Member of the Surbana Jurong Group

New Intercity Fleet Maintenance Facility Groundwater and Dewatering Management Plan

Groundwater and Dewatering Management Plan for EPBC 2016_7681

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Revision 2 of this document was reviewed, updated and endorsed by Cardno in January 2020.

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Glossary of Terms, Acronyms

Acronym	Name
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
As	Arsenic
AHD	Australian Height Datum
BACI	Before-After Control-Impact
Ca	Calcium
CBD	Central Business District
Cd	Cadmium
Cl	Chloride
COC	Chain of Custody
CMP	Construction Management Plan
Cu	Copper
DO	Dissolved Oxygen
DoEE	Department of the Environment and Energy
DPI	NSW Department of Industry Land and Water Division
EC	Electrical Conductivity
EMP	Environment Management Plan -(C) Construction -(O) Operation
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
Fe	Iron
FFMP	Flora and Fauna Management Plan
GDE	Groundwater Dependent Ecosystem
GWDMP	Groundwater and Dewatering Management Plan
HCO_3	Bicarbonate
Hg	Mercury
HV	High Voltage
K	Permeability, of soil, rock etc. or Potassium
Km	Kilometre
L/sec	Litres per Second, measure of flow
LGA	Local Government Area
M	Meter
m/day	meters per day, measure of flow rate or permeability
m/sec	meters per second, measure of flow rate or permeability
Mbgl	Meters below ground level
Mg	Magnesium
Mn	Manganese
NSW	New South Wales
Na	Sodium
NATA	National Association of Testing Authorities
NH_4	Ammonia
Ni	Nickle
NIF	New Intercity Fleet
NIFMF	New Intercity Fleet Maintenance Facility
NWQMS	National Water Quality Management Strategy
Pb	Lead
REF	Review of Environmental Factors
SIS	Species Impact Statement
SO_4	Sulphate
SWL	Standing Water Level
TARP	Trigger Action Response Plan

Acronym	Name
TDS	Total Dissolved Solids
TSC Act	Threatened Species Conservation Act 1994
TfNSW	Transport for New South Wales
TOC	Top of Casing
Zn	Zinc

Executive Summary

The NSW Government is delivering a New Intercity Fleet to replace the trains carrying customers from Sydney to the Central Coast, Newcastle, the Blue Mountains and the Illawarra. A purpose-built maintenance facility is being constructed at Kangy Angy on the Central Coast to service and maintain the new fleet of trains. To support the Project determination, approval was sought and received under Section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The New Intercity Fleet Maintenance Facility, Kangy Angy, NSW (EPBC 2016/7681) approval (Appendix B) requires a Groundwater Management Plan to be prepared and implemented for the Project (EPBC Condition No. 2).

The conditions attached to the project approval are discussed within this report and include:

- *(Commonwealth) "A detailed Groundwater Assessment is to be developed as part of, but prior to the finalisation of the detailed design process undertaken to confirm the potential impacts of the Project on local and regional groundwater conditions. The groundwater assessment shall identify management and mitigation measures to be implemented to ensure that groundwater impacts are appropriately managed";*
- *(State) Groundwater and Dewatering Management Plan as described in section 7.10.4 of the review of environmental factors; and*
- *(State) The Groundwater and Dewatering Management Plan must be submitted to the Department at least 1 month before construction commences, and construction cannot commence until the plan is approved by the Minister.*

The groundwater assessment shall be prepared in consultation with WaterNSW, DPI and Central Coast Council, and include consideration of impacts to adjacent GDE's.

The purpose of this plan is to:

1. Provide a reference guide for the management of groundwater during construction and operation of the facility;
2. To minimise potential impacts to groundwater dependent ecosystems (GDE's) and other beneficial uses i.e. nearby registered groundwater bores;
3. Comply with the Conditions of Approval listed in the New Intercity Fleet Maintenance Facility Project Determination Report (August 2017), in particular the requirements of the EPBC Approval Condition No.2; and
4. Comply with statutory or legislative requirements as they apply, i.e. Water Management Act 2000.

The site is underlain by quaternary alluvium and Terrigal Formation bedrock. These two geological units form two separate aquifer systems. Water quality information from registered bores indicates groundwater is relatively fresh in the alluvial aquifer and generally fresh to slightly brackish in the Terrigal Formation.

The potential risks related to groundwater include;

- *Risk to the project due to groundwater (inflows, dewatering, construction impacts);*
- *Risk to groundwater due to the project (contamination, reduced flow, changes in quality), the risk can be further divided based on the Construction Phase and the Operational Phase; and*
- *Risk to groundwater dependent ecosystems due to project impact on groundwater.*

To aid in mitigation of potential risks and to manage impacts on groundwater dependent ecosystems, this document presents;

- *An assessment of the current groundwater regime;*
- *A summary of potential impacts related to the facility;*

- *A summary mitigation / remediation measures; and*
- *A monitoring program (including groundwater and GDEs)*

The primary strategies to manage key risks include:

- *Baseline testing/sampling prior to construction;*
- *Continuous monitoring during construction and operation: and*
- *Development and implementation of flora & fauna/conservation management plans (including contingency measures)*

Mitigation measures which may be undertaken in the event impacts are detected or contamination found include:

- *Reducing dewatering rates to allow water table recovery;*
- *Recharge of pumped water through:*
    - *Soak away trenches; or*
    - *Reinjection bores.*
    - *Redirection of recharge to GDE areas should it is noted a decline in GDE health*
- *Minimising earthworks during periods of rainfall;*
- *Controlling surface water runoff and recharge; and*
- *Physical removal of any contamination sources.*

The project construction is not anticipated to cause permanent changes to the groundwater level or quality. GDE areas are not anticipated to be affected by construction dewatering. Dewatering to install the track subsurface drainage is expected to have a minor, short term impact on the local water table level during construction, this impact is anticipated to be within the natural range of variation. Project construction may cause contamination of the aquifer through fuel, oil or chemical spills however such spills are considered unlikely and/or minor on the basis that the site facility/operations will not be storing large amounts of chemicals and appropriate control measures will be initiated via the design phase and through the CEMP and OEMP.

In the event of contamination remediation measures will include:

- *Assessment of the impact through:*
    - *Determining and immediately controlling the source and if able removing it (for example excavation of contaminated soil);*
    - *Increased monitoring and installation of additional monitoring bores to assess the distribution and concentration of any migrating contamination;*
    - *Assess the risk to the environment, beneficial use and potential for harm; and if required;*
    - *Undertake numerical flow and fate and transport modelling to assess potential movement, receiving environment and remediation options;*
- *Development of a remediation action plan.*

If the above assessment indicates there is a potential risk of contamination and harm to the environment (aquifer/surface water movement offsite), beneficial use or GDE's a remediation action plan will be developed which may include one or more of the following:

- *Pump and treat;*
- *Cut off walls;*
- *Reactive barriers;*
- *Initiation of a bush regeneration program (via the Vegetation Management Plan) of the GDE communities;*
- *A combination of the above.*

- *Verify the remediation measures through; increased monitoring and reassessment of modelling.*

Any remediation measures, if determined to be required, will be in consultation with the EPA, DPI and TfNSW.

With regards to operations, the primary impact to groundwater level would be due to the under track drainage system. In general:

- The track is being constructed primarily on fill embankments, water draining into the under track drainage will be surface water;
- Where the under track drainage system is required to fall below the design groundwater level, blank (i.e. non-slotted) pipe shall be used to prevent groundwater ingress; and
- Groundwater ingress to the under track drainage system may occur during periods of high groundwater. At these times, the water recharge to the GDE would be high and flow through the drainage system would also be high, hence the risk to GDE from lower water levels or contamination would be minimal.

Whilst the risk to GDE's would be minimal, where an impact to the groundwater occurs (for example, significant noticeable groundwater drawdown from the intersection of the groundwater by the under track drainage system) contingency/mitigation measures may include:

- Recharge of groundwater between the affected GDE and source of the drawdown (using polished water from detention basins or pumped from the dewatering system).
- If chemicals of concern are noted in the monitoring bores, in addition to determining and eliminating the source, then as an interim contingency measure the monitoring bores may also be used to draw the watertable down in the vicinity of the GDE to prevent chemicals migrating into the natural environment and to mitigate the risk of contamination in the short term while longer term remedial measures can be implemented.
- Long term mitigation could include measures such as cut-off walls, pump and treat systems or chemical/biological treatment.

A further assessment and monitoring of the health of the GDE by an ecologist would also be carried out in line with the above suggested measures.

Operational requirements will be further reassessed in the development of the OEMP using groundwater monitoring results obtained during baseline and construction phase.

1 Introduction

1.1 Background

The NSW Long Term Transport Master Plan (NSW Government 2012, Transport Master Plan) identified the need to enhance rail passenger services; in particular for longer distance travel outside the metropolitan networks. In May 2014 the NSW Government announced its intention to invest in the procurement of the New Intercity Fleet (NIF), a fleet of trains that will cover the Central Coast, Newcastle and South Coast lines. The new fleet will allow for the replacement of the existing older train fleet currently in use.

The primary need for the "New Intercity Fleet Maintenance Facility" (the Project) is a direct result of the current procurement of the New Intercity Fleet trains and the requirement to adequately maintain these trains. The Kangy Angy site (this Project) is a priority site due to its ability to improve current train operations across the Sydney metropolitan network.

Currently intercity trains are maintained at Flemington Maintenance Centre with periodic major overhauls undertaken at Auburn. Intercity trains are currently stabled at a number of locations, including Flemington, Eveleigh, Mount Victoria, Lithgow, Gosford, Broadmeadow, Newcastle, Port Kembla and Wollongong. As part of the purchase of the NIF trains, the development of an enclosed maintenance facility (this Project) is to provide a dedicated space for the NIF rolling stock to be maintained.

1.2 Project Description

The Project will be located at Kangy Angy (the site) within the Central Coast Local Government Area (LGA) some 63 km north of the Sydney CBD (Figure A-1). The project site is located on the down track side of the Main North Line, between Tuggerah and Ourimbah railway stations. The site is bordered by the Main North Rail line to the south east, Orchard Road to the north west, Ourimbah road to the south west and private property to the north east.

TfNSW is delivering a new train maintenance facility at a site in Kangy Angy on the Central Coast of NSW to support he procurement of the New Intercity Fleet. The facility will undertake light and heavy maintenance activities for the new fleet of trains. The new facility will include about six kilometres of electrified railway, and will be seven tracks wide at its widest point, will cover an area of approximately 500,000 square metres bounded by a perimeter fence. The general site layout is provided on Figure A-2.

The key components of this facility include:

- *Maintenance facility elements:*
- *Fleet maintenance building.*
- *Six standing roads (for maintenance works on the train sets and to hold trains).*
- *One standing road for wheel lathe operations.*
- *Auxiliary workshops electronic.*
- *Clean room.*
- *Material storage (including flammable liquid storage).*
- *Wheel lathe.*
- *Automatic train wash.*
- *Site access roads.*
- *Miscellaneous buildings:*
- *Administration facilities.*
- *Signalling building.*
- *Security building.*

- *Compressed air building.*
- *Water treatment plant.*
- *Substation building power supply (traction power, bulk power, signalling power supply).*
- *Other infrastructure including:*
- *New railway track infrastructure on the western side of the existing rail corridor to allow for trains to enter and exit the maintenance facility site from the Main North Line.*
- *A new rail bridge (consisting of two separate structures) over Chittaway Creek and Turpentine Road.*
- *A new access roadway and bridge to the maintenance facility site off Enterprise Drive.*
- *A new flood access road between Orchard Road and the proposed new access roadway.*
- *A series of detention ponds*
- *Staff car park.*
- *Relocation of existing high voltage (HV) power transmission lines (Ausgrid and Sydney Trains HV assets).*
- *Combined services route (i.e. rail related utilities such as power, communications and signalling cables).*

A Review of Environmental Factors (REF), Species Impact Statement (SIS) and Additional Species Impact Statement were prepared in accordance with the requirements under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the former Threatened Species Conservation Act 1994 (TSC Act). To support the Project determination, approval was sought and received under Section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The New Intercity Fleet Maintenance Facility, Kangy Angy, NSW (EPBC 2016/7681) approval (Appendix B) requires a Groundwater Management Plan to be prepared and implemented for the Project (EPBC Approval Condition No. 2). EPBC Approval Condition No. 2 requires the preparation and implementation of a Groundwater Management Plan, and the preparation of a Flood Impact Assessment and Groundwater Assessment to minimise impacts of the Project on Groundwater Dependent Ecosystems (GDEs) that support or may support Melaleuca biconvexa located on and offsite.

This Groundwater and Dewatering Management Plan has been prepared to satisfy the requirements of EPBC Approval Condition No. 2.

The justification and need to the Project is outlined in Section 2 of the Review of Environmental Factors (REF) Vol

1.3 Purpose of Plan

The purpose of this plan is to:

1. Provide a reference guide for the management of groundwater during construction and operation of the facility;
2. To minimise potential impacts to groundwater dependent ecosystems (GDE's) and other beneficial uses i.e. nearby registered groundwater bores;
3. Comply with the Conditions of Approval listed in the New Intercity Fleet Maintenance Facility Project Determination Report (August 2017), in particular the requirements of the EPBC Approval Condition No.2; and
4. Comply with statutory or legislative requirements as they apply, i.e. Water Management Act 2000.

1.4 Risk to Groundwater

In general, the potential permanent changes to groundwater quality and level are not anticipated to be significant with the local system finding a new equilibrium post construction.

In dry periods the water table naturally declines therefore inflows to excavations will be minimal and construction impacts will therefore be minimal or will decrease accordingly. During periods of high rainfall, the water table naturally increases and inflows to excavations will increase accordingly. However, during wet periods there is increased recharge across the entire aquifer system and the increased recharge offsets any potential drawdown (and quality) impacts due to dewatering.

The overall potential risks related to groundwater include;

- *Risk to the project due to groundwater i.e. inflows, dewatering, construction impacts;*
- *Risk to groundwater parameters due to the project (contamination, reduced flow, changes in quality);*
- *Indirect Risk to GDE's and other beneficial uses.*

These risks can be further divided based on the Construction Phase and the Operational Phases.

1.4.1 Construction Phase

The main risks to / from groundwater during the construction phase include:

- *Land clearing and subsequent changes to recharge and recharge water quality;*
- *Embankments and paved areas resulting in changes to recharge and flow paths;*
- *Excavations below the water table that require dewatering and disposal;*
- *Groundwater contamination from chemical and hydrocarbon spills;*
- *Construction of detention basins resulting in changes to recharge and flow paths;*
- *Degradation of known GDE's and beneficial uses (nearby water bores) from above activities.*

1.4.1.1 Land clearing

Land clearing and surface earthworks will expose the area to different infiltration rates which may change the rate of rainfall recharge and may temporarily increase dissolution of ions impact groundwater quality. These types of impacts are usually short lived.

1.4.1.2 Embankments and paved areas

Embankments and paved areas will reduce the amount and distribution of recharge and may change groundwater flow paths and quality.

1.4.1.3 Excavations below the water table

Excavations below the water table may require dewatering which may lower the water table in the local area and provides a window into the aquifer potentially shortening any contamination flow paths. Pumped groundwater will be required to be disposed and if contaminated may pose a risk to the receiving environment.

As groundwater inflows are towards the excavation, changes to groundwater quality are anticipated to be captured by the excavation and not enter the down-gradient groundwater system. As long as dewatering drawdowns are within the natural groundwater fluctuation ranges the impacts to quality are expected to be negligible.

1.4.1.4 Contamination

Contamination of the groundwater can occur through fuel, oil and chemical spills and sewage leakage. Spills may occur during refuelling operations, maintenance or service of construction equipment, cleaning operations or sewage leaks.

1.4.1.5 Detention basins

Detention basins will be used to alleviate downstream flooding and to treat surface runoff. Due to the shallow water table, basins may be very close to or intersect the water table and act as localised recharge sources. Any contamination washed into the basins during rainfall events may have a shortened pathway to groundwater.

