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Tallawong Road Stabling Facility

Soils, Surface Water and Hydrology

Impact Assessment

Report Number 610.12637

25 July 2013

Version: Revision 1

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street Lane Cove NSW 2066 Australia

(PO Box 176 Lane Cove NSW 1595 Australia)
T: 61 2 9428 8100 F: 61 2 9427 8200
E: sydney@slrconsulting.com www.slrconsulting.com

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
610.12637_R1R1	Revision 1	25 July 2013	Will Legg	Peter Gillam	Peter Gillam
610.12637_R1R0	Revision 0	25 June 2013	Will Legg	Peter Gillam	Peter Gillam

Executive Summary

This document presents a soils and water impact assessment of the proposed Rapid Transit Rail Facility (RTRF) proposal on land between Tallawong Road, Schofields Road and First Ponds Creek.

The construction and operation of the proposed RTRF have been assessed in terms of potential impacts to ground water, surface water, stormwater quality, creek erosion and flooding, salinity, acid sulphate soils and erosion.

The proposed RTRF is located above the First Ponds Creek floodplain and within an area of low acid sulphate soil potential and outside of the riparian corridor.

Water quality records for First Ponds Creek indicate a highly degraded local aquatic environment due to existing land uses. There is limited groundwater data for the site. No groundwater dependent ecosystems occur within the vicinity of the development.

The RTRF is proposed within a rapidly developing residential area and has been assessed against local and state objectives for flooding, water quality, ground water and erosion control.

The RTRF includes the following elements which have the potential to impact on the natural and urban water cycle:

- Amenities for 585 staff
- Rolling stock maintenance facilities including automated train washing, chemical storage and workshops
- Office buildings, warehouses, internal access roads, landscaping and rail yards
- Stormwater and Water Sensitive Urban Design (WSUD) infrastructure

Potential and Residual Construction Impacts

Construction works are generally located outside the floodplain and riparian corridor with the exception of the stormwater discharge point to First Ponds Creek. An existing stormwater discharge point will be utilised and any required physical structures will be designed to avoid entry into the non-biodiversity certified lands within the riparian corridor. All construction works would be carried out in accordance with a site specific Soil and Water Management Plan to ensure sediment and erosion controls are in place and consistent with current best practice. Stormwater impacts during construction are further mitigated by two stormwater detention basins that will have a stormwater quality and flood control function that transitions between construction and operational phases.

The indicative layout plan makes sufficient allocation for soil and water controls to be managed through working controls such as detailed design, normal construction practice and other working controls. Soil and water impact risks associated with construction are therefore categorised as low.

Potential and Residual Operational Impacts

In order to mitigate the potential impacts of the urban water cycle on First Ponds Creek, Sydney's drinking water catchments and the local groundwater table, the indicative layout plan incorporates various water cycle management measures including:

- two flood detention basins;

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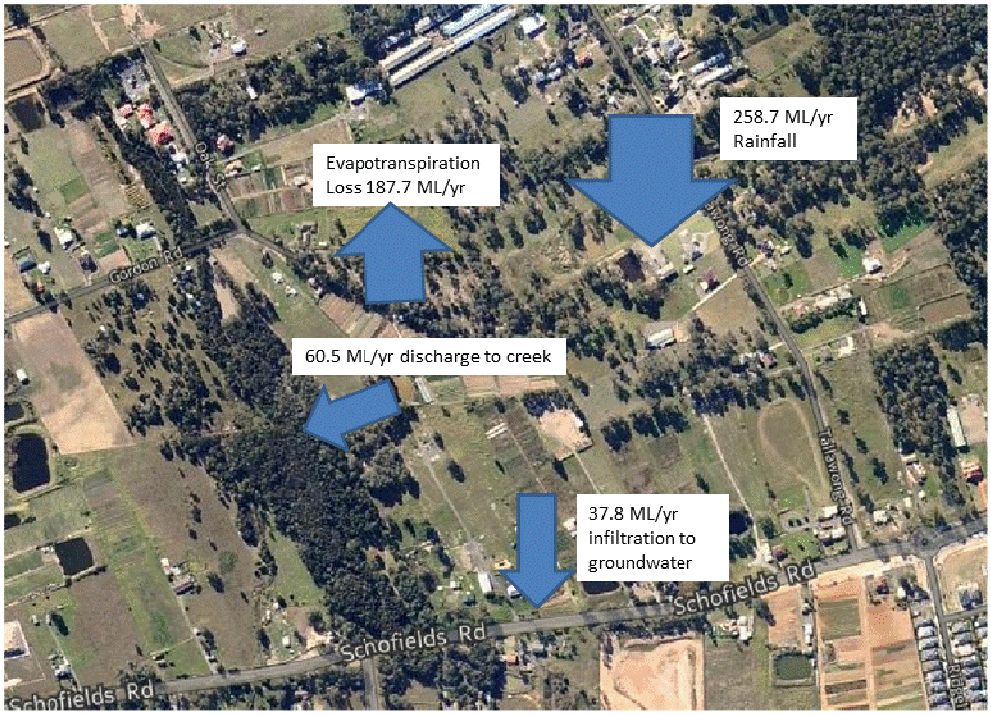
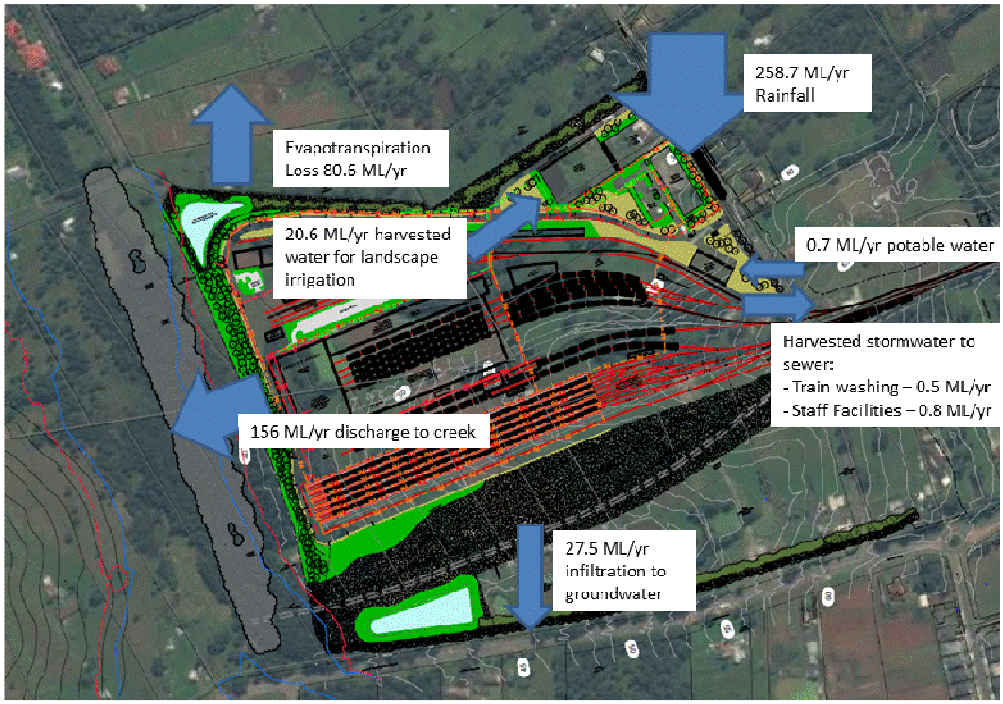
- vegetated swales and water quality treatment elements co located within the flood detention basins;
- rainwater harvesting tanks to collect stormwater from warehouse and office roofs; and
- oil and grit separators to control the release of hydrocarbons associated with train maintenance.

