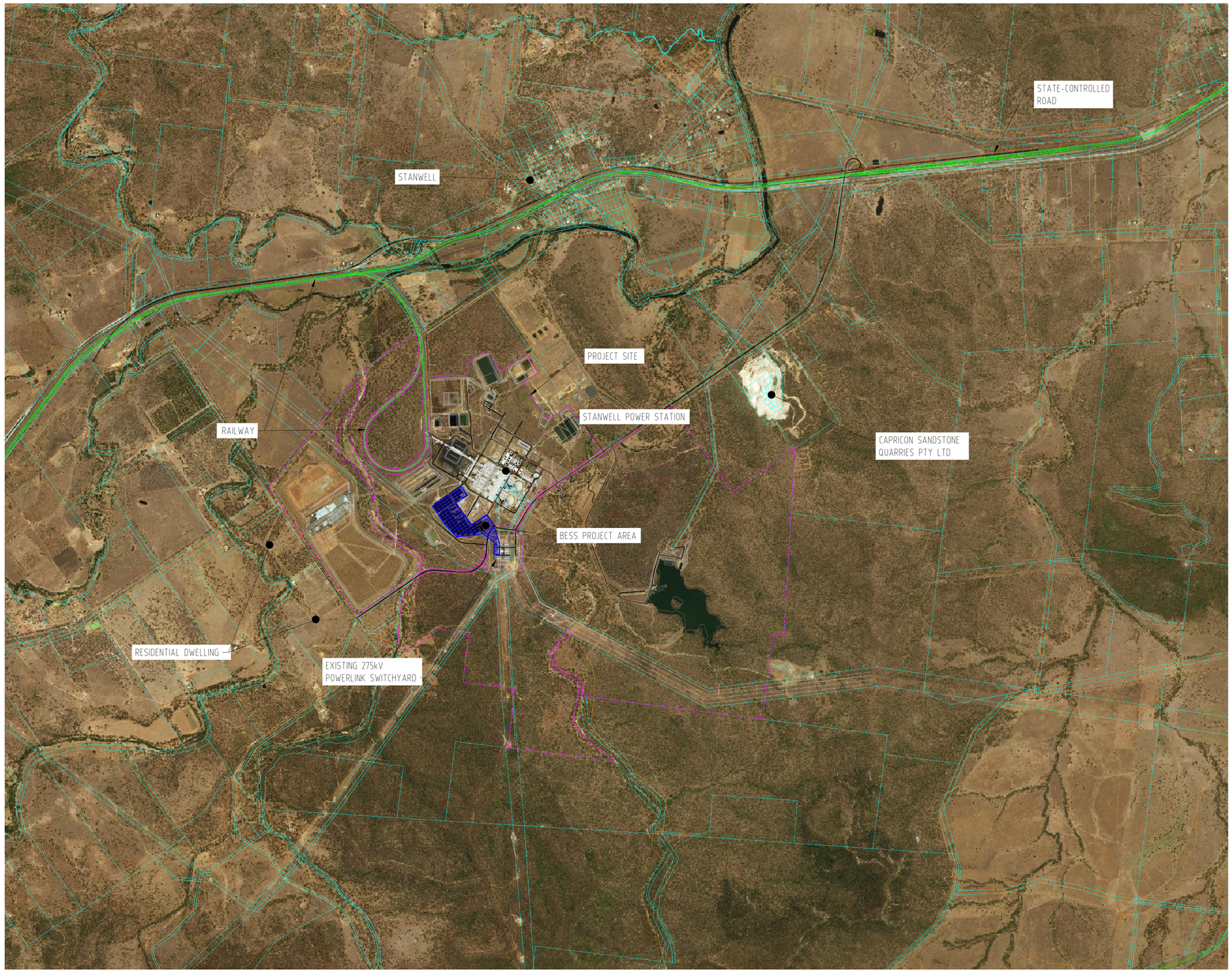

LEGEND:

- BESS SITE BOUNDARY
- EASEMENT
- ROAD AND TRACK BASELINE
- RAILWAY
- PROJECT SITE CADASTRE

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

REVISION	DESCRIPTION	DRAWN BY	CHECKED	APPROVED	APPEA No.
A	ISSUED FOR CLIENT REVIEW	LM	HJD		

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SWITCHROOM FOLDER
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SUPERSEDED DRGS:
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REFERENCE DRGS:
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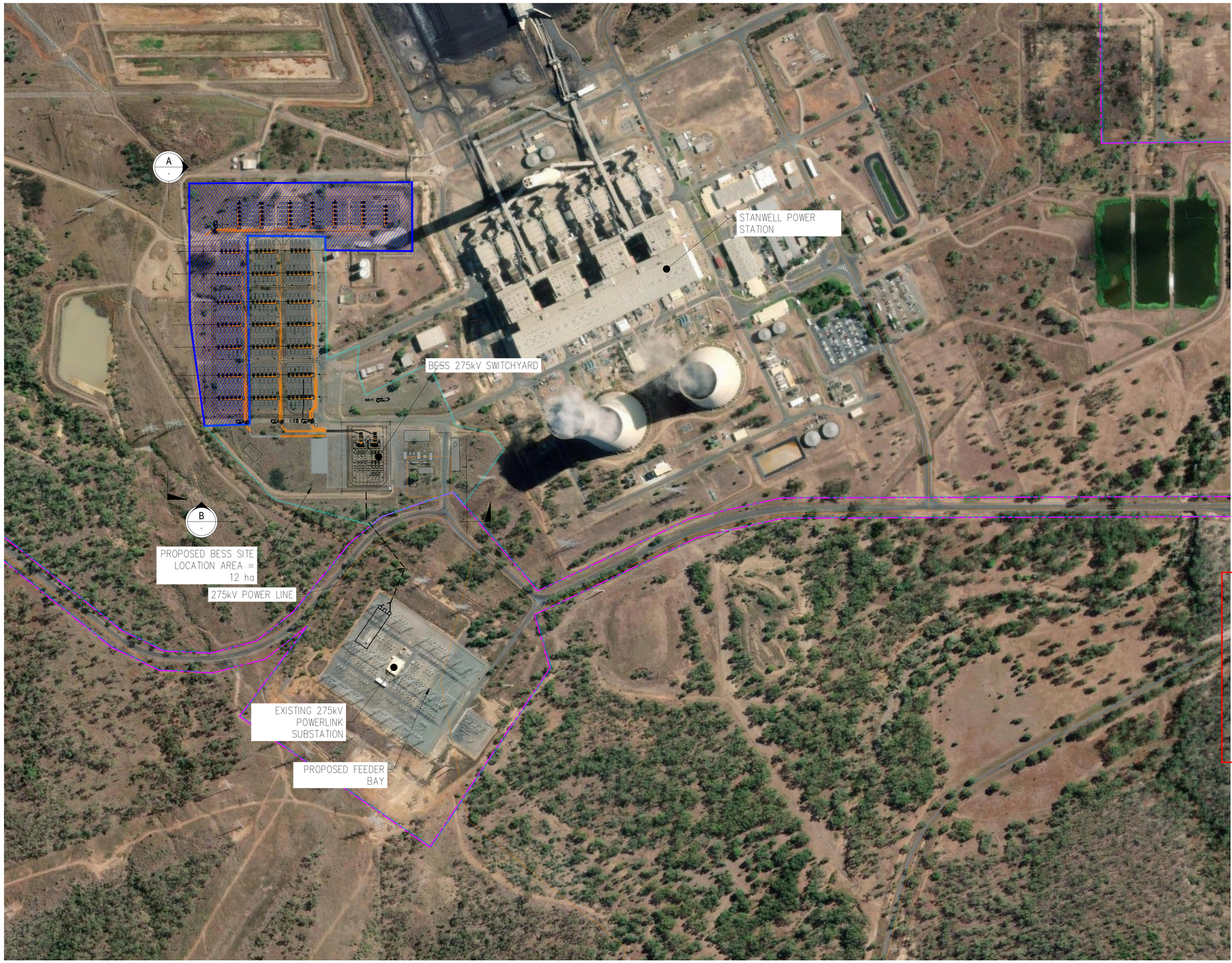
STANWELL Power Station | stanwell

CENTRAL RENEWABLE ENERGY ZONE
BATTERY STORAGE SYSTEM
OVERALL PROJECT SITE
LOCATION PLAN

AURECON DRAWING No.
CRBP-DRG-JJ-0004
STANWELL DRAWING No.
CRBP-0000-AGP-100-DRG-G-0004

Drawn	M.G.	Revision
Date	20.05.2022	B
Scale	1:3000	



LEGEND:

- STAGE 1
- STAGE 2
- EASEMENT
- ROAD AND TRACK BASELINE
- RAILWAY
- SITE CADASTRE
- BESS SITE BOUNDARY
- PROPOSED INTERNAL ACCESS

NOTES:

1. BESS FACILITY LAYOUT TO BE LOCATED WITHIN THE AREA SHOWN.
2. STAGE 1 CONFIGURATION IS 300 MW / 1200 MWh.
3. STAGE 2 CONFIGURATION IS 300 MW / 1200 MWh.
4. LAYOUT SHOWN IS INDICATIVE ONLY FOR THE COMBINED 600 MW / 2,400 MWh.

ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

5 June 2024

DATE

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

REVISION	DESCRIPTION	
A	ISSUED FOR CLIENT REVIEW	
	DRAWN BY: J.M	
	CHECKED: H.D	
	APPROVED:	
	APEQ No.	

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SWITCHROOM FOLDER

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STANWELL Power Station | stanwell

CENTRAL RENEWABLE ENERGY ZONE
BATTERY STORAGE SYSTEM
SITE
LOCATION PLAN

AURECON DRAWING No.
CRBP-DRG-JJ-0003
STANWELL DRAWING No.
CRBP-0000-AGP-100-DRG-G-0003

Drawn E.C.	Revision C
Date 19.04.2024	
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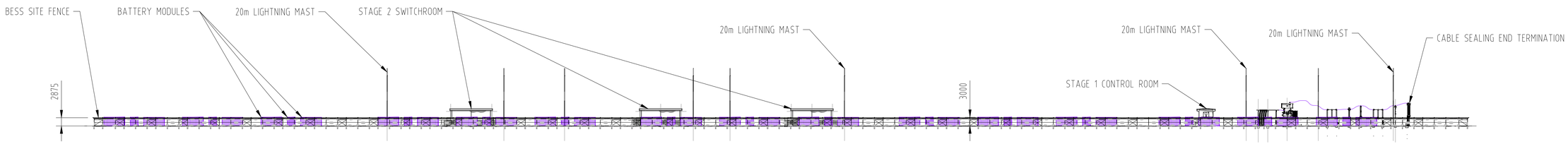
NOTES:

1. REFER TO NOTES IN LAYOUT DRAWING.



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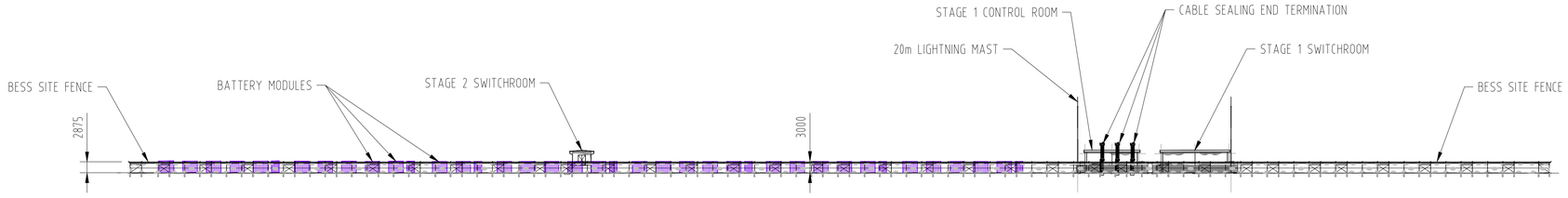

ELEVATION B
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APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

REVISION	DESCRIPTION	ISSUED FOR CLIENT	REVIEW	DRAWN BY: LM	CHECKED: HJD	APPROVED:	APEGA No.
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SWITCHROOM FOLDER
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REFERENCE DRGS:
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STANWELL Power Station | stanwell

CENTRAL RENEWABLE ENERGY ZONE
BATTERY STORAGE SYSTEM
SITE
ELEVATIONS

AURECON DRAWING No.
CRBP-DRG-JJ-0005
STANWELL DRAWING No.
CRBP-0000-AGP-100-DRG-G-0005

Drawn	V.S	Revision
Date	06.04.2022	A
Scale	1:750	

Stanwell BESS

Concept Stormwater Management Plan

Stanwell Corporation Limited

Reference: P512486

Revision: 2

ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

5 June 2024

DATE

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

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Document control record

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Document control						aurecon
Report title		Concept Stormwater Management Plan				
Document code		CRBP-AUR-PMT-GE-PLN-0001	**Project number**		P512486	
File path		Https://aurecongroup.sharepoint.com/sites/522977/5_WorkingFiles/14 CREZ General Support/007 DA Amendment/03_Stormwater/002_Working/REPORT/CRBP-AUR-PMT-GE-PLN-0001.docx				
Client		Stanwell Corporation Limited				
Client contact		Derek Cameron	**Client reference**		Stanwell BESS	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2022-09-15	Draft for client review	Adrian Low	HC	HC	MG
1	2022-10-15	Final	Adrian Low	HC	HC	HC
2	2024-04-10	Revision	Peter G.	Dinesh P.	Dinesh P.	Mark G.
Current revision						

Approval			
Author signature		Approver signature	
Name	Peter Gillam / Dinesh Parsad (RPEQ)	Name	Mark Griffith
Title	Director / Lead Engineer	Title	Project Manager

Contents

Appendices

Figures

Tables

1 Introduction

Scope and Purpose

This Conceptual Stormwater Management Plan (CSMP) has been developed by Aurecon on behalf of Stanwell Corporation Limited (Stanwell) to support a Development Application (DA) for the construction of a Battery Energy Storage System (BESS) located at 397 & 519 Power Station Road, Stanwell (hereinafter referred to as the Project). The Project proposes the installation of a BESS capable of storing and exporting electrical energy to the National Electrical Market (NEM).

This CSMP outlines conceptual stormwater measures in managing runoff (both quantity and quality) discharge from the site (for early stages and the Ultimate Developed scenarios) and excludes detailed drainage layout internally within the Project Area and construction phase Erosion and Sediment Control Plan (ESC).

1.1 Site Description

1.1.1 Location and Land Use

The Project is located at 397 & 519 Power Station Road, Stanwell, formally described as Lot 44 on SP140243 and Lot 1 on RP886588 (hereinafter referred to as the Project Site). The Project Site is located within the Central Queensland Region approximately 28km southwest of Rockhampton. The Project locality plan is shown in Figure 1.

The land surrounding the Project Site is characterised by rural land utilised for grazing purposes. The nearest township is Stanwell, located approximately 1.7km to the north. Capricorn Sandstone Quarries Pty Ltd is located approximately 600m east of the Project Site.

The Project Site has a total area of 1,118.3 ha. However, the ultimate project footprint (hereinafter referred to as the Project Area) will encompass an area of approximately 12.3 Ha located directly southeast of the Stanwell Power Station (Lot 44 on SP140243) and north of the Powerlink Switchyard (Lot 1 on RP886588). The proposed development area (Project Area) is shown in Figure 3.

The existing Stanwell Power Station includes large-scale coal power generation infrastructure, water storage facilities, coal stockpiles and transmission line infrastructure.

The existing Stanwell Power Station includes large-scale coal power generation infrastructure, water storage facilities, coal stockpiles and transmission line infrastructure. The existing Power Station is drained by existing pipes to a legal point of discharge to the north-east.

The Project area lies to the south west of the existing Power Station and to the east of transmission line easements. The Project area comprises grassed lands and unsealed roads.

1.1.2 Topography and Drainage

Existing Power Station

The existing power station is drained by pipe and pit network to the north stormwater dam. The dam and its discharge point provides water quality and quantity management for the plant prior to discharge at the legal point of discharge.

Stormwater pipe networks are notionally shown in Figure 3.

Project Area

The Project Area is located near a crest and the existing terrain generally falls south and runoff is directed to the Southern Stormwater Dam via open channel (see Figure 3). The dam spillway is located on the south eastern corner of the dam, which subsequently discharges into Stony Creek.

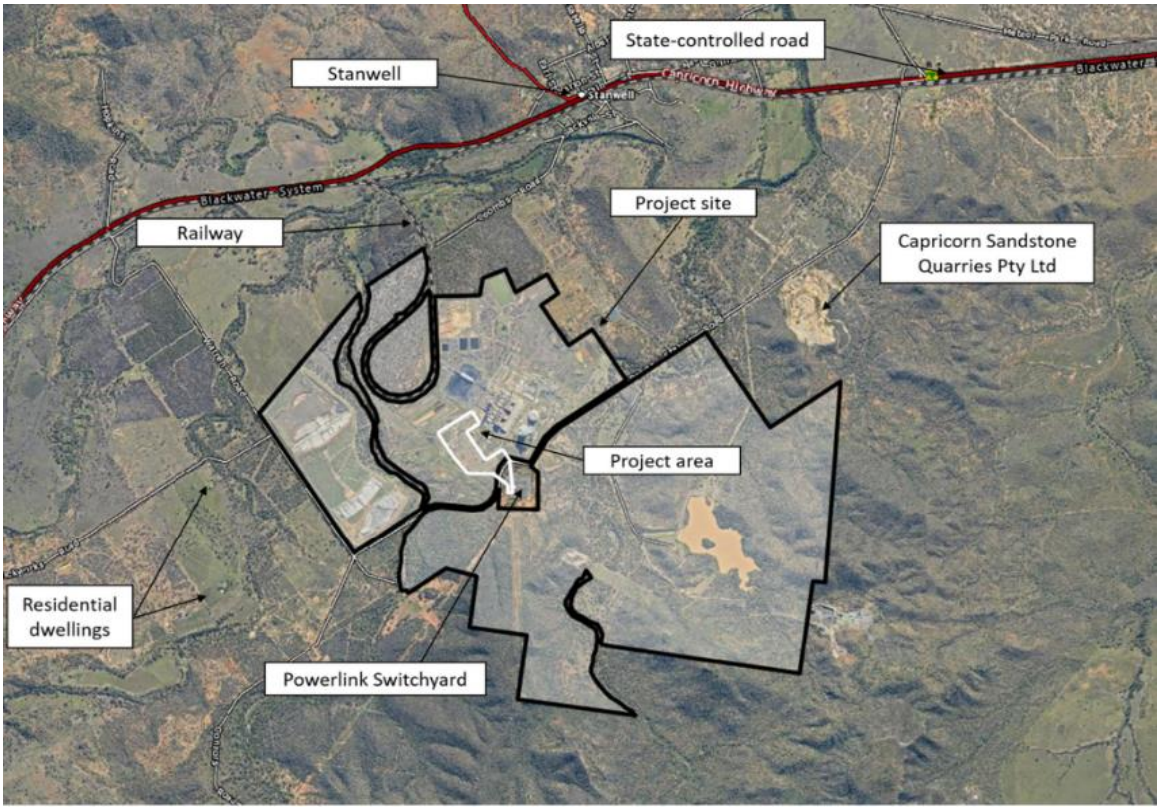


Figure 1 Project Locality Plan

1.1.3 Flood Overlay

Based on the online FloodCheck tool provided by Business Queensland, the Project Area is not located within the 1% AEP flood overlay (see Figure 2). Therefore, it does not warrant any two-dimensional hydraulic modelling and does not present any tailwater constraint for the pre and post development flow assessment.

This mapping shows some existing flooding occurs between the cooling towers and Power Station Road.

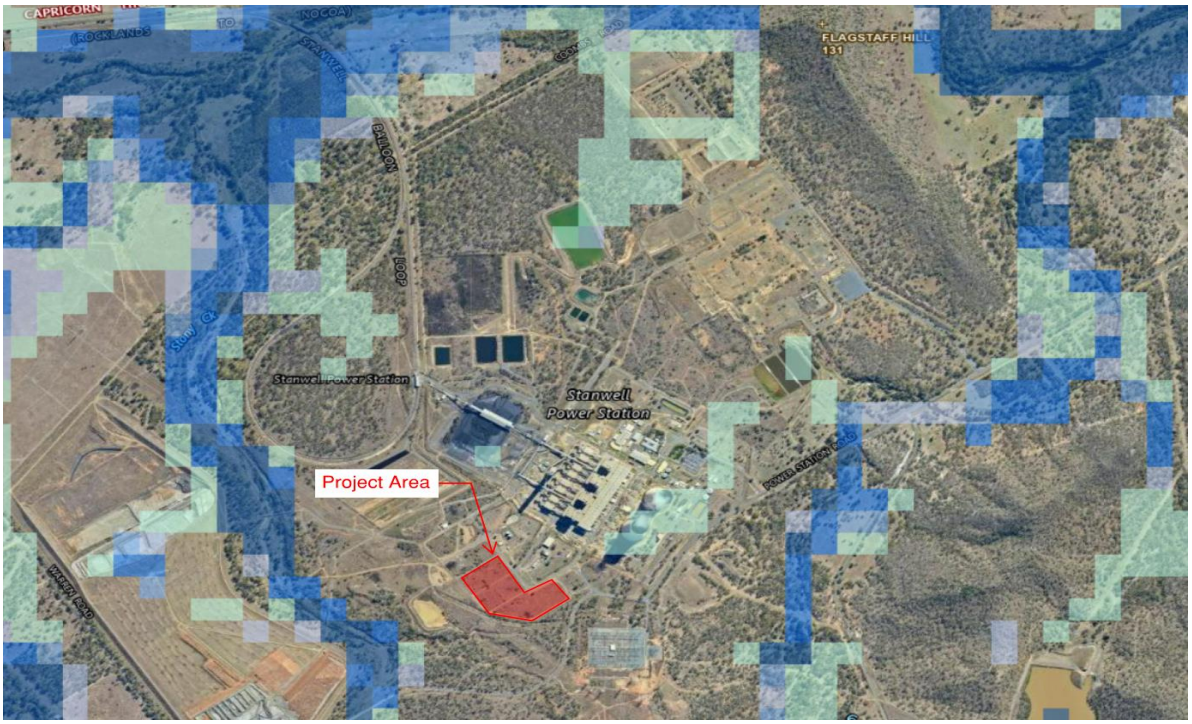


Figure 2 Flood Mapping for 1%AEP event *(Source: https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/maps/flood-mapping)*

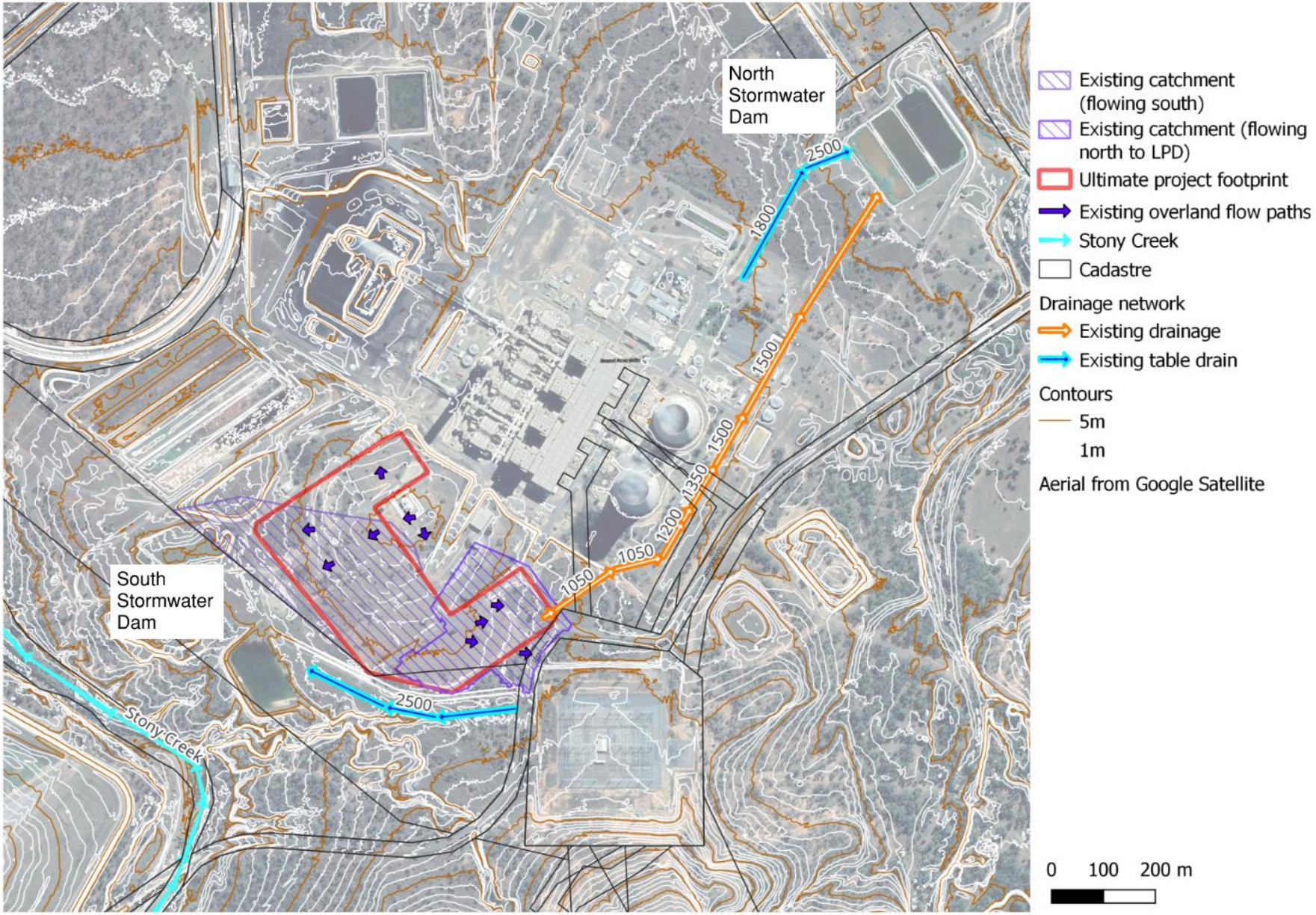


Figure 3 Existing topography and drainage plan

1.1.4 Acid Sulfate Soils

A Geotechnical Desktop Study and Gap Analysis Report for the site makes reference to the CSIRO Australian Soil Resource Information System (ASRIS) Acid Sulfate Soils (ASS) map. Mapping indicates that the Stanwell Power Station site has a low probability of occurrence for ASS. This is not further considered.

1.2 Proposed Development

The Project involves installing a BESS capable of storing and exporting electrical energy to the NEM. The BESS will be connected to the adjoining Powerlink Switchyard, located on Lot 1 on RP886588 via a 275kV transmission line. It is important to note that the proposed development does not include the feeder bay within the Powerlink Switchyard as these works will be undertaken by Powerlink.

The Project will occur in stages (see Figure 4). The land use proposed is considered consistent with the existing use of the land for power generation.

The 300 MW/1,200 MWh project is referred to as Unit 1 and Unit 2, delivered together as Stage 2. A future Stage 2 could consist of up to an additional 300 MW/1,200MWh for a total of 600 MW / 2,400 MWh for the site.

Initial design was 82 batteries to get 150 MW for 2 hours (300 MWh), we now have 324 batteries to get 300 MW for 4 hours (1,200 MWh). So the capacity of the site has quadrupled, we have slightly less than 4 times the batteries (328 to 324) as the batteries are more efficient at slower discharge.