1.4.1.6 Degradation of GDEs

The above direct groundwater risks are also deemed to have an indirect potential impact to the two known GDEs that occur on the site. GDEs are defined as those '*ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services'.* GDEs require groundwater to maintain their composition and functioning. The removal or change in groundwater availability or quality will influence the composition, structure and function of these ecosystems.

As outlined in the REF, two plant communities within the Project site were determined as being GDEs. These consist of:

- *Melaleuca biconvexa – Swamp Mahogany – Cabbage Palm Forest*
- *Jackwood – Lilly Pilly – Sassafras Rainforest*

1.4.1.7 Beneficial Uses

Beneficial uses include the use of active nearby residential shallow aquifer "water bores" for both domestic and agricultural use.

The above identified direct impacts to groundwater (especially the interference/change to aquifer recharge and quality) have the potential to cause degradation and eventual loss of these ecosystems along with the fauna dependant on these plant communities. With regards to beneficial uses, the risk lies with potential loss of groundwater availability and quality.

1.4.2 Operational Phase

The potential risks to groundwater quality during operation of the facility include:

- *Contamination from the stormwater detention basins;*
- *Increased point source recharge causing localised flooding or water logging;*
- *General site contamination from the operation of the facility.*

As per Section 7.10.3 of the Project REF, there will be no new or residual excavations that would require dewatering through pumping during the operation of the facility and therefore it is considered to be a negligible potential impact to groundwater during operational activity.

The primary impact to groundwater level during operations would be due to the under track drainage system. In general:

- The track is being constructed primarily on fill embankments, water draining into the under track drainage will be surface water;
- Where the under track drainage system is required to fall below the design groundwater level, blank (i.e. non-slotted) pipe shall be used to prevent groundwater ingress; and
- Groundwater ingress to the under track drainage system may occur during periods of high groundwater. At these times, the water recharge to the GDE would be high and

flow through the drainage system would also be high, hence the risk to GDE from lower water levels or contamination would be minimal.

The operational risks to groundwater are associated with contamination from potential chemical and fuel spills (as per Section 7.10.4 of the REF). This risk will be managed through the implementation of the maintenance facility operators spill response procedure, which will form part of the Operational Environmental Management Plan (as per TfNSW Condition of Approval No.14).

As done during the construction phase, during the operation of the facility hazardous materials procedures, including procedures for managing spills and refuelling will be implemented to minimise risks of groundwater contamination from chemical spills or leaks.

Operational requirements will be reassessed in the development of the OEMP using groundwater monitoring results during baseline and construction phase. Baseline monitoring does not indicate existing contamination onsite. In the event of a spill the groundwater monitoring program would be adjusted to included targeted analysis to assess a spills potential impact to the groundwater system.

1.4.2.1 Detention basins

The storm water detention basins may allow enhanced recharge through their base. Any contamination entering the basins may enter the groundwater system. Due to the excavation of the basins below natural ground level the base may intersect the water table shortening the flow path. Detention basins that intersect the aquifer are to be lined to minimise the risk of contamination and minimise the volume of groundwater seepage.

1.4.2.2 Localised groundwater mounding

The detention basins may act as localised recharge sources which may increase the local water table elevation. This may lead to water logging and/or salinization issues.

1.4.2.3 General site contamination

Operation of the facility for its intended purpose will involve train movements, maintenance, and repair, some manufacturing and cleaning, general vehicle movements and amenities infrastructure. All these may be potential sources of contamination.

1.4.3 Risk Assessment

The identified risks to groundwater have been rated in accordance with a structured framework, outlined in Table 1-1 to Table 1-3 below.

Table 1-1: Risk Framework

		Consequence				
Likelihood		1. Minor	2. Moderate	3. High	4. Major	5. Critical
	5. Highly Likely	Medium	High	High	Severe	Severe
	4. Likely	Low	Medium	High	High	Severe
	3. Possible	Low	Medium	Medium	High	Severe
	2. Unlikely	Low	Low	Medium	High	High
	1. Rare	Low	Low	Low	Medium	High

Table 1-2: Likelihood and consequence

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
Minor	Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.
Moderate	Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.
High	High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.
Major	The plan's objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.
Critical	The plan's objectives are unable to be achieved, with no evidenced mitigation strategies.

Table 1-3: Risk assessment and controls

Risk	Likelihood	Consequence	Risk Rating	Control Measures	Residual Risk	Risk Owner
Fuel spills during construction	3	4	High	Dedicated refuelling sites, store fuels in bunded areas	Fuel spills	Contractor
Fuel spills during operations	3	4	High	Dedicated refuelling sites, store fuels in bunded areas	Fuel spills	Operator
Groundwater Mounding	4	2	Medium	Line detention ponds, limit the rate of groundwater infiltration, place ponds / recharge trenches in area of high permeability	Groundwater Mounding	Designer

Risk	Likelihood	Consequence	Risk Rating	Control Measures	Residual Risk	Risk Owner
Water quality changes during construction	4	2	Medium	Minimise earth work during wet periods, ensure recharge water is of appropriate quality, follow this plan	Water quality changes	Contractor
Water quality changes during operation	4	2	Medium	Continue monitoring during operations, follow this plan	Water quality changes	Operator
Groundwater inflows to excavations causing instability	5	1	Medium	Follow good practice when working in excavations.	Groundwater inflows to excavations	Contractor
General site contamination during construction	3	3	Medium	Dedicated refuelling sites, store hazardous materials in bunded areas	General site Contamination	Contractor
General site contamination during operation	3	3	Medium	Dedicated refuelling sites, store hazardous materials in bunded areas.	General site Contamination	Operator
Water table drawdown	3	4	High	Restrict inflows to excavations, recharge the water table with pumped water, Minimise the time excavations are open and dewatered	Water table drawdown	Contractor
Groundwater Disposal contamination, water logging, insufficient capacity	5	3	High	Adequate assessment during design phase, appropriately designed disposal facilities (trenches, ponds), monitoring of quality, adequate cleaning / settlement and storage times	Water logging, Water quality changes, inability to dispose required volume	Contractor Operator, Designer
Degradation / loss of GDE's	2	4	High	GWDMP, monitoring and assessment	Loss of habitat	Contractor/Operator

Risk	Likelihood	Consequence	Risk Rating	Control Measures	Residual Risk	Risk Owner
(due to GW impacts)				(Vegetation health and groundwater) throughout the construction and operation phase, implementation of CEMP and OEMP		
Impacts to Beneficial Use (registered bores) during construction	1	3	Low	GWDMP, base line bore survey	Claims against the project	Contractor
Impacts to Beneficial Use (registered bores) during operation	1	3	Low	GWDMP, base line bore survey, construction monitoring program	Claims against the project	Operator

2 Regulatory Context

2.1 Conditions of Approval

The project has been granted both State and Commonwealth planning approval under Part 5 of the Environmental Planning and Assessment 1979 (EP&A Act) and under Sections 130(1) and 133 of the EPBC Act respectively, see Appendix B. The specific conditions of approval which relate to Groundwater are provided below.

2.1.1 Conditions Attached to the Approval:

State

New Intercity Fleet Maintenance Facility Determination Report, #57 Groundwater Assessment:

- *"A detailed Groundwater Assessment is to be developed as part of, but prior to the finalisation of the detailed design process undertaken to confirm the potential impacts of the Project on local and regional groundwater conditions. The groundwater assessment shall identify management and mitigation measures to be implemented to ensure that groundwater impacts are appropriately managed".*

The groundwater assessment shall be prepared in consultation with the NSW Department of Industry Land and Water Division (DPI), WaterNSW and Central Coast Council, and include consideration of impacts to adjacent GDE's.

Commonwealth

Conditions attached to the above State Approval.

To minimise the impacts of the action on Groundwater Dependent Ecosystems that support or may support Biconvex Paperbark located onsite and offsite, the person taking the action must implement Conditions 51 and 52 of the State Conditions of approval and must prepare and implement:

- Groundwater and Dewatering Management Plan as described in section 7.10.4 of the review of environmental factors, and
- The Groundwater and Dewatering Management Plan must be submitted to the Department at least 1 month before construction commences, and construction cannot commence until the plan is approved by the Minister.

Note: The above reference to Conditions 51 & 52 of the State Conditions changed in the final Determination Assessment to State Conditions 56 & 57. Condition 56, relates to Flood Impact Assessment.

In relation to monitoring of groundwater, the Department of the Environment and Energy (DoEE) Guideline for "*Groundwater and Dewatering Management Plans (GWDMP)"* requires the plan to be approved prior to the start of construction. The GWDMP requires the following to be addressed:

Table 2-1: Department of the Environment and Energy (DoEE) Guideline for "Groundwater Management Plans

Groundwater Management Plan (GWMP) (derived from EMP Guidelines)	Where addressed in GWDMP
1. The program includes an **executive summary** which states the relevant approval conditions, expands upon the purpose of the program, and outlines the primary strategies to manage key risks to program objectives.	Executive Summary
2. The program sufficiently **describes the project** so as to give context to the purpose of the program, and includes: a) the location and nature of project activities and timeframes; b) environmental information for these locations; and c) details relevant to specific approval conditions.	Section 1 and Section 2
3. The program describes the **purpose of monitoring** and its functional relationship to operational decisions.	Section 1.3
4. The program implements monitoring and reporting guidelines in the **National Water Quality Management Strategy** (NWQMS). The program: a) delineates NWQMS environmental values of relevant waters**;** b) includes baseline data and information on current biological, water quality and flow of those waters; c) identifies and describes potential water quality and flow hazards; d) evaluates the risks and quantifies cumulative effects; e) includes threshold triggers and/or guideline values to protect MNES; and f) includes biological, chemical and flow monitoring and assessment procedures.	Table 10
5. The program states **monitoring objectives** to meet operational decision-making. To this end the program, for each objective: a) specifies the **variables to be measured**, the state and/or rate of change, the precision and confidence, the spatial resolution and time scales required to inform operational decision-making; and b) includes 'early-control' (that management actions are effective) and 'early warning' (corrective actions are required) functions, to inform timely decisions on corrective actions.	Section 4, a) 4.3 Section 5
6. The program describes the **monitoring methods** that will be implemented, and: a) includes quantitative (e.g. on-ground survey results) and qualitative baseline data (e.g. analysis of water quality) that establish the start quality/condition of the environment; b) describes the sampling strategy (including monitoring area, site selection and sampling intensity over space and time) and statistical analyses to be employed; c) justifies the sampling strategy/monitoring methods, including through the likely statistical power delivered by the strategy/method; d) field and laboratory quality control/assurance program; e) justifies the monitoring methods to be used, including:	Section 4 and 5 a) 5.4 b) 5.2, 5.3, 5.4 c) Section 7. d) Section 6 e) 7.2, 7.3 f) 4.3 g) 5.4.2

Groundwater Management Plan (GWMP) (derived from EMP Guidelines)	Where addressed in GWDMP
• *an assessment of effectiveness and constraints to use;* • *capacity to detect change in environmental condition due to the project;* f) commits to engage appropriately qualified experts to design and conduct monitoring and survey activities, and analyse monitoring results; and g) the location, nature and number of monitoring sites, including benchmark/reference sites to detect project attributable impacts (c.f. seasonal variation).	
7. The program **assesses the risk** of failure to achieve the program's objectives. To this end the program: a) states the program objectives; b) identifies events or circumstances that prejudice the program's objectives. The events or circumstances must address scientific/ecological uncertainty, stochastic events and legal/land use planning factors that may represent risks; c) includes a qualitative assessment of the likelihood and consequence of those events or circumstances, and the residual risk of failure to achieve those criteria due to identified events or circumstances; d) characterises risk as low, medium, high or severe, and derived from likelihood (highly likely, likely, possible, unlikely, rare) and consequence (minor, moderate, high, major and critical); and e) explains how consequence, likelihood and risk level for each risk have been determined.	a) 1.3.1 b) 1.4 c) 1.4.3 d) 1.4.3
8. The program **manages the risk** of failure by: a) enhancing monitoring and management activities for high risk events or circumstances, thereby providing a 'margin of safety' to detect, avoid or mitigate the likelihood and/or impacts of the event or circumstance; b) specifying management triggers (measurable events or circumstances) that detect actual or potential issues in a timely manner to avoid, minimise or mitigate adverse impacts; c) ensuring the monitoring program includes activities to detect management triggers, and explaining how monitoring activities may inform the selection and implementation of corrective actions; d) detailing effective contingency responses and corrective actions that may be implemented if a management trigger is realised; and e) monitoring the effectiveness of corrective actions and implementing a 'stop work' response in the event corrective actions are not effective.	1.4.3 7.2 7.3
9. The program **identifies and manages uncertainty**. To this end the program specifies: a) key data/information used to formulate the program; b) the limitations and/or uncertainty associated with the use of that data/information; and c) how limitations and/or uncertainty, and associated risks, are mitigated during program implementation. For example, where a margin of safety is applied to management measures until	9

Groundwater Management Plan (GWMP) (derived from EMP Guidelines)	Where addressed in GWDMP
uncertainty is reduced to an acceptable level or performance targets are attained/maintained.	
10. The program includes a **data handling program** for data storage and protection, data extraction, quality control, analysis, interpretation, reporting and presentation. Data ownership and distribution, availability and licensing to the Department for compliance and recovery planning purposes, must be specified. Timelines for the data handling, analyses and delivery should be specified.	5.5 5.6
11. The program outlines a **periodic technical review and evaluation** of the program and the likely composition of the review committee(s).	9
12. The program is required under **EPBC Act approval conditions**, and includes a table containing: a) approval condition requirements; b) section and page numbers which address the approval conditions; c) key commitments for meeting each condition requirement.	This table and Table 9
13. The program includes a schedule and triggers for **auditing** the implementation and effectiveness of the program, and outlines auditable systems for recording program implementation.	Table 9
14. The program includes an **adaptive implementation program** to ensure uncertainty is reduced over time, and that program objectives are achieved. The program therefore includes arrangements for: a) ensuring new data/information is collected and incorporated into the program, as a result of implementing the program and from new information derived from external sources (e.g. academic literature, EPBC policy statements); b) effectively coordinating, scheduling and/or triggering monitoring, risk management, auditing and reporting activities; c) periodically reviewing risks, including in response to the risk level, changing circumstances or the results from implementing contingency responses; d) frequent review of the effectiveness of management measures with significant levels of uncertainty, relatively long implementation timeframes, and upon which the program is highly dependent; e) addressing the consequences of significant environmental incidents (pre-determined and unanticipated); and f) **reviewing the program** under the following circumstances: • *performance reports indicate performance targets may not be achieved;* • *according to approved timeframes; and* • *the impacts of significant environmental incidents.*	5.4
15. The program specifies **reporting commitments**, including: a) reporting required under EPBC conditions of approval; b) an outline of the standard report content; and c) a schedule and triggers for reporting.	5.4, Table 9
16. The program specifies **accountabilities** for implementing the program, including risk management, reporting, review and auditing.	Table 9

Groundwater Management Plan (GWMP) (derived from EMP Guidelines)	Where addressed in GWDMP
17. **Maps**, **plans, figures, images** and **sections** used in the plan: a) shows the monitoring area in a state and regional context; b) must be clearly legible, including fine print, when printed on A4; c) shows areas with differing environmental condition or quality; d) shows the location of static monitoring plots and/or the general location of random monitoring/survey activities that will be undertaken; e) are scaled to enable the reader to clearly identify, based on local landmarks (trees, fences, structures) the location of management features being shown on the map; f) include appropriate standard metric scales to represent the information (for example 1:100 000). Datum – plans and cross sections refer to AHD; g) have metric measurements, graphic bar scales, local grid lines and standards and north point or orientation of sections (include a key) are used throughout; and h) include title blocks in the lower right hand corner with the following information: EPBC number and project name, title and number of the plan, author, scale, date, source and date of data.	Appendix A
18. The program **references scientific, legal or other claims or statements** that support the effectiveness of the program, e.g. references to scientific literature, published guidelines, legislation, conservation advice, recovery plans, threat abatement plans.	10
19. The program uses the terms '**will'** and **'must'** when committing to actions, instead of 'where possible', 'as required', 'to the greatest extent possible', 'should' or 'may'.	Whole Document
20. The **footer or header** of each page of the program states the name of the project, EPBC #, date of the program and sequential page numbering.	Whole Document
21. The program includes a **glossary of terms** comprised of acronyms, terms open to different interpretations, not in common use, technical or defined in the approval conditions.	Page i
22. The program includes risk assessment and management, monitoring and reporting schedules prepared in accordance with Appendix A.	1.4.3

Further specific requirements may be added subject to the Minister's conditions of approval.