Hydrologic modelling using standard industry software demonstrates that the RTRF indicative layout plan provides stormwater basins that will attenuate flood flows and erosive flows from the site, meeting the standards established in the NSW Floodplain Development Manual and local stream flow targets.

Figure A3 – Water balance for existing site and RTRF





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Water quality modelling demonstrates that stormwater basins in the RTRF indicative layout plan have capacity to achieve local stormwater pollution reduction targets and will deliver stormwater quality that is consistently below base line water quality in First Ponds Creek. Incorporating an infiltration function into the basins will provide a reasonable level of groundwater recharge and will reasonably mitigate potential impacts on the local groundwater table. Given the proximity of infiltration zones to the riparian corridor, there is a low potential for infiltration to cause salinity impacts on the proposed road and retaining wall infrastructure.

Liquid and waste storage requirements and train wash water capture will prevent contamination of stormwater and receiving waters.

Rainwater harvesting tanks and water recycling within the proposed automated train wash facilities will supply between 80 to 90% of RTRF non potable water demands with no reliance on dams or ground water extraction.

In light of these assessments, the RTRF indicative layout plan will deliver current best practice water cycle management and mitigate potential flooding, water quality, stream erosion and groundwater impacts. Soil and water impact risks associated with the operational phase are therefore categorised as low.

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1 INTRODUCTION

1.1 Engagement

SLR Consulting Australia Pty Ltd (SLR) were engaged by JBA Urban Planning Consultants Pty Ltd (JBA) on behalf of Transport for New South Wales (TfNSW) to provide Hydrological Input and Assessment of the Rapid Transit Rail Facility (RTRF) proposal on land between Tallawong Road, Schofields Road and First Ponds Creek, Schofields (the proposed RTRF site).

This report constitutes a soil and water (soil, stormwater quality and quantity) impact assessment of the proposed RTRF site based upon a desktop review of background studies in relation to the North West Rail Link (NWRL) project and field observations.

1.2 Background

Transport for NSW (TfNSW) proposes to develop a Rapid Transit Rail Facility on land between Tallawong Road, Schofields Road and First Ponds Creek in the localities of Rouse Hill and Schofields. The Rapid Transit Rail Facility would comprise a purpose built train stabling and maintenance facility to support Sydney's new rapid transit rail network.

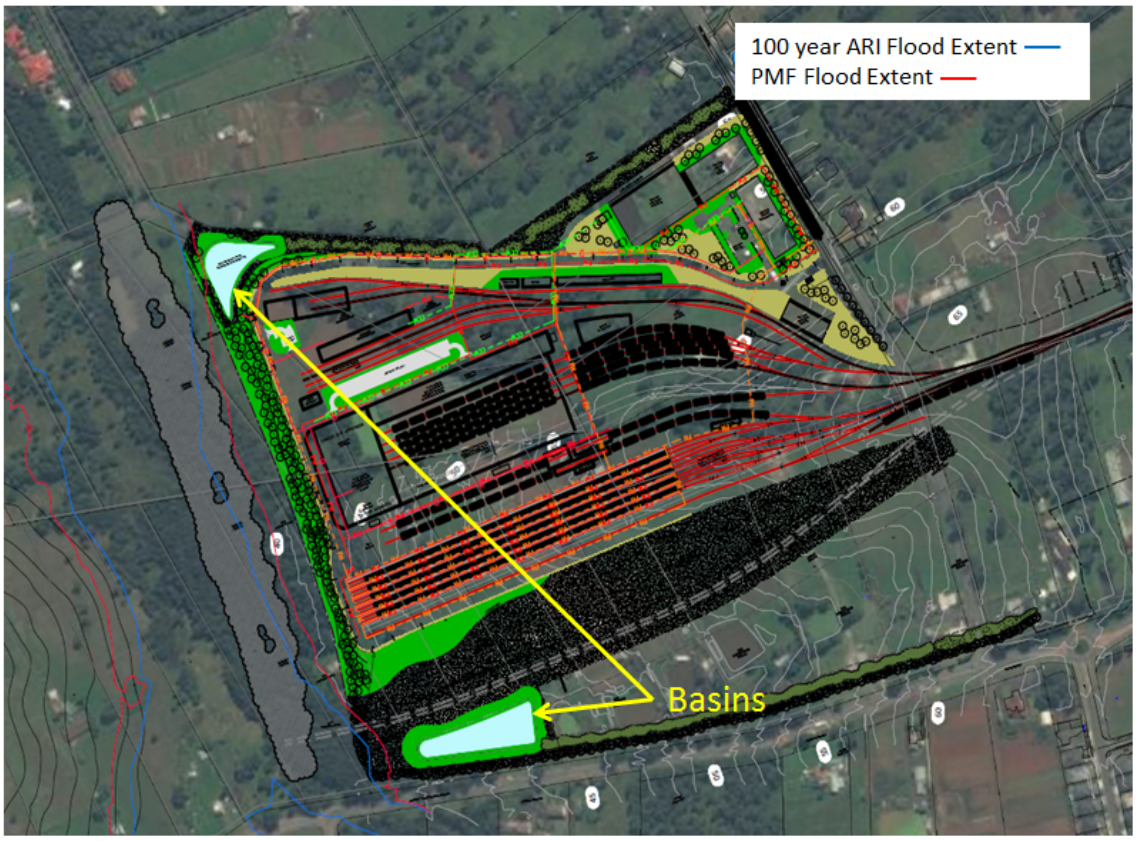
Sydney's Rail Future: Modernising Sydney's Trains, released in June 2012, sets the long term strategy to increase the capacity of Sydney's rail network through investment in new services and upgrading of existing infrastructure. New generation, single deck rapid transit trains are a key element of the strategy.

The operational and land requirements for the rapid transit network are being progressed in accordance with the NSW Long Term Master Plan, released in December 2012. *Sydney's Rail Future* forms an integral component of the Long Term Transport Master Plan. It is important to ensure that the delivery of rapid transit infrastructure can occur as outlined in *Sydney's Rail Future*.

The Rapid Transit Rail Facility is to cater for future expansion of the rapid transit system, including a future harbour crossing and link to the southern suburbs. The facility would be constructed in two phases and would provide stabling for 45 trains and maintenance facilities for 76 trains. The initial design capacity would be 20 trains (stabling and maintenance).