The 300 MW project (Units 1 and 2) will be delivered as one Stage, with a single period of earthworks/benching and a single period of battery deliveries.

All stages are included in this assessment to provide some flexibility to the planning of stormwater management elements and ensure sufficient land is put aside for stormwater management. The assessment should be updated once the final detailed design of each Stage is complete

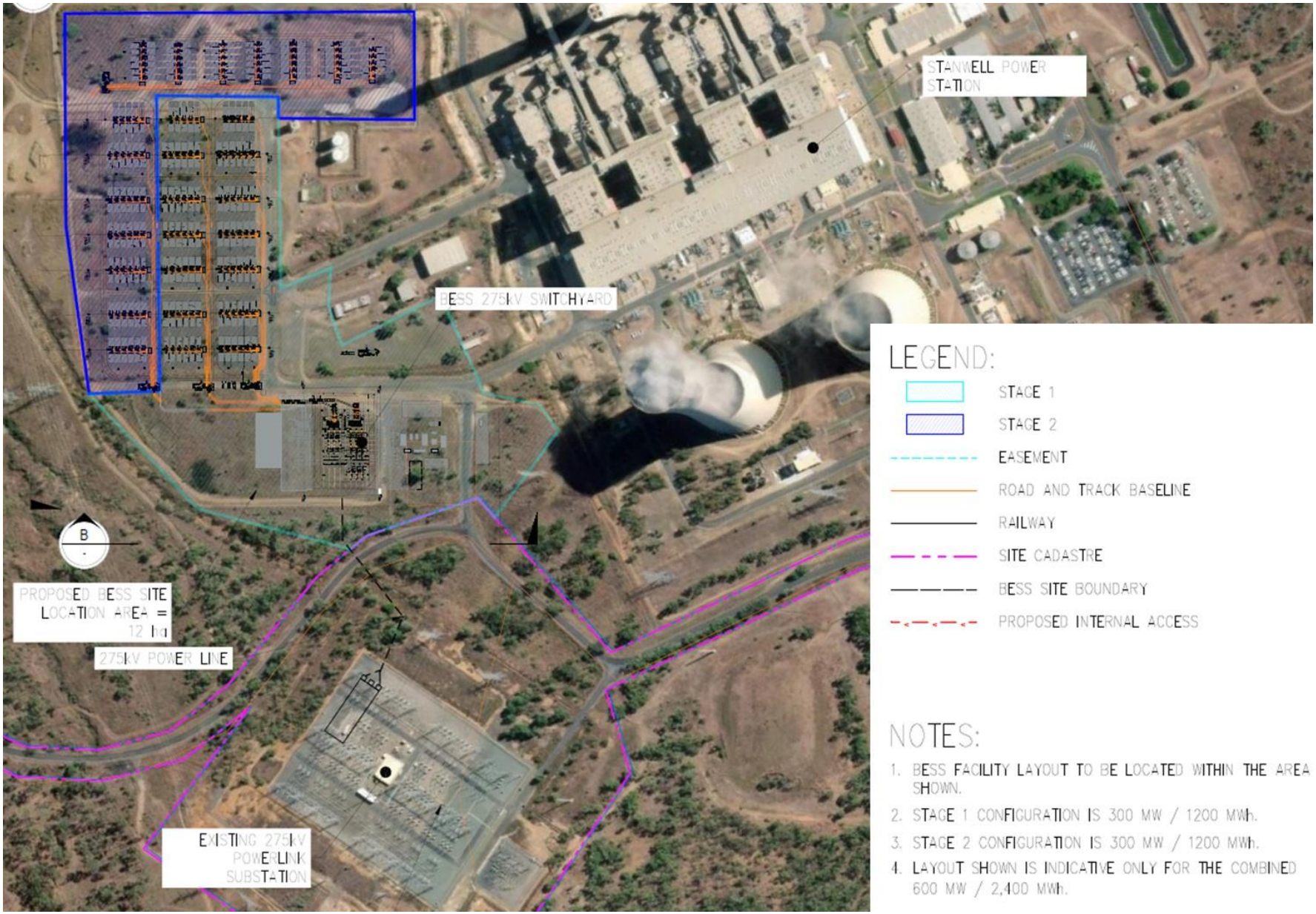


Figure 4 Proposed Site Layout

2 Stormwater Management

2.1 Stormwater Management Compliance Standards

As per correspondence with Rockhampton Regional Council dated 28 July 2022, the key matters to be addressed from a stormwater management perspective were as follows:

- Provide a stormwater drainage strategy for the proposed development, prepared by a suitably qualified registered engineer that clearly demonstrates how the post-development runoff for the site will be limited to the pre-development scenario and conveyed to a lawful point of discharge in accordance with the requirements of the Queensland Urban Drainage Manual.
- Provide detailed stormwater quality modelling (MUSIC) that demonstrates that the proposed development is able to comply with water quality design objectives outlined in the State Planning Policy (SPP).
- The risk to water quality would be oil contamination from leaks at the transformer and runoff from the proposed impervious area. As per the standard practice, the transformer area should be bunded and drained to a Stormwater Quality Improvement Device (SQID) to intercept any contaminated water. Further details will be required in this regard to demonstrate how the development complies with SPP requirements.

It should be noted that the hydrologic assessment excludes assessment of increased rainfall intensity due to climate change.

2.2 Stormwater Management Strategy Overview

A stormwater management strategy has been developed for the project area which seeks to deliver the compliance standards as follows:

- Stormwater runoff from the Project Area will be collected within new water quality and detention basins adjacent to the early stages of the Project.
- Detention and water quality basins will drain to an existing pipe network that lies to the east of the Power Station cooling towers and discharge via the existing Northern Stormwater Dam and legal point of discharge
- Detention storages will attenuate runoff from the Project Area and preserve peak flows within the existing pipe network for the 5% Annual Exceedance Probability (AEP) and preserve peak 1% AEP flows along the flow path discharging to the Northern Stormwater Dam
- Bioretention / biofiltration will treat stormwater runoff to achieve the generic pollution reduction targets for runoff from the Project Area prior to runoff entering the existing pipe network.
- Sufficient basin storage will be provided to support the delivery of the Project in stages with capacity for the initial stages and ultimate development. The detention strategy provides flexibility to accommodate the detailed drainage layout and grading by providing the option to consolidate detention and water quality within a single basin or to distribute the detention and water quality across two areas.

2.3 Stormwater Quantity Management

The Project Area is located within a larger catchment area that currently reports to the Southern Stormwater Dam (see Figure 5) but is proposed to be regraded to drain towards the east and connect to an existing pit and pipe network shown in Figure 5. Pipes shown discharge to the Northern Stormwater Dam and the legal point of discharge.

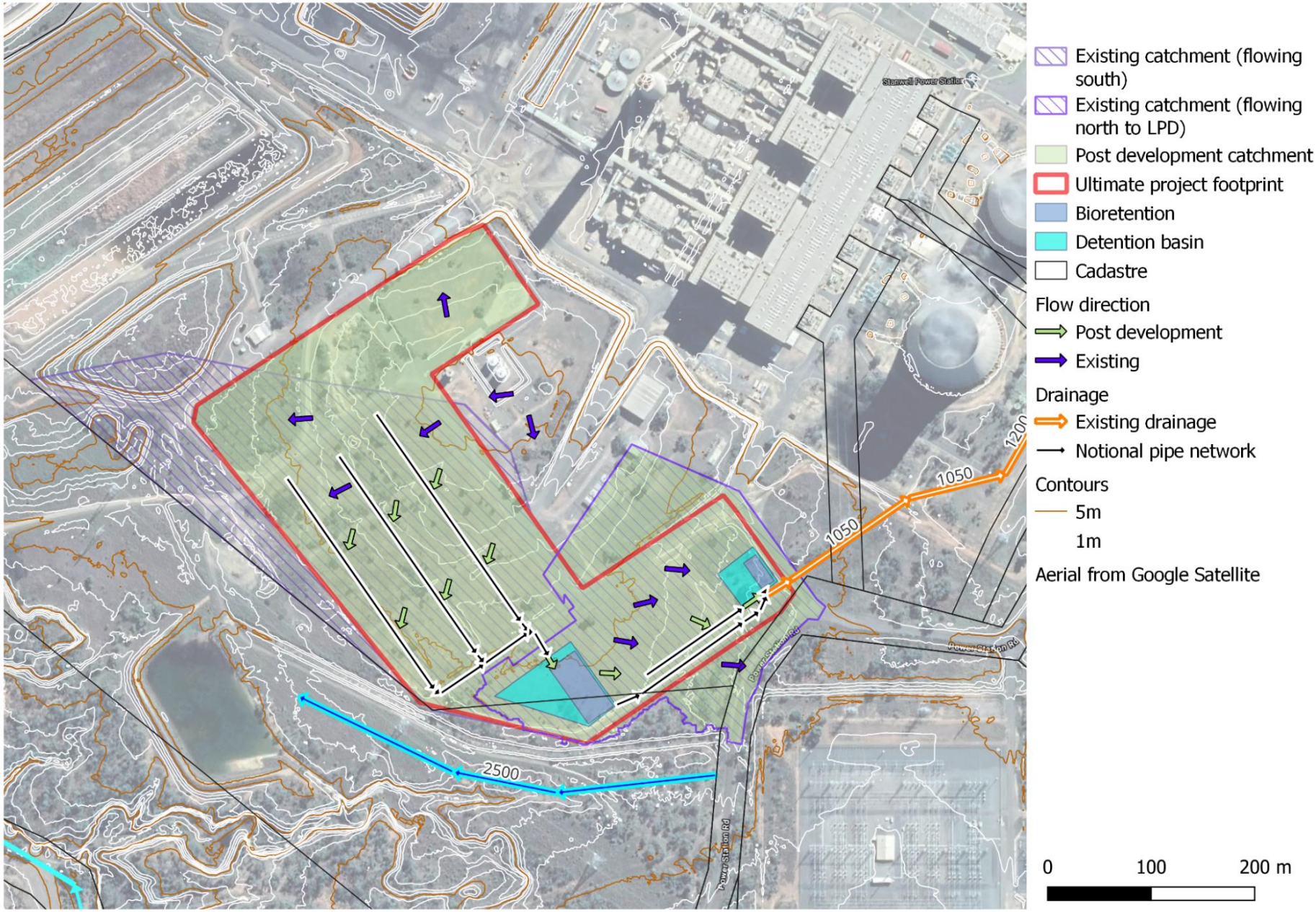


Figure 5 Catchment Boundaries – Contributing catchment flowing north to Northern Stormwater Dam (LPD) vs catchment flowing to Southern Stormwater Dam

The pre and post development flows within the existing pit and pipe network was assessed using the DRAINS software. Site drainage plans were provided for the site which form the basis of the hydraulic model geometry. No survey or site verification was undertaken that the drains shown in the plans were constructed as shown on the plans.

As shown in Figure 5, it is worth noting that under ultimate development conditions, the Project Area would increase the existing catchment to existing stormwater network by 8.79ha. Table 1 compares the pre and ultimate development catchments, noting that Stage 1 accounts for approximately 3.57 Ha of the catchment area.

Table 1 Pre and Post Development Catchment Comparison at the existing pipe network

	Pre-Development	Post-Development (Ultimate)
Total Catchment (ha)	5.47	14.26 (including detention basin area)
% Imperviousness	11	70 (Including basins)

2.3.1 Hydrology

The Project Site coordinates (23.513S, 150.316E) were used to obtain the Australian Rainfall and Runoff (ARR 2016) temporal patterns and IFD data from BoM. The temporal patterns and IFD depths (see Table 2) were then utilised in developing the ILSAX hydrological model in DRAINS.

Table 2 IFD Rainfall Depth *(Source: BoM)*

Duration (mins)	Annual Exceedance Probability (AEP)						
	63.2%	**50%**	**20%**	**10%**	**5%**	**2%**	**1%**
5	9.34	10.3	13.6	15.8	17.9	20.8	23.1
10	15.6	17.2	22.5	26.1	29.7	34.6	38.4
15	20.0	22.1	28.8	33.5	38.2	44.5	49.4
20	23.3	25.7	33.6	39.1	44.6	52.0	57.7
25	25.9	28.6	37.4	43.5	49.7	58.0	64.4
30	28.0	31.0	40.6	47.2	53.9	62.9	70.0
45	32.7	36.2	47.6	55.5	63.5	74.2	82.7
60	35.9	39.8	52.5	61.4	70.3	82.5	92.0
90	40.3	44.8	59.6	69.9	80.3	94.6	106
120	43.4	48.4	64.7	76.3	87.9	104	117
180	47.8	53.6	72.5	86.0	99.7	119	134

It should be noted that the hydrologic assessment excludes assessment of increased rainfall intensity due to climate change.

Times of concentration have been adopted as 6 minutes and 12 minutes for paved and unpaved areas respectively.

Table 3 shows the ILSAX hydrological model parameters adopted in the DRAINS model. Time of concentration assumptions are shown in Table 4.

Table 3 ILSAX Hydrological Model Parameters

Paved (impervious) area depression storage (mm)	**1**
Supplementary area depression storage (mm)	1
Grassed (pervious) area depression storage (mm)	5
Soil Type	3 (slow infiltration rates)

Table 4 Time of concentration

Time of concentration	
Grassed catchment	12 minutes
Paved catchment	6 minutes

2.3.2 Hydraulic Modelling

Pre Development

The combined hydrology and hydraulics of the existing pit and pipe network was assessed using DRAINS software. Site drainage plans were provided for the site which form the basis of the hydraulic model geometry. No survey or site verification was undertaken that the drains shown in the plans were constructed as shown on the plans.

Predevelopment hydraulic grades in the pipeline for the 5% AEP flow are provided in Appendix B. Note that free outlet conditions were adopted in this assessment due to the grades of the site downstream and limited scope of this assessment. Further refinement of the pipe hydraulics will be required during detailed design.

Hydraulic modelling shows high velocities develop within sections of the existing pipe network. It is not proposed to alter the network function to reduce these velocities but it is noted that they may result in reduced pipe life span.

Post Development

In order to attenuate increased post development flows (due to increased catchment and increased imperviousness), DRAINS modelling of proposed detention basins has been carried out to demonstrate that the site can provide sufficient storages within the available detention storage area to attenuate discharge in the downstream network such that pipe flows and overland flow is preserved in the 5% and 1% AEP events.

DRAINS modelling of the existing pipe network shows that a small amount of overland flow (0.01m^3/s) may result in a 5% AEP event. The drainage networks has capacity to convey 5% AEP flows from the existing catchment.

A long section from the post development DRAINS model is shown in Appendix B for the 5% AEP event. This shows that the pipe network can accommodate the increased catchment with detention while maintaining a hydraulic grade line.

Note that free outlet conditions were adopted in this assessment due to the grades of the site downstream and limited scope of this assessment. Further refinement of the pipe hydraulics will be required during detailed design. However, this assessment provides an indication that the detention arrangement is sufficient and can be optimised to ensure no change to pipe performance.

2.3.3 Pre and Post Development Flow Comparison

DRAINS modelling of the proposed stormwater management strategy shows that the detention storages will attenuate runoff from the Project Area and preserve peak flows within the existing pipe network for the 5% AEP and preserve peak 1% AEP flows along the flow path discharging to the Northern Stormwater Dam.

While the peak 1% AEP flow is shown to be maintained, it is likely that the overland flow from the basin may be concentrated and require the design of flow spreaders and swales to safely convey overland flows to the Norther Stormwater Dam. DRAINS modelling shows a wide flow width which can be contained within drainage swales during detailed design.

This modelling demonstrates that the drainage modifications are unlikely to alter the existing flood behaviour shown between the cooling towers and Power Station Road in flood mapping presented in Section 1.1.3 above.

A summary of detention basin hydraulics and a comparison of the existing upstream pipe performance is provided in Table 5 below.

Table 5 Pre and Post development drainage function

Annual Exceedence Probability	Detention Volume (cubic.m)	Notional Detention Depth (m)	Pipe outlet discharge (m^3/s)	Spillway outlet discharge (m^3/s)	Downstream Discharge in Network (m^3/s)	Target Discharge in Network (m^3/s)
5% AEP	3,700	0.75	2.0	0	Pipe – 2.0 Overland – 0.01	Pipe – 1.9 Overland – 0.02
1% AEP	5,700	1.2	1.43	0.32	Pipe - 2.2 Overland - 0.01	Pipe – 2.6 Overland – 0.3

2.4 Stormwater Quality Management

In accordance with the Urban Stormwater – Queensland Best Practice Environmental Management Guidelines (2009), the pollutant load reductions targets for Central Coast (South), where the Project Site is located, are shown in Table 6.

Table 6 Pollutant Load Reduction Targets for Central Coast (South)

Pollutant Type	Percentage Load Reduction (%)
Total Suspended Solids (TSS)	85
Total Phosphorus (TP)	70
Total Nitrogen (TN)	45
Gross Pollutants (GP)	90

The water quality modelling has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software.

As the detailed internal layout within the Project Area is yet to be finalised, it is assumed that all runoff from the Project Site will be treated within bioretention basins (see Figure 6) co-located within detention basins.

The feasibility of providing biofiltration has been checked by comparing the level change between the existing stormwater network and the proposed finished surface levels within the Project Area. The level change shows that sufficient vertical capacity to create biofiltration that can drain freely to the downstream existing pipe invert within the base of the flood detention basin.

Bioretention systems operate by filtering pollutants from runoff through a soil media prior to discharge. There is an opportunity to provide water quality treatment swales within the Project Area.

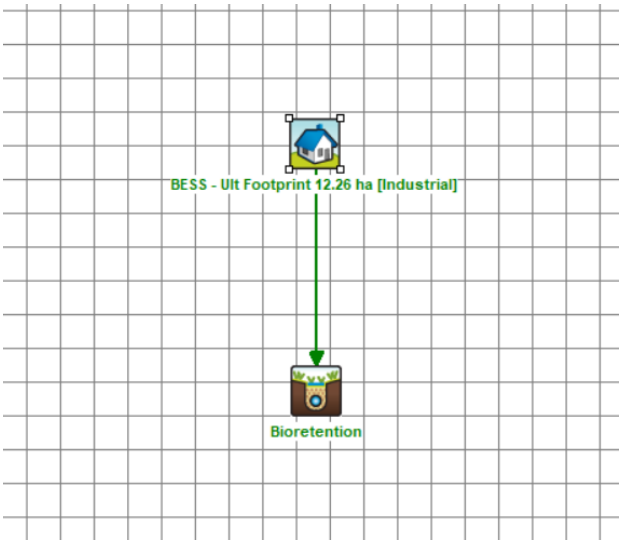


Figure 6 MUSIC Model Schematic

2.4.1 Meteorological Data

The Rockhampton Aero weather station (Site number: 039083) reports the local annual rainfall average is 799 mm. A 6-minute continuous rainfall record was selected as summarised in Table 7 summarises the rainfall data adopted in the MUSIC model. The average rainfall in the record adopted provides a reasonable basis for the climate in Rockhampton.

Table 7 Rainfall Data Adopted in MUSIC Model

Gauge Station	Rockhampton
Period	1/1/1990 to 31/12/1999
Time Step	6 minutes
Average annual rainfall	737 mm
Evapo-transpiration	1701 mm

Potential Evapotranspiration (PET) data was obtained from the Bureau of Meteorology (BoM) website and is summarised in Table 8.

Table 8 Potential Evapotranspiration Data *(Source: BoM)*

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PET (mm)	195	150	165	120	90	75	75	90	120	165	180	195

2.4.2 Source Node Parameters

The Project Site has been modelled as Industrial land use and the lumped catchment approach is adopted. Total imperviousness for the site has been adopted as 80% which assumes unpaved areas arounds the batteries and road verges. The rainfall runoff and pollutant load parameters are in accordance with Whitsunday Region parameters published by Water by Design MUSIC Modelling Guidelines (2018) and are summarised in Table 9 and Table 10.

Table 9 Rainfall Runoff Parameters

Parameter	Value
Rainfall Threshold	1 mm/day
Soil Storage Capacity	100 mm
Initial Storage	30%
Field Capacity	100 mm
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Coefficient – b	1
Initial Depth	10 mm
Parameter	Value
Rainfall Threshold	1 mm/day
Soil Storage Capacity	100 mm

Table 10 Pollutant Load Parameters

Flow Type	TSS Log^{10} Values		TP Log^{10} Values		TN Log^{10} Values	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Baseflow	0.78	0.45	-1.11	0.48	0.14	0.20
Stormflow	1.92	0.44	-0.59	0.36	0.25	0.32

2.4.3 Treatment Node Parameters

Table 11 summarises the bioretention basin parameters adopted in the MUSIC model.

Table 11 Bioretention Basin Parameters

Parameters	Values
Stage 1 Surface Area and Filter Area	555 m^2 and 555 m^2

Parameters	Values
Ultimate Development Surface Area and Filter Area	1,600 m^2 and 1,600 m^2
Extended Detention Depth	0.3 m
Saturated Hydraulic Conductivity	200 mm/h
Filter Depth	0.5 m
TN Content of Filter Media	400 mg/kg
Orthophosphate Content of Filter Media	30 mg/kg
Is Base Lined?	Yes
Unlined Filter Media Perimeter	0.01
Exfiltration Rate	0 mm/h
Vegetation Properties	Vegetated with Effective Nutrient Removal Plants
Overflow Weir Width	2 m
Underdrain Present?	Yes
Submerged Zone with Carbon Present?	No
Submerged Zone Depth	N/A

Note: Water by Design recommends sensitivity using 50mm/hr. This is only to provide a picture if the media is partially blocked but not required performance evaluation.

2.4.4 MUSIC Modelling Results

Results of the MUSIC modelling for treatment train effectiveness for Stage 1 is summarised in Table 12. Table 13 presents the performance of the basin under ultimate development conditions.

Table 12 Stage 1 MUSIC Modelling Results

Pollutant	Source (kg/yr)	Residual Load (kg/yr)	% Reduction Achieved	% Reduction Targets
Total Suspended Solids	3,329	391	87	85
Total Phosphorus	9	2	79	70
Total Nitrogen	56	24	56	45
Gross Pollutants	592	0	100	90

Table 13 Ultimate Development MUSIC Modelling Results

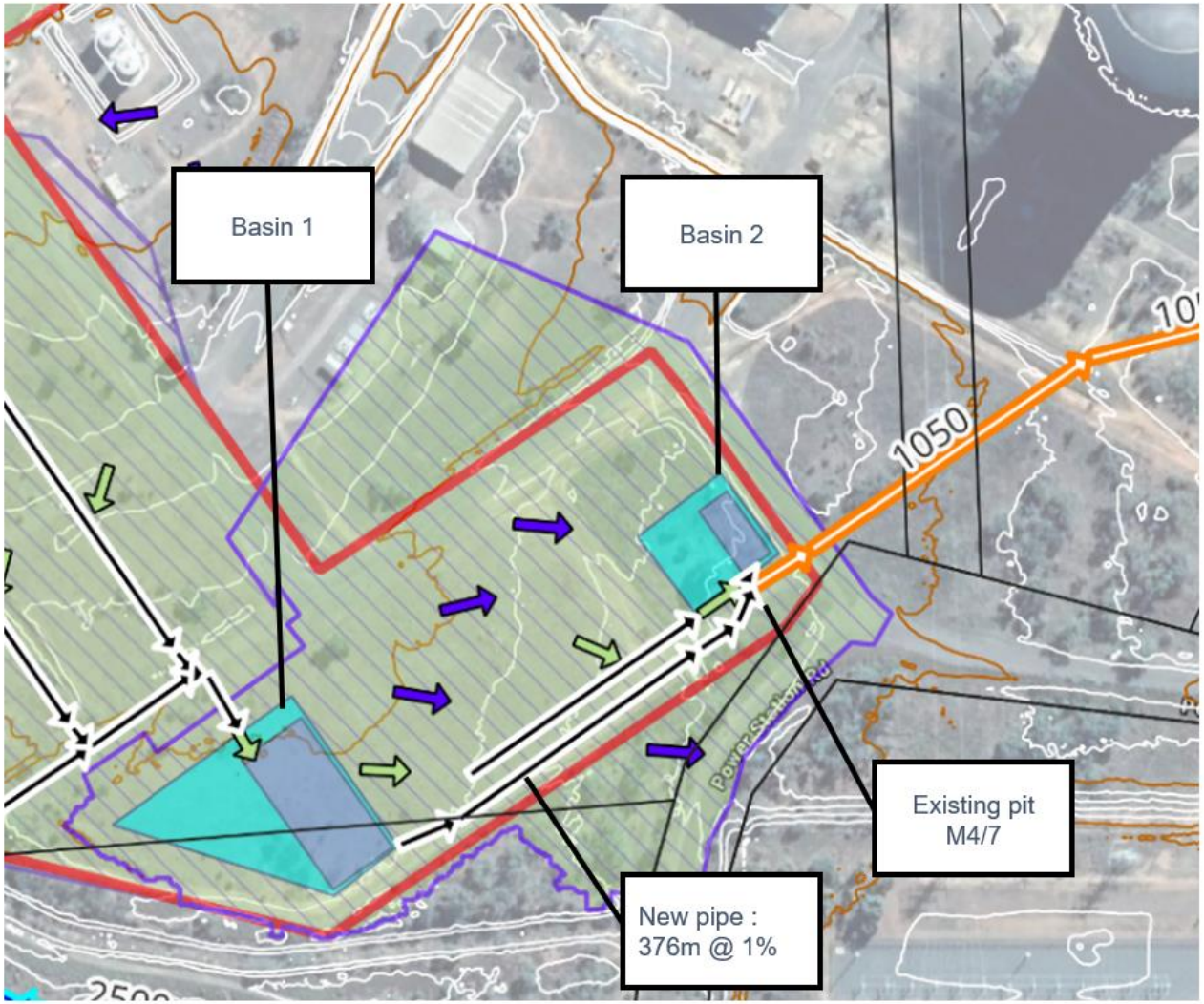
Pollutant	Source (kg/yr)	Residual Load (kg/yr)	% Reduction Achieved	% Reduction Targets
Total Suspended Solids	9,620	1,130	88.2	85
Total Phosphorus	25	4.7	81.2	70
Total Nitrogen	161	68.5	57.5	45
Gross Pollutants	1,710	0	100	90

Sensitivity testing shows that if the biofiltration media is partially blocked, then the stormwater targets are not achieved. Therefore, maintaining plant health will be critical to achieving the pollution reduction targets. This is addressed in the risk register in Appendix A.

. .

3 Implementation

A general arrangement and indicative levels have been provided to assist in the implementation of the future design stages. These are provided in Figure 7 .



Basin 1 Levels
Existing ground surface : 69.6 mAHD
Finished surface pad level : 71.1 mAHD

Existing pit invert level (Pit M4/7) : 65.0 mAHD
New pipe : 376m @ 1%
Upstream pipe invert : 68.76 mAHD

Under side of biofiltration filter media : 68.96 mAHD
Filter media surface (500mm layer) : 69.46 mAHD
EDD level (300mm) : 69.76 mAHD

1% AEP flood level (900mm deep) : 70.6 mAHD

Level change between BES pad level and EDD - 1.2m (MIN)
Freeboard to finished surface pad level : 500mm

Basin 2 Levels
Existing ground surface : 67.6 mAHD
Finished surface pad level : 69.2 mAHD

Existing pit invert level (Pit M4/7) : 65.0 mAHD

Under side of biofiltration filter media : 65.2 mAHD
Filter media surface (500mm layer) : 65.7 mAHD
EDD level (300mm) : 66.0 mAHD

1% AEP flood level (900mm deep) : 66.9 mAHD

Minimum finished surface pad level - 67.4m (MIN)
Freeboard to finished surface pad level : 500mm

Figure 7 General arrangement and notional levels

4 Findings and Recommendations

This concept stormwater management plan has assessed the hydrology and hydraulics of the Project Site for pre and post development scenarios and investigated stormwater quality treatment devices to meet the pollutant removal targets.