2.1.2 Licensing

2.1.2.1 Monitoring bores

Interactions, access and /or impacts to groundwater require NSW State licensing or approvals or both prior to interacting with it.

A Water Act 1912 licence is no longer required for monitoring bores that are:

- *Associated with State Significant Development, State Significant Infrastructure and Public Priority Infrastructure Projects; or*

- *Located outside of the Great Artesian Basin, that are less than 40m deep, provided they are constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia 2012.*
- *Any 'bored' investigation that is greater than 3m below the surface or encounters or has the potential to encounter groundwater must be conducted in accordance with the "Minimum Construction Requirements for Water Bores in Australia "3rd Ed 2012 (Federal legislative document) and any State specific requirements. This includes but is not limited to the following:*
- *Ensuring drilling activities do not cause harm to the groundwater environment;*
- *Including avoiding interconnection of separate aquifers;*
- *Spreading contamination or interconnecting contaminated and non-contaminated aquifers*
- *Construction of bores in accordance with required standards; and*
- *Decommissioning of boreholes in accordance with Minimum Construction Requirements for Water Bores in Australia. Note: this applies to geotechnical boreholes that have intersected or the potential to intersect groundwater not just water bores.*

The Project is located outside the Great Artesian Basin and has bores that are less than 40m deep and will therefore not require monitoring bore approvals to drill or licensing, but all bores must be constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia 2012.

2.1.2.2 Dewatering

Dewatering activities will be undertaken during construction and a license is required under the *NSW Water Management Act 2000*.

A Water Supply Works application was submitted to NSW Natural Resources Access Regulator. Water Supply Works approval was granted on the 3rd August 2018 (approval number 20WA219911).

Disposal of dewatering water is conducted under the *NSW Protection of the Environment Operations Act (1997)* for discharge of water from a point source, the project manages water discharges under section 2 of Environmental Protection Licence 21089.

3 Hydrogeological Setting

3.1 Hydrogeology

The project site is located on the south eastern side of Ourimbah Creek with Chittaway cutting across the southern end of the site and Bangalow Creek to the south west. The majority of the site sits on a slightly elevated hill adjacent to the Ourimbah Creek flood plain.

3.1.1 Aquifers

The site is underlain by quaternary alluvium and Terrigal Formation bedrock. These two geological units form two separate aquifer systems:

- *Quaternary Alluvium forms an unconfined, low to moderate permeability shallow water table aquifer consisting of sand, gravel and silty clays.*
- *Terrigal Formation forms an unconfined to confined low permeability aquifer with groundwater flow mainly through secondary permeability. The formation is described as interbedded silt and fine sandstone, shale, and fine to coarse grained quartz to quartz-lithic sandstone with minor red sandstone.*

3.1.2 Recharge and Discharge

Groundwater recharge to both aquifers is through rainfall infiltration. The alluvial aquifer may also receive recharge from surface flows. Groundwater discharge occurs through evapotranspiration, baseflow to creek and groundwater pumping. Groundwater may also transfer from the underlying Terrigal Formation to the alluvium where a positive head exists.

3.1.3 Gradient and Flow Direction

The groundwater level is expected to be a subdued version of topography with flow from areas of higher elevation towards the drainage lines. Gradients within the alluvium are expected to be relatively small due to the high permeability. The gradient within the Terrigal Formation may be much higher in the surrounding hills, especially to the south and southeast of the site.

Within the site boundary groundwater flows are predominantly towards Bangalow and Ourimbah Creeks to the west, north and north east. Groundwater may move from the higher ground to the south and south east through the site and likely constitutes upgradient flow in the Tuggerah Formation. Within the alluvial aquifer upgradient background water may be encountered south west of the site.

The interpreted groundwater elevation, based on observations in the geotechnical data report (Coffey 2016), is shown on Figure A-5 for the shallow alluvial / colluvium / residual soil aquifer. The Terrigal Formation and associated deeper groundwater aquifer is not anticipated to be intersected.

3.1.4 Depth to Water

Groundwater levels have been recorded in a series of open standpipe piezometers installed during the concept design phase investigations (Coffey 2016) and additional standpipes by SMEC in 2018, reported in the groundwater monitoring report NIF-SMEC-RPT-GE360002.

The water table under the site is noted as being generally shallow, with groundwater ranging from the existing ground surface to approximately 6.26 (BH01) meters below ground level (mbgl). The groundwater elevation ranges from 3m AHD to 13.37m AHD. The site generally sits above the 10m AHD contour.

The baseline monitoring results show a large natural variation in groundwater level linked to climatic trends. Review of the data showed water levels near ground surface following a period

of above average rainfall in early 2016. The 2018 monitoring shows lower groundwater levels (up to 3m lower) following a trend of lower rainfall.

3.1.5 Groundwater Quality

Water quality information from registered bores indicates groundwater is relatively fresh in the alluvial aquifer and generally fresh to slightly brackish in the Terrigal Formation.

Concept design stage durability analysis (Coffey 2016) indicates (BH1, 3, 5 and 19) the following:

- *pH – 4.9 to 5.8*
- *EC (µS/cm) – 240 to 460*
- *Sulphate (mg/L) – 14 to 77*
- *Chloride (mg/L) – 5.8 to 55*

The SMEC 2018 baseline groundwater quality sampling rounds show the following ranges:

- *pH – 4.4 to 6.2*
- *EC (µS/cm) – 138 to 1420*
- *Sulphate (mg/L) – 3 to 189*
- *Chloride (mg/L) – 28 to 424*

3.1.6 Groundwater Dependent Ecosystems

As stated in Section 1.4.1.6, the REF ecological studies identified two plant communities within the Project site as being groundwater dependent consisting of the following:

- *Melaleuca biconvexa – Swamp Mahogany – Cabbage Palm Forest*
- *Jackwood – Lilly Pilly – Sassafras Rainforest.*

From a groundwater perspective, the project may impact the above identified GDE's on site. Within the project boundary land clearing will remove vegetation from these GDE's and land modifications may change the hydrogeological regime however, any dewatering during construction will be temporary.

The location of three GDE exclusion zones relative to the proposed infrastructure is shown on Figure A-2.

Further details of regarding GDE's are discussed in Section 4.

3.1.7 Beneficial Use

The REF (TfNSW 2016) identified 23 registered groundwater bores within approximately one kilometre of the site. However, the REF stipulates that only two of the nearby bores (GW078813 and GW067278) are in the shallow aquifer and only pose a potential for some impact as they are in close proximity to the main building, where dewatering is expected. The impact is considered negligible as the groundwater levels at these bores are between approximately three and six metres below ground level and the maximum depth of excavation at the main building is approximately two metres below ground level.

Dewatering has an estimated maximum radius of influence of 60m, under the worst case (e.g. high water table and high permeability). During these times recharge is anticipated to offset any drawdown and the change in groundwater level at the private bore locations is expected to be minimal and likely not discernible from natural variations.

In addition, the groundwater in the excavation area appears to be semi isolated from the main alluvial flood plain groundwater as it forms a slightly elevated mound with flow outwards to the south west, west, north and north east. The impacts of any dewatering are anticipated to be minimal due to this slight groundwater mound and there is minimal to no through flow from up

gradient. Most private bores are located at lower elevations to the site with a deeper depth to water. Removal of water from a higher elevation may reduce the recharge to the system down-gradient however the area of the site is significantly smaller than the overall recharge area. The private bore closest to the excavation area has been purchased by the project.

Where registered bore owners are willing to participate, a bore survey of the above two bores (and any other nearby registered bores considered to be potentially impacted) will be carried out to assess the status of these registered bores. Registered bore locations are shown on Figure A-4.

3.1.7.1 Registered bore status

A survey registered bores within proximity of the project is summarised in table 3.1-1. The closest register bore is located approx. 260m away from dewatering activities. Note dewatering has an estimated maximum radius of influence of 60m, under the worst case (e.g. high water table and high permeability).

Table 3.1-1 Registered Bore Status within proximity to the project

Bore ID	**Site ID**	Bore Depth (m)	Drilled Depth (m)	Latitude	Longitude	Reference Elevation (m AHD)	Proximity to dewatering activities
GW047760.1.1	**GW047760**	51	51	[redacted]	[redacted]	32.9	2,680m
GW058853.1.1	**GW058853**	61	61	[redacted]	[redacted]	56.8	1,825m
GW059399.1.1	**GW059399**	112		[redacted]	[redacted]	15.9	1,080m
GW059613.1.1	**GW059613**	12.2	12.5	[redacted]	[redacted]	13.1	260m
GW060342.1.1	**GW060342**			[redacted]	[redacted]	26.3	1,110m
GW062047.1.1	**GW062047**	92	92	[redacted]	[redacted]	15.6	1,040m
GW064184.1.1	**GW064184**	7	7	[redacted]	[redacted]8	16.6	1,580m
GW066025.1.1	**GW066025**	45		[redacted]	[redacted]	14.1	900m
GW067278.1.1	**GW067278**	29	29	[redacted]	[redacted]	14	700m
GW067287.1.1	**GW067287**	37	37	[redacted]	[redacted]	10	830m
GW067288.1.1	**GW067288**	73	73	[redacted]	[redacted]	12	840m
GW078813.1.1	**GW078813**	30	30	[redacted]	[redacted]	12.8	620m
GW200235.1.1	**GW200235**	66.5	66.5	[redacted]	[redacted]	17.2	1,570m
GW200404.1.1	**GW200404**	12.2	12.5	[redacted]	[redacted]	13.1	300m
GW200498.1.1	**GW200498**	45	45	[redacted]	[redacted]	14.8	780m
GW019717.1.1	**GW019717**	5.4	5.5	[redacted]	[redacted]	31.7	1,630m
GW202226.1.1	**GW202226**	66	66	[redacted]	[redacted]	-	1,320m

4 Groundwater Dependent Ecosystems

4.1 Summary

The project is due to impact 26.6 hectares of Swamp Forest GDE (WSP, 2017) in the form of two plant community types that conform to the Swamp Forest GDE:

- *Melaleuca biconvexa – Swamp Mahogany – Cabbage Palm Forest*
- *Jackwood – Lilly Pilly – Sassafras Riparian Warm Temperate Rainforest.*

In addition, the ground water dependent species *Melaleuca biconvexa*, listed as vulnerable under the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999*, is present on site. Approximately 1,030 *Melaleuca biconvexa* individuals are due to be retained onsite in distinct protection areas, shown in Figure A-2.

All vegetation monitoring during and after construction shall be conducted in accordance with the Flora and Fauna Management Plan (FFMP). As part of the vegetation monitoring conducted an ecologist shall provide an overall assessment on GDE's health in accordance with the FFMP.

Condition monitoring of the retained stands of *Melaleuca biconvexa* will be conducted in the form of a BACI (Before After Control Impact) monitoring program.

The threatened frogs, Mahony's Toadlet (*Uperoleia mahonyi*) and Wallum Froglet (*Crinia tinnula*), are considered to be sensitive to ground water changes (being adapted to acid swamp conditions) and foraging and shelter habitat will be impacted in the form of clearing 13.8 hectares of Mahony's Toadlet habitat and 2.4 hectares of Wallum Froglet habitat. A monitoring program will be conducted for these species and is detailed in the Conservation Management Plan (CMP) for Mahony's Toadlet and Wallum Froglet. As part of the monitoring, management triggers are proposed. Further remedial actions are proposed should management measures implemented as part of the project be found not be successful.

4.2 Monitoring for Groundwater Dependent Ecosystems

Quantitative monitoring of terrestrial biodiversity values with potential to be impacted will be undertaken in the project area using a modified Before-After Control-Impact (BACI) design. Data collected as a part of the project Species Impact Statement will be supplemented with additional monitoring prior to dewatering to provide a baseline. Additional survey will be undertaken during construction at maximum six month intervals and for a suitable period during operations. The duration of operational monitoring is determined based on results of annual analysis of data as well as observed impacts to surface features and other monitoring (e.g. groundwater). If data analysis indicates changes are occurring, impacts to surface features are observed or changes to other monitoring programs indicate impacts may have or are occurring, monitoring will continue for a suitable period, determined in conjunction with TfNSW.

Data is collected at control (reference) site in the same manner and for the same duration as impact sites. Control sites are those that are to have a low likelihood of impact due to the project. This site provides data against which potentially impacted sites can be analysed. The use of control sites allows us to distinguish between impacts associated with the project and those associated with broader environmental and anthropomorphic variables (observed at both control and impact sites).

The location of the control site is the northernmost GDE exclusion zone as shown in Figure A-2.

Monitoring of the following biodiversity values in the retained areas project area and reference sites will be undertaken annually in the following areas:

- *One vegetation plot in each retained area of Melaleuca biconvexa – Swamp Mahogany – Cabbage Palm Forest and Jackwood – Lilly Pilly – Sassafras Riparian Warm Temperate Rainforest;*
- *Retained and translocated Melaleuca biconvex; and*
- *Mahony's Toadlet and Wallum Froglet.*

GDE Monitoring

Impacts to GDE vegetation may be evidenced by a change to the number of species at different sites, or an overall change in the species composition, as some species may be less affected than others. In affected areas, these impacts may manifest as the following:

- *Change in floristic Total Species Richness (TSR): the number of individual species and is calculated by summing the total number of unique species detected at each monitoring point during each season and year. This is a simple presence-absence measure and does not account for the relative abundance of each species; and*
- *Changes in the floristic species composition: the assemblage of different individual plant species that make up a vegetation community.*

Data is analysed statistically by calculating the TSR for each monitoring site through the sum of the number of species detected at each transect for each survey. Exploratory data analysis of this data is then undertaken which involves the plotting on a graph of the TSR for each survey year from when monitoring first commenced up to the current date of data collection to provide a visual indication of trends between impact and control sites, as well as trends prior to and following construction. To formally quantify whether trends detected visually represent actual changes in TSR, generalised linear mixed models (Bolker et al. 2009) are then tested for all sites.

Trends in floristic species composition is analysed at each transect within GDE's to determine whether there is a shift in the type of species detected before construction and following construction.

As part of the vegetation monitoring conducted an ecologist shall provide an overall a qualitative health assessment of the GDE's

***Melaleuca Biconvex* Monitoring**

Qualitative assessment of *Melaleuca biconvexa* monitoring data is also undertaken looking for changes in retained and translocated stands of *Melaleuca biconvexa*, including reduction in or impacts to suitable habitat. A range of monitored parameters will be collected to inform changes to condition of retained and translocated *Melaleuca biconvexa*. These include:

- *Area of stands;*
- *Height and DBH of selected individuals;*
- *Plant health / dieback;*
- *Leaves yellowing; and*
- *Evidence of myrtle rust.*

Additional details on the data collected and the timing of *Melaleuca biconvexa* monitoring are detailed in the CMP.