An indicative layout for the facility is shown in Figure 1.

Figure 1 Indicative Layout Plan



1.3 Overview of Facilities

The proposed facility will include:

- Sidings and train stabling yards and
- Facilities for cleaning, maintenance, repair and overhaul of rail systems and tracks and rolling stock
- Warehousing
- Admistriation, staff facilities, training areas and an operations control centre
- Refuse and hazardous material storage
- Internal access roads, car parking and landscaping

1.4 Specific Water Infrastructure

The following elements form part of the facility water cycle.

1.4.1 Staff Amenities

The facility will provide amenities to support up to 585 staff in positions of operations, administration and maintenance.

1.4.2 Automated Train Wash

An automated train wash is specialised plant that will wash down up to 45 rolling stock once a week unless otherwise required. The facility will use rainwater harvested from roof areas and will recycle 80% of water used in an onsite water treatment and recycling plant. Wastewater from the plant will be disposed to sewer.

1.4.3 Stormwater Harvesting Tanks

The proposed facility includes stormwater harvesting tanks to provide rainwater for toilet flushing, lands scape watering and train washing.

1.4.4 Stormwater Detention/Quality Basins

The facility will provide two stormwater basins with combined flood detention and water quality function.

Other stormwater treatment devices will be included to remove grit, hydrocarbons and sediments.

1.4.5 Landscaping

The site will be screened by a landscape buffer including mass planting along road frontages, the site northern frontage. Plantings will also be provided around carpark areas and buildings.

2 EXISTING ENVIRONMENT

2.1 Topography

Elevations generally fall from east to west ranging from approximately 64 mAHD at Tallawong Road to approximately 40 m AHD at the western boundary.

There are three distinct ridge lines within the proposed RTRF site forming three surface water sub-catchments. Surface water runoff would tend to flow south westerly in the southern portion of the site, westerly in the centre of the site and north-west of the proposed RTRF site and north-westerly in the north-east of the proposed RTRF site.

2.2 Regional Soils

The proposed RTRF site is shown (AECOM 2012b) to experience Blacktown soil landscape characterised as poorly drain soils with low fertility, localised high plasticity and expansive subsoils. They are generally moderately deep (1.0 m) red and brown podsols. These alluvial soils are classified as a high erosion hazard.

2.3 Acid Sulphate Soils

Acid sulphate soil risk mapping carried out by the former NSW Department of Land and Water Conservation shows that the site is within an area designated as 'no known risk' of acid sulphate soil or potential acid sulphate soils.

2.4 Geology

The proposed RTRF site is shown within the Regional Geological Map GSNSW (1991) to be underlain by Bringelly Shale. Bringelly Shale consists of undifferentiated shale, carbonaceous claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff of the Wianamatta group.

Fluvial deposits of fine grained sand, silt and clay are shown to occur within the creek line to the north-west of the proposed RTRF site.

2.5 Hydrogeology

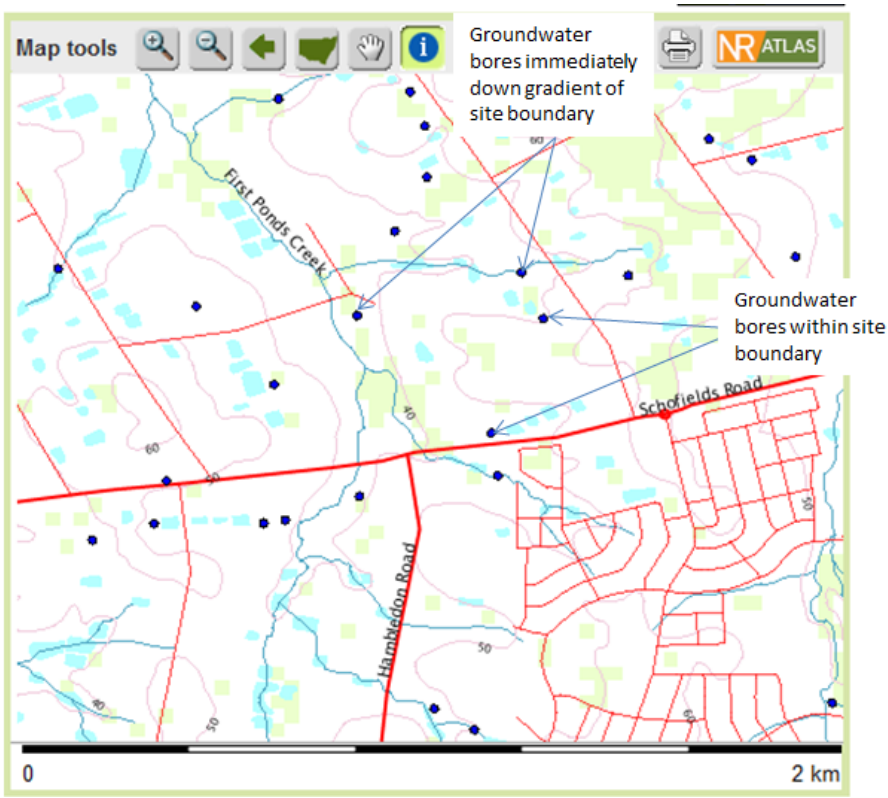
Limited groundwater data is available for the proposed RTRF site but groundwater flow is likely to flow westerly towards First Ponds Creek. During inspections there was little base flow within the First Ponds Creek indicating a general absence of a ground water table under the site.

Several groundwater bores were identified within and around the proposed RTRF site and are shown in **Figure 2**. The nature and extent of the groundwater bores is unknown and no information was available at the time of searching for groundwater conditions.

Generally, the quality of groundwater in shale of the Wianamatta Group tends to have an EC varying between 2000 μS/cm to in excess of 10,000 μS/cm in this part of the Sydney basin (AECOM 2012b) indicating brackish groundwater.

The Geological Survey of NSW Geology of the Penrith 1:100,000 sheet 9030 explanatory notes states that the permeability of the intact rock substance of most shale and sandstone in the area is generally very low.

Figure 2 Recorded bore locations within NSW Office of Water database



Extract from NSW Office of Water Groundwater Works Tool (accessed 11 June 2013)

2.6 Rainfall and Evaporation

The proposed RTRF site's climate is characterised by high summer-autumn and low winter-spring rainfall with average monthly rainfall ranges from approximately 70-120 millimetres in the summer-autumn months to approximately 40-110 millimetres in the winter-spring months.

Average monthly evaporation in the region ranges from less than 100 millimetres in the winter months to over 400 millimetres in the summer months.

2.7 Local Catchment

The proposed RTRF site is located within the First Ponds Creek catchment, part of the wider Hawkesbury-Nepean catchment.