The following stormwater management measures are recommended:

The existing drainage network to the east of the cooling towers has capacity to convey the vast majority of the 5% AEP peak flow with a small amount of overland flow (0.01 m^3/s) potentially occurring within the undeveloped section of the site that lies between the cooling towers and Power Station Road. Flood mapping overlays show this area to be flood affected under existing conditions.

For the Ultimate Development scenario, it is proposed to capture stormwater and create detention storage and biofiltration treatment at the southern corner of the Project Area and connect drainage to this existing pipe network without affecting the pipe network and overland flow path performance.

This will reduce the overall catchment area reporting to the Southern site boundary and increase the catchment area reporting to the Northern Stormwater Dam and Legal Point of Discharge without increasing pipe or overland flow path peak flows.

Detention storages will discharge via a new pipe connection to be constructed as part of the detention basin. This pipe will connect to the existing pit and 1050mm reinforced concrete pipe which forms the upstream end of the stormwater drainage network passing along the southeastern side of the cooling towers and towards the Northern Stormwater Dam and Legal Point of Discharge.

- Modelling shows that a notional flood detention volume of 5,700 m^3 is required to ensure the Ultimate Development causes no increase in peak 5% and 1% AEP flows in the pipe and overland flow paths respectively. This detention volume could be consolidated into a single basin (average depth 0.8m) at the southern site corner, or may be provided in two separate locations to accommodate an earthworks design that drains towards the south and north east of the transformer area.
- Hydraulic modelling of the drainage network in DRAINS shows that the existing level of service provided by the stormwater network would be preserved, resulting in no additional overland flow in a 5% or 1% AEP event. This modelling demonstrates that the drainage modifications are unlikely to alter the existing flood behaviour shown between the cooling towers and Power Station Road in flood mapping presented in Section 1.1.3 above.
- While the peak 1% AEP flow is shown to be maintained, it is likely that the overland flow from the basin may be concentrated and require the design of flow spreaders and swales to safely convey overland flows to the Norther Stormwater Dam.
- Detention basin outlets should include a pipe discharge and spillway. The spillway should only be engaged in events exceeding the 5% AEP flow.
- Peak flows in the downstream overland flow path are shown to be maintained however further consideration should be given to concentrated flows leaving the basin spillway and the need for level spreaders and drainage swales to ensure that overland flows are conveyed to the Northern Stormwater Dam as per current flow arrangement.

The feasibility of providing biofiltration has shown that there is significant level change between the existing stormwater network and the proposed finished surface levels within the Project Area. This allows for the creation of biofiltration basins

- MUSIC modelling has been undertaken to show that the water quality load reduction targets can be achieved by providing biofiltration within the flood detention storages.
- The delivery of this stormwater detention storage and biofiltration basin area could also be staged.

The detailed internal layout within the Project Area is yet to be finalised. The following should be considered as part of the design within the Project Area

New pipes discharging to the biofiltration arrangement outlined above must accommodate the extended detention depth, filter layer and drainage media while maintaining free outlet conditions in the downstream, existing pipe network.

- Biofiltration should be provided with maintenance access to assist with regular maintenance of the filter surface area

New pipes discharging to the detention basins must consider the impact of tailwater levels induced by the detention basins. Modelling presented above limits the 1% AEP depths to less than 1m average to facilitate drainage design.

- Detailed design of detention basin outlets should consider the management of concentrated flows downstream of the basin and where necessary, this should include formalised swale drainage to safely convey overland flow to the downstream Northern Storage Dam in a way that does not increase erosion or vegetation loss.

Detention basin pipe outlets would be designed to accommodate the preferred detention storage arrangement, whether that be a single detention basin or multiple basins.

The following additional items are noted:

- All transformers to be installed by the project (including main power transformer and BESS step up transformers) will be installed with facilities to contain the total volume of insulating liquid within the transformers. In the case of the main power transformers, where these bunds will be outdoors, subject to prevailing weather conditions and likely to accumulate rain water, an oil water treatment or containment system will be installed to ensure that no discharge of contaminated water to the surrounding environment occurs.

Appendix A – Risk Register

Table 14. Risk register

Risk Register	Mitigation
DA design is not informed by survey	During detailed design, update hydraulic model with any additional survey detail
Hydrologic assessment excludes assessment of increased rainfall intensity due to climate change.	During detailed design, include sensitivity testing using climate change rainfall IFD parameters which will affect the pipe capacity, pipe size and surcharge. During detailed design, ensure additional capacity is provided downstream of surcharging pits
Biofiltration media specified has a high saturated hydraulic conductivity, which is subject to reduced performance should filter media becomes partially blocked	Ensure adequate means for maintenance and ensure plant health. As part of detailed design the basin shall include: Access tracks to improve maintenance operations A mix of drought tolerant plant species Saturated zone of 400mm to preserve water within the base to assist plants during dry spells be accompanied by a monitoring and maintenance plan.
High velocities in existing pipe	Note potential impacts on asset life. Consider future potential to relay this pipe during detailed design once modelling has been updated with surveyed pit and pipe details.

Appendix B – DRAINS Modelling

Long sections

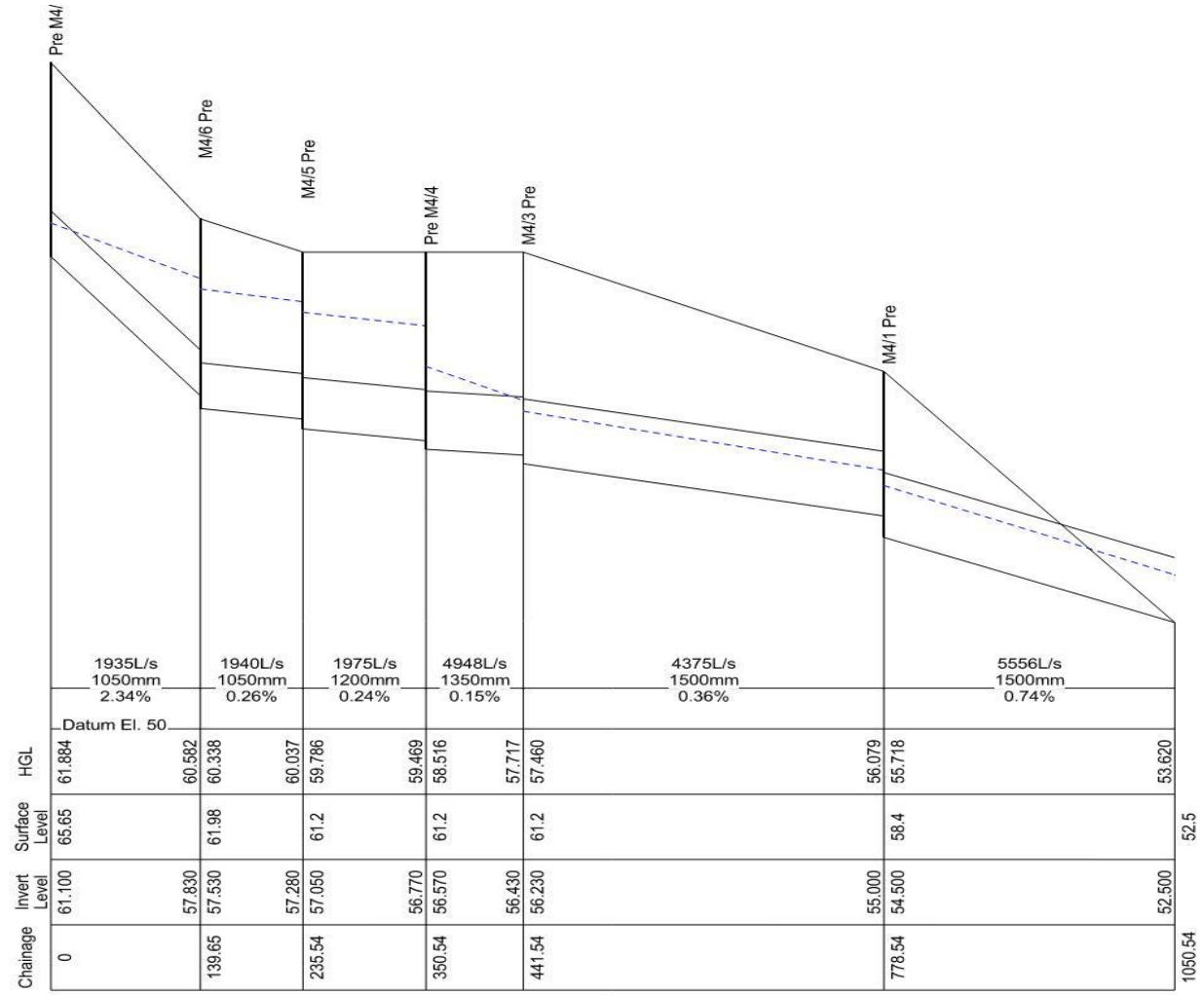


Figure 8 DRAINS long section of existing drainage network during a 5% AEP storm event

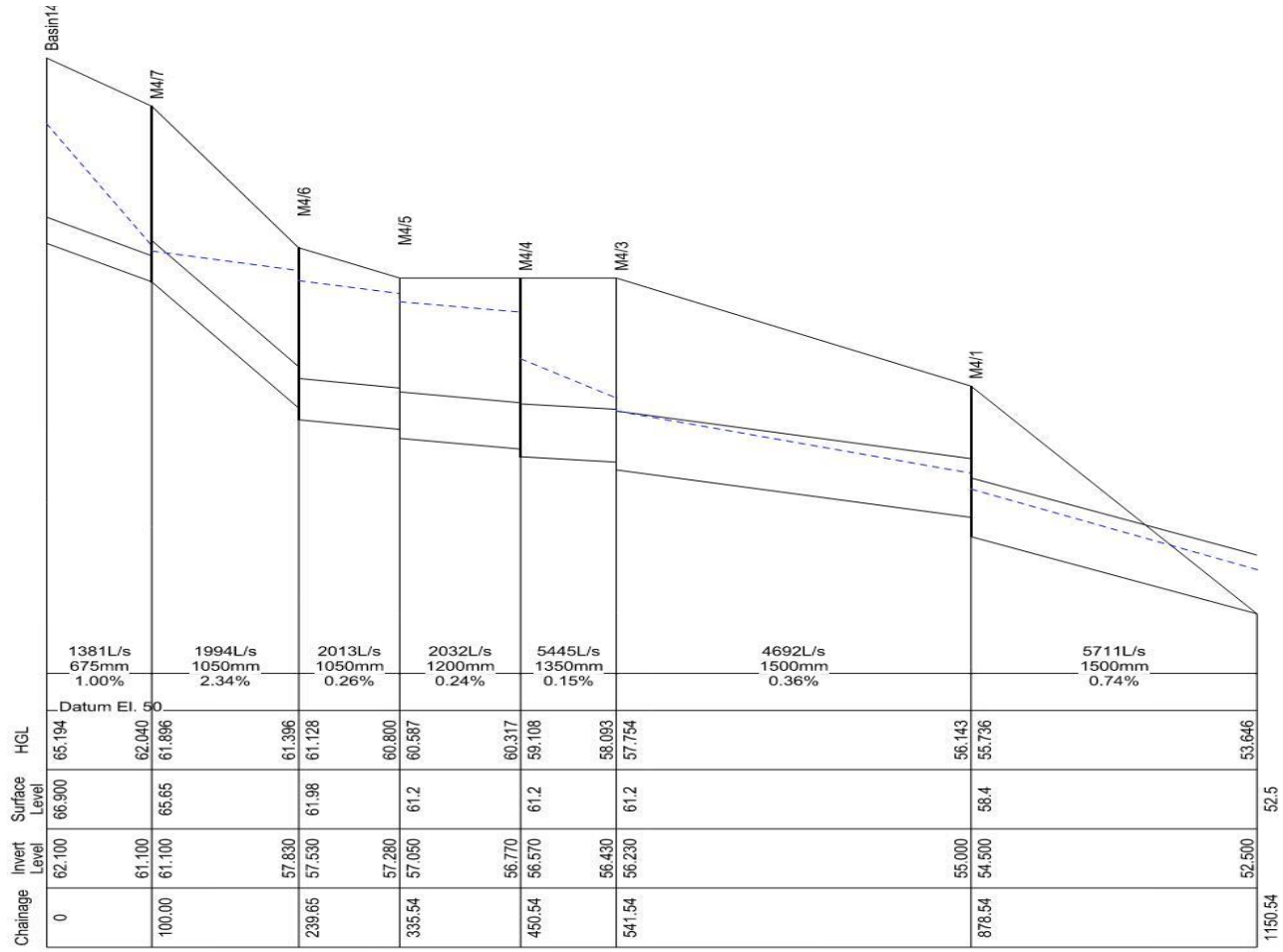


Figure 9 DRAINS long section of proposed drainage network during a 5% AEP storm event

Existing Drainage Network

Modelling Node Details

PIT / NODE DETAILS			Version 15														
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		Width
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)
Pre M4/7	OnGrade	Dummy	Dummy		1.5	65.65		0	0	436.513	-236.014	No	4938560	1 x Ku	No	New	
M4/6 Pre	OnGrade	Dummy	Dummy		1.5	61.98		0	0	456.944	-235.568	Yes	4938593	1 x Ku	No	New	
M4/5 Pre	OnGrade	Dummy	Dummy		1.5	61.2		0	0	476.391	-235.507	Yes	4938588	1 x Ku	No	New	
Pre M4/4	OnGrade	Dummy	Dummy		1.5	61.2		0	0	492.622	-235.655	No	4938561	1 x Ku	No	New	
M4/3 Pre	OnGrade	Dummy	Dummy		1.5	61.2		0	0	508.397	-235.655	Yes	4938578	1 x Ku	No	New	
M4/1 Pre	OnGrade	Dummy	Dummy		1.5	58.4		0	0	538.871	-235.297	No	4938562	1 x Ku	No	New	
Outlet Pre	Node					52.5		0		570.601	-234.938		4938567		No		
DETENTION BASIN DETAILS																	
Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id		
SUB-CATCHMENT DETAILS																	
Name	Pit or	Total	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp
	Node	Area	Area	Area	Area	Time	Time	Time	Length	Length	Length	Slope(%)	Slope	Slope	Rough	Rough	Rough
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%			
Pre-dev	Pre M4/7	5.471	11	89	0	5	12	30									
Cooling Towers Pre	Pre M4/4	6.628	100	0	0	5	12	30									
External Pre	M4/1 Pre	2.966	80	20	0	5	12	1									
PIPE DETAILS																	
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)
P7890	Pre M4/7	M4/6 Pre	139.65	61.1	57.83	2.34	Concrete, under roads, 1% minimum slope	1050	1070	0.013	Existing	1	Pre M4/7	0			
P7888	M4/6 Pre	M4/5 Pre	95.89	57.53	57.28	0.26	Concrete, under roads, 0.5% minimum slope	1050	1070	0.013	Existing	1	M4/6 Pre	0			
P7886	M4/5 Pre	Pre M4/4	115	57.05	56.77	0.24	Concrete, under roads, 0.5% minimum slope	1200	1200	0.013	Existing	1	M4/5 Pre	0			
P7884	Pre M4/4	M4/3 Pre	91	56.57	56.43	0.15	Concrete, under roads, 0.5% minimum slope	1350	1370	0.013	Existing	1	Pre M4/4	0			
P7880	M4/3 Pre	M4/1 Pre	337	56.23	55	0.36	Concrete, under roads, 0.5% minimum slope	1500	1524	0.013	Existing	1	M4/3 Pre	0			
P7877	M4/1 Pre	Outlet Pre	272	54.5	52.5	0.74	Concrete, under roads, 0.5% minimum slope	1500	1524	0.013	Existing	1	M4/1 Pre	0			
DETAILS of SERVICES CROSSING PIPES																	
Pipe	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	etc							
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc							
CHANNEL DETAILS																	
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed				
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)					
OVERFLOW ROUTE DETAILS																	
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id	U/S IL	D/S IL	Length (m)
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing					
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%					
OF18039	Pre M4/7	Pre M4/4	0.5				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	10	0		4938603	75	65	100
OF18036	Pre M4/4	M4/1 Pre	0.6				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	5	0		4938586	65	60	100
OF18034	M4/1 Pre	Outlet Pre	0.5				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	7.5	0		4938569	60	52.5	100

PIPE COVER DETAILS																		
Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)														
P7890	Concrete, under roads, 1% minimum slope	1070	0.6	2.99														
P7888	Concrete, under roads, 0.5% minimum slope	1070	0.6	2.77														
P7886	Concrete, under roads, 0.5% minimum slope	1200	0.6	2.86														
P7884	Concrete, under roads, 0.5% minimum slope	1370	0.6	3.17														
P7880	Concrete, under roads, 0.5% minimum slope	1524	0.6	1.77														
P7877	Concrete, under roads, 0.5% minimum slope	1524	0.6	-1.63	Unsafe													

Existing Drainage Network Results – 5% AEP storm event

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pre M4/7	62.02		2.243		3.63	0.02	Inlet Capacity	
M4/6 Pre	60.58		0		1.4		None	
M4/5 Pre	59.92		0		1.28		None	
Pre M4/4	59.39		4.767		1.81	0.037	Inlet Capacity	
M4/3 Pre	57.7		0		3.5		None	
M4/1 Pre	55.9		2.284		2.5	0.015	Inlet Capacity	
Outlet Pre	53.61		0.363					
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
	Flow Q	Max Q	Max Q	Tc	Tc	Tc		
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)		
Pre-dev	1.958	0.267	1.691	5	12	30	5% AEP, 15 min burst, Storm 5	
Cooling Towers Pre	3.734	3.734	0	5	12	30	5% AEP, 5 min burst, Storm 1	
External Pre	1.448	1.362	0.191	5	12	1	5% AEP, 15 min burst, Storm 3	
PIPE DETAILS								
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm			
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)				
P7890	1.935	2.74	61.884	60.576	5% AEP, 15 min burst, Storm 5			
P7888	1.94	2.16	60.283	59.924	5% AEP, 15 min burst, Storm 5			
P7886	1.975	1.75	59.688	59.39	5% AEP, 15 min burst, Storm 5			
P7884	5.056	3.54	58.473	57.703	5% AEP, 20 min burst, Storm 6			
P7880	4.369	3.17	57.459	56.078	5% AEP, 15 min burst, Storm 5			
P7877	5.57	3.87	55.72	53.623	5% AEP, 15 min burst, Storm 7			
CHANNEL DETAILS								

Name	Max Q	Max V			Due to Storm			
	(cu.m/s)	(m/s)						
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF18039	0.02	0.02	0.514	0.042	0.08	0.52	1.94	5% AEP, 15 min burst, Storm 5
OF18036	0.037	0.037	0.687	0.058	0.1	1.05	1.67	5% AEP, 5 min burst, Storm 1
OF18034	0.015	0.015	0.576	0.04	0.06	0.47	1.6	5% AEP, 15 min burst, Storm 3
DETENTION BASIN DETAILS								
Name	Max WL	MaxVol	Max Q	Max Q	Max Q			
			Total	Low Level	High Level			
Run Log for 240408 Post and Pre Spillway run at 12:14:48 on 16/4/2024 using version 2022.012								
No water upwelling from any pit. Freeboard was adequate at all pits.								
Flows were safe in all overflow routes.								

Existing Drainage Network Results – 1% AEP storm event

DRAINS results prepared from Version 2022.012								
PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
Pre M4/7	65.4		2.975		0.25	0.027	Inlet Capacity	
M4/6 Pre	63.66		0		0		Outlet System	
M4/5 Pre	62.19		0		0		Outlet System	
Pre M4/4	61.19		5.72		0.01	2.754	Inlet Capacity	
M4/3 Pre	60.06		0		1.14		None	
M4/1 Pre	58.39		7.709		0.01	1.423	Inlet Capacity	
Outlet Pre	53.89		4.539					
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
	Flow Q	Max Q	Max Q	Tc	Tc	Tc		
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)		
Pre-dev	2.663	0.346	2.317	5	12	30	1% AEP, 15 min burst, Storm 6	
Cooling Towers Pre	4.883	4.883	0	5	12	30	1% AEP, 5 min burst, Storm 1	
External Pre	1.875	1.748	0.127	5	12	1	1% AEP, 5 min burst, Storm 1	
PIPE DETAILS								
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm			
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)				
P7890	2.633	2.93	64.777	63.656	1% AEP, 15 min burst, Storm 6			
P7888	2.634	2.93	62.997	62.187	1% AEP, 15 min burst, Storm 6			
P7886	2.635	2.33	61.748	61.193	1% AEP, 15 min burst, Storm 6			
P7884	6.474	4.39	60.579	60.064	1% AEP, 15 min burst, Storm 4			
P7880	5.578	3.06	59.61	58.388	1% AEP, 15 min burst, Storm 9			
P7877	7.837	4.49	56.971	53.892	1% AEP, 15 min burst, Storm 6			

CHANNEL DETAILS								
Name	Max Q	Max V			Due to Storm			
	(cu.m/s)	(m/s)						
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF18039	0.027	0.027	0.514	0.046	0.1	0.67	2.08	1% AEP, 15 min burst, Storm 6
OF18036	2.754	2.754	0.717	0.232	0.91	6.4	3.91	1% AEP, 15 min burst, Storm 6
OF18034	1.423	1.423	0.576	0.178	0.64	5.04	3.63	1% AEP, 10 min burst, Storm 6
DETENTION BASIN DETAILS								
Name	Max WL	MaxVol	Max Q	Max Q	Max Q			
			Total	Low Level	High Level			
Run Log for 240408 Post and Pre Spillway run at 12:19:48 on 16/4/2024 using version 2022.012								
Upwelling occurred at: M4/1 Pre, Pre M4/4								
The maximum flow in these overflow routes is unsafe: OF18036, OF18034								

Proposed Drainage Network

Modelling Node Details

PIT / NODE DETAILS			Version 15															
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow	Pit is	Internal	
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		Width	
				(cu.m)	Coeff. Ku			(cu.m/s)									(mm)	
M4/7	OnGrade	Dummy	Dummy		1.5	65.65		0	0	436.752	-210.74	No	174408	1 x Ku	No	New		
M4/6	OnGrade	Dummy	Dummy		1.5	61.98		0	0	459.036	-210.947	Yes	42266	1 x Ku	No	New		
M4/5	OnGrade	Dummy	Dummy		1.5	61.2		0	0	476.75	-211.128	Yes	534146	1 x Ku	No	New		
M4/4	OnGrade	Dummy	Dummy		1.5	61.2		0	0	494.535	-211.128	No	534150	1 x Ku	No	New		
M4/3	OnGrade	Dummy	Dummy		1.5	61.2		0	0	509.724	-211.224	Yes	534200	1 x Ku	No	New		
M4/1	OnGrade	Dummy	Dummy		1.5	58.4		0	0	539.622	-211.32	No	534255	1 x Ku	No	New		
Outlet	Node					52.5		0		570.77	-211.224		534221		No			
DETENTION BASIN DETAILS																		
Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id			
Basin14578	62.1	4		Culvert	0.5					411.077	-202.636	No			5658176			
	64.8	4																
	64.9	4700																
	66.9	4700																
SUB-CATCHMENT DETAILS																		
Name	Pit or	Total	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	
	Node	Area	Area	Area	Area	Time	Time	Time	Length	Length	Length	Slope(%)	Slope	Slope	Rough	Rough	Rough	
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%				
BESS	Basin14578	12.261	80	20	0	5	12	30										
Cat 1	M4/7	2.004	11	89	0	5	12	30										
Cooling Tower	M4/4	6.628	100	0	0	5	12	30										
External	M4/1	2.966	80	20	0	5	12	1										
PIPE DETAILS																		
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg	
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)	
Pipe9109	Basin14578	M4/7	100	62.1	61.1	1	Concrete, under roads, 1% minimum slope	675	675	0.013	NewFixed	1	Basin14578	0				
Pipe 1050 1	M4/7	M4/6	139.65	61.1	57.83	2.34	Concrete, under roads, 1% minimum slope	1050	1070	0.013	Existing	1	M4/7	0				
Pipe 1050 2	M4/6	M4/5	95.89	57.53	57.28	0.26	Concrete, under roads, 0.5% minimum slope	1050	1070	0.013	Existing	1	M4/6	0				
Pipe 1200	M4/5	M4/4	115	57.05	56.77	0.24	Concrete, under roads, 0.5% minimum slope	1200	1200	0.013	Existing	1	M4/5	0				
Pipe 1350	M4/4	M4/3	91	56.57	56.43	0.15	Concrete, under roads, 0.5% minimum slope	1350	1370	0.013	Existing	1	M4/4	0				
Pipe 1500	M4/3	M4/1	337	56.23	55	0.36	Concrete, under roads, 0.5% minimum slope	1500	1524	0.013	Existing	1	M4/3	0				
Pipe Outlet	M4/1	Outlet	272	54.5	52.5	0.74	Concrete, under roads, 0.5% minimum slope	1500	1524	0.013	Existing	1	M4/1	0				
DETAILS of SERVICES CROSSING PIPES																		
Pipe	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	Chg	Bottom	Height of Service	etc								
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc								
CHANNEL DETAILS																		
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed					
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)						
OVERFLOW ROUTE DETAILS																		
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area		id	U/S IL	D/S IL	Length (m)	
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing						
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%						

PIT / NODE DETAILS			Version 15														
Spillway	Basin14578	M4/7	1.4	65.85	2	1.6	Swale with 1:4 sideslopes	0.45	0.3	1	1	0		5658209	65.85	65.65	100
OF12055	M4/7	M4/4	0.5				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	10	0		968130	75	65	100
OF12056	M4/4	M4/1	0.6				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	5	0		968131	65	60	100
OF12568	M4/1	Outlet	0.5				7.5 m roadway with 3% crossfall and barrier kerb	0.3	0.15	0.4	7.5	0		1405970	60	52.5	100
PIPE COVER DETAILS																	
Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)													
Pipe9109	Concrete, under roads, 1% minimum slope	675	0.6	-0.73	Unsafe												
Pipe 1050 1	Concrete, under roads, 1% minimum slope	1070	0.6	2.99													
Pipe 1050 2	Concrete, under roads, 0.5% minimum slope	1070	0.6	2.77													
Pipe 1200	Concrete, under roads, 0.5% minimum slope	1200	0.6	2.86													
Pipe 1350	Concrete, under roads, 0.5% minimum slope	1370	0.6	3.17													
Pipe 1500	Concrete, under roads, 0.5% minimum slope	1524	0.6	1.77													
Pipe Outlet	Concrete, under roads, 0.5% minimum slope	1524	0.6	-1.63	Unsafe												

Proposed Drainage Network Results – 5% AEP storm event

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
M4/7	62.04		0.821		3.61	0.007	Inlet Capacity	
M4/6	61.37		0		0.61		None	
M4/5	60.8		0		0.4		None	
M4/4	60.43		4.756		0.77	0.037	Inlet Capacity	
M4/3	58.02		0		3.18		None	
M4/1	55.99		2.772		2.41	0.015	Inlet Capacity	
Outlet	53.64		1.13					
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
	Flow Q	Max Q	Max Q	Tc	Tc	Tc		
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)		
BESS	5.988	5.629	0.791	5	12	30	5% AEP, 15 min burst, Storm 3	
Cat 1	0.717	0.098	0.619	5	12	30	5% AEP, 15 min burst, Storm 5	
Cooling Tower	3.734	3.734	0	5	12	30	5% AEP, 5 min burst, Storm 1	
External	1.448	1.362	0.191	5	12	1	5% AEP, 15 min burst, Storm 3	
PIPE DETAILS								
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm			
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)				
Pipe9109	1.38	3.86	65.194	62.04	5% AEP, 45 min burst, Storm 9			
Pipe 1050 1	1.994	2.78	61.896	61.372	5% AEP, 15 min burst, Storm 5			
Pipe 1050 2	2.013	2.24	61.115	60.8	5% AEP, 15 min burst, Storm 5			
Pipe 1200	2.039	1.8	60.637	60.432	5% AEP, 5 min burst, Storm 1			
Pipe 1350	5.482	3.72	59.119	58.019	5% AEP, 5 min burst, Storm 1			
Pipe 1500	4.607	3.24	57.754	56.107	5% AEP, 10 min burst, Storm 6			
Pipe Outlet	5.718	3.88	55.736	53.648	5% AEP, 15 min burst, Storm 7			
CHANNEL DETAILS								
Name	Max Q	Max V			Due to Storm			
	(cu.m/s)	(m/s)						
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Spillway	0	0	0.332	0	0	0	0	
OF12055	0.007	0.007	0.514	0.029	0.04	0.33	1.49	5% AEP, 15 min burst, Storm 5
OF12056	0.037	0.037	0.687	0.058	0.1	1.05	1.66	5% AEP, 5 min burst, Storm 1

OF12568	0.015	0.015	0.576	0.04	0.06	0.47	1.6	5% AEP, 15 min burst, Storm 3
DETENTION BASIN DETAILS								
Name	Max WL	MaxVol	Max Q	Max Q	Max Q			
			Total	Low Level	High Level			
Basin14578	65.64	3642.5	1.38	1.38	0			
Run Log for 240408 Post and Pre Spillway run at 12:27:03 on 16/4/2024 using version 2022.012								
No water upwelling from any pit. Freeboard was adequate at all pits.								
Flows were safe in all overflow routes.								