Mahony's Toadlet and Wallum Froglet Monitoring

Qualitative assessment of frog monitoring data is also undertaken looking for changes in frog habitat, including reduction in or impacts to suitable habitat (note that these could likely be the same measurements as for other vegetation monitoring). Data collected will be compared to baseline and previous years to allow analysis of temporal changes. The report will:

- *Describe any spatial and temporal changes in the distribution and abundance of Mahony's Toadlet and Wallum Froglet;*

- *Describe any spatial and temporal changes in the distribution, abundance and composition of plant communities;*
- *Describe the condition of amphibian populations in exclusion zones;*
- *Describe the condition of plants communities in exclusion zones;*
- *Outline any changes to Mahony ' s Toadlet and Wallum Froglet habitat that may have resulted from project related impacts;*
- *If any impacts have occurred, describe what mitigation measures were used to mitigate the impact;*
- *Outline any adaptive monitoring or additional monitoring protocols developed as a consequence of annual monitoring; and*
- *Provide recommendations (where necessary) for updating this CMP based on the outcome of annual monitoring.*

Further details on the data collected and the timing of vegetation monitoring are detailed in the Conservation Management Plan for Mahony's Toadlet and Wallum Froglet.

GDE management actions, triggers, mitigations and contingencies are presented in Section 9.

5 Monitoring Program

5.1 Introduction

This section outlines the intended groundwater monitoring program, locations, frequency and data requirements.

5.2 Pre-Construction Monitoring

5.2.1 Concept Design Stage

Concept design monitoring was undertaken as part of the geotechnical field investigations undertaken by Coffey (2016). Ten open standpipe piezometers were installed, four in January 2016 and an additional six in June 2016. Fortnightly water level monitoring was undertaken from June to September 2016.

Four groundwater samples were collected and analysed for Chloride, Conductivity, pH and Sulphate during this period for durability purposes.

5.2.2 Pre-Construction Detailed Design Stage

Existing piezometers are to be monitored throughout the detailed design and construction phase until the piezometers are decommissioned as required by the construction programme.

5.3 Long Term Monitoring Locations

New long term monitoring bores are to be installed up and down gradient from the site. Locations are shown in Figure A-2.

Groundwater monitoring locations have been chosen to allow assessment of project impacts to groundwater. Monitoring bores shall be located upgradient, within-site and down gradient within site constraints.

There are six groundwater monitoring bores to be installed within the project boundary. These bores are located outside the construction foot print and will be used for pre, construction and operational monitoring purposes. The groundwater monitoring bore locations are indicated on Figure A-2 and the details provided in Table 5-1. The location of long term monitoring bores have taken into account the local and regional hydrogeological setting (Section 3) and project construction constraints. The monitoring bores are all installed in the shallow alluvial/ highly weathered residual material of the unconfined aquifer.

Table 5-1: Groundwater monitoring bore details

ID	Easting	Northing	RL TOC (mAHD)	Total Depth from TOC (m)	Screen Length (m)	Screen interval (mbTOC) (m to m)	Notes / Justification
P101	[redacted]	[redacted]	13.13	9	3	4.7 - 9	Up Gradient Monitoring
P102	[redacted]	[redacted]	12.35	7.3	3	3.5-7.3	Site Monitoring
P103	[redacted]	[redacted]	14.94	8.8	3	4.8-8.8	Up Gradient Monitoring
BH01_P	[redacted]	[redacted]	11.46	7	6	1–7	Existing Piezometer - Adopt as long term up gradient monitoring

ID	Easting	Northing	RL TOC (mAHD)	Total Depth from TOC (m)	Screen Length (m)	Screen interval (mbTOC) (m to m)	Notes / Justification
BH03_P	[redacted]	[redacted]	11.17	8	6	2–8	Existing Piezometer - To be decommissioned
BH05_P	[redacted]	[redacted]	10.68	5.9	3	2.9–5.9	Existing Piezometer - To be decommissioned
BH10_P	[redacted]	[redacted]	13.7	10	3	7–10	Existing Piezometer - To be decommissioned
BH11_P	[redacted]	[redacted]	13.34	3	2	1–3	Existing Piezometer - To be decommissioned
BH12_P	[redacted]	[redacted]	13.34	8	3	5–8	Existing Piezometer - To be decommissioned
BH16_P	[redacted]	[redacted]	11.41	7	3	4–7	Existing Piezometer - Adopt as long term down gradient monitoring
BH19_P	[redacted]	[redacted]	9.95	6	3	3–6	Existing Piezometer - Adopt as long term down gradient monitoring
BH30_P	[redacted]	[redacted]	12.41	4	3	1–4	Existing Piezometer - To be decommissioned
BH37_P	[redacted]	[redacted]	10.2	7	3	4–7	Existing Piezometer - Adopt as long term down gradient monitoring. Decommissioned on 01/10/19
BH37_P_*Relo*	[redacted]	[redacted]		7	3	4-7	Bore drilled on 1st October 2019 – representative of the decommissioned BH_37_P

5.4 Monitoring Frequency & Reporting Requirements

The reporting requirements under this management plan are listed in Table 5-2. Reporting will be undertaken quarterly, unless additional reporting is triggered by exceedances of the trigger values or contamination. Monitoring reports will be provided at 12 monthly intervals from the start of construction. Water level measurements will be recorded continuously in the monitoring bores with the use of electronic data pressure transducer loggers and manual measurements and retrieval of data will be undertaken at the frequency indicated in Table 6.

Operational reporting requirements will be determined once the construction reporting has been completed.

Table 5-2: Monitoring frequency and requirements

Frequency	Manual Water Level [1]	Water Quality Analysis	GDE Ecologist Survey	Reporting	Comment
	Preconstruction				
Monthly	X	X			3 rounds of Preconstruction monitoring (in addition to 2016 results)
Prior to dewatering			X		Supplementary baseline ecological survey of GDE sites
Quarterly (start of construction)				X	Used to update GWDMP prior to the start of construction
	Construction Phase				
Monthly					*Manual Water Level readings moved to quarterly following the 2019 Annual report*
Quarterly	X	X		X	Manual Water Level Quarterly groundwater analysis and factual reporting
6 Months			X		Ecological survey of GDE sites
Annual				X	Annual monitoring reporting
	Operational Phase[2]				
Monthly	X				Water levels initially monthly reducing to quarterly after 3 months
Quarterly	X	X		X	Quarterly groundwater analysis and factual reporting, reducing to annually if no impacts, or independently certified as rehabilitated, assessed quarterly.
6 Months			X		Ecological survey of GDE sites

Annual		X		X	Annual monitoring reporting

Note: (1) Water level measurements will be collected monthly and every time the monitoring bore is accessed download of the installed data loggers will occur. The manual water level reading will be used to calibrate the data logger data. Water level hydrographs will include: continuous logger data, manual readings, daily rainfall and ground elevation.

(2) Operational requirements will be reassessed in the development of the OEMP – using groundwater monitoring results obtained during the baseline and construction phase.

5.4.1 Justification of Frequency

Construction of the Project will commence in May 2018 (subject to approval of this and other plans). This time frame is insufficient for the collection of long term time series baseline data covering seasonal variations. The project will assess potential impacts based on trends and adopted trigger values. The duration and frequency of the monitoring programme will be continually assessed based on the results of monitoring and updated periodically. The proposed frequency is consistent with standard construction monitoring programs for groundwater. The groundwater system is a low permeability system and the frequency is considered sufficient to capture and monitor potential changes from construction related impacts. According to this plan monitoring frequency may change if impacts are detected.

5.4.2 Reporting Requirements

The reporting requirements are indicated in Table 5-2. In general reporting will be quarterly and consist of factual reports unless additional reporting is triggered by exceedances of the trigger values or contamination. Annual monitoring reports will be provided at 12 monthly intervals from the start of construction.

Operational reporting will be dependent on operational requirements. Presently this is thought to be annual for three years unless construction phase monitoring indicates impacts or contamination requiring additional assessment, or until independently certified as recovered/rehabilitated.

Reporting of regular monitoring results shall be to TfNSW or a nominated representative.

Where trigger values are exceeded over a prolonged period or other groundwater impacts become apparent and an assessment of groundwater impact is required, the DPI, EPA (if required) and TfNSW are to be informed of the outcome of assessment and of actions taken or proposed to be taken (refer to Sections 7.2.2, 7.3 and 9.2.3).

6 Sampling Regime and Parameters

6.1 Introduction

This section presents the intended sampling regime and parameters to be collected or analysed.

6.2 Regime and Parameters

6.2.1 Standards

Groundwater monitoring bores will be constructed in accordance with the "Minimum Construction Requirements for Water Bores in Australia, 3rd Ed 2012.

Groundwater measurements and sampling will be undertaken in general accordance with the methods outlined in the standard environmental monitoring practices and AS/NZS 5667.11:1998 Water quality sampling – guidance on sampling of groundwater.

Monitoring sampling and testing of groundwater shall be undertaken by appropriately qualified hydrogeologists or environmental scientists.

6.2.2 Water Level Measurement

Water level measurements may be categorised as:

- *Discontinuous; isolated infrequent measurements usually taken weekly or less often; and*
- *Continuous; regular measurements usually daily or more frequent.*

Water level measurements will be discontinuous and continuous from preconstruction stage through to the conclusion of construction. During the operational phase, water level measurement shall continue as determined in the OEMP. Continuous measurements will be obtained via installed pressure transducers with data logging capability (data loggers, or loggers) installed in monitoring piezometers. Manual measurements will be collected each time the logger is downloaded to calibrate the data and provide backup in the event of logger failure.

6.2.3 Sample Collection Methodology & Analysis

All groundwater samples will be collected via bailing in general accordance with the methods outlined in the AS/NZS 5667.11:1998 Water quality sampling – guidance on sampling of groundwater. The standing water level will be measured and the installed data logger removed (and downloaded) before bailing. The bore will then be purged using a disposable bailer. The bailed water will be pored through a flow cell containing calibrated field meters. The bore will be bailed until either:

- *Stabilisation of field parameters over three consecutive bailer volumes;*
- *The bore runs dry; or*
- *Removal of approximately three bore volumes.*

The groundwater will then be sampled by directly filling laboratory supplied samples bottlers from the bailer. Samples for dissolved metals will be field filtered using a 0.45µ filter and the bottle marked for dissolved metals analysis.

A new set of disposable gloves will be worn for sampling each bore and bailers will be dedicated to each bore. If contamination is detected the bailer will be replaced each round or until contamination is no longer detected.

A record of each sampling event will be kept for each bore as per Section 5 of this report. All samples will be stored in a chilled esky for transport to the nominated NATA accredited laboratory.

6.2.3.1 Field parameter stabilisation

Field parameter stabilisation will be used as the method for determining when to collect representative samples. The difference between three consecutive bailer volumes must not exceed 10% for pH, electrical conductivity and or total dissolved solids and redox potential. The redox potential is considered a more suitable measure of representative conditions than dissolved oxygen (DO) which can vary in shallow aquifers due to temperature, air pressure and chemical and biological oxygen demand. The field meter readings will be recorded on the sampling record sheet.

6.2.3.2 Sample collection frequency

Pre-construction phase

A minimum of 3 sample collection rounds and analysis will be taken before the start of construction. The results will be used to update this report before finalisation and set trigger levels for water quality.

Construction phase

Groundwater samples will be collected for analysis every quarter. Additional sampling and analysis rounds will be undertaken if triggered by:

- Contamination;
- To assess water quality trends;
- Or as otherwise directed by the EPA / TfNSW.

The project will assess potential impacts based on trends and adopted trigger values and the duration and frequency of the monitoring programme will be continually assessed based on the results of monitoring and updated periodically.

Operational phase

The need for operational groundwater samples will be determined during the course of the construction period, and if required, the OEMP will outline the required sampling frequency.

6.2.3.3 Analytical suite

The groundwater analytical suite is provided in Table 6-1.

Pre-construction phase

Pre-construction monitoring is designed to assess the baseline groundwater conditions and presence of any contamination and is therefore comprehensive.

Construction phase

Construction phase monitoring is designed to detect any potential contamination or impact to water quality resulting from the construction. Construction of the Project will involve; earthworks, embankments and excavations, heavy machinery, vehicles, earth moving equipment, re-fuelling operations, maintenance and servicing of equipment, cleaning / washing and amenities.

The construction phase analytical suite is considered to be standard and is designed to indicate changes in quality and the presence of contamination. Should contamination be found this will trigger further sampling and analysis to identify the contaminant of concern.

Operational phase

The operational phase analytical suite is a reduced suite designed to determine if any changes that may have occurred have been rehabilitated. These will be developed and form part of an OEMP if required from the construction phase.

Table 6-1: Analytical suite

Monitoring Phase	Analytical suite
Preconstruction (comprehensive)	pH, EC TDS, Alkalinity, Hardness, Ca, Mg, K, Na, Cl, HCO3, SO4, NH4, Total N, Total P, Nitrate, Nitrite, PO4, Total and Dissolved – Fe, Mn, As, Cu, Pb, Zn, Ni, Hg, Cd, TPH,TRH, Oil and Grease, OCP, OPP.
Construction (standard)	pH, EC TDS, Alkalinity, Hardness, Ca, Mg, K, Na, Cl, HCO3, SO4, NH4, Total N, Total P, PO4, Total and Dissolved – Fe, Mn, As, Cu, Pb, Zn, Ni, Hg, Cd, TPH
IF contamination found	More detailed analysis for the indicated contaminant (Oil and Grease, BTEX, PAH, Etc.) as required
Operational (reduced)	pH, EC TDS, Ca, Mg, K, Na, Cl, HCO3, SO4, NH4, TPH The operational phase suite is provided as a guide and will be developed and form part of an OEMP if required.

6.3 Sample Quality Control Regime

6.3.1 Identification and Records

Sample containers are to be supplied by a NATA Accredited Laboratory. Containers will be clearly labelled and include the following:

- Job / Project reference number;
- Sample location name; and
- Date and time of sampling.

Samples for metals analysis will indicate if total of dissolved solids analysis is required and the appropriate tick box checked on the bottle.

A field sheet will be completed for each sample location. The field sheet will include the following details:

- Sample location name;
- Date and time of sampling;
- Sampling method, i.e. bailing, foot valve, pump;
- Name of field sampler;
- Weather conditions;
- Field water quality parameters;
- Standing water level and total depth of the bore;
- Visual and odour observations; and
- Details of QA/QC samples collected.

6.3.2 Sample Collection

To minimise the potential for contamination and maintain the integrity of collected samples the following basic precautions will be take:

- All sample containers will be supplied by a NATA accredited Laboratory;
- Field equipment will be clean prior to starting sampling and between each sample location;
- Sample containers will remain capped until filling and then immediately sealed; and
- A clean pair of disposable gloves will be used for each sample location.

6.3.3 Sample Preservation and Transport

Laboratory supplied sample containers have preservatives added and are assumed to be correct for the intended analysis. On collection, each sample will be placed in a chilled esky for transport to the laboratory. Samples will be delivered to a NATA accredited Laboratory within holding times, generally daily.

6.3.4 Chain of Custody

Chain of Custody (COC) documentation will be supplied and filled in for each esky of samples delivered to the Laboratory. COC forms are to be filled in by couriers and any persons receiving and or transporting the samples.

6.3.5 Laboratory Analysis

All sample analysis will be undertaken by NATA Accredited Laboratories using industry accepted analytical methods.

6.3.6 Quality Control Samples

A duplicate sample will be collected for every monitoring round or one for every 10 samples for quality control purposes. The results of the duplicate sample will be compared with the original and any identified quality issues discussed with the laboratory.

7 Data Analysis and Reporting

7.1 Introduction

The preconstruction monitoring data provides an indication of baseline or background groundwater conditions and the degree of variation for a range of parameters. This provides the initial baseline data for comparison with the construction and operational sampling results. However, it is likely the range of climatic conditions which may be experienced during construction and operation of the project will not be observed during the preconstruction phase of monitoring. It is also understood construction activities, by their very nature, will likely result in some transient changes to groundwater quality. However, construction related changes are likely to be local and short lived.