First Ponds Creek flows through a culvert beneath Schofields Road, approximately 300 metres west of the proposed RTRF site, before flowing northerly to its confluence with a tributary of First Ponds Creek (the tributary) approximately 250 metres to the north of Schofields Road. First Ponds Creek continues to flow north/north-west beyond the proposed RTRF site.

The south western edge of the proposed RTRF site borders the tributary, which drains a catchment area of approximately 55 hectares up-gradient of Schofields Road.

First Ponds Creek drains a catchment area of approximately 300 hectares at the confluence with the tributary. The catchment currently consists of both rural and medium density residential areas. It is estimated that the catchment is currently approximately 11 % impervious which will most likely increase as the North Western Growth Centre expands.

The existing hydrological constraints at the proposed RTRF site are summarised within **Figure A1**.

2.8 Waterways

First Ponds Creek is a second order stream under the Strahler method and has a Category 2 classification.

The First Ponds Creek Tributary is a first order stream.

2.9 Flooding

Flood mapping for First Ponds Creek has been carried out by AECOM (2012) using hydrologic and hydraulic modelling software. This modelling is considered current and adequate for the purposes of the current study.

The modelled flood extents adjacent to the proposed RTRF site include the 100 year Average Recurrence Interval (ARI) and Probable Maximum Flood (PMF), which are shown in **Figure A1**.

The First Ponds Creek 100 year ARI flood extent is shown to have a variable width of between 140 to 250 metres adjacent to the proposed RTRF site with a typical width of approximately 160 metres. The 100 year ARI flood extent is wider than the riparian corridor and slightly encroaches within the south western corner of the RTRF site and runs along the north western boundary of the RTRF site.

The PMF extent ranges in width between approximately 200 and 300 metres adjacent to the proposed RTRF site with a typical flood width of 210 metres. The PMF has been shown to cross into the proposed RTRF site at the north western and south western extents of the RTRF site.

2.9.1 Potential Climate Change Impacts on Flooding

Due to the broad nature of the floodplain relative to magnitude of flow, flood levels are considered to be relatively insensitive to increased rainfall intensities (AECOM 2012). It is predicted that a 30% increase in rainfall intensity as a result of climate change would only lead to an increase of between 0.04 and 0.17 metres in the 100 year ARI peak flood level.

2.10 Surface Water Quality

The Hawkesbury-Nepean River Environmental Monitoring Program (DECC 2009) describes current water quality within the wider Hawkesbury-Nepean River System as poor due to sewage treatment plant discharges as well as uncontrolled pollution from urban and agricultural runoff.

Water quality monitoring in First Ponds Creek collected between 2008 and 2011 by Blacktown City Council at the Windsor Road Bridge in Riverstone (approximately 4.2 kilometres north-west and down-gradient of the proposed RTRF site) was compared with ANZECC (2000) water quality trigger values for the protection of fresh water ecosystems in lowland rivers in eastern Australia. The monitoring site is distant and is not reflective of the water quality in First Ponds Creek adjacent to the site, but it is the best data available.

This data is summarised below and is considered to be representative of water quality in First Ponds Creek at the proposed RTRF site given the consistency of the rural land use within the catchment upstream of the proposed RTRF site and between the proposed RTRF site and the sampling location.

Table 1 Blacktown City Council Water Quality Data summary

Parameter	Units	ANZECC 2000 Trigger Value or acceptable limits	Dataset	Mean	Minimum	Maximum
Electrical Conductivity	uS/cm	125 - 2200	Sep 2008 – Sep 2011	1510	**0**	**3349**
Turbidity	NTU	6 - 50	Sep 2008 – Sep 2011	29	**1.1**	**83.2**
Dissolved Oxygen	%	90 - 110	Sep 2008 – Sep 2011	**78**	**38**	110
pH		6.5 – 8.0	Sep 2008 – Sep 2011	7.3	**5.7**	**8.8**
Total Nitrogen	ug/L	500	Oct 2010 – Sep 2011	**2008**	500	**4900**
Total Phosphorus	ug/L	50	Oct 2010 – Sep 2011	**427**	80	**990**

1 ANZECC 2000 default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems

2 **Bold** values indicate data which exceeds adopted trigger values or is outside the adopted acceptable limits

The water quality data indicates that downstream of the proposed RTRF site, First Ponds Creek is heavily impacted with mean concentrations for Total Nitrogen (TN) over four times the trigger value (500 µg/L) and Total Phosphorus (TP) over eight times the trigger value (50µg/L). Mean concentrations of Dissolved Oxygen (DO) were also outside the acceptable limits.

3 METHODOLOGY

The following section describes the Director Generals Requirements for the facility and outlines the process undertaken to identify potential impacts, mitigation measures and identify residual impacts relating to water and soils within the proposed RTRF facility.

In accordance with the Director General's Requirements, this assessment has includes:

- modelling and assessment of the potential impacts of the project on:
    - the quantity and quality of existing surface and ground water resources;
    - affected licensed water users and basic landholder rights;
    - water courses and riparian areas and their associated catchments;
    - flooding up to and including the probable maximum flood;
- a description of the water management system for the project (including all infrastructure and storages); and
- a description of measures to minimise water discharges and to mitigate and manage surface and ground water impacts

3.1 Guiding Documents

Relevant guidelines and standards that have been considered in this assessment are outlined below:

Water Quality

- Managing Urban Stormwater: Soils and Construction (Landcom, 2004)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)
- Australian Runoff Quality (Institute of Engineers Australia, 2005)
- Blacktown City Council Development Control Plan 2006, Part R Water Sensitive Urban Design and Integrate Water Cycle Management;
- Landcom Water Sensitive Urban Design Book 1, Policy, Draft (2009)
- Water management:
- Water Act 1912
- Water Management Act 2000
- Stream ecology and riparian management
- Fisheries Management Act 1994
- NSW State Rivers and Estuaries Policy (NSW Water Resources Council, 1993)
- Guidelines for Design of Fish and Fauna Friendly Waterway Crossings (Fairfull and Witheridge 2003)
- Fish Passage Requirements for Water Crossings (Fairfull and Witheridge, 2003)
- Controlled Activities – Guidelines for Riparian Corridors (NSW Office of Water, 2011)
- Controlled Activities - Guidelines for Watercourse Crossings (NSW Office of Water, 2010)
- Controlled Activities - Guidelines for Instream Works (NSW Office of Water, 2010)
- Controlled Activities – Guidelines for Laying Pipes and Cables in Watercourses (NSW Office of Water, 2011)
- Controlled Activities - Guidelines for Outlet Structures (NSW Office of Water, 2010)

Flooding:

- NSW Floodplain Development Manual (Department of Infrastructure, Planning and Natural Resources, 2005)

3.2 Flooding

Flood extents produced by AECOM (2012) have been plotted over the latest indicative layout plan to allow the assessment and interpretation of how the proposed facility will impact on existing flood risks during construction and operational phases.