Proposed Drainage Network Results – 1% AEP storm event

PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint	
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)		
			(cu.m/s)	(cu.m)	(m)			
M4/7	63.56		1.09		2.09	0.01	Inlet Capacity	
M4/6	62.53		0		0		Outlet System	
M4/5	62.3		0		0		Outlet System	
M4/4	61.19		5.489		0.01	2.311	Inlet Capacity	
M4/3	60.09		0		1.11		None	
M4/1	58.39		5.956		0.01	1.383	Inlet Capacity	
Outlet	53.89		3.227					
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
	Flow Q	Max Q	Max Q	Tc	Tc	Tc		
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)		
BESS	7.753	7.226	0.527	5	12	30	1% AEP, 5 min burst, Storm 1	
Cat 1	0.976	0.127	0.849	5	12	30	1% AEP, 15 min burst, Storm 6	
Cooling Tower	4.883	4.883	0	5	12	30	1% AEP, 5 min burst, Storm 1	
External	1.875	1.748	0.127	5	12	1	1% AEP, 5 min burst, Storm 1	
PIPE DETAILS								
Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm			
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)				
Pipe9109	1.433	4	65.754	63.556	1% AEP, 45 min burst, Storm 8			
Pipe 1050 1	2.178	2.42	63.188	62.53	1% AEP, 25 min burst, Storm 4			
Pipe 1050 2	2.225	2.47	62.426	62.299	1% AEP, 15 min burst, Storm 6			
Pipe 1200	2.288	2.02	61.809	61.19	1% AEP, 15 min burst, Storm 9			
Pipe 1350	6.635	4.5	60.592	60.091	1% AEP, 5 min burst, Storm 1			
Pipe 1500	5.559	3.05	59.63	58.389	1% AEP, 10 min burst, Storm 7			
Pipe Outlet	7.821	4.48	56.972	53.891	1% AEP, 10 min burst, Storm 7			
CHANNEL DETAILS								
Name	Max Q	Max V			Due to Storm			
	(cu.m/s)	(m/s)						
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Spillway	0.316	0.316	0.979	0.294	0.27	2.35	0.91	1% AEP, 45 min burst, Storm 6
OF12055	0.01	0.01	0.514	0.032	0.05	0.37	1.63	1% AEP, 15 min burst, Storm 6
OF12056	2.311	2.311	0.717	0.219	0.81	6.08	3.71	1% AEP, 10 min burst, Storm 7
OF12568	1.383	1.383	0.576	0.176	0.63	5	3.6	1% AEP, 10 min burst, Storm 10

DETENTION BASIN DETAILS								
Name	Max WL	MaxVol	Max Q	Max Q	Max Q			
			Total	Low Level	High Level			
Basin14578	66.06	5642.4	1.749	1.433	0.316			
Run Log for 240408 Post and Pre Spillway run at 12:30:36 on 16/4/2024 using version 2022.012								
Upwelling occurred at: M4/1, M4/4								
The maximum flow in these overflow routes is unsafe: OF12568, OF12056								

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ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

5 June 2024

DATE

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

Stanwell BESS FEED

Traffic Impact Assessment

Stanwell Corporation

Reference: 522977

Revision: 0

2024-04-19

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Document control record

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Document control		aurecon				
Report title		Traffic Impact Assessment				
Document code		CRBP-AUR-PMT-GE-RPT-0001	**Project number**		522977	
File path		Https://aurecongroup.sharepoint.com/sites/522977/5_WorkingFiles/14 CREZ General Support/007 DA Amendment/04_Traffic/Stanwell BESS - Updated Traffic Impact Assessment.docx				
Client		Stanwell Corporation				
Client contact		Derek Cameron	**Client reference**		N/A	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
A	2022-10-12	Final	Anjali Sanil Kumar Demi Starick	Ben Simpson	Erin Thomas RPEQ	Ben Vardon
B.01	2024-04-10	Draft – Amended Development Application	Demi Starick	Ben Simpson	Trudy Angrave RPEQ	Mark Griffith
B.02	2024-04-15	Updated draft	Demi Starick	Ben Simpson	Trudy Angrave RPEQ	Mark Griffith
0	2024-04-19	Final	Demi Starick	Ben Simpson	Trudy Angrave RPEQ	Mark Griffith
Current revision		**0**				

Approval			
Author signature		Approver signature	
Name	Demi Starick	Name	Mark Griffith
Title	Traffic Engineer, Integrated Transport and Mobility	Title	Power Generation Practice Leader, Queensland

Contents

Appendices

Figures

Tables

1 Introduction

1.1 Background

An amended Development Permit is currently being sought for a Battery Energy Storage System (BESS) facility development located at 397 and 519 Power Station Road, Stanwell (the Project / the BESS). Once completed, the BESS will be capable of storing and exporting electrical energy to the National Electricity Market (NEM).

The amended Project, proposed as two units for concurrent completion, includes the following elements:

- Unit 1: installation of 162 batteries with an output of 150 MW/600 MWh,
- Unit 2: installation of an additional 162 batteries with an output of 150MW/ 600 MWh.

Together Units 1 & 2 Comprise Stage 1 for a total capacity of 300MW / 1,200MWh

A future Stage 2 would consist of an additional 300MW/1,200 MWh for a total BESS capacity of 600MW / 2,400MWh.

Rockhampton Regional Council (RRC) issued a request for further information on the previous application that was ultimately approved (RFI, Reference D/82-2022) in which they requested "*… a short Traffic Impact Assessment report addressing the impacts of construction traffic generated by the development and how these impacts will be catered by the existing infrastructure, and/or what measures are proposed to ameliorate any impacts.*"

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Stanwell Corporation to prepare an updated Traffic Impact Assessment (TIA) for submission as a part of the Development Permit application for the Project, relating to the construction traffic generated by the development.

This updated revision of the TIA considers updated information provided by Stanwell Corporation in March/April 2024.

1.2 Scope and study area

The scope of this TIA is limited to construction traffic generated by the proposed development and the potential impacts to existing infrastructure and road safety along Power Station Road and associated intersections within the extents of this TIA, as shown in Figure 1 on the following page. The Stanwell Power Station internal road network connectivity with Power Station Road is illustrated in Figure 2 on the following page, highlighting the existing intersection assessed as a part of this TIA. If required, mitigation measures to ease the construction impact will be discussed and recommended in this report.

This TIA focuses on the six (6) week delivery program scheduled for the Unit 1 BESS and Unit 2 BESS which includes the peak construction activity. The future Stage 2 does not have specific timing confirmed and is not included within this TIA.

A TIA was previously prepared by Advisian for a separate hydrogen facility project located within the Stanwell power station, which included assessment of the road impacts under the construction and operational phases. This report references information from this TIA where relevant.

This updated TIA has been developed in accordance with the key principles from the Guide to Traffic Impact Assessment, Transport and Main Roads (GTIA) (dated December 2018) and in response to the Rockhampton Regional Council information request issued pursuant to the previous application (Reference D/82-2022 now approved). It is noted that the GTIA specifically addresses development-related traffic impacts on the broader state-controlled road (SCR) network, and only provides "some guidance on the method to assess localised impacts" (i.e. on local Council roads). The GTIA has however been used as the basis of assessing state-controlled-roads (SCR) and the initial basis for assessing RRC controlled roads for the purposes of this assessment.

Figure 1: Study area (Image excerpt: Queensland Globe)

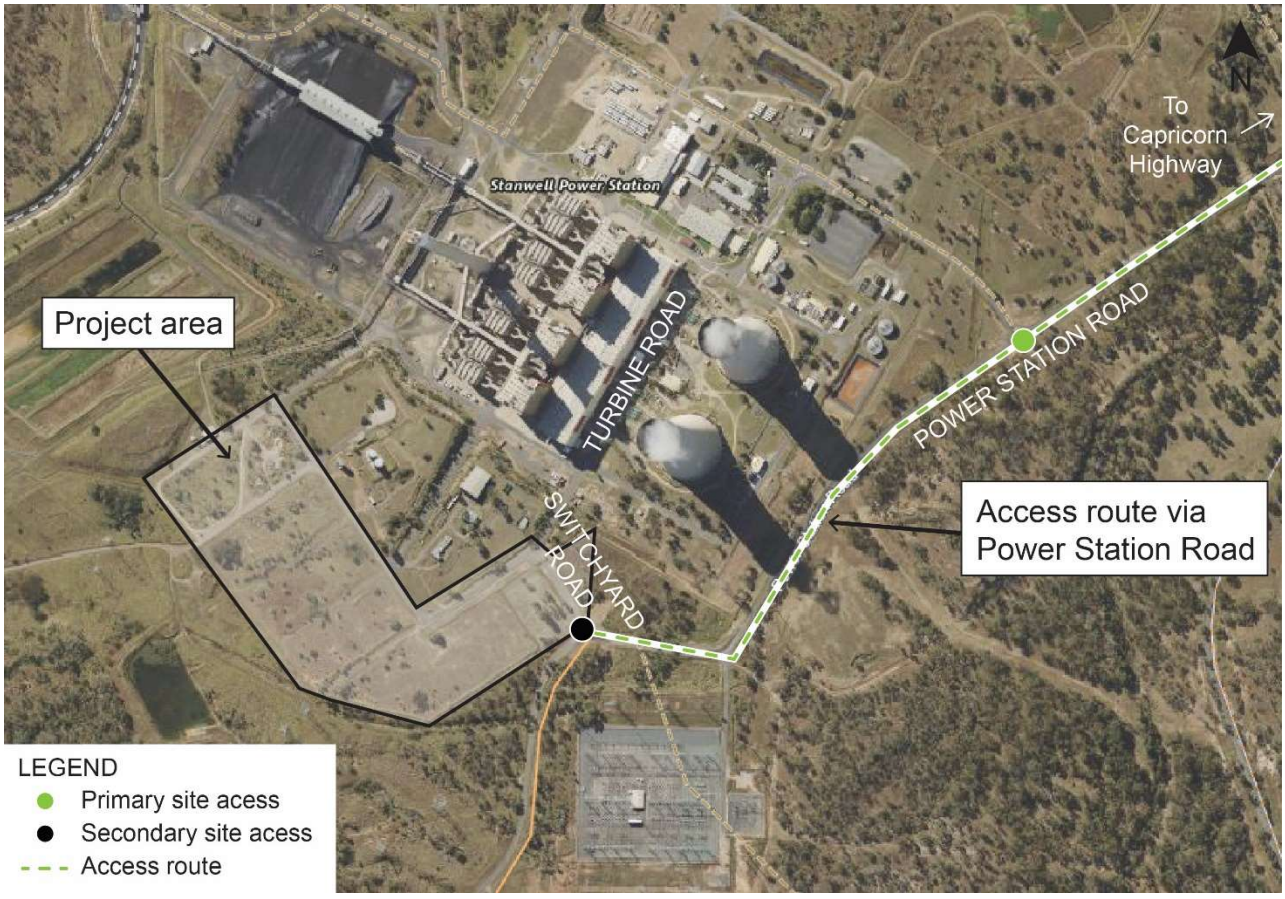


Figure 2: Stanwell Power Station Access Points (Image excerpt: Queensland Globe)

1.3 References

This TIA has been undertaken by referencing the following data sources and documentation:

- AADT Segment Report, 2020 – Area 404 – Fitzroy District, Road Section 16A – CAPRICORN HIGHWAY (ROCKHAMPTON – DUARINGA), Road Segment from 13.367km to 17.856km, Segment Site - 61457 (TMR)
- Central Renewable Energy Zone - Battery Energy Storage System (CREZ BESS) Planning Report (Aurecon, Rev A, 28 April 2022)
- 411001-00029-GE-RPT-0001 Stanwell Hydrogen Pilot Plant Facility Traffic Impact Assessment (Advisian, 9 September 2020)
- Power Station Road Culvert Inspection Technical Memo #2 (Cardno, Rev 1, 23 September 2019)
- Stanwell BESS FEED Logistics Assessment (Aurecon, Rev A, 18 November 2021)
- Queensland Option Data Portal (2022)
- Austroads Guide to Road Design (AGRD) Part 3, 4, and 4A
- Austroads Guide to Traffic Management (AGTM) Part 6
- 275/22kV Substation and BESS Area Site Plan, drawing no. *CRBP-YUR-34000-EL-SKT-0301* (Yurika, 17 January 2024) (Revision B only)
- 275/33kV Substation and BESS Area, drawing no. (Yurika 12 February 2024) (Revision B only):
  - *CRBP-YUR-34000-CI-DRG-1501*
  - *CRBP-YUR-34000-CI-DRG-1503*
  - *CRBP-YUR-34000-CI-DRG-1504*
  - *CRBP-YUR-34000-CI-DRG-1505*
- Other documents and/or guidelines as referenced in this report.

1.4 Disclaimer

The analysis in this report has been prepared with due care but is subject to several assumptions which are outlined in the relevant sections, based upon information available at the time of writing.

The review and assessment are based on information provided to Aurecon by other parties.

Aurecon has not independently verified this information and does not accept responsibility or liability for any inaccuracies or shortcomings in this information.

The review and assessment are provided strictly on the basis that the information that has been provided is accurate, complete, and adequate.

Should these information sources be modified by these third parties, Aurecon assumes no responsibility for any resulting inaccuracies in its information.

The contents of this report must not be relied upon for design, construction, costing or programming purposes.

It is noted the workforce and heavy vehicles estimates included in this report should be verified at the start of the construction phase.

1.5 List of abbreviations and acronyms

Table 1: Abbreviations & acronyms

Abbreviation / Acronym	Reference
AADT	Annual average daily traffic
AGRD	Austroads Guide to Road Design
ASD	Approach sight distance
BESS	Battery energy storage system
CREZ	Central renewable energy zone
DOS	Degree of Saturation
EB	Eastbound
ESA	Equivalent standard axle
FEED	Front End Engineering Design
GTIA	Guide to traffic impact assessments
HV	Heavy vehicle
LOS	Level of Service
LV	Light vehicle
MGSD	Minimum gap sight distance
NEM	National energy market
OD	Over dimensional
OSOM	Over size over mass
RFI	Request for information
RRC	Rockhampton Regional Council
QPS	Queensland Police Service
SAR	Standard axle repetition
SCR	State controlled road
SISD	Safe intersection sight distance
TARS	Traffic analysis & reporting system
TIA	Traffic impact assessment
TCP	Traffic control plan
TMP	Traffic management plan
TMR QLD / TMR	Department of Transport & Main Roads Queensland
WB	West bound

2 Existing conditions

2.1 Land use and zoning

The Project is located at 397 and 519 Power Station Road, Stanwell, formally described as Lot 44 on SP140243 and Lot 1 on RP886588. It is located on vacant land within the Stanwell Power Station, a highly developed environment incorporating large-scale coal power generation infrastructure, water storage facilities, coal stockpiles and transmission line infrastructure.

It is understood that the Project area was previously used as a construction laydown area for other projects within the site.

The Project area is located entirely within a Special Industry Zone and Special Purpose Zone within the RRC Planning Scheme, as shown in Figure 3.

The BESS will be located entirely within the Special Industry Zone, with only the transmission line, connecting the BESS to the Powerlink Switchyard, proposed within the Special Purpose Zone.

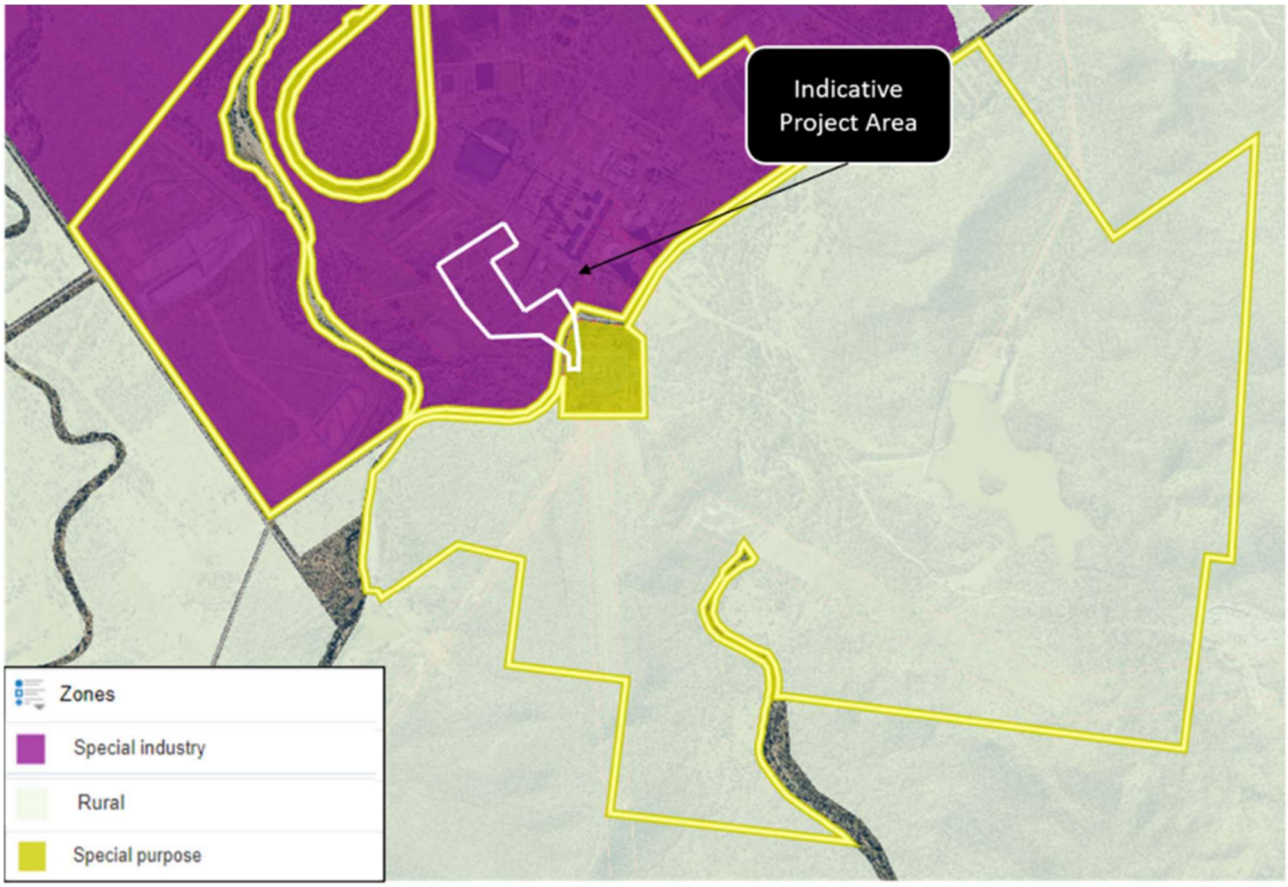


Figure 3: Project area zoning (Excerpt: CREZ BESS Planning Report, 2022)

2.2 Adjacent land uses /approvals

The land surrounding the Project area is generally characterised by rural land used for grazing purposes. The closest township to the Project is Stanwell, located approximately 1.7 km to the north.

A limited number of other developments are also accessed from Power Station Road, primarily including:

- Capricorn Sandstone Quarries Pty Ltd / Scotsman's Folly Quarry, with access located approximately 2.6 km north-east of the Project
- Stanwell Quarry – Central Queensland Quarries Pty, with access located approximately 1.4 km north-east of the Project

- Aurizon Stanwell Depot, with access located approximately 4.6 km north-east of the Project (adjacent Capricorn Highway).

The R. Moore Mechanical & Engineering site, located 1.7 km west of the Project area, may also be accessed via Power Station Road, but the site appears to be more conveniently accessed via Capricorn Highway from Warren Road (i.e. not Power Station Road).

A review of aerial imagery also indicates dwellings are located further to the west and north-east of the Project, with the closest dwelling to where the works are proposed being located approximately 2 km to the west.

2.3 Existing road network

2.3.1 Surrounding roads

The Project site is located approximately 2.6 km south of Stanwell township. Table 2 summarise the characteristics of the roads within the vicinity of the project area based on a desktop assessment.

Table 2: Existing road network details

Road	Description	Road Authority	Carriageway Width [1]	Posted Speed Limit
Power Station Rd	Undivided, sealed, rural, two-way / two lane	Rockhampton Regional Council (RCC)	7 m + shoulders	100 km/h (80 km/hr [2])
Capricorn Hwy	Undivided, sealed, rural, two-way / two lane	Department of Transport and Main Roads	9 m + shoulders	100 km/h
Switchyard Rd	Undivided, sealed, rural, two-way / two lane	Stanwell Corporation	4-7m (overgrown, poor condition)	-

[1] Approximate and varies; [2] In the vicinity of Power Station primary access point (only)

2.3.2 Key intersections

Two intersections within the study area have been considered for the purpose of this assessment:

- Capricorn Highway / Power Station Road – diagrammatically represented in Figure 4, and
- Power Station Road / Switchyard Road (Stanwell Power Station secondary access) – diagrammatically represented in Figure 5.

The Capricorn Highway / Power Station Road interchange is currently used for access to the Aurizon Stanwell Depot, Capricorn Sandstone Quarries / Scotsman's Folly Quarry, Stanwell Power Station, and Stanwell Quarries.

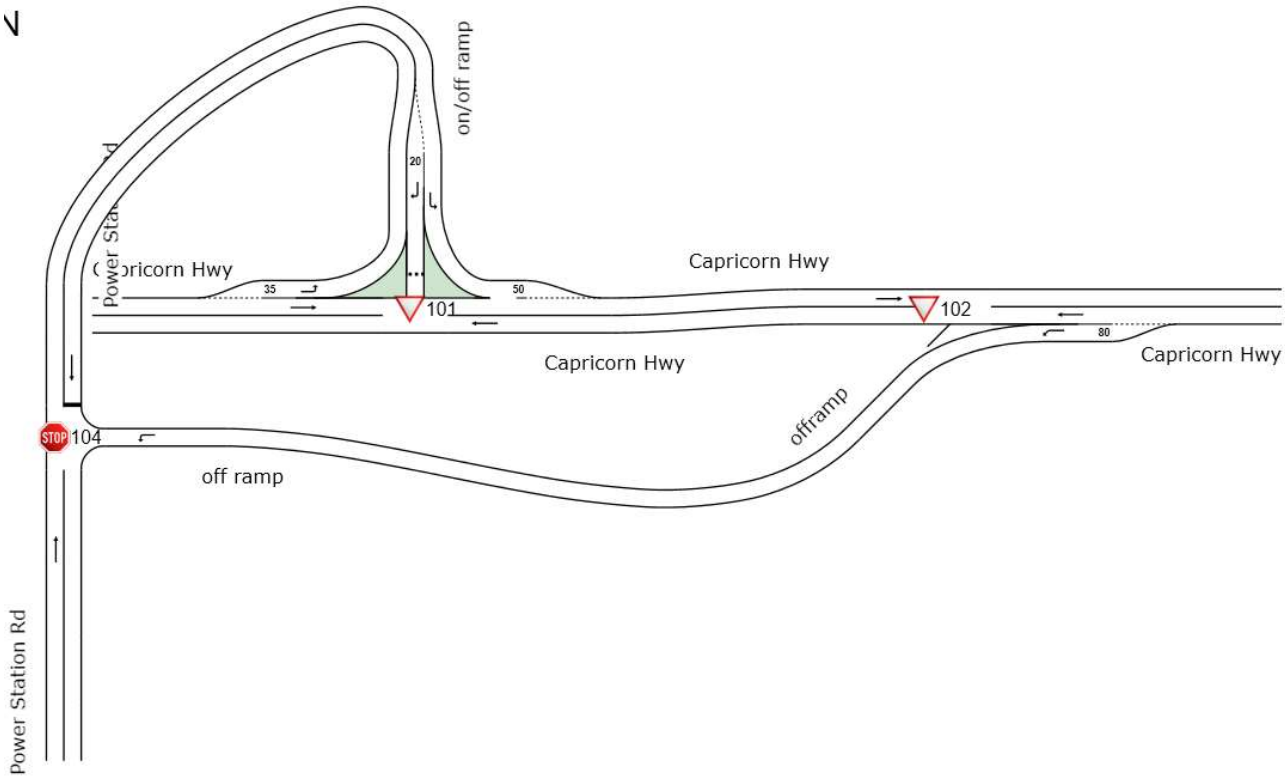


Figure 4: Capricorn Highway / Power Station Road Interchange

The Power Station Road / Stanwell Access Road is currently used for secondary 'back of house' access to the Stanwell Power Station, with the primary access for normal operations located approximately 800 m to the north-east on Power Station Road (refer to Figure 2).