Assessment of construction related impacts will therefore be against a combination of Trigger Values and Trends. As there is insufficient background data to set realistic trigger values which cover the potential range of climatic conditions the adopted trigger values will initially be 1.5 times the maximum analytical value recorded. This value is similar to two times the standard deviation but the limited data set does not allow for statistical analysis. The values will be assessed throughout the pre and construction phase monitoring and adjusted as required. In addition, the trend and combination of triggers is important for assessing if any changes are transient short lived and potentially climatic or natural or a result of construction or operation.

Exceedances of the trigger value for one or a few parameters does not necessarily indicate an issue. A trend for increasing concentrations over the trigger value is considered representative of a change due to construction or prevailing climatic conditions as opposed to one off results.

7.2 Groundwater Quality

The approach to be adopted when assessing impacts to groundwater quality is presented on Figure 1. A two pronged approach has been adopted consisting of:

- Trigger values; and
- Trends.

7.2.1 Trigger values

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC) provide a framework for setting trigger criteria based on background monitoring data. In general, a minimum of 12 rounds of analysis are required over a minimum of 12 months to allow capture of seasonal variations. Trigger values are generally set as the 80th percentile of the median background value. There is insufficient information from this site to allow a statistical assessment of trigger values.

The adopted interim trigger values are therefore set at 1.5 times the maximum baseline result for analytes considered to be representative of quality changes. The analytes of concern, baseline values and adopted trigger values are presented in Table 7-1.

Table 7-1: Analytes of concern and adopted trigger values

Analyte	Units	Baseline Results		Trigger Value	
		Minimum	Maximum		
pH		4.9	6.1	<4.5, >7.5	
TDS	mg/l	190	5620	>8430	
EC	µS/cm	240	1420	>2130	
NH_4	mg/l	0.02	4.75	>7.00	
PO_4	mg/l		0.92	1.38	*Revised trigger level as per 2019 Annual Report*
SO_4	mg/l	14	189	>280	

Analyte	Units	Baseline Results		Trigger Value	
		Minimum	Maximum		
Cl	mg/l	5.8	424	>630	

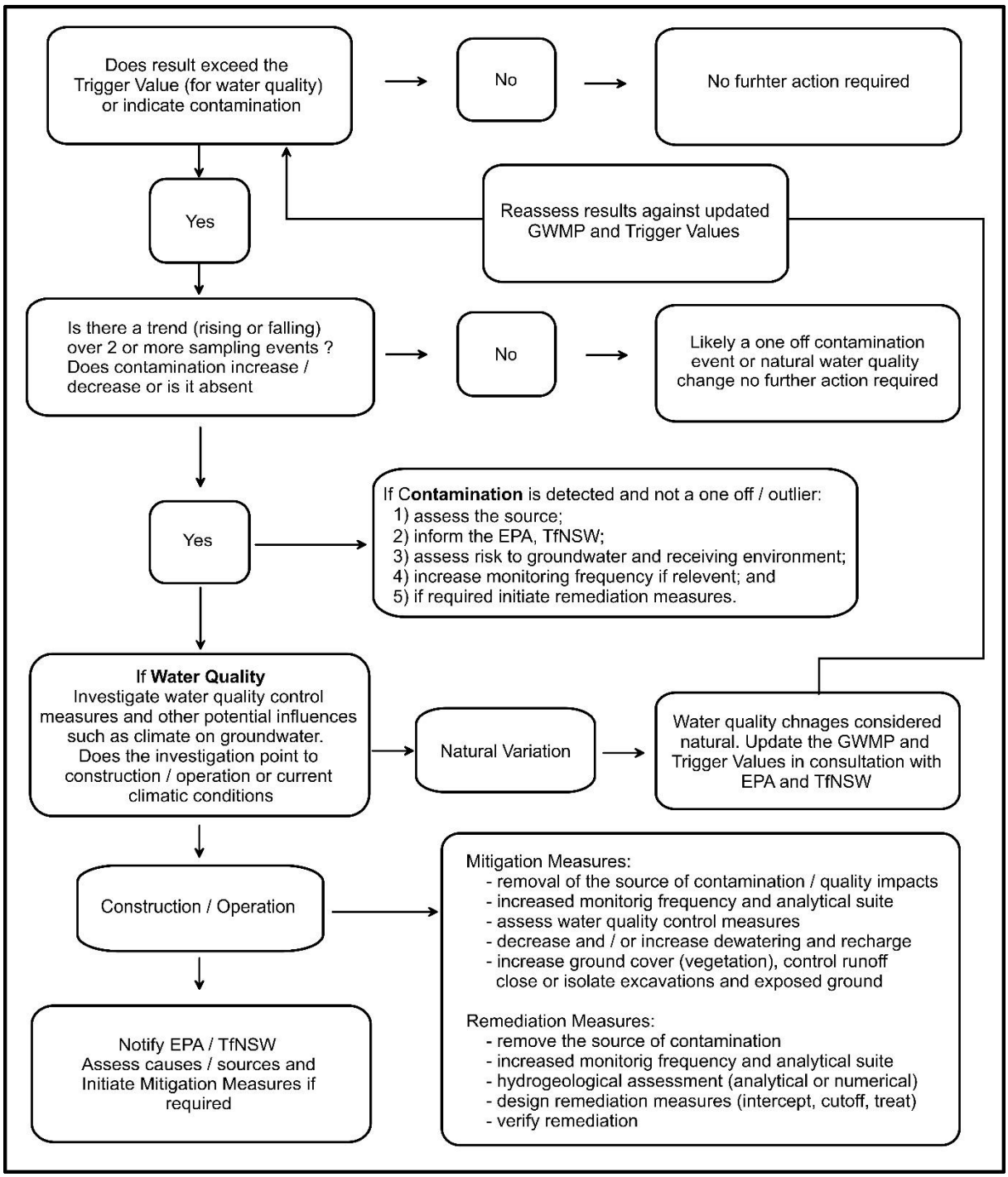


Figure 1: Approach for groundwater quality (and contamination) assessment

7.2.2 Trends

Construction activities will have temporary (transient) impacts to groundwater quality through changes to ground cover and recharge rates. These changes are usually manifest in the TDS / EC and associated major ions and result from dissolution of these ions during recharge events

(rainfall) due to disturbance of the soil profile. They are usually short lived with groundwater quality reverting back to natural background within weeks or months.

As these temporary changes are inevitable (unless there is no rainfall) a trend for increasing concentrations over consecutive monitoring events is considered more representative of water quality impacts or changes. Assessment of trends over three consecutive monitoring events will be made against site activities and the prevailing climatic conditions as per Figure 1.

Single analysis events which exceed the trigger value or where only one analyte exceeds the trigger are not considered to indicate changes as the full range of natural variation is not understood. In addition to the adopted trigger values trends and the number of analytes which are exceeded will be used to assess the exceedance. A trend is considered:

- *Three or more consecutive results which are above the trigger and increasing in value indicating potential changes to water quality; or*
- *The long term trend, five or more results, is for increasing values (or decreasing in the case of pH) indicating potential cumulative impacts.*

The general approach to assessing groundwater quality trends is:

1. Is there are any exceedances of the trigger value, if yes how many?, is there a trend for increasing concentration over previous rounds?, if no, no further action required;
2. Do two or more rounds exceed the trigger value, if yes than assess against the prevailing climatic conditions and construction activities and increase monitoring frequency, if no, no further action required;
3. If three or more rounds have exceedances of the trigger value then inform the EPA / TfNSW, conduct additional monitoring round and if required initiate mitigation measures.

7.3 Groundwater Levels

Based on observed natural variation and the likelihood of impact to GDE's and other beneficial uses, low water level triggers are presented in the table below:

Table 7-2: Low Level Trigger Value

Location	Low Level Trigger Elevation (mAHD)
P101	8
P102	6
P103	8
BH01_P	3
BH10_P	8
BH16_P	6
BH19_P	6

Note: low level triggers subject to review prior to start of dewatering with additional baseline results.

Monitoring bores are assessed individually and together for those within proximity to each other. The approach to be adopted when assessing groundwater levels is:

- *Compare the measured standing water level and processed logger data to the baseline data and the prevailing climatic conditions:*
- *Is the water level declining as a result of low rainfall or site activities (e.g. dewatering);*
- *Is the water level increasing as a result of high rainfall or site activities (e.g. storm water detention basins);*

- *Is the change in water level outside the baseline range or below the preliminary low level trigger;*
- *Is the decline, or rise considered to have an impact off-site and will that impact be detrimental to the receiving environment:*
    - No – increase monitoring frequency and reassess next round;
    - Yes – inform DPI, TfNSW, investigate potential causes and if project related initiate mitigation measures.

7.4 GDE Management Action Triggers

A Trigger Action Response Plan (TARP) is to be implemented. This outlined below and has been designed specifically to illustrate how the various predicted construction and operational impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions for GDEs.

The TARP system provides a simple, transparent and useable record of the monitoring of environmental performance and the implementation of management and/or contingency measures.

The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- *Trigger levels from monitoring to assess performance*
- *Triggers that flag implementation of contingency measures.*

This TARP is relevant only to the project area, and will specifically be revised as project needs dictate and/or to incorporate specific baseline monitoring, including the location of control and impact sites for the terrestrial biodiversity monitoring program.

The TARPs for biodiversity values associated with GDEs are detailed below:

Table 7-3: Swamp Forest GDE Trigger and Action

Aspect	Monitoring				Trigger				
	Sites	Parameters	Frequency	Purpose	Level	Action	Responsibility	Timing	Purpose
Swamp Forest GDE	One per GDE management zone One per GDE control		Baseline data prior to dewatering. Monitoring during construction. A minimum of two years of monitoring post-construction If Level 2 triggers are reached, monitoring will continue in consultation with TfNSW. Vegetation monitoring is undertaken twice per year in autumn and spring.	To determine if dewatering on site is impacting retained GDEs	Level 1: No statistical difference between control and impact sites	Continue monitoring	TfNSW	Nil	Inform stakeholders of baseline assessment and monitoring. Identify, investigate and report on impacts to groundwater quality and levels
					Level 2: Significant statistical difference between control and impact sites or between before and after construction at the control sites (one year duration – first year after dewatering commences).	Engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts Inform TfNSW of investigation outcomes Investigation of possible mitigation measures in consultation with TfNSW Prepare and implement a site mitigation/action plan in consultation with TfNSW, if necessary Implement a site-specific monitoring program, where relevant, to determine if impacts is short, medium or long term in duration. Assess requirements for offset, in consultation with TfNSW.		Investigation initiated within 1 week Results of investigation reported to TfNSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required	

Table 7-4: Melaleuca biconvexa GDE Trigger and Action

Aspect	Monitoring				Trigger				
	Sites	Parameters	Frequency	Purpose	Level	Action	Responsibility	Timing	Purpose
Melaleuca biconvexa	Reference sites, retained sites and translocated sites	Collection on tree health assessment data	Baseline data prior to dewatering. Monitoring during construction. A minimum of two years of monitoring post-construction If Level 2 triggers are reached, monitoring will continue in consultation with TfNSW. Vegetation monitoring is undertaken annually in autumn.	To determine if dewatering on site is impacting retained and translocated Melaleuca biconvexa stands.	Level 1: No statistical difference between control and impact sites	Continue monitoring	TfNSW	Nil	Inform stakeholders of baseline assessment and monitoring. Identify, investigate and report on impacts to groundwater quality and levels
					Level 2: Significant statistical difference between control and impact sites or between before and after dewatering at the control sites (one year duration – first year after dewatering commences).	Engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts Inform TfNSW of investigation outcomes Investigation of possible mitigation measures in consultation with TfNSW Prepare and implement a site mitigation/action plan in consultation with TfNSW, if necessary Implement a site-specific monitoring program, where relevant, to determine if impacts is short, medium or long term in duration. Assess requirements for offset, in consultation with TfNSW.		Investigation initiated within 1 week Results of investigation reported to TfNSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required	

8 Construction Dewatering Management

8.1 Introduction

Groundwater dewatering may be undertaken during excavation of:

- *Utilities trenches and excavations;*
- *Subsurface drainage;*
- *Train workshop service pits;*
- *Automatic train wash facilities;*
- *Wheel bathe building*
- *Stormwater detention basins; and*
- *Piling for structural foundations.*

Groundwater encountered during excavation will be pumped from the excavation for polishing and recharge to the groundwater system / disposal to local waterways.

Dewatering of groundwater will occur in line with TfNSW Water Reuse and Discharge Guidelines.

8.2 Dewatering

8.2.1 Inflows

Inflows to excavations will be assessed during the detailed design stage and finalised prior to the start of construction. Design elements which may intercept the groundwater table and upper-bound predictions of steady state pumping requirements are summarised in Table 8-1.

Table 8-1: Estimated groundwater inflows to excavations under high water table conditions

Excavation with Potential Groundwater Inflow	Approximate Excavation Area (m^2)	Reduced Level of Base of Excavation (m AHD)	Depth Below Maximum SWL (m)	Estimated Steady State Inflow (m3/day)	Estimated Radius of Influence (m)	Distance to GDE (m)
Track Subsurface Drainage	12000	8.7	2.3	160	<30	>20
Detention Basin	12000	8.7	2.3	160	<30	>40
Maintenance Troughs	1000	11.7	1	40	<10	>20
Wheel Lathe Building	600	7.5	5	80	<60	20
Biowash	500	8.5	4	75	<50	20

Due to the low permeability of the material, the radius of influence will be relatively small.

With the exception of the subsurface drainage, GDE areas are expected to be unaffected by construction dewatering.

Dewatering to install the track subsurface drainage is expected to have a minor, short term impact on the local watertable level during construction, this impact is anticipated to be within the natural range of variation.

The above inflow and pumping rates are applicable to the construction phase only. Ongoing dewatering during operations should be limited to drainage from the track subsurface drainage and only during periods of high groundwater.

Under the extreme case pumping scenario (i.e. high permeability and high water table, wet conditions) the drawdown radius is greater however, during these times there is higher recharge and any impacts are expected to be offset by the recharge.

8.2.2 Pumping

Inflows to excavations are anticipated to be relatively low (but variable) due to the limited depth/area of water table intersection. Dewatering will therefore be undertaken using sump and pump techniques, spearpoint or other similar techniques.

Groundwater may be pumped from several different locations at once and pumping will be sporadic. The dewatered volume will therefore be monitored via a flow meter(s) at the discharge point.

Pumping / extraction of groundwater on site is subject to application of a water license under the *Water Management Act* (2000) from WaterNSW and its conditions refer to Section 2.1.2.2.

8.2.3 Water Quality

The intention of the construction dewatering plan should be to minimise the potential for water quality changes / contamination by minimising the time / flow path from dewatering to recharge.

Recharge water will be of the same quality as the receiving groundwater. The quality targets are provided in the table below and are generally equivalent to the background groundwater quality and are equal to the adopted trigger values. The period between dewatering and recharge will be short and water quality changes (e.g. due to evaporation) are not anticipated. Turbidity (suspended solids) is considered the main water quality issue and will be managed by settlement, flocculation and, if required, coarse (sand) filtering.