These flood extents were produced specifically for a previous version of similar investigations and are considered to be current and accurate. These extents are presented in **Figure A2.**

Conceptual modelling of flood detention basins has been undertaken to assess the impacts of the proposed RTRF site on local hydrology and to assess the impact of the proposed RTRF flood mitigation strategy.

The location of temporary and permanent works within floodplain storage zones has also been assessed for loss of floodplain storage and flood hazard.

3.3 Water Quality

The Model for Urban Stormwater Improvement Conceptualisation software (MUSIC) was used to assess the performance of proposed basins in meeting stormwater quality and stream erosion control objectives

The quality and frequency of discharges to waterways and groundwater was assessed against ANZECC guidelines, and Blacktown Council and TfNSW Sustainable Design Guidelines and water quality targets.

3.4 Groundwater

Proposed earthworks and site operations were reviewed against available groundwater data including:

- NSW Office of Water Groundwater Works tool was accessed to review groundwater bores within proximity to the proposed RTRF site.
- Groundwater conditions and impacts from previous studies (AECOM, 2012A).

3.5 Acid Sulphate Soils, Salinity and Erosion

Soil risk maps were reviewed to determine whether any works would be constrained or may impact on local soil issues.

4 CONSTRUCTION IMPACTS

Under the *NSW Protection of the Environment Operations* (POEO) *Act 1997*, builders and landscapers are bound by law to prevent construction sediments and wastewater from leaving building sites. The implications of this on surface water are discussed below.

4.1 Hydrological Impacts

Construction activities such as stripping, stockpiling and earthworks will not significantly alter the existing hydrology of the site.

Sediment control and stormwater harvesting for dust suppression will be carried out to prevent air quality issues and illegal discharge to receiving waters which will most likely result in a net reduction in stormwater discharge from the site. This is a short term impact and does not pose a significant long term issue for receiving environments and no further mitigation measures are proposed.

As the proposed RTRF site is progressively developed with impervious surfaces including rooves, roads and rail sidings, there will be a increase the frequency and intensity of runoff generated within the site, a reduction in the demand for water for dust suppression, and a net increase in discharge of stormwater to First Ponds Creek. This will be a temporary increase while the site transitions from a state of near completion to being fully operational when further stormwater mitigation works will be incorporated. This temporary increase in runoff rates will not result in significant or lasting impacts on First Ponds Creek.

4.2 Flooding Impacts

During construction, earthworks, clearing, and installation of outlet pipes from the detention basins along the western boundary of the proposed RTRF site will encroach into lands affected by the PMF and 100 year ARI flood as presented in **Figure A2**. As the works would only be temporary and on the outer extent of the floodplain, there is considered to be negligible impact on downstream flooding or loss of floodplain storage and no further mitigation is required.

4.3 Erosion and Sedimentation

During construction, earthworks will generate stormwater borne sediment loads which must be intercepted to prevent illegal sediment discharge to First Ponds Creek. Mitigation measures and residual impacts are discussed in Section 6.2

Stormwater detention basins will be established in proximity of soils having a moderate to low soil erosion risk and will present a low soil erosion risk during the construction phase.

4.4 Spoil Handling and Stockpiling

Construction of the RTRF will generate spoil as a result of excavations. There is potential for runoff from stockpile areas to contribute to stormwater borne sediment loads that will be intercepted by a combination of mitigation measures discussed in Section 6.2.

4.5 Demolition Works

Civil construction works at the proposed RTRF site will require the demolition of existing buildings, stripping vegetation. Stockpiling of potentially contaminated material from the demolition sites will drain to First Ponds Creek and mitigation measures are discussed in Section 6.2.

4.6 Fuel and Chemical Handling and Storage

Small volumes of liquid wastes and fuels and oils will be stored on site associated with construction and earthworks machinery.

Accidental spillage or poor management of fuels, oils, lubricants, hydraulic fluids, solvents and other chemicals during the construction phase will be controlled through spill management actions to prevent water quality and ecological impacts in First Ponds Creek and no further mitigation measures are considered necessary.

4.7 Soil Salinity

Soils in the vicinity of First Ponds Creek have been identified as having a high salinity potential (AECOM 2012). Construction of retaining walls could potentially increase the movement of water through the soil profile and thus exacerbate salinity. Excess salt levels could potentially affect vegetation and in stream water quality. Mitigation measures are discussed in **Section 6.6**.

Temporary storage of sediment laden stormwater will be within grass lined basins to minimise infiltration to the water table. This is a temporary practice and would not result in long-term impacts on groundwater levels and would not impact on the soil salinity.

4.8 Acid Sulphate Soils

There is considered to be no risk of exposure of acid sulphate soils during construction works.

4.9 Groundwater Impacts

Dewatering could potentially lower groundwater levels within the local area which could indirectly impact groundwater dependent ecosystems. There are no tunnels or deep excavation works proposed during construction and the majority of earthworks are likely be filling activities rather than cutting activities. Therefore it is unlikely that the proposed development will have long-term impacts on groundwater levels.

There is potential for groundwater bores, if damaged, to act as a direct conduit for contaminants to be discharged to groundwater.

4.10 Riparian and Waterway Impacts

Any physical structures required to discharge waters from the proposed stormwater basins will be designed to avoid entry into the non-biodiversity certified lands within the riparian corridor and avoid the need for vegetation removal within this zone.

No bridges or rail crossings across First Ponds Creek are proposed.

5 OPERATION IMPACTS

5.1 Hydrological Impacts

The completed RTRF will result in an increase in the frequency and magnitude of stormwater runoff from the site. Mitigation measures including stormwater detention, infiltration and harvesting are required to intercept stormwater runoff and prevent creek bank instability and erosion, altered ephemeral hydrology and worsening of downstream flooding.

Hydrologic modelling software was used to assess peak flows and detention requirements. The modelling indicates that the basins would need to provide a combined detention volume of 7600 m^3 in order to preserve pre-development peak flows to First Ponds Creek up to the 100 year ARI event. Further details are provided in **Figure A1** and **Figure A2**.

A conceptual water balance, based on MUSIC modelling, shows the predicted increase in runoff volume being discharged to First Ponds Creek as a result of the development of the Tallawong Road. This assessment includes water harvested from rainwater tanks and infiltrated through detention basins floors and is presented in **Figure A3**.

5.2 Flooding Impacts

The indicative layout plan for the proposed RTRF shows two stormwater detention basins along the western site boundary with a combined water surface footprint of **5400 m^2**. These basins are situated outside the 100 year ARI flood extent but are within the PMF floodplain. The edge of northern basin embankment and toe of the northern basin batter encroach within the PMF floodplain.

Stormwater detention basin embankments are completely outside the 100 year ARI extent, which is the design standard for new development, and will not impact on downstream flooding.

The basin embankments encroach on the PMF flood extent but the associated impacts will not affect design standard flooding.

All other development and retaining walls are outside of the floodplain.

5.3 Surface Water Quality Impacts

The proposed RTRF will introduce impervious areas and site operations that will increase potential stormwater pollution loads into the First Ponds Creek catchment including hydrocarbons, oils, sediments and dust loads associated with mechanical upkeep of trains.