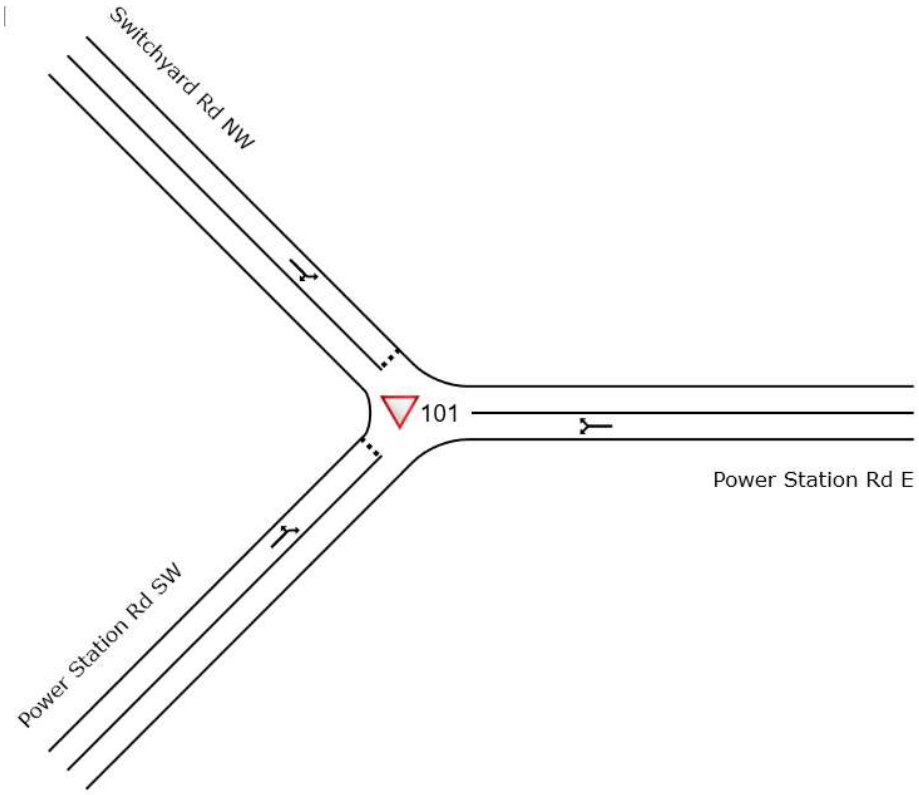


Figure 5: Power Station Road / Switchyard Road intersection

2.3.3 Background traffic volumes

Capricorn Highway

The Annual Average Daily Traffic (AADT) Segment Report for Capricorn Highway from 2020 is available from Queensland Government's Traffic Analysis and Reporting System (TARS). The count was located approximately 185 m west of Meteor Park Road between E Williams Road and Power Station Road (approximately 3.3km east of the Capricorn Highway / Power Station Road interchange).

Capricorn Highway carries 3,994 vehicles per day (AADT) with approximately 22% HV.

Power Station Road

Reference is made to the previous assessment for the pilot hydrogen project assessment, which included a traffic count undertaken in November 2016 by Rockhampton Regional Council on Power Station Road at the primary access point for Stanwell Power Station (approximately 1.5 km from Capricorn Highway).

The data indicated a total of 315 vpd at the location with 20% HV, reflecting this road's primary role in providing access to the limited number of developments along it.

A peak hour traffic count was also undertaken by Stanwell Corporation at the same location on Tuesday 7th July 2020. The count was completed for the AM and PM peak periods between 6:00-8:00am and 4:00-6:00pm respectively, with 6:00-7:00am and 4:30-5:30pm peak hours.

The Stanwell Corporation 2020 traffic count indicated significantly higher daily traffic volumes compared to RRC's 2016 counts (in the order of 10x) and this occurred due to the former occurring during increased activity at the plant due to an outage / shutdown.

The daily RRC 2016 data has therefore been adopted for the assessment(s) included later in this report.

Switchyard Road / Power Station

No traffic count data was available on Switchyard Road for the purposes of this assessment. We understand that Switchyard Road has very low and infrequent traffic movements, which is supported by the Power Station Road / Power Station primary access intersection traffic count provided by Stanwell Corporation (which indicates little traffic volume along Power Station Road to the south-west (toward Switchyard Road).

Background Traffic Volume Summary

Existing AM and PM peak hour and daily traffic volumes at the roads and intersections discussed above are summarised in Figure 6, Figure 7, and Figure 8 respectively. Several assumptions have been made to estimate movements and periods not available from the data considered in this report, including:

- Capricorn Highway 8% peak-to-daily split and Power Station Road 10% peak-to-daily split,
- Capricorn Highway daily directional split assumed the same in AM and PM peak hours,
- Power Station Road traffic volume distributions: 20% to/from west / 80% to/from east on Capricorn Highway
- Power Station Road daily 50% eastbound / 50% westbound split, and
- Power Station Road / Primary Access intersection turning distributions taken from 2020 Stanwell Corporation counts.

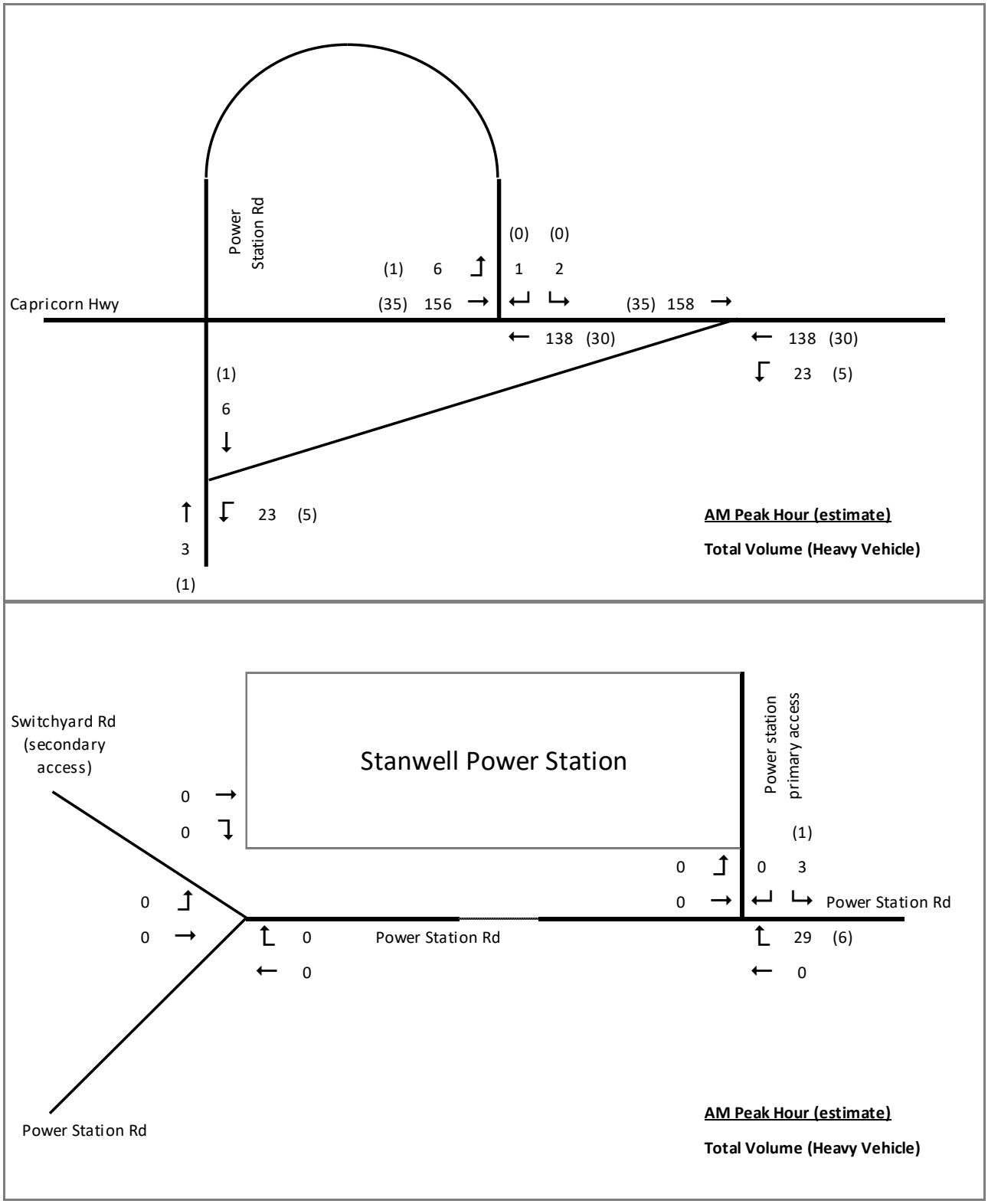


Figure 6: Existing Traffic Volumes – AM Peak Hour

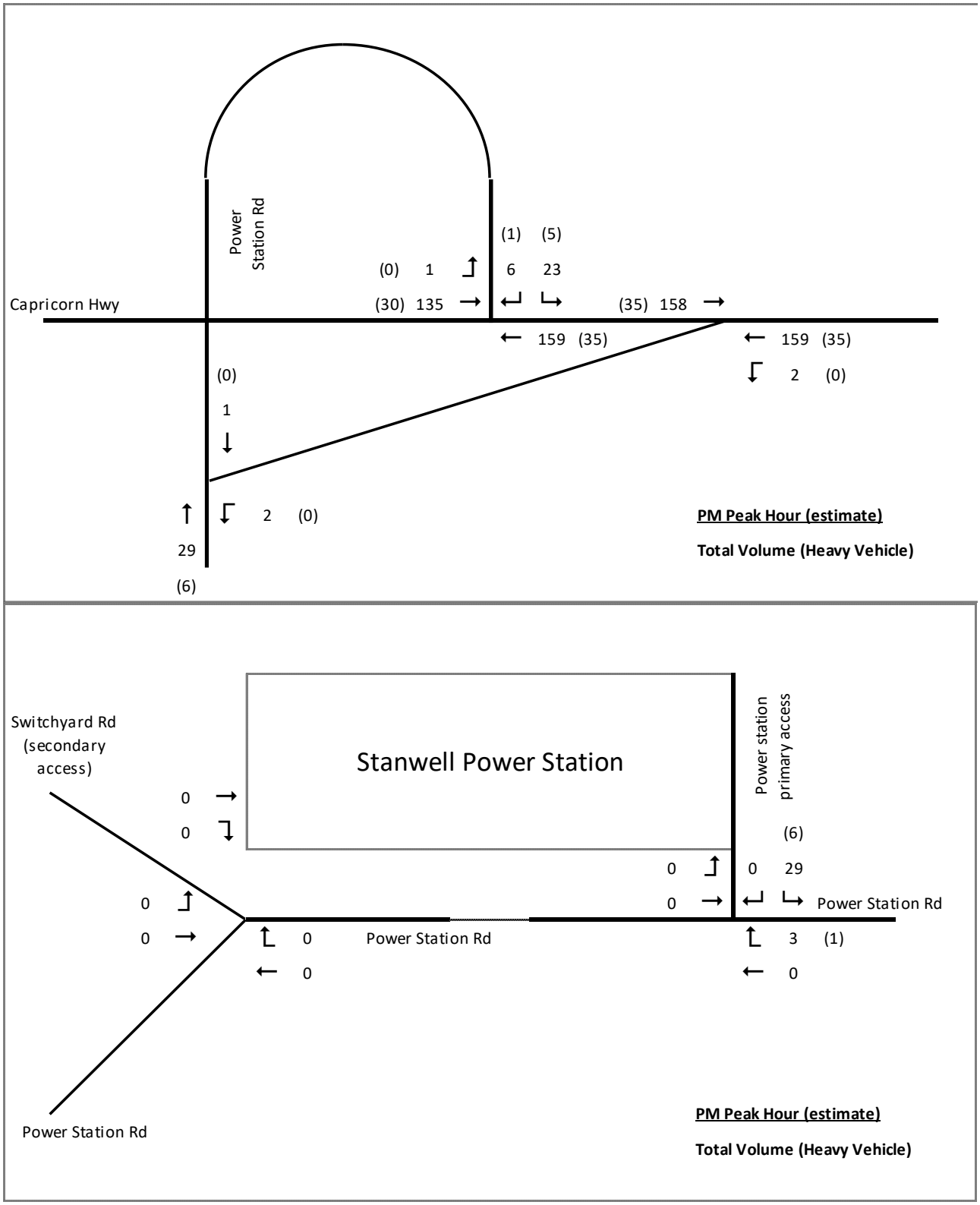


Figure 7: Existing Traffic Volumes – PM Peak Hour

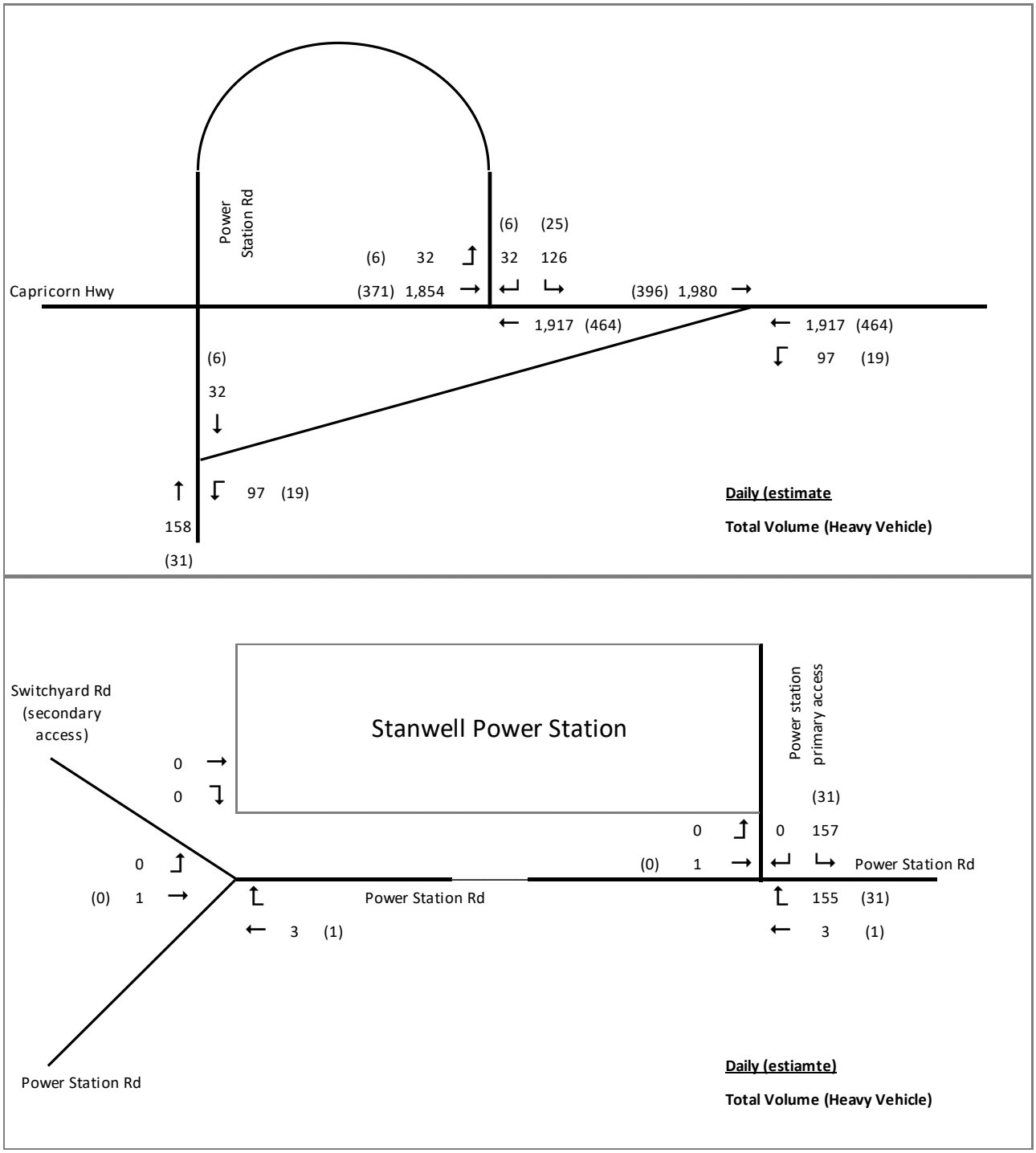


Figure 8: Existing Traffic Volumes – Daily

2.3.4 Peak period determination

Traffic data at the Power Station Road / Power Station primary access intersection, collected by Stanwell Corporation, has been assessed to determine the peak AM and PM peak hours. Based on this data,[1] the peak hours were identified as:

- AM: 6:00 - 7:00 am, and
- PM: 4:30 - 5:30 pm

[1] This data was collected during non-typical operation of the power station (unscheduled outage) and may not reflect typical peak hours on Power Station Road.

Peak traffic generation of construction activities will depend on the construction schedule and timing of deliveries and worker start and finish times. For the purposes of this assessment, these are assumed to occur at the same AM and PM peak hours nominated above.

2.3.5 Traffic growth rate

Capricorn Highway

Traffic census data from Queensland Government's TARS, indicates traffic volumes on Capricorn Highway have remained constant between 2016-2021 and have generally decreased between 2010-2021 as illustrated in Figure 9.[2]

For the purposes of this assessment, traffic growth on Capricorn Highway is therefore assumed to be negligible (i.e., zero).

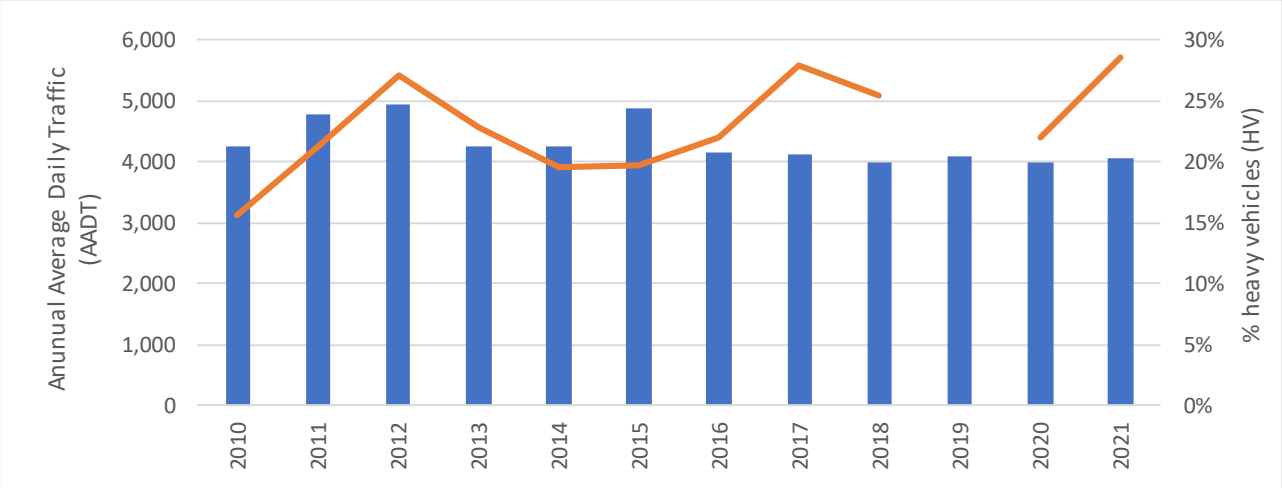


Figure 9: Capricorn Highway (east of Power Station Road)

Power Station Road

No historic traffic growth data is available on Power Station Road. Given the existing uses accessed from Power Station Road very little, to no growth, could be expected along this road in the short to medium term (noting the Stanwell Power Station Hydrogen project is understood to not yet be a committed project).

2.3.6 Opening year

Opening year is assumed to be 2026, as per information provided by Stanwell Corporation (subject to timing of relevant permits and approvals).

2.3.7 Road safety issues

Crash data collected by TMR between 2019-2023 indicates that there were three reported crashes within the study area on Power Station Road, shown in Figure 10:

- In July 2019, a crash occurred in the early morning and involved a single vehicle travelling south-west on Power Station Road leaving the carriageway on an unlit right bend, located on a slight crest, and hitting a fixed object. The crash resulted in one (1) hospitalisation.

  It is noted that warning signage is placed in advance of the bend in both directions (with speed reduction warning of 40 km/h) and chevron signage is provided to delineate the direction of travel on the curve in both directions – however it unknown if this was in place at the time of the reported crash.

[2] It is acknowledged that TARS includes data up to 2022, however post 2020 traffic data is not considered to be representative due to COVID and has been omitted from this assessment.

- In March 2020, a crash occurred during the day and involved a single truck travelling north on the Power Station Road ramp towards Capricorn Highway. The truck left the right turn bend and hit a fixed object after leaving the traffic lanes and the casualty resulted in one (1) hospitalisation.

  It is noted that warning signage is placed in advance of the bend for vehicles travelling north on Power Station Road (with speed reduction warning of 40 km/h) but no chevron signage is provided to delineate the direction of travel on the curve. It is unknown if there are currently chevrons installed at this location.

- In September 2022, a crash occurred during the day and involved a single truck travelling west on Power Station Road near the access road to the Amcor Quarries & Concrete Stanwell Quarry. Details are limited, however data indicates that the incident occurred due to manoeuvring undertaken by the truck. The crash resulted in one (1) hospitalisation.

  Without further details of the circumstances of this crash, it is difficult to determine whether a design, geometric, or other contributing factor are attributable. It is noted that embankments either side of the road at this location are relatively steep and, if a truck chooses to manoeuvre off-road here, may cause top-heavy vehicles to tip if traversed.

It is noted that while it is not located at the reported crash sites, Power Station Road / Switchyard Road intersection is a Y-junction where both the south-west Power Station Road leg and the north-west Switchyard Road leg gives way. Give-way line-marking appears to be worn and faded.

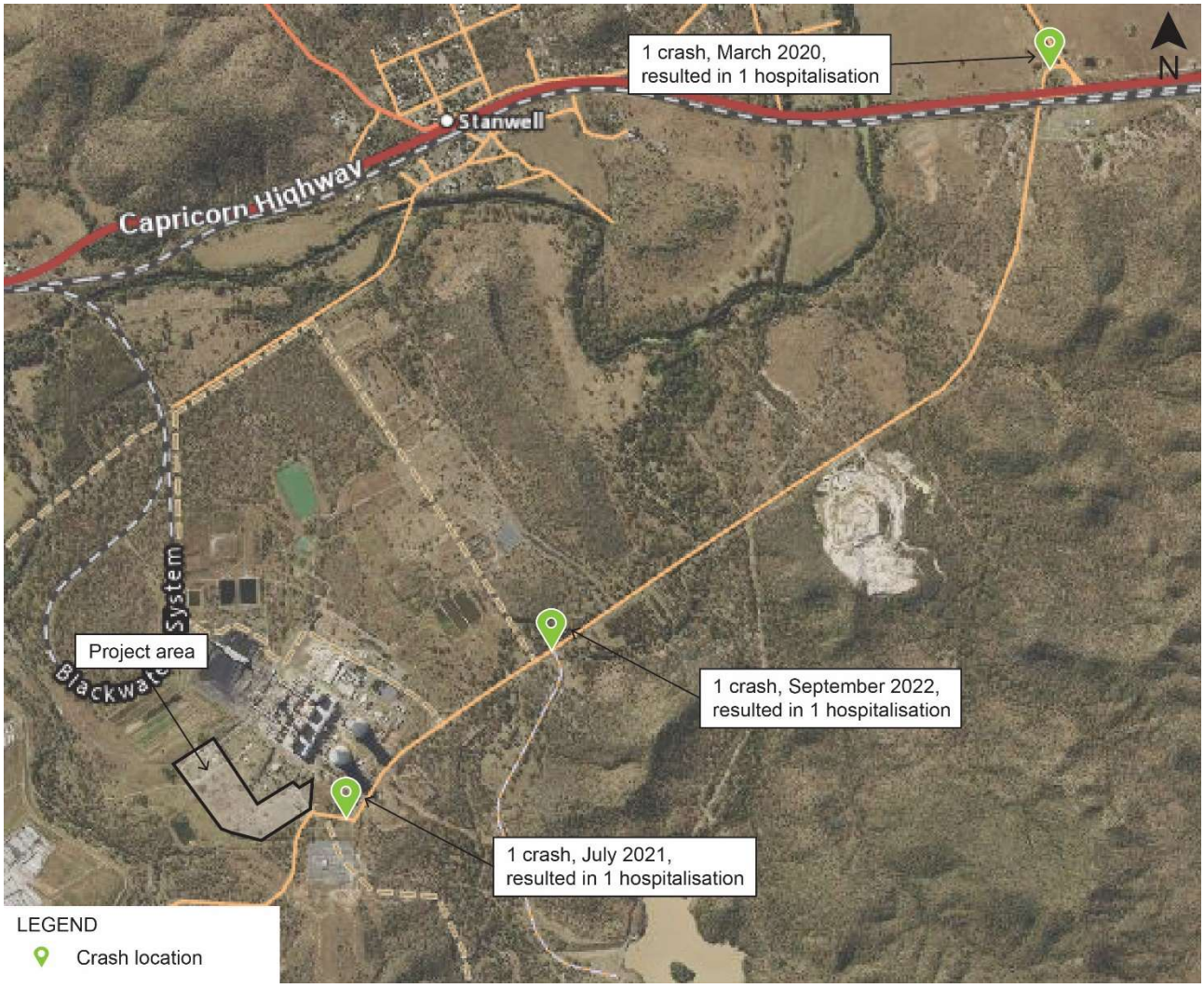


Figure 10: Crash history in study area (Image excerpt: Queensland Globe; data source: TMR, 2023)

2.3.8 Sight distance assessment

Safe Intersection Sight Distance (SISD), Approach Sight Distance (ASD), and Minimum Gap Sight Distance (MGSD) have been assessed based on Austroads Guide to Road Design (Part 3 and Part 4A) for trucks as summarised Table 3. The below desktop assessment indicates that sight distances at each intersection appear to be appropriate.

Table 3: Existing sight distance assessment

Road	Assessed Speed (km/h)	Type	Required Sight Distance (m)	Condition
Power Station Road / Capricorn Highway	100	SISD [1]	233	Met
		ASD [2]	248	Met
		MGSD, ta= 4	111	Met
Power Station Road / Stanwell Access Road (Primary access)	80	SISD [1]	161	Met
		ASD [2]	170	Met
		MGSD, ta= 4	89	Met
Power Station Road / Switchyard Road (Secondary Access)	Assuming 60 (based on geometric constraints)	SISD [1]	101	Met
		ASD [2]	106	Met
		MGSD, ta= 4	67	Met

[1] Reaction time = 2.5s, Coefficient of deceleration = 0.24, [2] Reaction time = 2.5s, Coefficient of deceleration = 0.22, grade = 0%

2.4 Alternative transport modes

2.4.1 Public transport

No public transport routes operate on Power Station Road. We understand Stanwell Corporation runs several private bus services between the power station and Gracemere / Rockhampton for employees only. It is assumed that operations staff for this Project could also use the service.

2.4.2 Active transport

There is no existing walking or cycling facilities or connections to the site on Power Station Road. Accordingly, it is highly unlikely that employees or visitors will walk or cycle to the power station.

Capricorn Highway is a nominated 'Priority Route C'[3] under TMR QLD's addendum to the Central Queensland Priority Route Maps.'

2.5 Parking

There is no existing parking specifically available within the Project site area. On-site parking is available within the broader Stanwell Power Station site (accessed from the primary Power Station access).

[3] 'The priority reflects that the road authority may intend to undertake further planning, design and/ or construction on the route such as an upgrade of the existing infrastructure or filling missing links', with 'C' denoting 'for delivery in the next 15 to 20 years')

2.6 Pavement

Cardno was engaged by RCC in 2019 to investigate and determine if the existing pavement was adequate for transport of a large generator. Based on Cardno's assessment, it is understood that Capricorn Highway and Power Station Road have granular pavement with thin bituminous surfacing.

The existing pavement along Power Station Road was found to be in fair condition, except for some isolated areas (locations were not specified). The pavement was considered adequate to withstand the load from the transportation of the generator.