Table 8-2: Recharge water quality targets

Analyte	Units	Baseline Results		Trigger Value
		Minimum	Maximum	
pH		4.9	6.1	<7.5
TDS	mg/l	190	5620	<8430
EC	µS/cm	240	1420	<2130
NH_4	mg/l	0.02	4.75	<7.00
PO_4	mg/l	<0.01	0.02	<0.04
SO_4	mg/l	14	189	<280
Cl	mg/l	5.8	424	<630

8.2.4 Disposal

Pumped groundwater will be recharged to the groundwater system. Where water quality does not meet the disposal criteria, waters shall be polished to remove suspended solids or other constituents following TfNSW water discharge guidelines. Specific details of discharge requirements during construction and operation shall be developed based on specific WaterNSW permit requirements and shall be included in the CEMP and OEMP as required. In general the disposal strategy will include direct injection / soak away trenches / ponds / swales or similar to be used for re-infiltration of groundwater. Polishing of pumped water, if required, may be via:

- *Settlement in a lined pond aided by exposure to sunlight and flocculant as required;*
- *Water quality checking via:*
    - *visual inspection of hydrocarbon sheens;*
    - *field testing of turbidity;*
    - *field meter check for pH, EC, TDS; and*
    - *weekly laboratory analysis for EC, TDS, Cl, NH4, TPH when dewatering.*

- *Pumping to soak away ponds / trenches for recharging to the groundwater system.*

Water which does not meet the disposal targets for quality will not be disposed and the following will be undertaken:

- *Recheck the water quality against the most recent groundwater analytical results;*
    - *If it is equal to or better to recent results, then discharge and adjust the disposal target accordingly;*
    - *If it is worse, then the water will need to be stored until it can be treated for onsite recharging (in accordance to relevant NSW regulatory requirements) and/or disposed of to an approved liquid waste receival facility.*

In addition to the above, assess the reason for the poor water quality, for example;

- *Hot dry weather (evaporation);*
- *Low rainfall (= low recharge and natural increase in dissolved salts);*
- *Poor working conditions in excavations (for example very turbid water);*
- *Inadequate polishing time;*
- *Natural change in groundwater quality (see points 1 and 2); or*
- *Potential contamination caused from construction activities i.e. spillages.*

9 Environmental Management

9.1 Environmental Management Objectives and Key Actions

A series of environmental management objectives and actions have been developed to manage potential impacts to groundwater, beneficial use and GDEs caused by the construction and operation of the Project. These are:

1. Minimise the potential for changes to groundwater quality and quantity through construction and operation of the facility;
2. Minimise the potential for impacts to beneficial use and GDEs through construction and operation of the facility; and
3. Monitor and report sufficiently to demonstrate compliance and enable management to make informed decisions that minimise the groundwater related impacts through construction and operation of the facility.

The key elements of the environmental management process associated with each objective and provided in Table 9-1.

Table 9-1: Key elements of environmental management to achieve identified objectives

Element	Definition / Description
Objective	What is intended / required to be achieved
Management Action	Task (s) undertaken to achieve the Objective
Performance Indicator	Metrics for evaluating the outcomes achieved by Management Actions
Monitoring / Reporting evidence	Demonstrates that the management action has been applied and the outcome evaluated
Timing	Period or duration management action shall be applied
Responsibility	Accountability for ensuring management action is applied / completed

The key management actions, performance indicators, evidence, timing and responsibilities for each objective are provided in Table 9-2.

Table 9-2: Key actions for management of groundwater

Objective	Management Actions	Performance Indicators	Reporting / Evidence	Timing / Phase	Responsibility
1	Minimise the potential for changes to groundwater quality through construction and operation of the facility				
1.1	Install groundwater monitoring network and collect baseline groundwater quality data; prior to the start of construction, during and post construction	Bores installed, and monitoring commenced prior to construction	Installation report, GWDMP completion	Pre Construction, construction and operation	JHG / Designers
1.2	Obtain approval for the GWDMP prior to the start of construction	GWDMP approved	Approved GWDMP	Pre Construction	TfNSW
1.3	Management and disposal of any encountered groundwater in accordance with the GWDMP, CEMP, relevant Project Site dewatering/vegetation management plans NSW waste, environmental legislation/site Environment Protection Licence (EPL) and any TfNSW contractual requirements. This may include obtaining a dewatering license (from WaterNSW) prior to the start of dewatering.	Compliance with CEMP and relevant legislation and Dewatering license approved	Auditing of CEMP systems and procedures and actual setup of controls Dewatering License	Pre Construction, Prior to dewatering, Construction	JHG
1.4	Minimise clearing of vegetation and maintain adequately bunded and silt fenced stock piles in accordance with the CEMP and Construction Management Plan (CMP)	No significant impact to sensitive flora or Fauna, surface runoff controlled and sediment free	Vegetation survey, water quality monitoring results	Construction	JHG, Environmental Manager
1.5	Develop and implement excavation techniques (in areas of expected shallow water table and high inflows) to ensure the size and duration the excavation would	Auditing of excavation to ensure compliance with proposed excavation techniques including size	Water quality monitoring results	Pre Construction and Construction	JHG Designers/Construction Managers and Environment Manager

Objective	Management Actions	Performance Indicators	Reporting / Evidence	Timing / Phase	Responsibility
	remain open is minimised as far as practicable.	of excavation and duration of opening			
1.6	Undertake vehicle re-fuelling and maintenance in designated, bunded areas	No spills requiring clean up / remediation	Water quality monitoring results, incident reports,	Construction and Operation	JHG / Operator, Environmental Manager
1.7	As part of the CEMP and OEMP, develop and implement hazardous material handling, storage and incident procedures. This will cover appropriate storage/monitoring of hazardous materials, refuelling operations and managing spills	Appropriate containment and management of hazardous materials and spillages preventing and egress into groundwater	Auditing of CEMP and OEMP, systems and procedures and actual setup of controls Water quality monitoring results	Pre-Construction/ Construction – CEMP development and implementation Pre-Operation/Operation OEMP development and implementation	JHG/Operation Environmental Manager
2	Minimise the potential for changes to groundwater quantity through construction and operation of the facility				
2.1	Install groundwater monitoring network and collect baseline groundwater quality data; prior to the start of construction, during and post construction	Bores installed, and monitoring commenced prior to construction	Installation report, GWDMP completion	Pre Construction, construction and operation	JHG / Designers
2.2	Obtain approval for the GWDMP prior to the start of construction	GWDMP approved	Approved GWDMP	Pre Construction	TfNSW
2.3	Obtain a dewatering license prior to the start of dewatering under the *NSW Water Management Act 2000*	Dewatering license approved	Dewatering License	Prior to dewatering	JHG
2.4	Conduct a baseline bore survey to assess beneficial use	No impact to existing beneficial use	No (justified) complaints against the project	Prior to dewatering and post construction	JHG
2.5	Recharge dewatering water back to the aquifer to maintain quantity	Monitoring indicates no impact to quantity (levels)	Monitoring, quarterly / annual reporting	Construction	JHG
3	Minimise the potential for impacts to Beneficial use and Groundwater Dependent Ecosystems (GDEs) through construction and operation of the facility				

Objective	Management Actions	Performance Indicators	Reporting / Evidence	Timing / Phase	Responsibility
3.1	Install groundwater monitoring network and collect baseline groundwater quality data; prior to the start of construction, during and post construction	Bores installed, and monitoring commenced prior to construction	Installation report, GWDMP completion	Pre Construction, construction and operation	JHG / Designers
3.2	Obtain approval and implement for the GWDMP	GWDMP approved	Approved GWDMP	Pre Construction, construction and operation	JHG / Designers
3.3	Obtain a dewatering license prior to the start of dewatering and as per Management Condition 2.5 recharge appropriate extracted groundwater back to the aquifer	Dewatering license approved Monitoring indicates no impact to quantity (levels)	Dewatering License	Prior to dewatering	JHG
3.4	Develop and Implement an approved Project Site Flora and Fauna Management Plan (including the Threatened Flora Management Plan, for *Melaleuca biconvexa* and Swamp Schlerophyll Forest)	No detected adverse impacts on retained onsite plant communities. Enhancement / successful regeneration of retained currently degraded plant communities	Auditing of the Flora and Fauna Management Plan (including ongoing ecological assessment of health of plant communities and *Melaleuca biconvex)*	Pre Construction, construction and operation	JHG / Operator Environmental Manager
	Develop and Implement an approved Project Site Conservation Management Plan for Mahony's Toadlet and Wallum Froglet	No detected adverse impacts on retained Mahony's Toadlet and Wallum Froglet habitat	Auditing of the Conservation Management Plan (including ongoing ecological assessment of health of retained habitat)	Pre Construction, construction and operation	TfNSW
3.5	In line with above Management Action (3.4), carry out both quantitative and qualitative monitoring by a suitably trained	No significant impact to sensitive flora or Fauna,	Ecologist monitoring results	Pre Construction, construction and operation	JHG, Environmental Manager, TfNSW and Operational Environmental Manager

Objective	Management Actions	Performance Indicators	Reporting / Evidence	Timing / Phase	Responsibility
	ecologist of the GDEs to determine any changes to species, diversity and health of these ecosystems.				
3.6	Minimise clearing of vegetation (via approved REF vegetation exclusion zones) and maintain adequately bunded and silt fenced stock piles in accordance with the EMP and CMP	No significant impact to sensitive flora or Fauna, surface runoff controlled and sediment free	Vegetation and *Melaleuca biconvex* monitoring, water quality monitoring results	Pre Construction, construction and operation	JHG, Environmental Manager
3.7	Gradual recharging of clean surface water, via a series of “check dams” in swale drains running adjacent to identified protected GDE areas. This will allow clean surface water to disperse and infiltrate back into the groundwater system	As above	As above	Operational	Operator Environmental Manager
4	Monitor and report sufficiently to demonstrate compliance and enable management to make informed decisions that minimise the groundwater related impacts through construction and operation of the facility				
4.1	Undertake routine groundwater monitoring for levels and quality	Collection of monthly and quarterly monitoring data	Populated data base	Pre, construction and Operation	Designers, JHG, Operators
4.2	Regular reporting of monitoring results	quarterly and annual monitoring reports required	Reports provided	Pre, construction and Operation	Designers, JHG, Operators
4.3	Undertake regular assessment of the GWDMP and update as required	Record of review process	Updated and Approved GWDMP	Pre, construction and Operation	Designers, JHG, Operators
4.4	Conduct periodic audits/inspections as per CEMP OEMP and Project Site Vegetation Management Plan requirements	Audit Reports Results	Results of Auditing/corrective actions closeouts	Construction and Operation	JHG / Operator Environmental Manager

9.2 Environmental Mitigation Measures and Remediation Measures

9.2.1 Introduction

This section provides an outline of the specific mitigation and or remediation actions to be taken in the event of construction and operational related impacts to groundwater. Mitigation measures are measures which may be undertaken to limit the impact while continuing activities. Remediation measures are measures designed to correct adverse impacts.

9.2.2 Mitigation Measures

Mitigation measures which may be undertaken in the event impacts are detected or contamination found include:

- *Reducing dewatering rates to allow water table recovery;*
- *Recharge of pumped water through:*
    - *Soak away trenches; or*
    - *Reinjection bores.*
    - *Redirection of recharge to GDE areas should it is noted a decline in GDE health*
- *Minimising earthworks during periods of rainfall;*
- *Controlling surface water runoff and recharge; and*
- *Physical removal of any contamination sources (physical spills will be managed under the Project Environmental Management Plan).*

If groundwater levels are found to be declining during a period of dewatering activities the rate of dewatering may need to be slowed or stopped until the actual cause is addressed. The full range of natural groundwater level variation may not have been observed in baseline monitoring. Any water level decline will be assessed against the prevailing climatic conditions and construction activities.

Earthworks may result in some temporary changes to groundwater quality and potentially to recharge. To minimise impacts earthworks will, where practicable, avoid wet periods, natural ground covers will be maintained and stormwater controls (sediment fences, detention basins, grassed swales) maintained.

Contamination sources, such as fuel, oil and chemicals will be contained in appropriate bunded/covered areas as per CEMP and OEMP. Any spills will be cleaned immediately and the contaminated soil excavated and removed in accordance with the CEMP and OEMP.

9.2.3 Triggering of Water level / Quality Mitigation Measures

Triggering of mitigation measures will be in response to three or more consecutive rounds which exceed the trigger value or five of more rounds which show a trend of increasing concentration although only the last two or three round need to exceed the trigger values. In all cases the cause of the exceedance will be assessed against the prevailing climatic conditions and construction activities. The DPI, EPA (if required) and TfNSW are to be informed of the outcome of assessment and any actions taken or proposed.

9.2.4 GDE Mitigation and Management Strategies

General mitigation measures related to GDEs are outlined in the New Intercity Fleet Maintenance Facility Project Species Impact Statement (WSP, 2017). These measures include:

- *A groundwater management plan and monitoring program would be developed and implemented to address potential impacts to groundwater, if encountered;*
- *Revegetate disturbed areas with native vegetation, where appropriate;*

- *Implementation of appropriate sediment controls; and*
- *Weed removal and ongoing management.*

Additional measures to avoid and mitigate impacts to biodiversity values present include:

- *Implementation of the monitoring program outlined in Section 5;*
- *Manage any impacts in accordance with the management action triggers;*
- *If impacts are observed these must be reported as per the contingency plan outlined below; and*
- *Ensure construction personnel are appropriately inducted and aware of any issues relating to biodiversity, as well as obligations to appropriately manage impacts.*

9.2.5 Remediation Measures

The project construction is not anticipated to cause permanent changes to the groundwater level or quality. Project construction may cause contamination of the aquifer through fuel, oil or chemical spills however such spills are considered unlikely and/or minor on the basis that the site facility/operations will not be storing large amounts of chemicals and appropriate control measures will be initiated via the design phase and through the CEMP and OEMP.

In the event of contamination remediation measures will include:

- *Assessment of the impact through:*
    - *Determining and immediately controlling the source and if able removing it (for example excavation of contaminated soil);*
    - *Increased monitoring and installation of additional monitoring bores to assess the distribution and concentration of any migrating contamination;*
    - *Assess the risk to the environment, beneficial use and potential for harm; and if required;*
    - *Undertake numerical flow and fate and transport modelling to assess potential movement, receiving environment and remediation options.*
- *Development of a remediation action plan*

If the above assessment indicates there is a potential risk of contamination and harm to the environment (aquifer/surface water movement offsite), beneficial use or GDE's a remediation action plan will be developed which may include one or more of the following:

    - *Pump and treat;*
    - *Cut off walls;*
    - *Reactive barriers;*
    - *Initiation of a bush regeneration program (via the Vegetation Management Plan) of the GDE communities;*
    - *A combination of the above.*
- *Verify the remediation measures through; increased monitoring and reassessment of modelling.*

Any remediation measures, if determined to be required, will be in consultation with the EPA, DPI and TfNSW.

9.2.6 GDE Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in the FFMP and/or CMP, JHG (as directed by TfNSW) will implement the following Contingency Plan:

- *The observation will be reported to the JHG Environment Manager within 24 hours;*
- *The observation will be recorded;*

- *JHG will report any exceedances of the performance measure to the TfNSW Environmental Representative and other relevant stakeholder as soon as practicable after JHG becomes aware of the exceedances;*
- *JHG/TfNSW will assess the exceedances referred to in the TARP and where appropriate, implement measures in accordance with the appropriate Management Plan/s;*
- *The JHG Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies, if necessary;*
- *JHG will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders;*
- *JHG will submit the proposed course of action to TfNSW for direction and approval;*
- *JHG will implement the approved course of action(as directed by TfNSW); and*
- *JHG/TfNSW will continue to monitor performance with the new action plan in place and, if successful will formalise these actions as part of the Management Plan.*

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences. While not envisaged to be required, where an impact to the groundwater occurs (for example, significant noticeable groundwater drawdown from the intersection of the groundwater by the under track drainage system) contingency/mitigation measures may include:

- Recharge of groundwater between the affected GDE and source of the drawdown (using polished water from detention basins or pumped from the dewatering system).

  If chemicals of concern are noted in the monitoring bores, in addition to determining and eliminating the source, as an interim contingency measure the monitoring bores may also be used to draw the watertable down in the vicinity of the GDE to prevent chemicals migrating into the natural environment and to mitigate the risk of contamination in the short term while longer term remedial measures can be implemented.

- Long term mitigation could include measures such as cut-off walls, pump and treat systems or chemical/biological treatment.

A further assessment and monitoring of the health of the GDE by an ecologist would also be carried out in line with the above suggested measures.

10 References

Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000. National Water Quality Management Strategy, Paper No 4 Volume 1 Chapter 1, Australian Water Association, Artarmon, NSW 2064.