5.4 Groundwater Impacts

The impervious areas associated with the proposed RTRF will reduce local groundwater recharge.

The basins onsite will be unlined and landscape areas will be provided to encourage infiltration and minimise impacts.

A conceptual water balance which shows the predicted reduction in volume of water infiltrated to ground as a result of the development of the Tallawong Road facility is presented in **Figure A3**.

Due to the low hydraulic conductivity of the underlying soils, the risk of potentially contaminated surface water seeping to ground within permeable surfaces such as the track areas is likely to pose a negligible risk to groundwater quality beneath the proposed RTRF site. Therefore the potential risk to receptors such as groundwater dependant ecosystems and First Ponds Creek are likely to be negligible.

6 CONSTRUCTION MITIGATION MEASURES AND RESIDUAL IMPACTS

6.1 General

Under current practices, the control and mitigation of potential surface water quality impacts during the construction phase is defined in a Soil and Water Management Plan (SWMP) prepared as part of the overall Construction Environmental Management Plan (CEMP). These management plans would specify the following typical measures in accordance with Best Management Practices (BMPs) set out in *'Soils and Construction: Managing Urban Stormwater'* (Landcom 2009).

Water quality mitigation measures would also be implemented in accordance with relevant requirements of:

- NOW Guidelines for Controlled Activities.
- ANZECC Guidelines for Fresh and Marine Water Quality.
- ANZECC Guidelines for Water Quality Monitoring and Reporting.
- Water Management Act 2000.
- Applicable Environment Protection Licences.

6.2 Erosion and Sediment Control

Sediment fences and clean water diversion bunds will be established around stockpiles and earthworks areas to reduce and capture sediments in stormwater runoff. Check dams, temporary ground stabilisation and site regrading will be implemented if appropriate.

In addition to sediment control measures on the construction site sediment basins will be provided as needed or by grass lining the two stormwater basins to remove sediment from stormwater prior to discharge. Water discharged from the basins will either be via tankers for subsequent disposal at an appropriate facility offsite, or via the existing discharge point to First Ponds Creek. A swale will be used to convey stormwater from the basin to the discharge point. It is likely that both proposed stormwater basins will be required to function as sediment basins until the development is 90% complete. Swales will be used to convey stormwater runoff to the sediment basin until the stormwater drainage network is installed.

The sediment basin and swales should be constructed at the commencement of the earthworks program to provide sediment control throughout the construction phase. The exact size and layout of basins would need to be modified to suit the ever changing form and needs of the construction site as the works progress and would be determined as part of the CEMP in accordance with the requirements of the relevant Environment Protection Licence.

Treatment measures would be applied to water collected in sediment basins, including settling of coarse sediments, the use of flocculation for finer sediments and pH correction.

As a first preference, treated surface water collected in sediment basins would be reused onsite, eg for dust suppression. Additional opportunities for re-using water on site or for construction would be investigated and implemented where feasible and reasonable.

Exclusion zones would be designated on construction sites to limit disturbance. Re-vegetating or stabilising disturbed areas would occur as soon as feasible.

Surface controls to promote ground stability, limit run-off lengths and reduce run-off velocities within the work sites would be implemented. Ground stability would be re-established as soon as practicable following the completion of construction.

Installation of any permanent scour protection measures required for the operational phase would occur as soon as practical.

6.3 Contamination and Spills

Site specific controls would be developed to reduce the potential for environmental releases of potentially harmful chemicals and to reduce the risk of any such releases entering local waterways.

Incidental spills will either be intercepted by active spill management practices in accordance with the CEMP or will be intercepted by sediment control devices.

Storage of hazardous materials such as oils, chemicals and refuelling activities would occur in bunded areas.

6.4 Flooding

There are no major works within the floodplain except for the construction of stormwater basin pipes to Second Ponds Creek. Other civil works which encroach within the 100 year ARI flood extent will be completed within a short timeframe in order to minimise impacts to the floodplain.

Construction equipment (or excess material) would be removed from flood prone areas (being the 100 year ARI flood extent) if wet weather is approaching and at the completion of each day's work activity. Stockpile sites would be located outside the Probable Maximum Flood (PMF) extent.

6.5 Groundwater

The control and mitigation of potential groundwater quality and quantity impacts during the construction phase will be defined as part of the Construction Environmental Management Plan (CEMP). It is considered that best management practice techniques will be sufficient to mitigate any impacts to groundwater.

6.6 Salinity and Soils

Retaining walls will be designed to be free draining and prevent the alteration of groundwater and will mitigate the concentration of salinity within soils.

6.7 Riparian and Waterway Impacts

Any physical structures required to discharge waters from the proposed stormwater basins will be designed to avoid entry into the non-biodiversity certified lands in the riparian corridor and avoid the need for vegetation removal within this zone.

Temporary stockpile locations for both site establishment and earthworks operations would be specified prior to the commencement of construction activities. Diversion drains and erosion and sediment control measures would be in place prior to the commencement of any stockpiling activities. Material would only be stockpiled in designated stockpiling areas.

Where water is released into local creeks, outlet scour protection and energy dissipation would be implemented. The discharge point would be at the upstream end of a large pool where feasible and reasonable, to allow for slowing of water.

6.8 Monitoring and Implementation

A qualified environmental officer would be employed to advise on appropriate controls and to monitor the implementation and maintenance of mitigation measures.

All site staff would be engaged through toolbox talks or similar with appropriate training on soil and water management practices.

A surface water quality monitoring program for the construction period would be implemented to monitor water quality upstream and downstream of the construction areas. The monitoring programme would commence prior to commencement of any construction works and would build on available water quality data.

Surface water and water quality monitoring would be carried out periodically and after rainfall events. Monitoring would examine a range of appropriate indicators in accordance with standard guidelines.

7 OPERATIONAL MITIGATION MEASURES AND RESIDUAL IMPACTS

7.1 General

A holistic approach to water quality and stormwater management would be adopted that incorporates Water Sensitive Urban Design principles to minimise impacts on the existing hydrologic regime. Water quality treatment measures (including a combination of bioretention systems, water quality basins, swales and gross pollutant traps) would be integrated into the drainage system.

The following flow management objectives would apply to the site and are adopted from Blacktown City Council's stormwater management targets:

- Hydrologic objectives for the completed facility will include the following:
- achieve a Stream Erosion Index (SEI) of 2
- maintain 1.5 year ARI peak discharge to pre-development magnitude
- preserve predevelopment peak discharges.

The following stormwater pollutant reduction targets would apply to the site, and are adopted from the Landcom (2009) and Blacktown City Councils DCP (2006):

- 85% of the post development mean annual load of total suspended solids
- 65% of the post development mean annual load of total phosphorus
- 45% of the post development mean annual load of total nitrogen

The TfNSW Sustainable Design Guidelines for Rail (Version 2) targets for stormwater pollution reduction will be achieved by meeting the above targets.