2.7 Transport infrastructure

Cardno previously determined the suitability of existing culverts and pavement to transport a large generator along Power Station Road to the Stanwell Power Station in 2019. This assessment concluded that:

- "The culverts are generally in fair condition and appear to only require minor repairs",
- "The pavement was found to be generally in fair condition, and suitable for transportation of the generator",
- "The culverts will be heavily loaded and, in some cases, may exceed the ultimate capacity", and therefore:
  - recommended several minor repairs be completed prior to generator transport (it is not known if these have been completed to date), and
  - propping of certain culverts and link slabs prior to generator transport (with details of propping to be confirmed).

The pavement degradation since 2019 is unknown and it is recommended an updated assessment be completed prior to commencement of construction as part of the TMP.

2.8 Base case traffic volumes

Based on the discussions in Sections 2.3.5 and 2.3.6, existing traffic volumes on Capricorn Highway and Power Station Road (summarised in Section 2.3.3 and specifically Figure 6, Figure 7 and Figure 8) have been assumed as the base scenario traffic volumes for this assessment.

3 Development proposal

3.1 Stanwell BESS facility site plan

A Development Permit is currently being sought for a BESS and associated ancillary infrastructure at 397 and 519 Power Station Road, Stanwell. The Project site and area are depicted in Figure 11 and Figure 12.

The Project includes the construction of the following items over an indicative 19-month construction program:

- Enclosed modular batteries and inverters with an output of 300 MW / 1200 MWh.
- A 275 kV substation located to the east of the battery system enclosures
- Underground or overhead 275 kV cable leading to the Powerlink Switchyard
- 275 kV, 200 MVA transformer with approximate dimensions of 10.3 m x 3.9 m x 4.4 m
- 275 kV gantry terminal point
- Gable sealing and surge arrester structure
- Access driveway and a 6m road providing access to all equipment
- Control room to house site controllers
- Perimeter fencing.

Figure 11: Stanwell BESS Project area (Image excerpt: QGlobe)

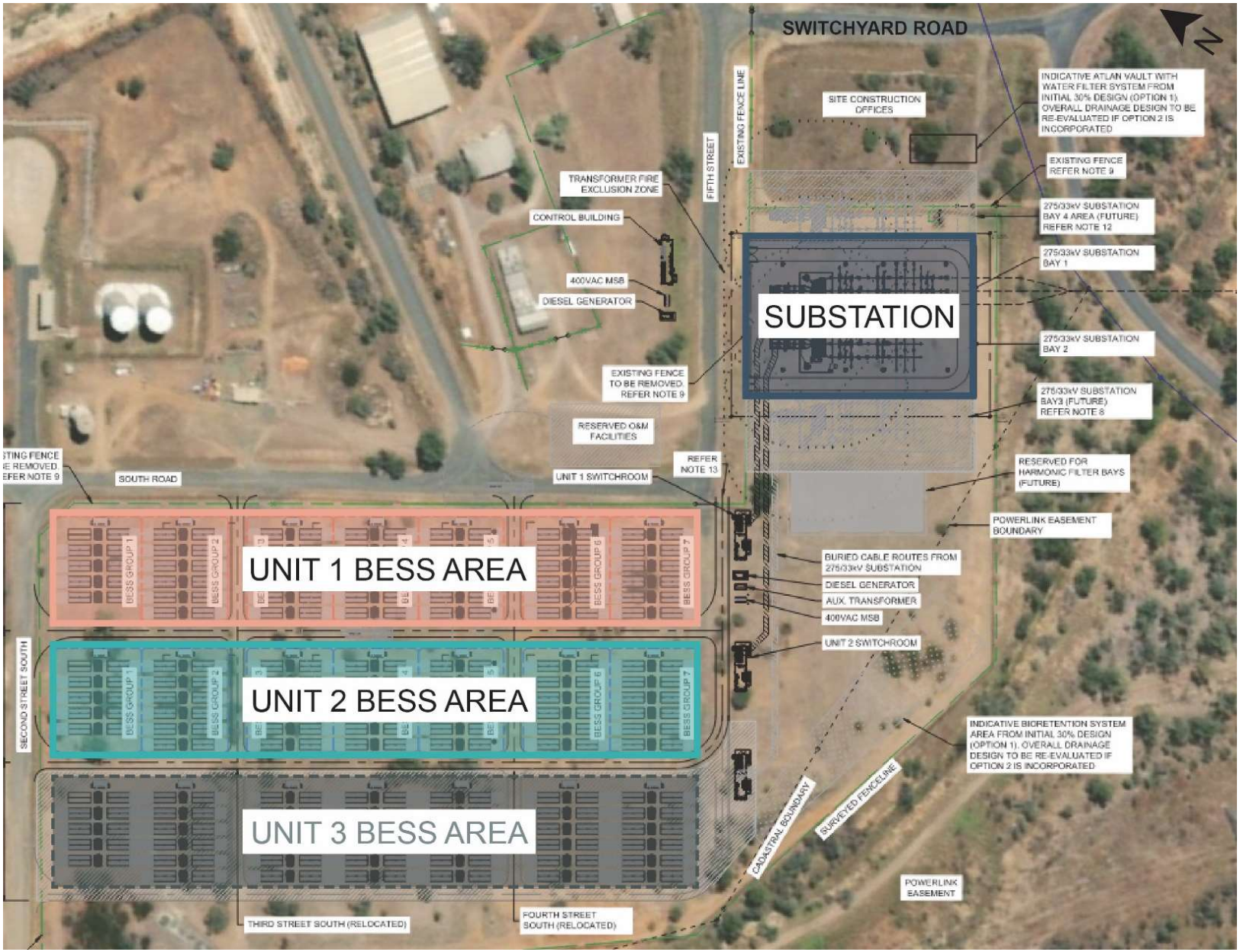


Figure 12: Stanwell BESS site layout (Source: Drawing no. CRBP-YUR-34000-EL-SKT-0, Yurika, 2024)

3.2 Construction and operational details

It is understood that the construction methodology will generally be as follows:

- Establishment of site offices and security fencing,
- Preparation of project area,
- Road upgrades,
- Excavation, filling, and compaction,
- Transportation and installation of new transformers located within substation,
- Construction of foundation to support BESS and substation,
- Transportation and installation of BESS units,
- Installation of the 275 kV transmission line,

Assessment of the operational phase is excluded from this assessment.

3.3 Proposed access and parking

The proposed construction vehicle access route to site is illustrated in both Figure 13. The route comprises the following movements: Capricorn Highway → Power Station Road → Switchyard Road Access Driveway.

All vehicles will be able to access the site from the east or west from Capricorn Highway, ***except*** the largest vehicle expected to access the site (substation transformer delivery) which is recommended to access Power Station Road via the eastbound Capricorn Highway on ramp loop (for egress, the prime mover and trailer combination will be dismantled).

Most construction vehicles will use Power Station Road / Switchyard Road access intersection, as shown in Figure 14. As part of the development Switchyard Road is proposed to be upgraded and widened to accommodate construction traffic movements.

Car parking for the Project will be located within the project area to the east (refer to Figure 14).

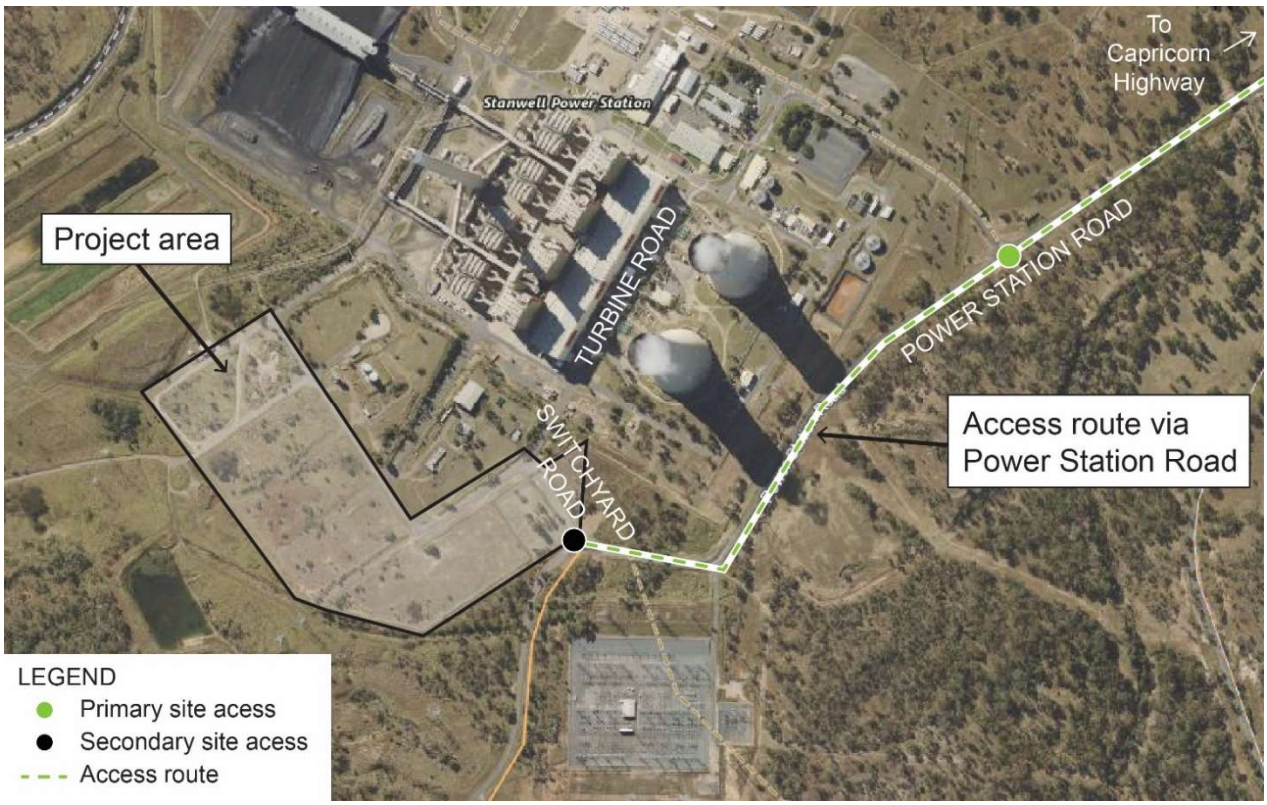


Figure 13: Proposed construction vehicle access route (Image excerpt: Queensland Globe)

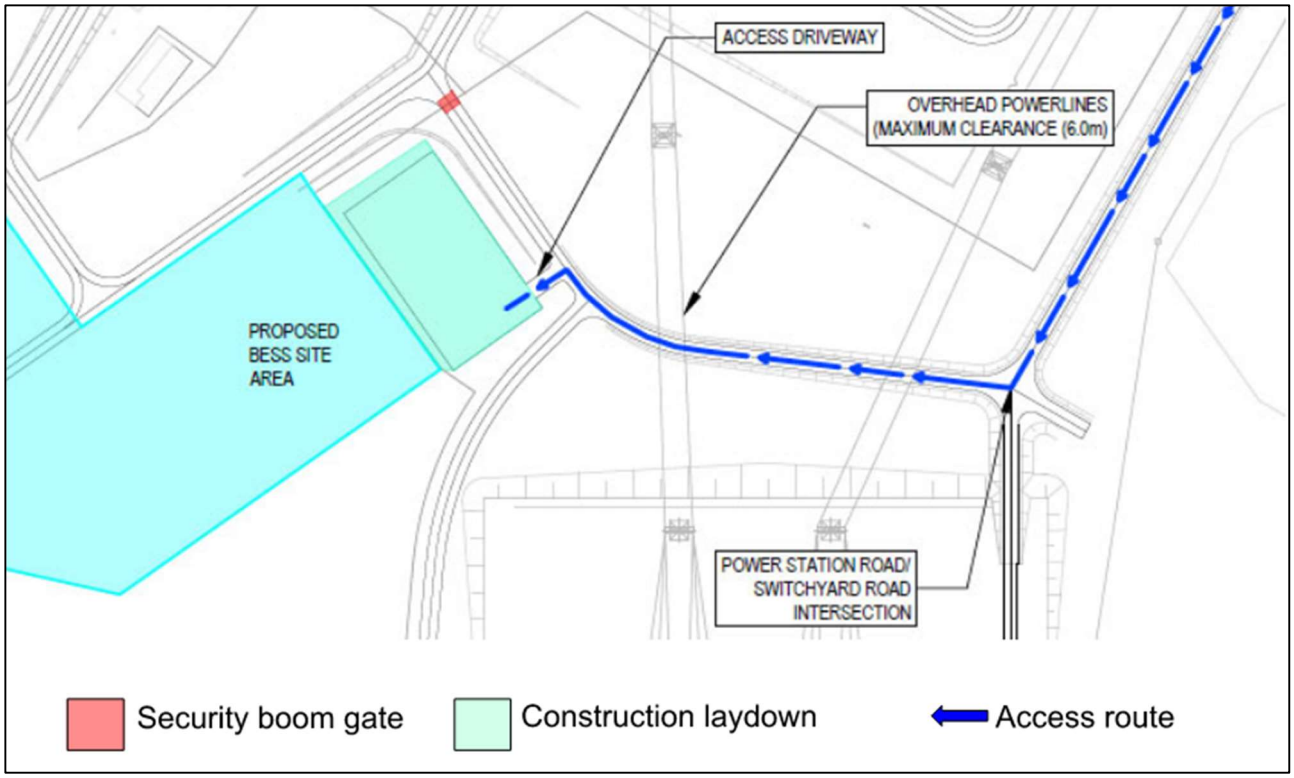


Figure 14: Project area construction vehicle access (Excerpt: CREZ BESS Planning Report, 2022)

4 Construction traffic

4.1 Traffic generation

Based on information provided by the project team, the traffic generation activities expected over the 19-month construction program include:

- Extraction and delivery of fill material
- Delivery of construction material including but not limited to gravel, pavement materials, pre-mixed concrete, precast concrete, reinforcement, structural steel, and fittings.
- Delivery of construction machinery (excavators on low loader platform trailers, etc.),
- Delivery of transformers, substations, and battery systems
- Delivery of electrical equipment
- Movement of construction workforce
- Servicing trips.

An indicative project construction schedule over 19-months is provided in Table 4.

Table 4: Indicative construction period

Construction activity	Indicative schedule
Start mobilisation	14-May-24
Commence permanent works	18-Jun-24
Bulk earthworks*	Jun-24 to Aug-24
High Voltage Transformer 1 delivery	Feb-25
High Voltage Transformer 2 delivery	Mar-25
Battery deliveries*	Apr-25 to Aug-25
Construction completion	Dec-25
** Assumed peak construction periods*	

Two peak construction periods have been assumed based on information provided by Stanwell Corporation:

- **Bulk earthworks**
  - indicative 8-10 week period. The exact duration of bulk earthworks will be fully defined during detailed design and/or the construction stage.
  - **8-week period** has been adopted for the purposes of this assessment. Bulk earthworks import is assumed to occur six (6) days a week (total 48 days of delivery).
- **Battery deliveries**
  - indicative 4-6 week delivery program.
  - **4-week period** has been adopted for the purposes of this assessment. Battery delivery is assumed to occur six (6) days a week (total 24 days of deliveries) during the working hours of 6.00 am to 6.00 pm.

The following vehicles are typically expected to access the site during construction:

- 12m single unit trucks
- 19m semi-trailers to import batteries, and/or with low loader platform trailers for equipment
- 26m B-doubles to bring in worker huts

- Truck and dog combinations for extraction and/or delivery of fill material, construction material, etc.
- A special low loader to transport the two substation transformer deliveries.

The special low loader vehicle has been assessed by Aurecon previously as part of Stanwell BESS FEED logistics plan prepared by Aurecon which included 2 prime movers, followed by a 16-axle low-bed modular trailer to host the transformer, and another prime mover at the rear as illustrated in Figure 15 below.

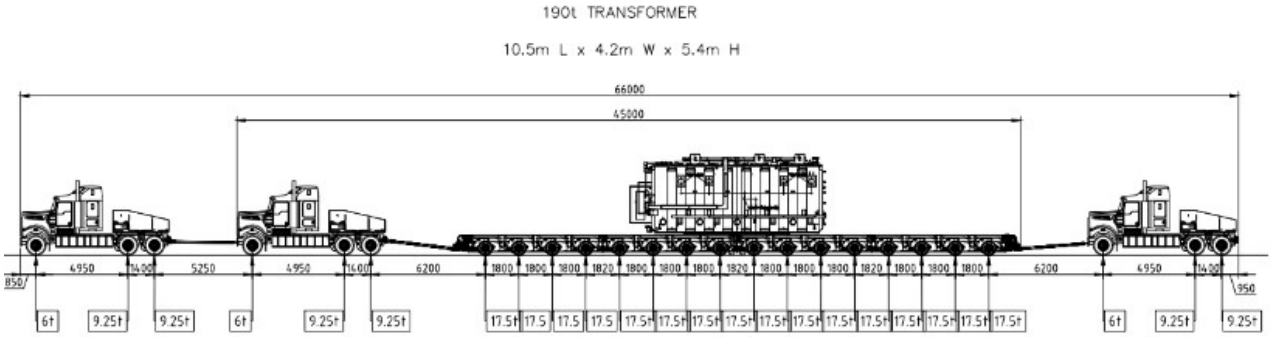


Figure 15: Transformer transport vehicle specifications

4.2 Trip distribution

Construction traffic trip distribution for the bulk earthworks and battery deliveries peak construction periods is assumed to be:

- 100% of trips use Capricorn Highway to access Power Station Road.
- Workforce trips (light vehicles):
  - 100% of trips are completed in peak hour corresponding with the start and finish of construction shifts.
  - 100% of trips are inbound during AM peak period and outbound during PM peak period.
- 80% East / 20% West split of origin/destination for trips on Capricorn Highway for:
  - Battery deliveries
  - Bulk earthworks deliveries.

4.3 Construction traffic volumes

4.3.1 Bulk earthworks

For bulk earthworks, the below construction information has been provided by the team:

- Eight-week peak construction program,
- Estimated earthworks volumes as per Yurika development drawings (referenced in Section 1.3).

Further information about bulk earthworks is currently unavailable, therefore a number of high-level assumptions have also been made about this peak construction period:

- A 3-axle truck and 3-axle dog trailer combination (as per NHVR guidelines) will be used to import earthworks materials (maximum permissible mass = 42 tonnes).
- Volume to tonnage conversion values for earthworks materials have been assumed as per Caterpillar's material densities published online.[4]

[4] Caterpillar, Material Density Tables To Help Estimate Earthwork Volumes, Caterpillar, n.d., accessed 15 April 2024.

- 10% of heavy vehicle trips are inbound during AM peak period and outbound during PM peak period, with the remainder occurring steadily throughout the day.
- 25 light vehicles per day: 25 'in' and 'out' movements per day, based on a total workforce of 30 and assuming 1.2 workers per vehicle.

The total heavy vehicle volumes associated with bulk earthworks import have been estimated based on information provided by the project team and assumptions, as summarised in Table 5.

Table 5: Heavy vehicles required for bulk earthworks import (estimate only)

Material	Typical mass of material* *(t per m^3)*	Total volume^, # *(m^3)*	TOTAL MASS *(t)*	No. of HV required to import fill
Fill (TMR type 2.1 crushed rock at 100% MDD)	1.87	4,290	9,126	218
Fill (TMR type 2.3 crushed rock at 100% MDD)	1.87	4,100	10,435	249
Imported fill	1.6	44,570	81,680	1,945
20mm blue metal loose aggregate	1.855	18,120	45,800	1,091
	TOTALS	86,200	147,040	**3,501**

* Material masses have been assumed based on material densities published online by Caterpillar.[5] Values other than imported fill have considered an average of wet and dry densities.
^ No bulking or fill factors have been applied to these volumes.

Volumes taken from CRBP-YUR-34000-CI-DRG-1504 andCRBP-YUR-34000-CI-DRG-1505

Based on the calculations detailed above, Table 6 has been prepared to summarise the estimated total, daily and peak hour construction traffic volumes.

Table 6: Bulk earthworks – estimated[6] construction traffic volumes

Movement	Total movements	Daily (vpd)	Peak Hour (vph)
Light vehicles (LV)	2,400	50	25
Heavy vehicles (HV)	7,002	146	15
Total	9,402	196	40

vpd – vehicles per day, vph – vehicles per hour

4.3.2 Battery delivery

The below construction information has been provided by the project team:

- 19-month indicative construction program, commencing May 2024 (subject to required permits and approvals),
- Six-week peak construction program,
- Import 324 batteries using 19 m semi-trailer trucks: 13 battery deliveries per day for six days a week totalling 648 trips over a six week period,
- Import two (2) transformers via special low loader: 4 trips (two loaded, two unloaded),

[5] Caterpillar, Material Density Tables To Help Estimate Earthwork Volumes, Caterpillar, n.d., accessed 15 April 2024.
[6] To be confirmed during detailed design.

- Various 19 m semi-trailer truck and/or B-double truck deliveries for worker huts, etc.: 3 per day
- 96 light vehicles per day: 96 'in' and 'out' movements per day, based on a total workforce of 115 and assuming 1.2 workers per vehicle.

On the above basis, Table 7 has been prepared to summarise the anticipated total, daily and peak hour construction traffic volumes.

Table 7: Battery delivery – construction traffic volumes

Movement	Total movements	Daily (vpd)	Peak Hour (vph)
Light vehicles (LV)	6,900	192	96
Heavy vehicles (HV)	1,224	32 (26 for battery deliveries + 6 trips for other deliveries)	17
Total	8,124	226	113

Vpd – vehicles per day, vph – vehicles per hour

4.3.3 Determination of peak construction period

Whilst the bulk earthworks peak construction extends over a longer period, the battery delivery peak includes higher daily and peak hour heavy vehicle volumes and has therefore been selected instead of the bulk earthworks as the basis of assessment for this TIA.

Figure 16, Figure 17, and Figure 18 have been prepared to summarise the AM peak and PM peak hour, and daily battery delivery construction traffic volumes respectively. Refer to Section 4.2 for an overview of the assumed traffic distributions to and from Capricorn Highway.