Transport for NSW 2017. New Intercity Fleet Maintenance Facility Project, Volume 1 – Review of Environmental Factors, June 2016. Prepared by WSP Parsons Brinkerhoff.

NSW Government 2012a, NSW Long Term Transport Master Plan, December 2012.

NSW Government 2012a, Sydney's Rail Future Modernising Sydney's Trains, June 2012.

Coffey 2016a, Geotechnical Data Report, for Transport for NSW New Intercity Fleet Maintenance Facility, September 2016

Coffey 2016b, Geotechnical Interpretation Report. For Transport of NSW, New Intercity Fleet Maintenance Facility, August 2016.

Department of Primary Industries - Methods for the identification of high probability groundwater dependent vegetation ecosystems 2016.

Minimum Construction Requirements for Water Bores in Australia 2012.

Bolker, B. M., M. E. Brooks, C. J. Clark, S. W. Geange, J. R. Poulsen, M. H. H. Stevens, and J. S. White (2009). Generalized linear mixed models: a practical guide for ecology and evolution. Trends in Ecology & Evolution 24, 127–135.

Campbell, B, Davidson B & Ludlow J 2019, *NIFMF Annual Monitoring Report – New Intercity Fleet Maintenance Facility (NIFMF)*, Cardno.

Appendix A – Site Plans

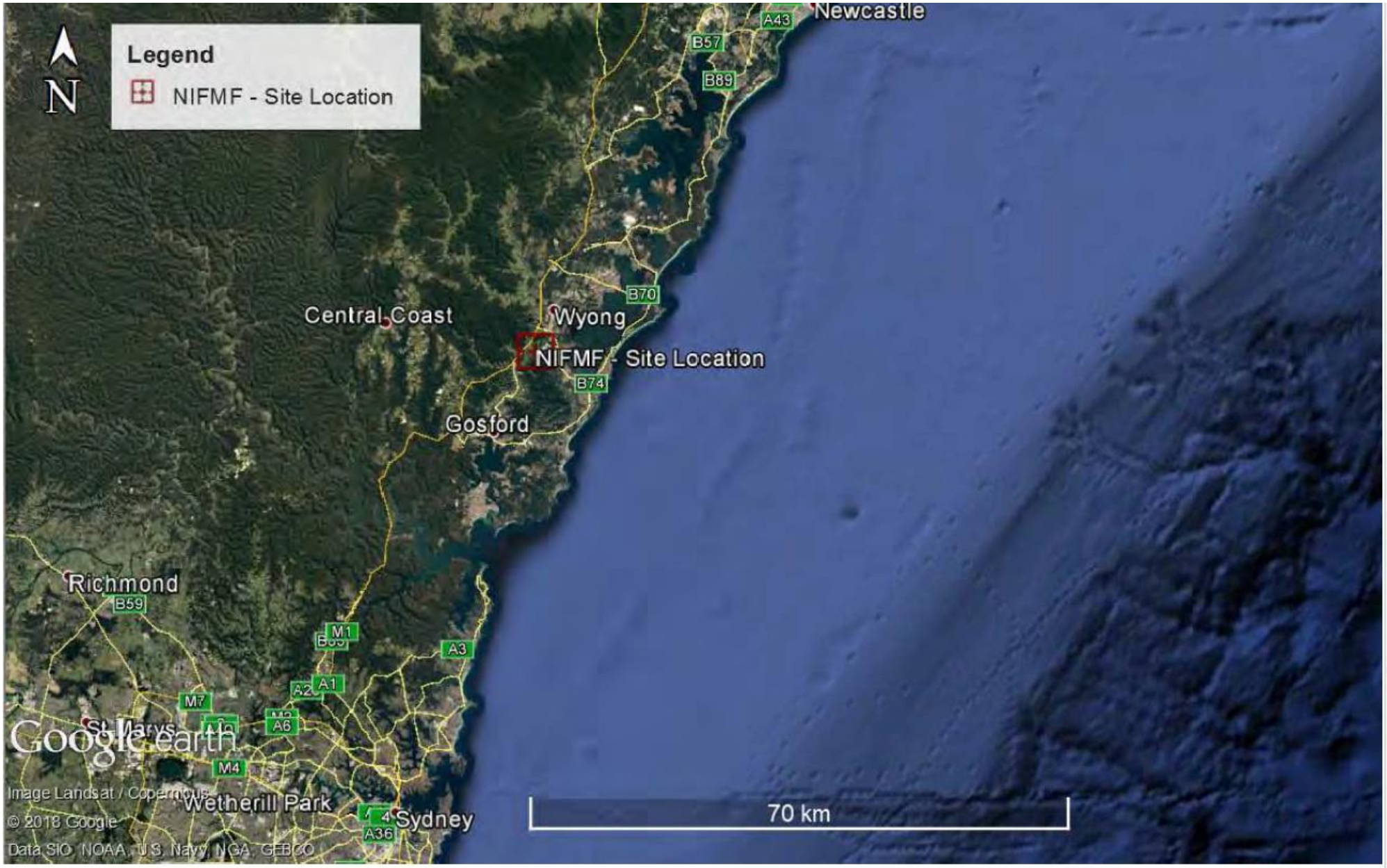
Figure A-1: Site Location Plan

Figure A-2: Site Plan, GDE and Monitoring Locations

Figure A-3: Geology Plan

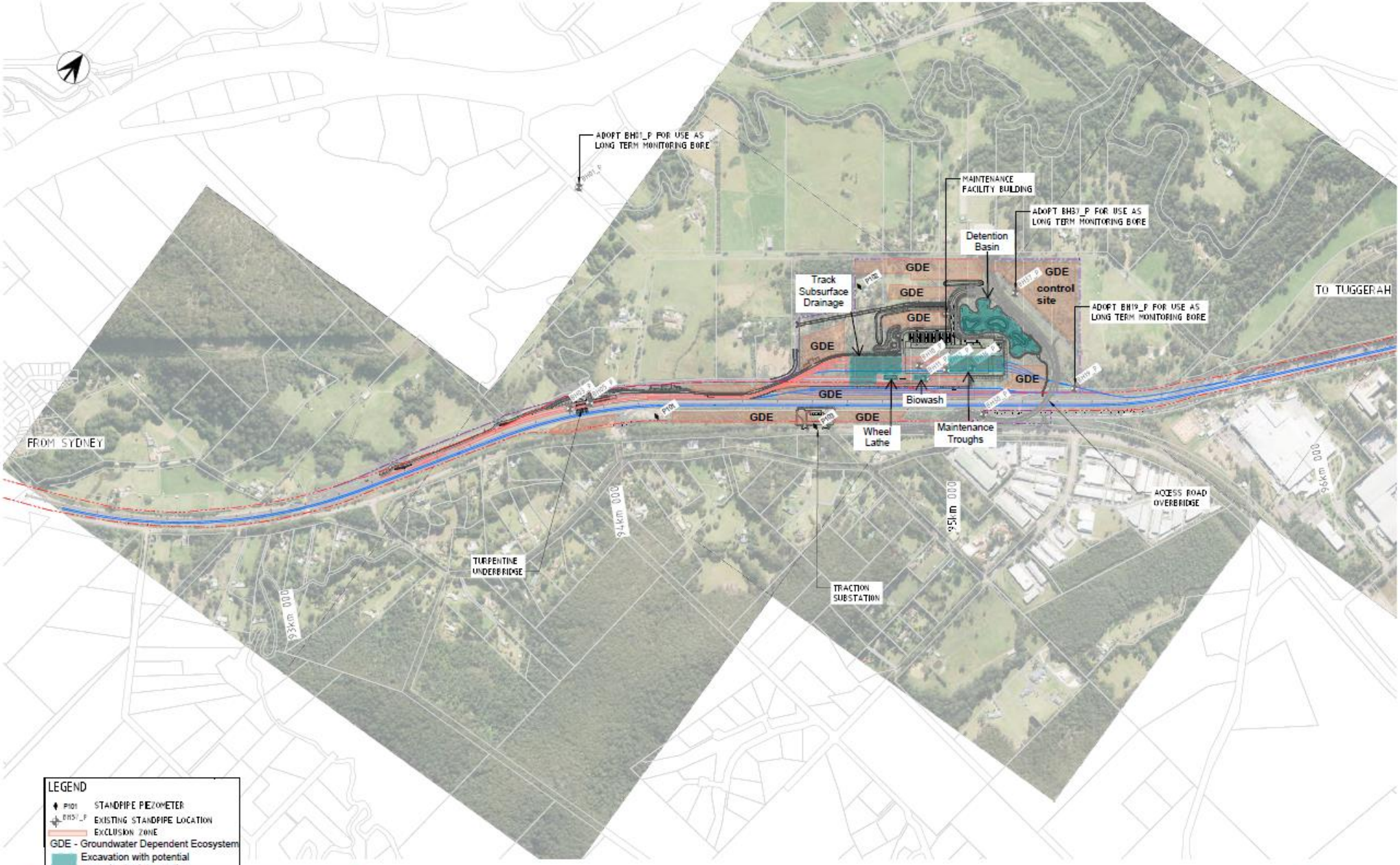
Figure A-4: Registered Groundwater Bores

Figure A-5: Interpreted Groundwater Elevation



NEW INTERCITY FLEET MAINTENANCE FACILITY
GROUNDWATER - AERIAL PLAN
FIGURE A-1

SMEC



NOT FOR CONSTRUCTION

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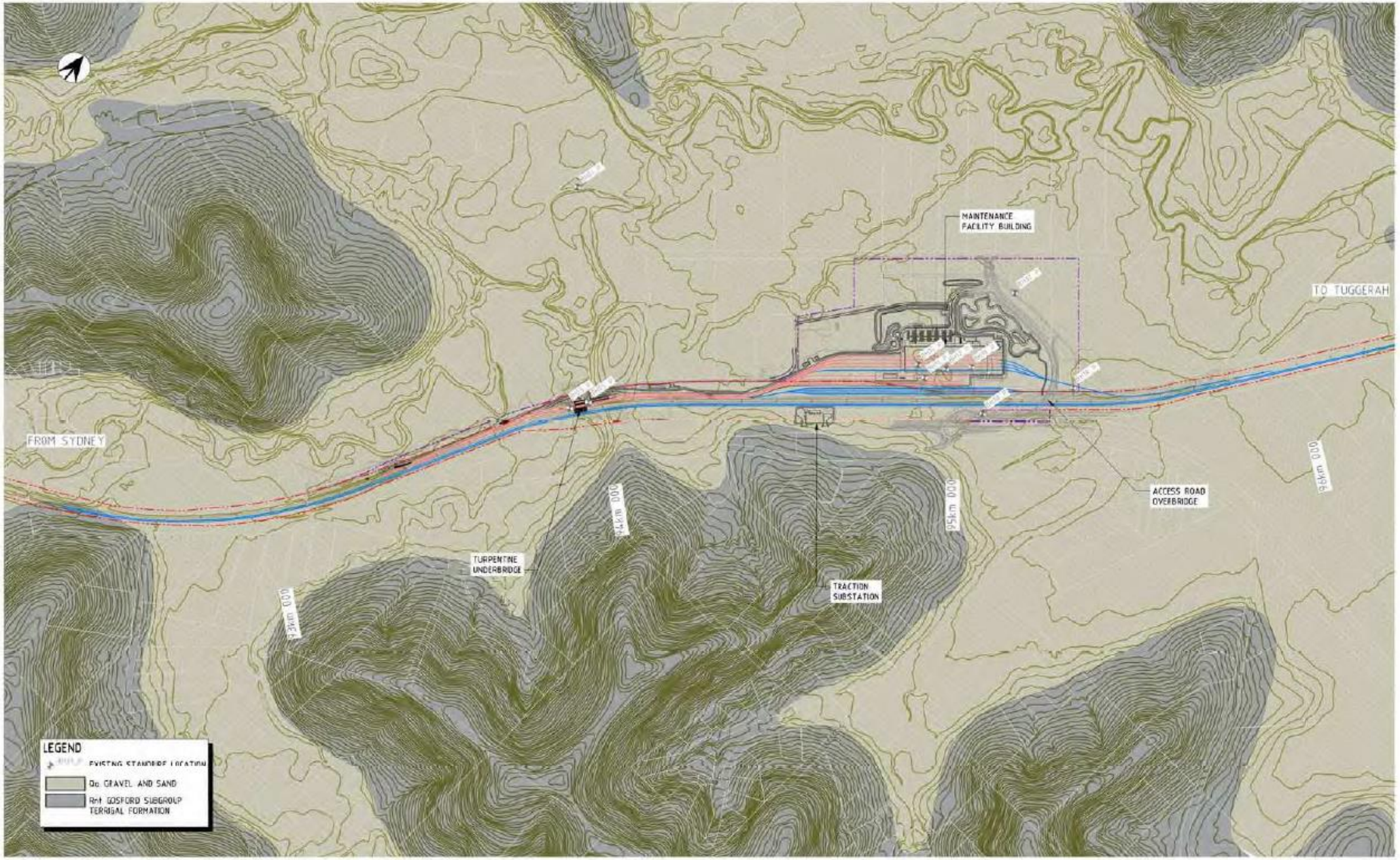
NEW INTERCITY FLEET MAINTENANCE FACILITY
GROUND WATER - AERIAL PLAN

INFORMATION DOCUMENT

NIF-SME-INF-180206-GE-AERIAL-PLAN-RC

FIGURE A-2

SMEC
Member of the Surbana Jurong Group
ABN 47 065 475 149
LEVEL 6 20 BERRY STREET
NORTH SYDNEY NSW 2060