The following site specific objectives have been adopted from the TfNSW Sustainable Design Guidelines for Rail (Version 2):

- ensure that potable water is not used as a substitute for non-potable water where on-site or local sources of non-potable water are available;
- ensure that an average of 90% of annual non-potable water demand is sourced from non-potable sources at the site;
- ensure that 85% of water used in the train wash is collected recycled and reused; and
- harvested rainwater to be used for landscape irrigation, the cooling tower, toilets, spot cleaning and other appropriate non potable water uses.

7.2 Stormwater Quality

7.2.1 Water quality treatment measures

The proposed stormwater basins have a dual stormwater detention and treatment function. The basins are suitable to incorporate a bioretention basin within the floor of the basin to filter stormwater prior to release to Second Ponds Creek or infiltration to groundwater.

Water discharged from the basins will either be via tankers for subsequent disposal at an appropriate facility offsite, or via the existing discharge point to First Ponds Creek. A swale will be used to convey stormwater from the basins to the discharge point.

Gross pollutant traps such as litter baskets will be installed to trap trash and leaf litter prior to discharge to the stormwater basins.

Continuous rainfall and pollutant export modelling, using MUSIC software, was performed to evaluate the residual impact of stormwater from the basins.

The size of the basins proposed in the latest indicative layout plan will accommodate a notional biofiltration footprint of 3000 square metres which will reduce stormwater pollution loads as summarised in Table 2. Modelling shows that basins will achieve best practice stormwater pollution reduction targets. Further bioretention system requirements are provided in **Figure A2**.

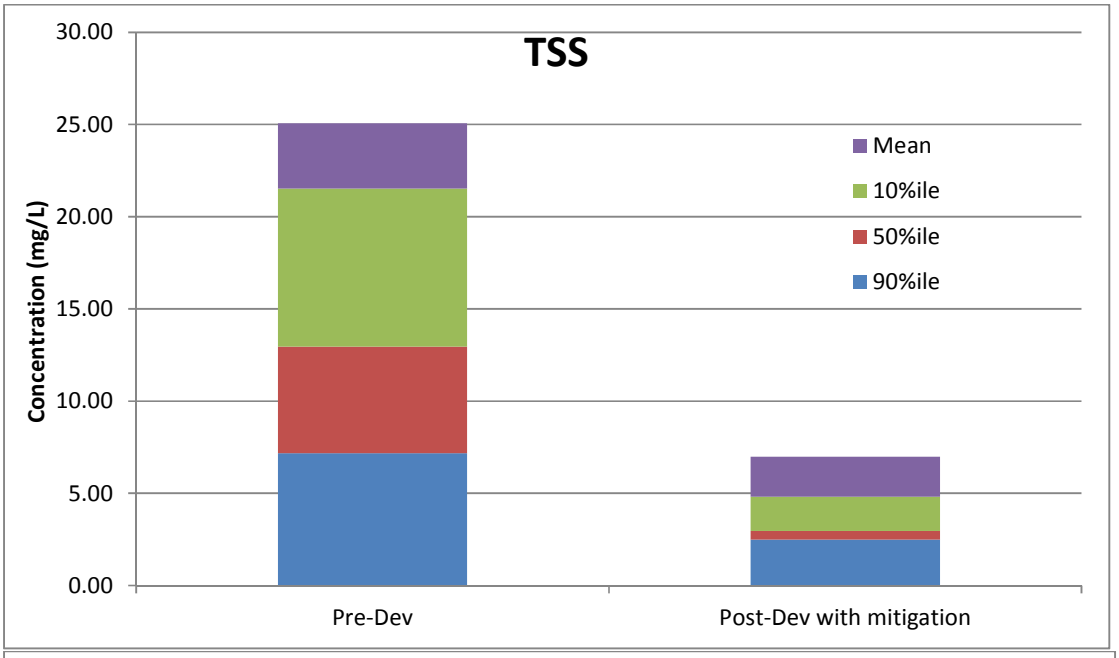
Table 2 Stormwater Pollutant Loads

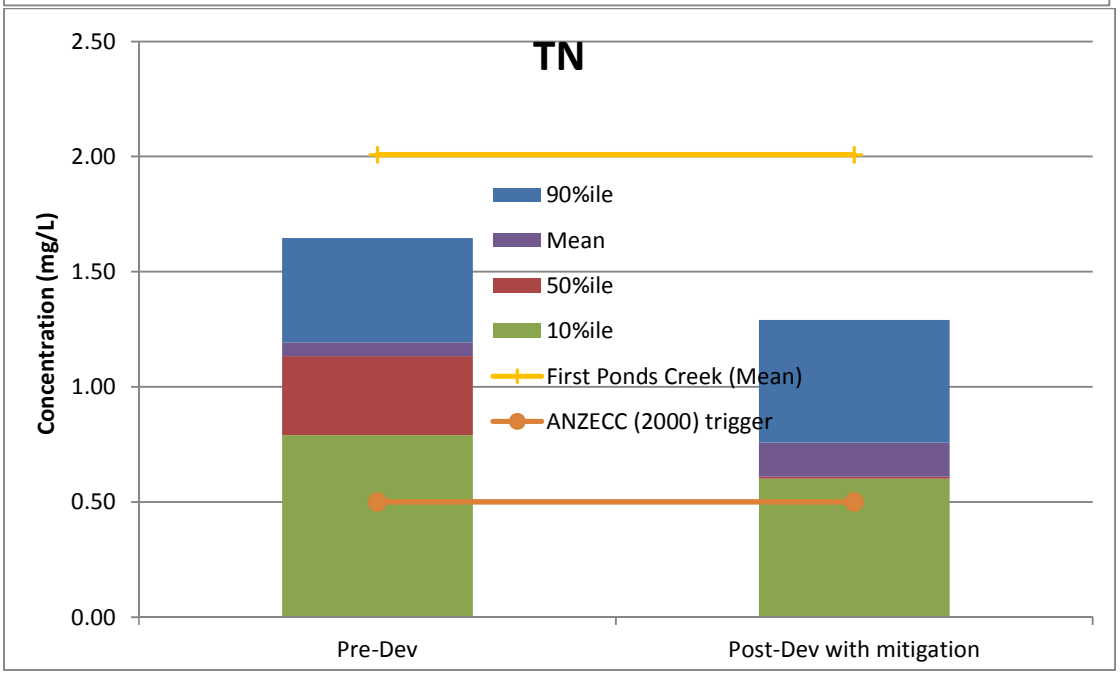
Mitigation	Existing Load (kg/yr)	Post Dev Load (no mitigation) (kg/yr)	Post Dev Load (with mitigation) (kg/yr)	Load Reduction (%)	Target Reduction (%)	Target Met
Total Suspended Solids						
Bio-retention	4290	26,500	3990	85	85	Yes
Bio-retention with infiltration through base			3960	85.1	85	Yes
Bio-retention with infiltration through base plus rainwater harvesting			3770	85.7	85	Yes
Total Phosphorus						
Bio-retention	11.1	54.5	13.4	75.5	65	Yes
Bio-retention with infiltration through base			13	76.2	65	Yes
Bio-retention with infiltration through base plus rainwater harvesting			12.6	77	65	Yes
Total Nitrogen						
Bio-retention	118	408	195	52.2	45	Yes
Bio-retention with infiltration through base			184	55.0	45	Yes
Bio-retention with infiltration through base plus rainwater harvesting			180	56.0	45	Yes