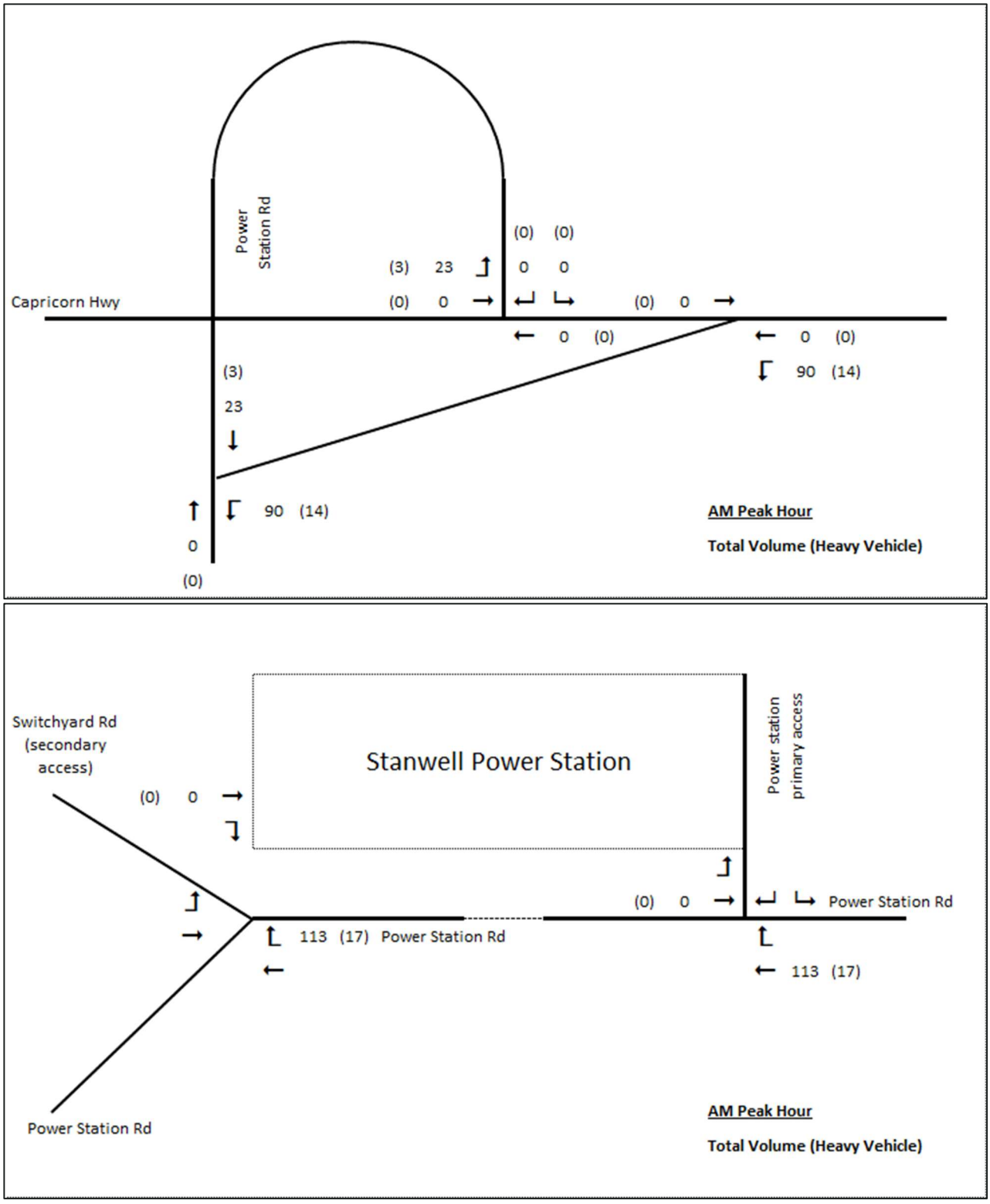


Figure 16: Construction traffic movements – AM Peak Hour

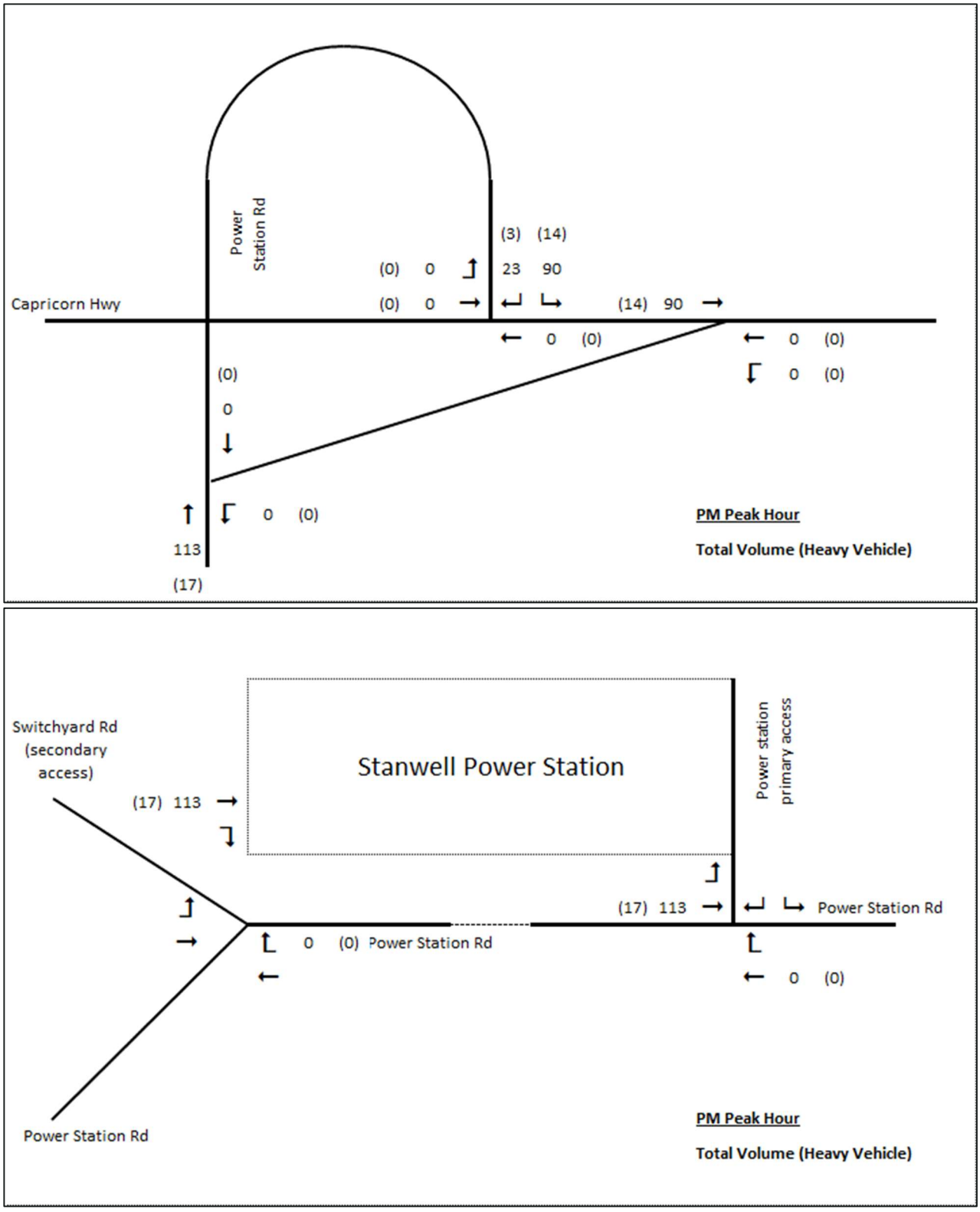


Figure 17: Construction traffic volumes - PM Peak Hour

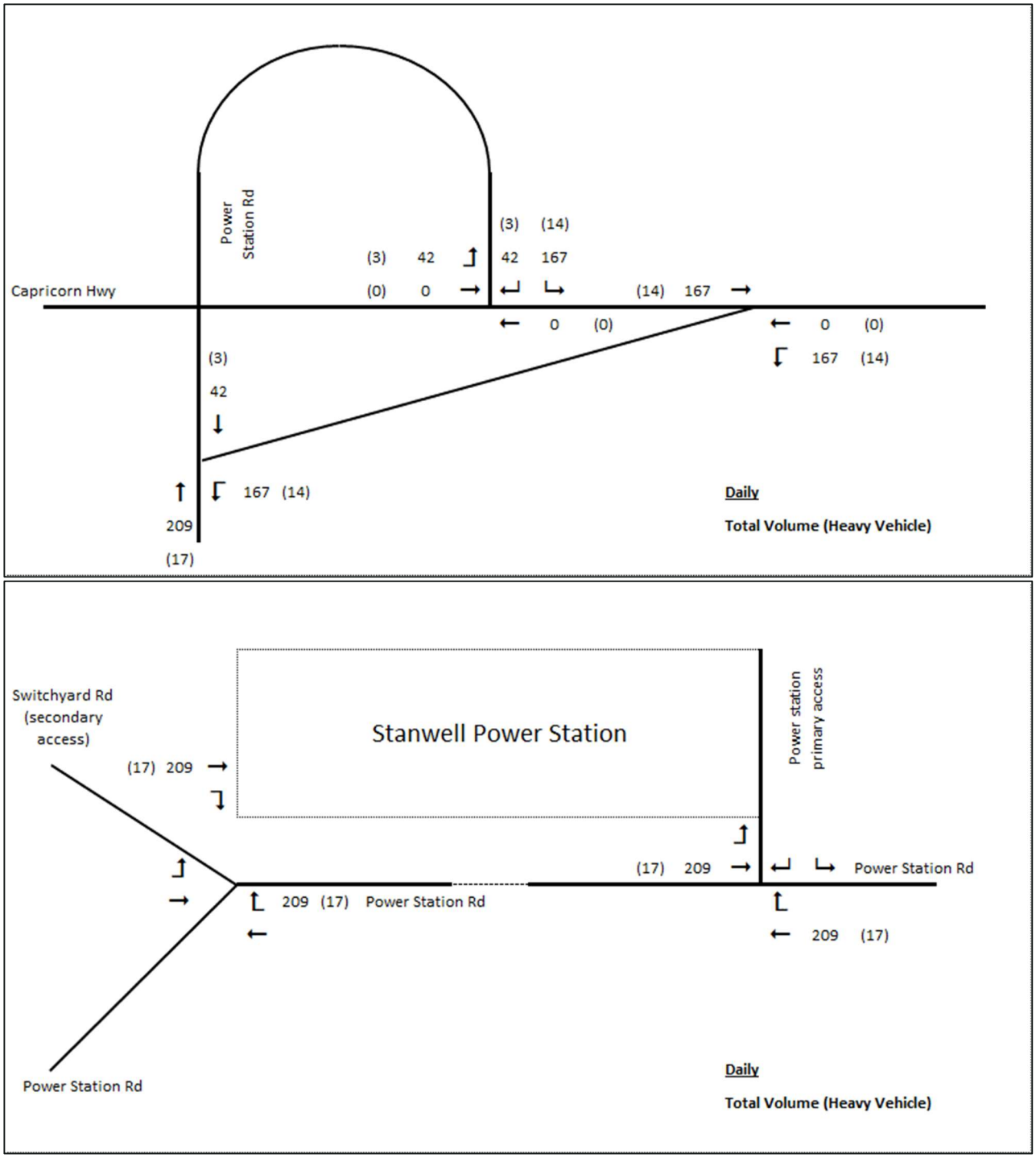


Figure 18: Construction traffic volumes - Daily

5 Impact Assessment and Mitigation

The following report sections provide the following impact assessment and mitigation measures (as required):

- Section 5.1 – Road safety
- Section 5.2 – Access and frontage assessment
- Section 5.3 – Intersection delay
- Section 5.4 - Road link capacity
- Section 5.5 – Pavement
- Section 5.6 – Transport infrastructure
- Section 5.7 – Other Considerations

5.1 Road safety

The TMR GTIA states any intersection turn movement or road link volume that increases more than 5% from the base case volume (in this case existing traffic volumes) requires a road safety impact assessment to determine whether risk has increased to the next level because of the construction traffic (in this instance).

Based on volumes summarised in Section 5.3 and 5.4 this includes the whole nominated study area comprising; Capricorn Highway / Power Station Road interchange, Power Station Road, and the Stanwell Power Station access intersections.

Accordingly, the following sets out a safety impact assessment of the nominated study area.

5.1.1 Crash history

Available crash history data indicates that there have been three crashes within the study area in the five-year period 2019-2023, as detailed in Section 2.3.4. There was no discernible design, geometric or other contributing factor to these reported crashes.

The expected increase in traffic from the proposed construction activities is therefore not expected to contribute to an increase crash risk at this location.

5.1.2 Sight distance desktop assessment

Existing site access intersections, and other intersections within the Project study area are proposed to be used for construction access (i.e., no new intersections or access intersections are proposed).

Notwithstanding, a high-level desktop sight distance assessment has been undertaken of the two Power Station access points (primary access and secondary access used for construction) in accordance with *Austroads Guide to Road Design Part 3 and Part 4A*:

- The primary Stanwell Power Station access is a T-junction intersection, with the main access to the Power Station terminating at Power Station Road. All approaches are straight and situated within a relatively flat topography, providing road users a clear view in all directions. Sight distances from all approaches appear to be unobstructed by roadside furniture or vegetation.
- The secondary Stanwell Power Station access, to be used by construction vehicles during construction, is a Y-junction intersection, with vehicles approaching the intersection via the southern leg of Power Station Road required to give way to all traffic (i.e., vehicles approaching the intersection via Switchyard Road and the eastern leg of Power Station Road are not required to yield).

  The intersection appears to be relatively level, noting the southern leg of Power Station Road appears to grade down slightly to the intersection. Views appear to be unobstructed for vehicles approaching the intersection via the eastern leg of Power Station Road. The Switchyard Road approach is straight and

level, though there is a possibility that southward views (looking right) are obstructed by vegetation growth.

The southern leg of Power Station Road approaches the intersection along a right bend, with warning signage. The bend is delineated by roadside reflectors. It is noted that there is an absence of line marking to delineate the requirement for vehicles to give way (cat eyes only).

The above is to be considered a preliminary assessment only and is not based on a site inspection. It is recommended that this assessment be revisited closer to construction and undertaken in-person to confirm there are no obstructions to sight distances (e.g., vegetation, etc. not identified from a desktop assessment).

5.1.3 Turn lane warrants

Based on the TMR GTIA, a turn lane warrant assessment is typically applied to new T-intersections and private access roads where the major road comprises one lane in each direction to determine what type of access / driveway would be required.

Notwithstanding, a turn lane warrant assessment has been undertaken of the egress movements from Capricorn Highway to Power Station Road during the AM peak hour (left turn from east and west approaches) in accordance with the Austroads Guide to Traffic Management Part 6, noting that these movements increase significantly from existing base case conditions.

The turn lane warrant assessment is summarised in Figure 19 based on turning movement summaries included in Figure 6 and Figure 16.

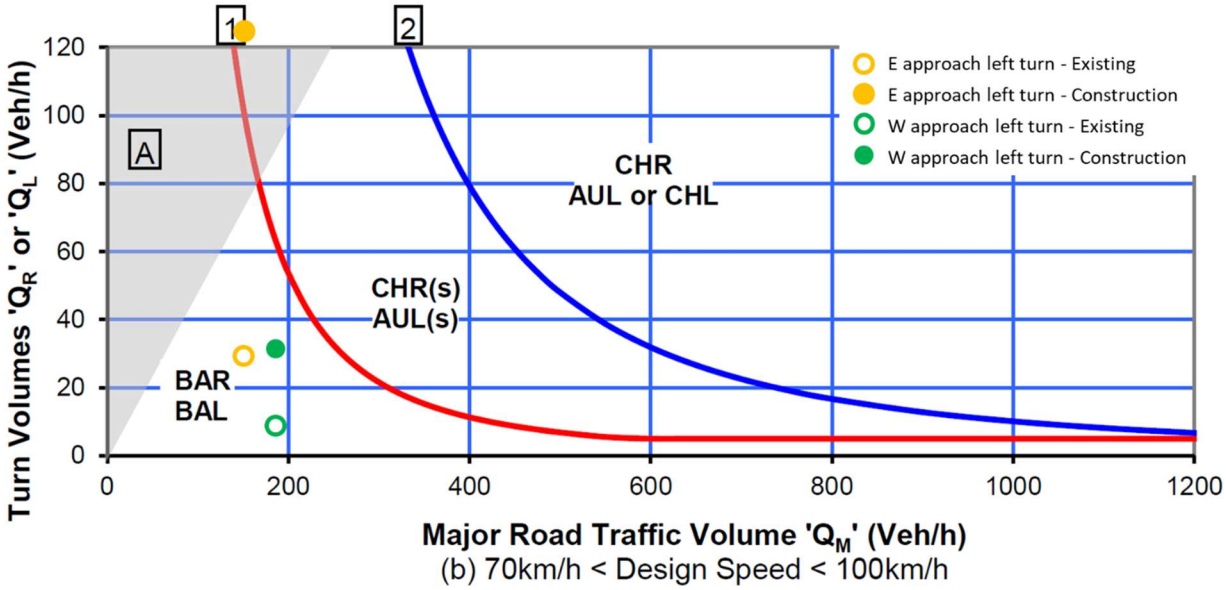


Figure 19: Turn Lane Warrant Assessment – Critical AM Peak Hour

The assessment indicates that under both existing and construction periods at a minimum, basic left turn lane treatments are warranted on Capricorn Highway (on both approaches) – except the left turn from the east approach which meets the criteria for a short channelised left turn treatment.

Both existing east and west approach left turn lane treatments include channelised left turn lanes which exceed or meet these turn lane warrants.

No mitigation is therefore considered warranted for the proposed construction generated traffic movements.

5.1.4 Risk assessment

The TMR GTIA requires a risk assessment of all developments to determine the likelihood and consequence of safety risks increasing because of development (construction traffic in this instance) as a first step in identifying if any works are required to mitigate risk. In regard to RRC controlled roads, the GTIA recommends that local government intersections be included in the assessment area if triggered by relevant impact assessment criteria.

A risk assessment has accordingly been undertaken to identify and assess existing safety risks, and to assess impacts of the construction period of the Project to understand if there is an increase in road safety risk or if any existing risk is acceptable.

The following items have been identified as relevant risks that would change the existing risk profile as part of the construction phase of the development (based on the TMR GTIA); 'increases in traffic volumes, including more traffic introduced on narrow rural roads' (noting these volumes are very low) and 'introduction of over-dimension or heavy vehicles'. Specifically, these relate to:

- More turn movements into Power Station Road from Capricorn Highway,
- Increased right turn movements to Switchyard Road from Power Station Road, and
- Increased traffic movement at the Capricorn Highway / Power Station Road interchange and along Power Station Road.

It is noted that as part of the construction process a Traffic Management Plan (TMP) will be put in place by the construction contractor. While these have not been developed, nor are they the focus of this assessment, it is expected that speed reductions, advance warning signage (of various types) and site traffic control will occur at variation locations along Power Station Road during construction.

Table 8 therefore summarises a safety risk score assessment based on the TMR GTIA (refer to Figure 20), assuming that appropriate traffic control treatments are in place during construction.

Table 8: Risk Assessment Summary (assuming construction traffic management controls)

Risk Item		Existing			During Construction		
		Likelihood	Consequence	Result	Likelihood	Consequence	Result
Increase in traffic volume, including more traffic introduced on narrow rural roads (increase crash risk, etc.)	Capricorn Hwy / Power Station Rd	3	4	M	3	4	M
	Power Station Rd [1]	2	4	M	2	4	M
	Power Station Rd / Primary Access	2	4	M	2	4	M
	Power Station Rd / Construction Access	1	4	M	2	4	M
Introduction or increases in over-dimension or heavy vehicles (increase crash risk, etc.)	Capricorn Hwy / Power Station Rd	3	4	M	3	4	M
	Power Station Rd [1]	2	4	M	2	4	M
	Power Station Road / Primary Access	2	4	M	2	4	M
	Power Station Road / Construction Access	1	4	M	2	4	M

[1] Power Station Road and third-party access intersections between Capricorn Highway and the Power Stations secondary access point.

		Potential consequence				
		Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality (5)
Potential likelihood	Almost certain (5)	M	M	H	H	H
	Likely (4)	M	M	M	H	H
	Moderate (3)	L	M	M	M	H
	Unlikely (2)	L	L	M	M	M
	Rare (1)	L	L	L	M	M

L: Low risk
M: Medium risk
H: High risk

Figure 20: Safety risk score matrix (TMR GTIA)

Assuming appropriate traffic management treatments within the study area, the risk assessment process indicates that while all risk scores remain below 'H', with no changes in risk assessment scores between existing and construction scenarios.

No road safety mitigations are required and therefore no further road safety assessment or road safety audit is necessary.

5.2 Access and frontage

The TMR GTIA requires an access and frontage impact assessment on the SCR network for the extent of the frontage of the site, or works, on both the site frontage side and potentially on the opposite side of the road. Based on the TMR GTIA access and frontage impacts and mitigation typically include (but are not limited to) access intersection works, kerb and channel, footpaths / cycle ways, stormwater infrastructure, bus stop relocation / provision, etc.

The site frontage and works do not front or propose access from the SCR network. Notwithstanding the below considers the access and frontage of the site and proposed works on the RRC network.

Directly along the site's frontage two site access intersections exist for the Stanwell power station (primary access and Switchyard Road secondary access). Between the Stanwell Power Station and Capricorn Highway several site access points exist, including:

- Stanwell Quarry – Central Queensland Quarries Pty (T-intersection), located approximately 1.4 km north-east of the Project
- Abandoned Stanwell Power station access (T-intersection), located approximately 1.7km north-east of the project.
- Capricorn Sandstone Quarries Pty Ltd / Scotsman's Folly Quarry (T-intersection), located approximately 2.6 km north-east of the Project, and
- Aurizon Stanwell Depot (T-intersection) located approximately 4.6 km north-east of the Project (adjacent Capricorn Highway).

Proposed construction traffic (6-week construction period) will impact these intersections due to increase light vehicle and heavy vehicle movements noting these are only through vehicle movements on Power Station Road. Notwithstanding, these traffic volumes are estimated to be quite low and are considered low risk and low impact to these access points and no mitigation measures are considered necessary.

No changes are proposed or considered necessary regarding existing access points from Power Station Road, or the configuration of it along frontage of the site and proposed works.

5.3 Intersection delay

The TMR GTIA requires and intersection delay assessment for all intersections where increased traffic exceeds 5% of the base traffic for any movement in the nominated peak periods at the year of opening (2023 construction period in this instance).

5.3.1 Turn movement volume increase

Table 9 has been prepared to summarise the turn movement increases under the construction period at the Capricorn Highway / Power Station Road interchange during the AM and PM peak hours.

Table 9: Capricorn Hwy / Power Station Rd – Movement volume for design peak, opening year (AM / PM)

Approach	Movement	Base scenario			Construction scenario			% Increase from base	Exceed 5%
		LV	HV	Total	LV	HV	Total		
Capricorn Hwy (East)	Left	23 / 2	5 / -	**28 / 2**	113 / 2	19 / -	132 / 2	**371%**/-	**Y** / -
	Through	138 / 159	30 / 35	**168 / 194**	138 / 159	30 / 35	168 / 194	-/ -	- / -
Capricorn Hwy (West)	Left	6 / 1	1 / -	**7 / 1**	29 / 1	4 / -	33 / 1	**371%** / -	**Y** / -
	Through	156 / 135	35 / 30	**191 / 165**	156 / 135	35 / 30	191 / 165	- / -	- / -
Power Station Rd (North)	Left	2 / 23	- / 5	**2 / 28**	2 / 113	- / 19	2 / 132	/ **371%**	- / **Y**
	Right	1 / 6	- / 1	**1 / 7**	1 / 29	- / 4	1 / 33	- / **371%**	- / **Y**
Total		**326 / 326**	**71 / 71**	**397 / 397**	439 / 439	88 / 88	527 / 527	32.7% / 32.7%	**Y / Y**

5.3.2 Delay assessment

The project intersections with SCR network links have been assessed for both base case and construction period (assumed 2023) in accordance with the procedure outlined in the TMR GTIA document, as summarised in the following:

- Each intersection that has any >5% turn movement volume increases has been analysed for the base case, and construction peak to determine the movement delays.
- Total vehicle -minutes across each intersection and scenario have been calculated, to determine the development impact in accordance with the aggregate intersection delay impact vehicle minutes formula. Where development traffic adds less than 5% of delay to the base case traffic aggregate, no mitigation to treat the intersection delay is required.
- With development intersection vehicle minutes is calculated by multiplying the 'with development' scenario average delay by movement, by the base case volume for each movement. This purposely does not count the impact as delays to development traffic, only to pre-existing traffic that is affected by the additional delays.
- Base case intersection vehicle minutes is calculated by multiplying the base case average delay by movement by the bas case volume for each movement.
- Identify any intersection upgrades if required to mitigate intersection delay.

A SIDRA intersection 9.0 performance assessment has been carried out for each of these intersections under the base case and construction year (assumed 2023) peak hour conditions to confirm that they will operate within acceptable capacity limits with the additional traffic forecast to be generated by the proposed development, in accordance with standard practice.

SIDRA parameters

Key SIDRA parameters adopted for measuring intersection performance, include the following:

- **Degree of Saturation (DoS)** - Degree of saturation (DoS) is defined as the ratio of demand to capacity of a given intersection. A DoS of 1.0 indicates the intersection is at full capacity, and above 1.0 is oversaturated, resulting in long queues and delays. In practice, a DoS of 1.0 would result in unstable flows, therefore there is a practical DoS which represents the target maximum saturation. The maximum target DoS for signalised intersections is 0.90, and for an unsignalised intersection is 0.80.
- **Average Delay** - The delay time, in seconds, which can be expected over all vehicles making a particular movement in the peak hour. More than 70 seconds of delay on a movement equates to a Level of Service of F and usually indicates severely congested conditions, while delays of 0 – 28 seconds represent good operation and delays of 43 – 56 seconds suggest operation near capacity, depending upon the nature of the movement and the intersection control.
- **Level of Service (LOS)** - An index of the operational performance, based upon delays, measured on an A to F scale, with LOS A representing the best operating conditions and LOS F the worst.
- **95th Percentile Queue** - The maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour. In other words, only 5% of queues during the peak hour will exceed this queue. The acceptability of this length varies according to site conditions but as a minimum it is important to at least achieve sight distance to the back of queue to avoid a safety risk. SIDRA intersection turn movements have been increased to be at least 1 light vehicle per hour, to meet program requirement.

5.3.3 Vehicle delay calculation

Table 10 provides a summary of the aggregate intersection delay calculations for the peak construction period (assumed 2023), and whether the intersection exceeds 5% of additional delay.

Table 10: Summary of construction year aggregate intersection delay calculations (AM / PM)

Intersection	Base (vehicle minutes)	Construction scenario (vehicle minutes)	Increase from base (%) *
Capricorn Hwy / Power Station Rd (east-bound on/off ramp)	1:13 / 3:18	1:12 / 3:18	-0.8% / -
Capricorn Hwy / west-bound off ramp	3:17 / 0:15	3:12 / 0:15	-2.4% / -
Power Station Rd / west-bound off ramp	3:23 / 2:26	3:23 / 2:23	- / -1.9%
Total	**7:53 / 5:58**	**7:48 / 5:56**	**-3.3% / -1.9%**

** It is noted that modelling for the Capricorn Highway / Power Station Road interchange was completed as a network model in SIDRA. As a result, the reductions are not intuitive with additional demand and show an overall reduction in aggregate delay. It is possible that SIDRA may be producing these results due to the program-determined variables that have been used.*

The above indicates the aggregate delay across the Capricorn Highway / Power Station Road interchange for existing demand is less than 5%, therefore no mitigation works are required.

5.4 Road link capacity

The TMR GTIA guidelines require a link capacity assessment be undertaken on all SCR roads where the development traffic exceeds 5% of the opening year AADT base volume.

For this project, the existing traffic volume is compared against the construction period volume. Table 11 indicates that the Capricorn Highway link exceeds 5% of the base traffic in either direction. Specifically, the westbound direction sees an increase of 9.0%, while the eastbound direction only sees a 2.3% increase.

Table 11: Road link capacity assessment – base volume change during battery delivery

Road link	Existing			Construction Traffic			24h volume change exceed 5% of base traffic?
	LV	HV	Total	LV	HV	Total	
Capricorn Hwy east bound	1,580	400	1,980	1,618	407	2,025	+5.7% Yes
Capricorn Hwy west bound	1,533	481	2,014	1,687	508	2,195	

Although expected construction volumes result in a *marginally* greater than 5% increase of base traffic on the westbound Capricorn Highway road link, there is not anticipated to be any material impact to LOS on this link. Therefore, no road link capacity assessment is considered necessary under the GTIA and consequently no mitigation measures are required.

5.5 Pavement

Pavement assessments have been conducted for both the bulk earthworks and battery delivery peak construction periods in the following sections as these assessments consider annualised impacts.

The class for each heavy vehicle is determined in accordance with Austroads and GTIA.

- 12.5m single unit truck – Class 4
- 19.0 semi-trailer – Class 9
- 26m B-double – Class 10
- Prime Mover 19m – Class 6

Based on the referenced pavement and culvert review, the pavement along both Capricorn Highway and Power Station Road is granular pavement with thin bituminous surfacing, however this will require confirmation.

As per section 13.1 of GTIA, for sealed roads, Standard Axle Repetition (SAR) has replaced Equivalent Standard Axle (ESA). For the purposes of this assessment, SAR4 has been used as Capricorn Highway is assumed to be granular pavement. [7]

Capricorn Highway

Construction activities are expected to result in increased activities of heavy vehicles along Capricorn Highway and an impact assessment of the road pavement has been undertaken in accordance with the GTIA.

The daily traffic volume for Capricorn Road is 3,994 vpd, with approximately 22% HV. As per TMR's *Guide to Traffic Impact Assessment Practice Note: Pavement Impact Assessment Section 3.3* in accordance with GTIA, a background SAR per HV of 3.2 is adopted as Capricorn Highway is categorised as "All other roads".

Table 12: Estimated background SAR4s – Capricorn Highway

Road Name	Direction	Vpd	% HV	AADT HV	SAR / HV	SAR / DAY	SAR / ANNUM
Capricorn Highway	WB	2,014	24%	481	3.2	1,539	561,808
Capricorn Highway	EB	1,980	20%	400	3.2	1,280	467,200

[7] As per TMR's *Guide to Traffic Impact Assessment Practice Note: Pavement Impact Assessment Section 2.1.2*, "SAR accounts for the exponential load damage by different pavement types such as for granular pavement (SAR4), asphalt (SAR5) and cement stabilised pavements (SAR12)."

Battery delivery

For battery delivery, a larger special low loader vehicle required for the two sub-station transformer deliveries, including two loaded trips to site) and two unloaded (with trailer and prime movers separate) trips from site, has been assumed to be eligible for the purposes of this assessment as on a per axle basis this is not expected to significantly vary to a Class 10 vehicle.

During the battery delivery peak construction period (4 weeks), a total of 936 heavy vehicle movements (Class 10) will be generated on Capricorn Highway, with 80% travelling to and from site from the east and 20% travelling to and from site from the west. The daily SAR4 impact due to battery deliveries is estimated below.

Table 13: Battery delivery construction traffic SAR4 – Capricorn Highway

Direction	Vehicle Class	HV Volume	SAR / HV	SAR Total	SAR Increase (%)	>5%
Eastbound (loaded)	Class 10	245	6.3	1,544	0.3%	No
Westbound (unloaded)	Class 10	245	0.53	130	0.0%	No
Westbound (loaded)	Class 10	980	6.3	6,174	1.1%	No
Eastbound (unloaded)	Class 10	980	0.53	519	0.1%	No

In both directions the construction traffic increases the SAR by 1.1% or less during the period of construction, therefore resulting in negligible impact on Capricorn Highway pavement.

Bulk earthworks

During bulk earthworks peak construction period (8 weeks), a total of 7,002 heavy vehicles movements (Class 9) will be generated on Capricorn Highway, again assuming that 80% are travelling to and from site from the east and 20% are travelling to and from site from the west. The daily SAR4 impact due to bulk earthworks is estimated below.

Table 14: Bulk earthworks construction traffic SAR4 – Capricorn Highway

Direction	Vehicle Class	HV Volume	SAR / HV	SAR Total	SAR Increase (%)	>5%
Eastbound (loaded)	Class 9	5,602	4.93	27,618	5.9%	Yes
Westbound (unloaded)	Class 9	1,401	0.51	715	0.1%	No
Westbound (loaded)	Class 9	1,401	4.93	6,907	1.2%	No
Eastbound (unloaded)	Class 9	5,602	0.51	2,857	0.6%	No

The eastbound direction the construction traffic increases the SAR by 5.9% during the period of construction and it may impact the life of the eastbound lane pavement. There is negligible impact on westbound pavement.

The recommendation is to conduct another pavement and culvert assessment prior to the commencement of construction activities due to the 5-year period that has elapsed since the last assessment.