NOT FOR CONSTRUCTION

NEW INTERCITY FLEET MAINTENANCE FACILITY

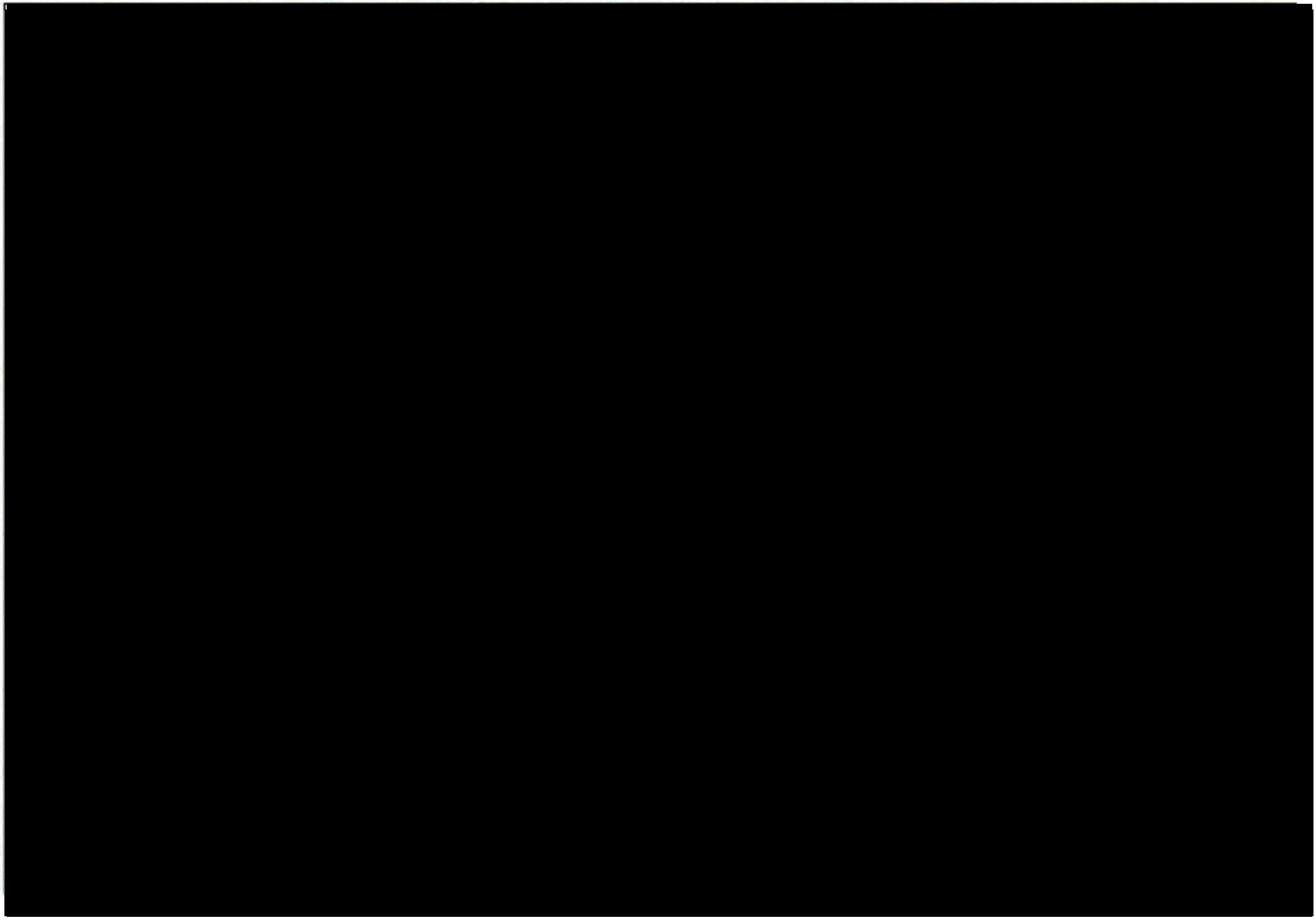
GEOLOGY PLAN

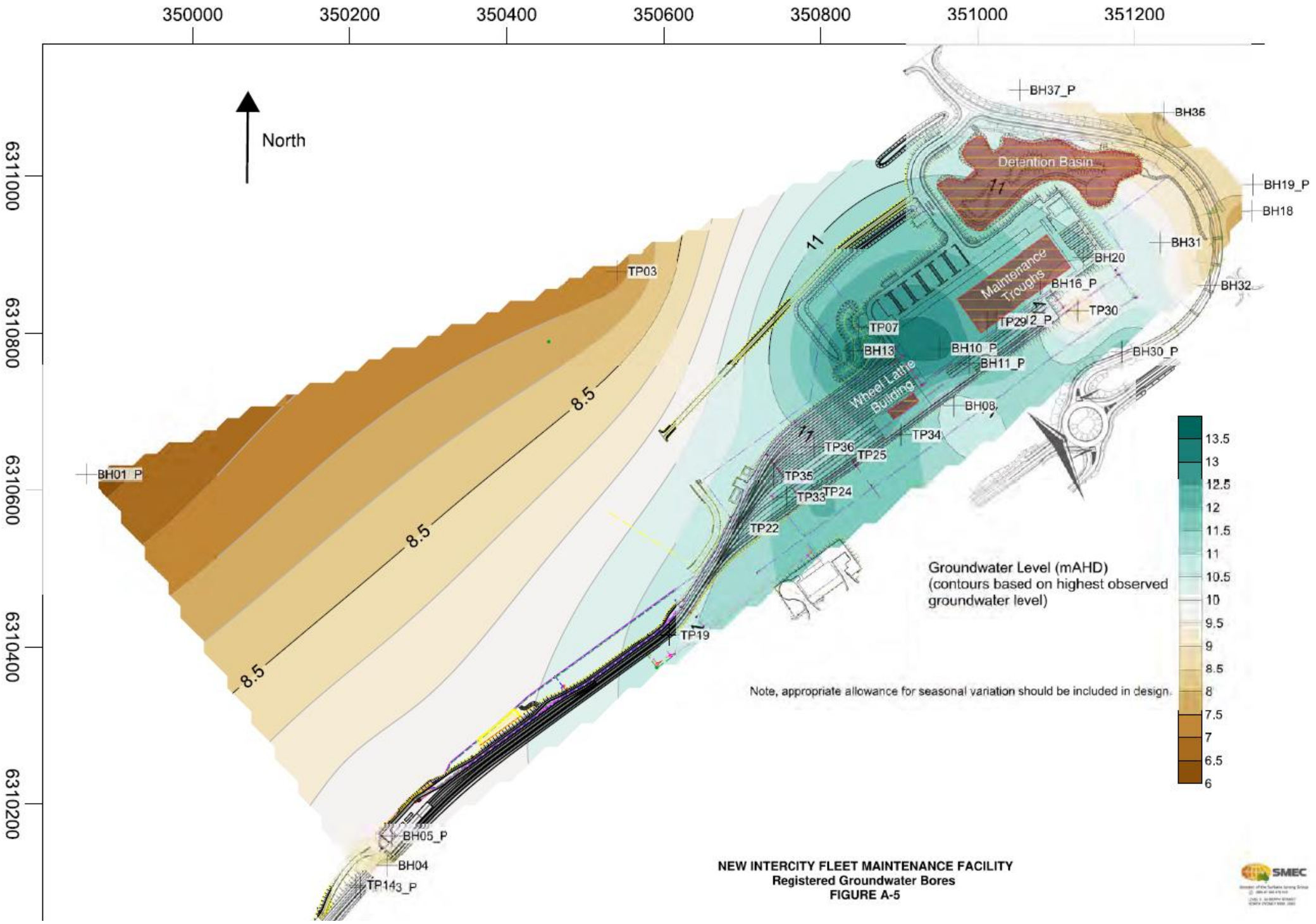
INFORMATION DOCUMENT

NIF-SME-INF-180124-GE-GEOLOGY-PLAN-RC

Figure A-3

SMEC





NEW INTERCITY FLEET MAINTENANCE FACILITY
Registered Groundwater Bores
FIGURE A-5

SMEC

Appendix B – Approval EPBC 2016_7681

Australian Government
Department of the Environment and Energy

Approval

New Intercity Fleet Maintenance Facility, Kangy Angy, NSW (EPBC 2016/7681)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted	Transport for NSW
proponent's ABN	ABN: 18 804 239 602
proposed action	To construct and operate a new train maintenance facility at a site in Kangy Angy, NSW [See EPBC Act referral 2016/7681].

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	Approved

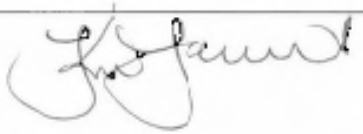
conditions of approval

This approval is subject to the conditions specified below.

expiry date of approval

This approval has effect until 31 December 2050.

Decision-maker

name and position	Kim Farrant Assistant Secretary Assessments (NSW, ACT) and Fuel Branch
signature	
date of decision	5-5-17

Conditions attached to the approval

1. The person taking the action must implement conditions 1, 10, 12, 13, 31, 35, 36, 37 of the **state conditions of approval**, as they relate to avoiding and mitigating the impacts of the action on **protected matters**.

2. To minimise the impacts of the action on Groundwater Dependent Ecosystems that support or may support Biconvex Paperbark located onsite and offsite, the person taking the action must implement conditions 51 and 52 of the **state conditions of approval** and must prepare and implement a Groundwater Management Plan as described in section 7.10.4 of the **review of environmental factors**, and:

    a. the Groundwater Management Plan must be submitted to the **Department** at least 1 month before **construction** commences, and construction cannot commence until the plan is approved by the **Minister**.

3. The person taking the action must not clear more than 19.6ha of high quality swamp forest and 3.6ha of wet open forest that is foraging habitat for the Swift Parrot and Regent Honeyeater within the impact area, as identified in Annexures 1 and 2.

4. To compensate for the impacts to foraging habitat for the Swift Parrot, the person taking the action must provide an offset package in accordance with the offset requirements calculated under BioBanking for the relevant plant community types, and:

    a. must meet at least 90% of the offset requirement through direct offsets, which must be located in the Central Coast region or Lake Macquarie region and must be consistent with the on-ground actions identified in the **national recovery plan for the Swift Parrot** to manage and protect Swift Parrot habitat at the landscape scale.

    b. may meet up to 10% of the offset requirement through **supplementary measures**, which must be consistent with actions identified in the **national recovery plan for the Swift Parrot**.

5. To compensate for the impacts to foraging habitat for the Regent Honeyeater, the person taking the action must provide an offset package in accordance with the offset requirements calculated under BioBanking for the relevant plant community types, and:

    a. must meet at least 90% of the offset requirement though direct offsets, which must be located in the Central Coast region or Lake Macquarie region and must be consistent with the on-ground actions identified in the **national recovery plan for the Regent Honeyeater** to improve the extent and quality of Regent Honeyeater habitat.

    b. may meet up to 10% of the offset requirement through **supplementary measures**, which must be consistent with actions identified in the **national recovery plan for the Regent Honeyeater**.

6. To quantify the offset requirements under BioBanking and the equivalent offset package for the **protected matters** referred to in conditions 4 and 5, the person taking the action must implement conditions 2 and 3 of the **OEH conditions of concurrence**, and:

    a. the Biodiversity Offset Strategy must be submitted to the **Department** at least 1 month before **construction** commences, and **construction** cannot commence until the strategy is approved by the **Minister**;

b. the Biodiversity Offset Strategy must:

   i. demonstrate how the proposed offset package will meet the requirements of conditions 4 and 5;

   ii. identify and describe the proposed offset sites, and include maps clearly depicting Swift Parrot and Regent Honeyeater habitat within the offset sites;

   iii. identify how the offset sites will be legally secured in perpetuity;

   iv. identify the long term objectives for future condition of the offset sites, management and monitoring actions, and timeframes for implementation;

   v. provide details of proposed **supplementary measures**, and the monetary value of each component of the offset package;

   vi. be implemented if approved.

7. The person taking the action must notify the Department in writing of any proposed change to the **state conditions of approval** referred to in conditions 1 and 2, or the **OEH conditions of concurrence** referred to in condition 6, within 14 days of proposing a change, and notify the Department of any change to the **state conditions of approval** referred to in conditions 1 and 2, or the **OEH conditions of concurrence** referred to in condition 6, within 14 days of a change to conditions being finalised.

8. Within 30 days after the **commencement** of the action, the person taking the action must advise the Department in writing of the actual date of **commencement**.

9. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of this approval, including measures taken to implement the management plans and strategies required by this approval, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval.

10. Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval and provide documentary evidence providing proof of the date of publication to the **Department**. The person taking the action must continue to publish the reports until such time as agreed to in writing by the Minister.

11. The person taking the action must notify the **Department** by email (to EPBCMonitoring@environment.gov.au or an email advised by the **Department**) of any actual or potential non-compliance with the conditions of this approval, including any plan or strategy required by the conditions of this approval, within 7 days of the person taking the action becoming aware of the actual or potential non-compliance.

12. Upon the direction of the **Minister**, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.

13. The person taking the action may choose to revise a management plan or strategy approved by the **Minister** under conditions 2 and 6 without submitting it for approval under

section 143A of the EPBC Act, if the taking of the action in accordance with the revised plan or strategy would not be likely to have a **new or increased impact**. If the person taking the action makes this choice they must notify the **Department** in writing that the approved plan or strategy has been revised and provide the **Department,** at least four weeks before implementing the revised plan, with:

a. an electronic copy of the revised management plan showing changes to the plan;

b. an explanation of the differences between the revised management plan and the approved management plan;

c. the reasons the person taking the action considers that taking the action in accordance with the revised management plan would not be likely to have a **new or increased impact**.

14. The person taking the action may revoke their choice under condition 13 at any time by notice to the **Department**. If the person taking the action revokes the choice to implement a revised plan or strategy, without approval under section 143A of the Act, the plan or strategy approved by the **Minister** must be implemented.

15. Condition 13 does not apply if the revisions to the approved strategy include changes to environmental offsets provided under the strategy in relation to a matter protected by a controlling provision for the action, unless otherwise agreed in writing by the **Minister**. This does not otherwise limit the circumstances in which the taking of the action in accordance with a revised plan or strategy would, or would not, be likely to have **new or increased impacts**.

16. If the **Minister** gives a notice to the person taking the action that the **Minister** is satisfied that the taking of the action in accordance with the revised plan or strategy would be likely to have a **new or increased impact**, then:

a. Condition 13 does not apply, or ceases to apply, in relation to the revised plan or strategy; and

b. The person taking the action must implement the plan or strategy approved by the **Minister**.

To avoid any doubt, this condition does not affect any operation of conditions 13, 14 and 15 in the period before the day the notice is given.

At the time of giving the notice the **Minister** may also notify that for a specified period of time that condition 13 does not apply for one or more specified plans or strategies required under the approval.

17. Conditions 13 to 16 are not intended to limit the operation of section 143A of the EPBC Act which allows the person taking the action to submit a revised plan or strategy to the **Minister** for approval.

18. If, at any time after 5 years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the **Minister**.

19. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all plans and strategies referred to in these conditions of approval on their website. Each plan or strategy must be published on the website within 1 month of being approved by the **Minister** or being submitted under condition 13a.

Definitions

Department means the Australian Government Department or any other agency administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) from time to time.

Commencement means any works associated with the action, other than surveys, acquisitions, fencing and signage.

Construction means any bulk earthworks (including levelling, cut and fill, or excavation that causes major disturbance to the ground surface) and/or clearance of native vegetation (including the cutting down, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation), excluding investigative works and service/utility relocation works (and associated construction compounds).

Minister means the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and includes a delegate of the Minister.

National recovery plan for the Swift Parrot means the document cited as Saunders, D.L. & C.L. Tzaros (2011). *National Recovery Plan for the Swift Parrot (*Lathamus discolor*)*, Birds Australia, Melbourne or as replaced from time to time.

National recovery plan for the Regent Honeyeater means the document cited as Department of the Environment (2016). *National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*)*, Commonwealth of Australia, Canberra or as replaced from time to time.

New or increased impact means a new or increased impact on any matter protected by the controlling provisions for the action, when compared to the plan or strategy that has been approved by the Minister.

OEH conditions of concurrence means the concurrence conditions attached to the Threatened Species Concurrence for the Proposed New Intercity Fleet Maintenance Facility Project granted under section 112C of the *NSW Environmental Planning and Assessment Act 1979* as in force or existing from time to time.

Protected matters means the threatened species protected by the controlling provisions for the action that the Department has considered impacts to, namely the Swift Parrot (*Lathamus discolor*), Regent Honeyeater (*Anthochaera phrygia*), and Biconvex Paperbark (*Melaleuca biconvexa*).

Review of environmental factors means the document titled *New Intercity Fleet Maintenance Facility Project – Review of Environmental Factors* authored by WSP Parsons Brinckerhoff dated June 2016.

State conditions of approval means the conditions attached to the approval under Part 5 of the *NSW Environmental Planning and Assessment Act 1979* for the New Intercity Fleet Maintenance Facility Project as in force or existing from time to time.

Supplementary measures means actions that do not directly offset the impacts on the protected matter but are anticipated to lead to benefits for the protected matter, for example funding for research or educational programs.

Note: Design is indicative only
Subject to detailed design

WSP | PARSONS BRINCKERHOFF

New Intercity Fleet Maintenance Facility Project
Figure 5.10
Swift Parrot habitat


Legend
Main North railway
Drainage
Subject site
Study area
Potential habitat
Swamp forest
Wet open forest
PACIFIC MOTORWAY
PACIFIC HIGHWAY
KANGY ANGY
ORCHARD ROAD
OURIMBAH
OURIMBAH ROAD
SERPENTINE ROAD
OLD CHITTAWAY ROAD
ENTERPRISE DRIVE
CHITTAWAY ROAD
FOUNTAINDALE
CATARACT ROAD
Map: 2202527A_GIS_F039_A1
Author: suansiv
Date: 11/05/2016
Approved by: -
Note: Design is indicative only
Subject to detailed design
WSP
PARSONS BRINCKERHOFF
New Intercity Fleet Maintenance Facility Project
Figure 5.5
Regent Honeyeater habitat

Member of the Surbana Jurong Group

SMEC Australia Pty Ltd
Level 5, 20 Berry Street
North Sydney, NSW, 2060