Power Station Road

It is noted that the GTIA does not apply to Power Station Road. Notwithstanding, for the purposes of this assessment and in response to RRC's RFI, construction activities are expected to result in increased

activities of heavy vehicles along Power Station Road and an impact assessment of the road pavement has been undertaken in accordance with the GTIA.

The daily traffic volume for Power Station Road is 315 vpd, with 20% HV. As per TMR's *Guide to Traffic Impact Assessment Practice Note: Pavement Impact Assessment Section 3.3* in accordance with GTIA, a background SAR per HV of 3.2 is adopted as Power Station Road is categorised as "All other roads". Refer to Table 15 for the estimated background SAR4s.

Table 15: Estimated background SAR4s – Power Station Road

Road Name	Direction	Vpd	% HV	AADT HV	SAR / HV	SAR / DAY	SAR / ANNUM
Power Station Rd	WB	126	20%	32	3.2	102	37,376
Power Station Rd	EB	126	20%	32	3.2	102	37,376

Battery delivery

During the peak construction period (6-weeks), a total of 936 heavy vehicle movements (Class 10) will be generated on Power Station Road. The daily SAR4 impact due to battery deliveries is estimated below.

As for Capricorn Highway, a larger special low loader vehicle required for the two sub-station transformer deliveries, including two loaded trips to site) and two unloaded (with trailer and prime movers separate) trips from site, has been assumed to be eligible for the purposes of this assessment as on a per axle basis this is not expected to significantly vary to a Class 10 vehicle.

Table 16: Construction traffic SAR4 – Power Station Road

Direction	Vehicle Class	HV Volume	SAR / HV	SAR Total	SAR Increase (%)	>5%
Westbound (loaded)	Class 10	1,224	6.3	7,711	20.6%	Yes
Eastbound (unloaded)	Class 10	1,224	0.53	649	1.7%	No

In the westbound direction the construction traffic increases the SAR by 20.6% during the period of construction and it may impact the life of the westbound lane pavement. There is negligible impact on eastbound pavement.

The recommendation is to conduct another pavement and culvert assessment prior to the commencement of construction activities.

Bulk earthworks

During bulk earthworks peak construction period (8 weeks), a total of 7,002 heavy vehicles movements (Class 9) will be generated on Power Station Road. The daily SAR4 due to bulk earthworks is estimated below.

Table 17: Bulk earthworks construction traffic SAR4 – Capricorn Highway

Direction	Vehicle Class	HV Volume	SAR / HV	SAR Total	SAR Increase (%)	>5%
Eastbound (loaded)	Class 9	7,002	6.3	44,113	118.0%	Yes
Westbound (unloaded)	Class 9	7,002	0.53	3,711	9.9%	Yes

It can be observed that in the eastbound direction the construction traffic increases the SAR by 118.02% during the period of construction and is likely to impact the life of the eastbound lane pavement. There is also a less significant impact on westbound pavement with a SAR increase of 9.93%.

The recommendation is to conduct another pavement and culvert assessment for Power Station Road prior to the commencement of construction activities due to the 5-year period that has elapsed since the last assessment.

5.6 Transport infrastructure

5.6.1 Access

As detailed in Aurecon's Central Renewable Energy Zone - Battery Energy Storage System (CREZ BESS) Planning Report, swept path modelling has been undertaken to determine the potential traffic impacts of transporting a 190t transformer of approximately 10.3 m x 3.9 m x 4.4 m in size to the Project Area.

A custom design vehicle was created on AutoCAD for swept path analysis (refer to Figure 15 in Section 4.1). It is noted that the vehicle specifications used for this analysis were based on a previous similar project with similar access conditions and transformer size.

The haulage route for all vehicles involves the Capricorn Highway, Power Station Road, and Switchyard Road.

The modelling for the largest 190t transformer haulage vehicle indicates that temporary removal and/or reinstatement of a grassed traffic island will be required at the Capricorn Highway eastbound on/off ramp loop as the vehicle will traverse across it to access Power Station Road (refer to Appendix A).

All other vehicles will be able to access Power Station Road from Capricorn Highway in the normal manner.

The final site turn-around is to be confirmed during detail design (i.e. from Power Station Road to Switchyard Road and vice versa).

5.6.2 Culverts

As noted in Section 2.7, Cardno previously determined the suitability of existing culverts and pavement to transport a large generator along Power Station Road to the Stanwell Power Station in 2019.

This assessment concluded that the culverts were generally in fair condition and only required minor repairs. Several culverts were however identified to require minor repairs and recommended propping of certain culverts and link slabs prior to transport of the large transformer.

The recommendation of this report is to conduct another pavement and culvert assessment prior to the commencement of construction activities.

5.7 Other considerations

Specific traffic management measures to be implemented during construction of the project will be identified and implemented by the construction contractor to the satisfaction of the relevant road authority.

Notwithstanding, it is expected that several construction traffic management measures will be employed to manage the increase in the number of vehicles (including heavy vehicles) accessing the Project site from the Capricorn Highway / Power Station Road interchange, along Power Station Road, and via the Power Station Road secondary access point (to be used for construction).

It is also noted that permitted will be required for OD and/or OSOM roads as discussed below.

5.7.1 Construction traffic management measures

Construction traffic management measures will be adopted for this project, including TMP and TCP. The Manual of Uniform Traffic Control Devices shall be used as a basis for developing TMP relating to all construction activities on and near all roads being used, including access roads. General traffic management

strategies and measures recommended to be adopted during the construction period include, but are not limited to:

- Power Station Road speed reduction on the approaches to the Power Station access points
- Power Station Road speed reduction on approach to/from the Capricorn Highway.
- Switchyard Road speed reduction,
- Warning signs on Power Station Road as required.

Notwithstanding the above, treatments may be required for specific instances, such as the one-off delivery of the 190t transformer (as well as escort and pilot vehicles, etc).

5.7.2 Over Dimensional (OD) / Over Size Over Mass (OSOM) Vehicles

The construction contractor may be required to procure permits/approvals for the transportation of transformers, batteries, and site machinery for certain excess mass/excess dimension vehicles. The construction contractor will therefore need to consider the following for the transportation of any excess mass/excess dimension vehicles:

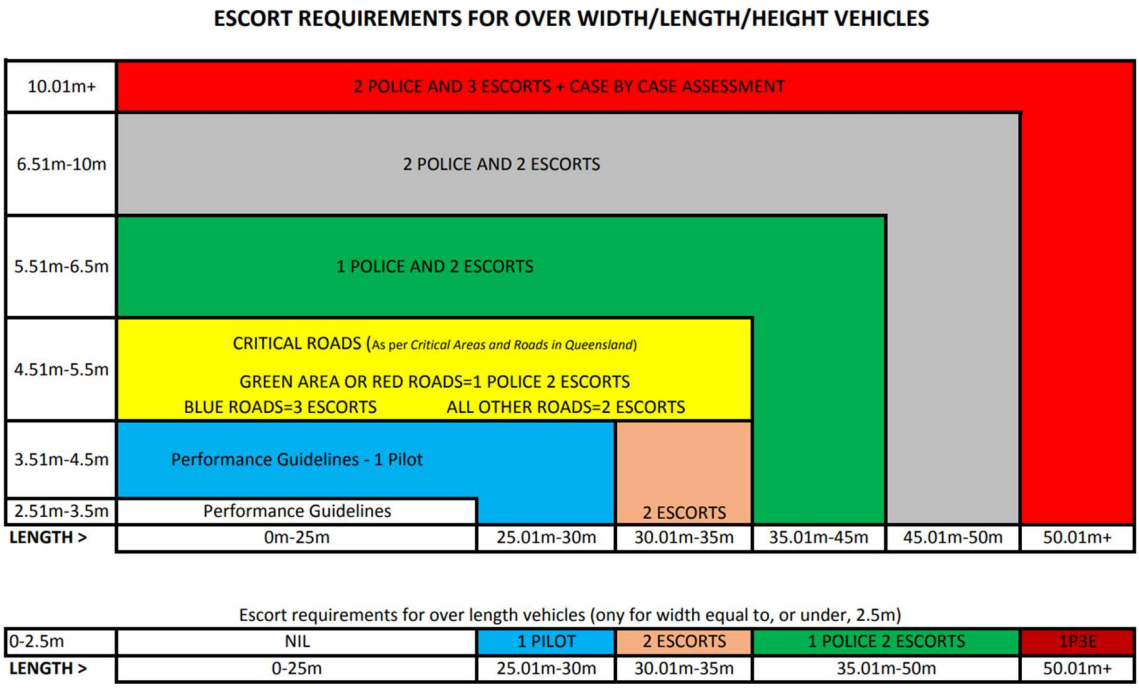
- Rockhampton Regional Council approvals
- TMR permit conditions
- approvals from Queensland Police Services (QPS)
- any other requirements under the Transport Operation (Road Use Management) Act 1995 (Qld).

The construction contractor should provide movement schedules to QPS, three months in advance of the movement schedule commencing, or later by the arrangement with Regional Traffic Coordinator.

A TMP should be prepared prior to commencement of any deliveries for high risk OSOM movements. The TMP's would include the following:

- Alternate diversion route for non-construction vehicle
- Potential lay-by areas for OSOM vehicles to allow vehicles to overtake at various locations along the corridor
- details of road work / pavement modifications
- vegetation management
- temporary parking restriction requirements
- earthwork and structural modifications
- intersection upgrades.

The requirements for escorting of over dimensional loads are also summarised in Figure 21.



Escort requirements for over length vehicles (ony for width equal to, or under, 2.5m)

0-2.5m	NIL	1 PILOT	2 ESCORTS	1 POLICE 2 ESCORTS	1P3E
LENGTH >	0-25m	25.01m-30m	30.01m-35m	35.01m-50m	50.01m+

Figure 21: Guide for Over dimensional vehicles (Queensland Police Service)

6 Conclusion

Based on the above discussions and analysis, the following is summarised:

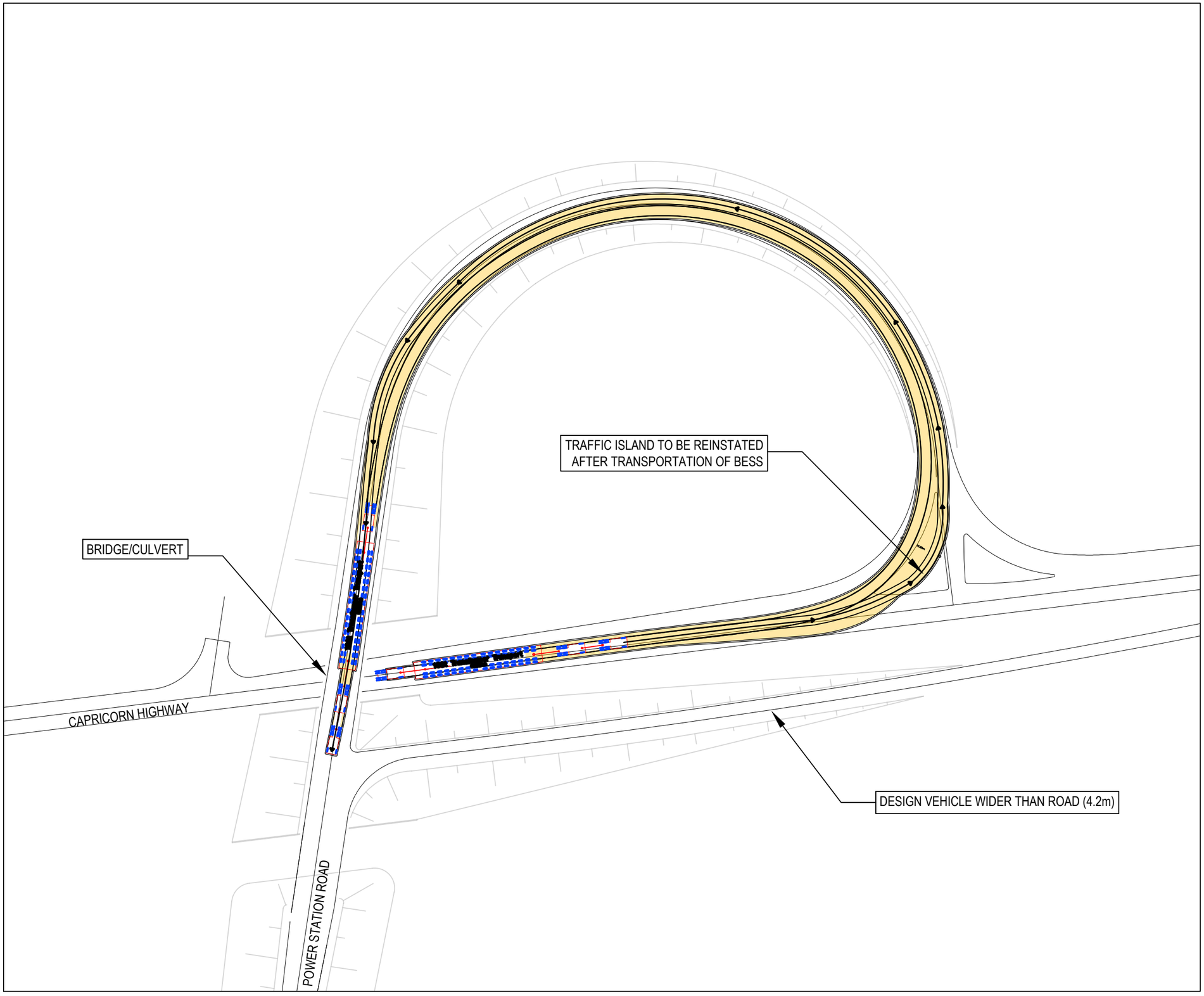
- The proposed BESS facility Stage 1 is proposed to be constructed concurrently as two units and is expected to generate peak construction traffic volume movements over a six-week period:
  - Unit 1: 150MW/600MWh installation, and
  - Unit 2: additional 150MW/600MWh.
- Access is proposed via Power Station Road / Switchyard Road intersection (i.e., the power station's secondary access) which is accessible from Power Station Road and Capricorn Highway to the north-east.
- Peak construction activity during battery delivery is expected to generate a total of 7,836 vehicle movements comprising:
  - Light vehicles (LV): 6,900 movements by construction workforce
  - Heavy vehicles (HV): 1,224 movements for construction material delivery (including transformers and batteries), equipment transportation, etc.
- Peak construction activity is expected to generate 218 vehicle movements per day comprising 192 LV and 26 HV, and 96 LV and 13 HV movements in any peak hour.
- An impact assessment has been undertaken in accordance with QLD TMR GTIA which includes:
  - A **road safety assessment** was completed in Section 5.1:
    - **Crash history** – the likely increase in construction traffic is not expected to increase crash risk at the location, and therefore no mitigation measures are required.
    - **Sight distance** – a preliminary desktop assessment shows unobstructed sight distances at intersections of Capricorn Highway/Power Station Road, Power Station Road/ Primary Access Road, and Power Station Road / Secondary Access Road. However, it is recommended that, an in-person assessment is to be conducted closer to construction to confirm these preliminary findings.
    - **Turn movements** – a turn lane warrant assessment was undertaken for egress movements from Capricorn Highway to Power Station Road during AM Peak hour. The assessment indicated that a basic left turn lane treatment is warranted on the western approach left turn lane into Capricorn Highway and a channelised left turn is warranted on the eastern approach left turn from Power Station Road onto Capricorn Highway. As both approaches currently meet or exceed these warranted treatments, no mitigation measures are required during construction.
    - **Risk assessment** – the existing safety risks and construction period impacts were assessed. It was observed that there are increased movements at Capricorn Highway/ Power Station Road interchange, along Power Station Road and Switchyard Road. However, it is noted that TMP(s) will be in place prior to commencement of construction, including speed reductions, advance warning signs and site traffic control. Therefore, no mitigation measures are required for road safety. Further to this, no additional road safety audits and or road safety assessments are considered warranted.
  - An **access and frontage impact assessment** in Section 5.2 indicates that the site frontage and construction works do not front or propose access from the SCR network. Notwithstanding, no changes are proposed or considered necessary regarding exiting access points from Power Station Road (RRC road).
  - An **intersection delay impact assessment** in Section 5.3 indicates that the change in aggregate delay across the Capricorn Highway / Power Station Road interchange is less than 5% therefore no mitigation works are required.
  - **A road link impact assessment** in Section 5.4 found that construction volume increases were *marginally* greater than the 5% specified in TMR's GTIA. However, as the additional demand is only

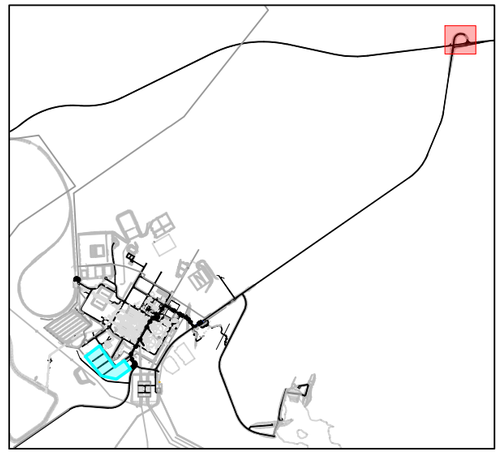
marginally greater than the threshold specified by TMR and is not expected to have a material impact on LOS on Capricorn Highway. Therefore, on balance it is considered unnecessary to undertake any further analysis and no mitigation measures are required.

- A **pavement impact assessment** in Section 5.5 identified that the proposed construction works may have an impact on:
  - the south-westbound pavement on Power Station Road due to battery delivery.
  - both traffic directions of pavement on Power Station Road and eastbound pavement on Capricorn Highway due to bulk earthworks.

  It is recommended that another pavement and culvert assessment prior to the commencement of construction activities is conducted for both Power Station Road and Capricorn Highway.
- A **transport infrastructure assessment** in Section 5.6:
  - **Transport infrastructure** – the swept path analysis of the custom low loader vehicle for transportation of the transformers shows that temporary removal of grassed traffic island will be required at Capricorn Highway eastbound on/off ramp loop. It is recommended that this is completed prior to transportation of the transformer. Transportation of the transformer will require approvals from RRC, TMR, and QPS. It is also recommended that a new pavement and culvert assessment is conducted prior to the commencement of construction activities.
  - **Culverts** – the culvert assessment shows that some culverts require minor repairs. It is recommended that another assessment is to be completed prior to the commencement of construction activities.
- **Other considerations assessed** in Section 5.7 - minor temporary traffic management measures and vehicle permitting will be required for all construction phases of the project as per TMP.

Appendix A
Swept Path Assessment





NOTES:

1. TRANSPORT VEHICLE CONSISTS OF 3 x PRIME MOVERS & 16 LINE MODULAR TRAILER (GROSS 353.5t)

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SUPERSEDED DRGS:

REFERENCE DRGS:

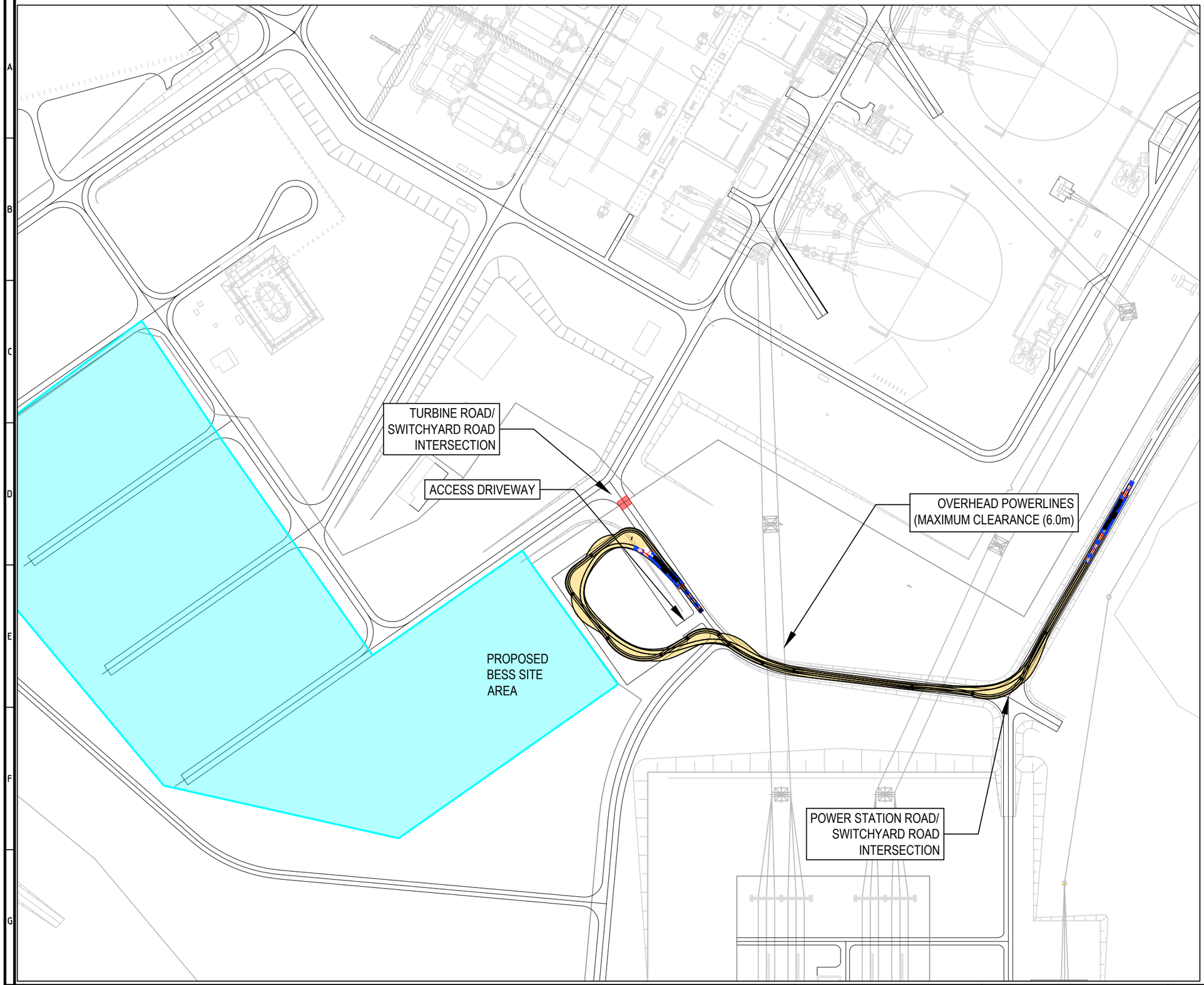
STANWELL Power Station | stanwell

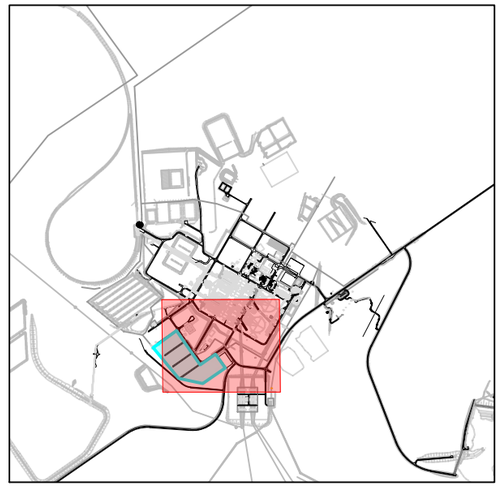
CENTRAL RENEWABLE ENERGY ZONE
BESS PROJECT
TRANSPORT LOGISTICS
ENTRY

AURECON DRAWING No.
CRBP-DRG-CC-0001

STANWELL DRAWING No.
CRBP-0000-AGP-100-DRG-C-0003

Drawn	P.S.
Date	21.12.2021
Scale	N.T.S
Revision	C





LEGEND

PROPOSED SITE BESS AREA

SECURITY GATE

NOTES:

1. TRANSPORT VEHICLE CONSISTS OF 3 x PRIME MOVERS & 16 LINE MODULAR TRAILER (GROSS 353.5t)
2. OPTION DEMONSTRATES TIGHTEST TURN FOR CRITICAL VEHICLE. CONTRACTOR MAY UTILISE LARGER TURNING CIRCLE.

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SUPERSEDED DRGS:

REFERENCE DRGS:

STANWELL Power Station | stanwell

CENTRAL RENEWABLE ENERGY ZONE
BESS PROJECT
TRANSPORT LOGISTICS
OPTION 3A

AURECON DRAWING No.
CRBP-DRG-CC-0002
STANWELL DRAWING No.
CRBP-0000-AGP-100-DRG-C-0004

Drawn	P.S.
Date	21.12.2021
Scale	N.T.S
Revision	C

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2022-11-02

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022

Rockhampton Regional Council (RRC)
C/- Hugh Campbell
Senior Consultant
Aurecon
sent via email: hugh.campbell2@aurecongroup.com.au

Dear Hugh

Stanwell BESS FEED Facility Development Application (D/82-2022) – Traffic Impact Assessment Report

Introduction

I refer to recent correspondence from Rockhampton Regional Council (RRC, dated 26 October 2022) regarding the development application for the Stanwell BESS facility proposed within the Stanwell power station site.

Specifically, the RRC provided draft conditions for the development but have limited approval to Stage 1 of the project as the traffic impact assessment submitted did not consider Stage 2 (e.g., the remainder of the project). Aurecon has subsequently discussed the Stanwell BESS facility traffic impact assessment with RRC's 'Engineering Development Unit' who assessed this report submitted with the application.

The following letter provides further discussion regarding construction of Stage 2 of the Stanwell BESS facility.

This letter addendum should be read in conjunction with the 'Stanwell BESS FEED Traffic Impact Assessment' (dated 12 October 2022 revision A).

Discussion

The overall development comprises a BESS facility with a total capacity of 1,450 MW / 2,900 MWh (including necessary transformer, cabling, and switching gear, etc.), including:

- Stage 1: of 150 MW / 300 MWh and
- Stage 2: 1,300 MW / 2,600 MWh.

Stage 1 includes delivery of a 190t transformer via special low lower transport (multiple axle custom low loader trailer and three (3) prime mover trucks, with a total length of 66m). It expected that this 190t transformer will be sufficient for capacity requirements beyond the Stage 1.

Construction of Stage 1 will extend over 12 months, with a peak 6-week construction period which includes the delivery of the battery systems. Stage 1 could be complete by early to mid-2024 (subject to required permits and approvals).

Stage 1 traffic volumes generated have been calculated to be 100 light vehicles and 20 heavy vehicles per day for the construction period.

Stage 2

Completion of Stage 2 is expected to occur over several years and will primarily be driven by market demands. It is not clear when the remainder of the development will be completed and there is insufficient information to understand the Stage 2 traffic impacts and what mitigations are required.

To the best of our understanding, it is likely that Stage 2 will be constructed in similar fashion to Stage 1. Therefore, we estimate that traffic volumes generated would be similar to Stage 1 with 100 light vehicles and 20 heavy vehicles per day for the construction period.

Conclusion

I recommend a Stage 2 Traffic Impact Assessment be undertaken in line with TMR and RCC requirements when construction program and staging inputs are available in detail to confirm that traffic volumes generated will not exceed the daily traffic generation rates calculated for Stage 1.

Should you have any questions or comments, please do not hesitate to contact me on +61 7 3173 9467 or at **erin.thomas@aurecongroup.com**.

Yours sincerely

Erin Thomas
Lead Engineer (RPEQ 18608) – Integrated Transport & Mobility (QLD)

Copies: Ben Simpson – Associate – Aurecon Integrated Transport & Mobility (SAVI)

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/82-2022

Dated: 17 November 2022