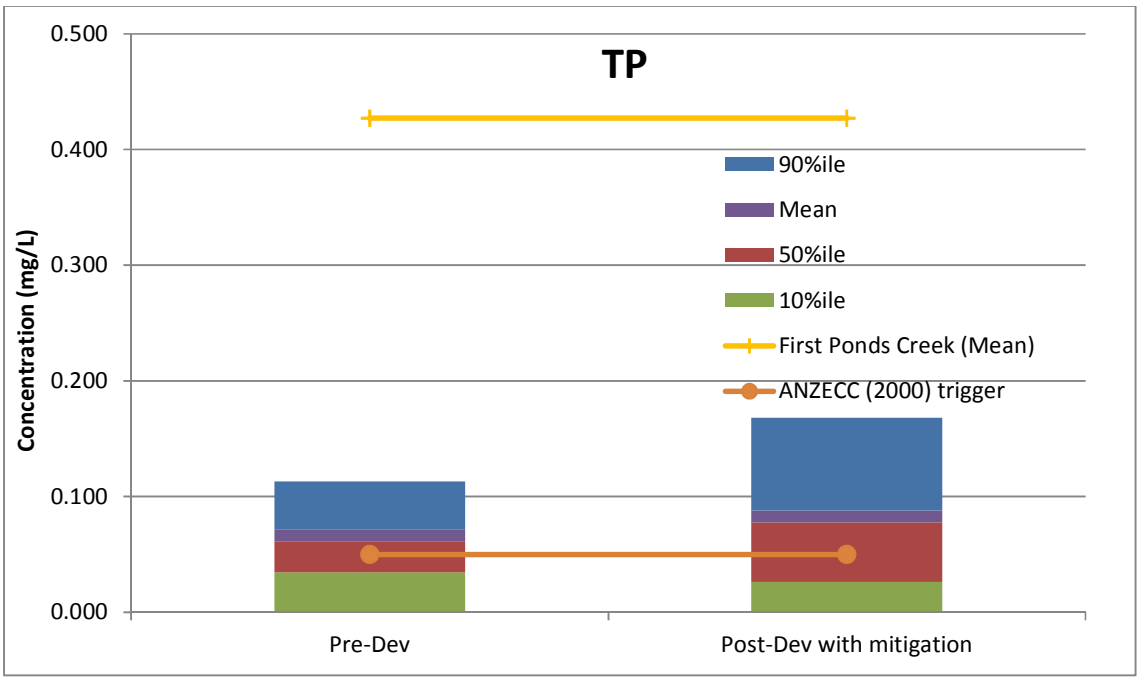
Modelling also indicates that the proposed WSUD basins on the RTRF indicative layout plan will reduce the concentration of Total Suspended Solids (TSS) and Total Phosphorus (TP) in stormwater to levels below those currently recorded in First Ponds Creek. The models predict that Total Nitrogen (TN) concentrations will increase but will generally be lower than background levels in First Pond Creek. A comparison of stormwater pollutant concentrations from the predevelopment (existing) and post development (WSUD measures) proposed RTRF site is presented in Figure 3.

It is noted that MUSIC predicts stormwater concentrations rather than ambient concentrations and are therefore not directly comparable to ANZECC guidelines. The ANZECC trigger values for lowland rivers have been included in Figure 3 to illustrate the degraded condition of the baseline water quality in First Ponds Creek.

Figure 3 Stormwater pollution concentrations under proposed and existing development scenarios







7.2.2 Monitoring

A surface water quality monitoring program would be developed post construction to monitor water quality upstream and downstream of the works. Monitoring procedures and performance criteria would be established in consultation with local councils and relevant government agencies.

7.3 Stream Flow

Continuous rainfall and runoff simulations were carried out using MUSIC software to quantify the existing and future annual hydrologic balance for the site. The results of this assessment are summarised in Figure A3 and show that the proposed stormwater basins will reduce the impacts of urban stormwater but will produce a residual impact as follows:

- A net doubling of the annual stormwater runoff to First Ponds Creek;
- A small reduction in stormwater infiltration to the groundwater table, which will be significantly reduced without encouraged infiltration to groundwater

The size of the basins proposed in the latest indicative layout plan gives adequate allowance for the inclusion of biofiltration and detention to achieve an SEI in the range of 1 to 1.5, which exceeds Blacktown Council's SEI objective. Despite the increase in runoff from the site, there will be a low risk of creek erosion due to runoff from the RTRF site.

7.4 Flooding

Stormwater detention basins proposed in the indicative layout plan have been sized using hydrologic modelling software to preserve pre-development peak flows to First Ponds Creek up to the 100 year ARI event. These are located out of the 100 year flood extent. The modelling indicates that the basins would need to provide a combined detention volume of approximately 7600 m^3 to ensure that there is no net increase in flow within the First Ponds Creek up to the 100 year event.

Development occurs outside the 100 year ARI flood extent and therefore will have no adverse impact on downstream flooding up to the 100 year ARI event. The facility is located so as to maintain the operation of key evacuation routes, minimise impacts on critical infrastructure and flood hazard for flooding up to the PMF.

The proposed facility is considered to be in line with current floodplain management standards and will have no impact on flood risk within the broader catchment or workers within the site.

7.5 Groundwater

No groundwater extraction is proposed under the RFRT.

The two stormwater basins should be unlined to encourage the infiltration of treated stormwater into to local groundwater table. The hydrologic model balance results presented above indicate a minor reduction in annual infiltration to groundwater.

Groundwater recharge at the site is dependent on infiltrating stormwater through the floor of stormwater basins. This represents a concentration of groundwater within potentially saline soils which is known to increase salinity impacts. This is mitigated however due to the infiltration zone being located well below any proposed infrastructure on the RTRF site. The infiltration rate is considered to be consistent with localised infiltration rates within the creek bed and therefore there will be a low risk of salinity impacts at the ground surface the site.

7.6 Contamination and Spills

Site specific controls around storage facilities will be developed to reduce the potential for environmental releases of potentially harmful chemicals and to reduce the risk of any such releases to First Ponds Creek.

Waste water associated with automated cleaning of rolling stock will be captured and recycled with excess water being discharged to sewer to prevent contaminants reaching First Ponds Creek.

8 CUMULATIVE IMPACTS CONSTRUCTION PHASE

8.1 Surface Water Quality

The incremental increase in stormwater pollutant loads during construction will be consistent with best practice and over time will be less than sediment loads form the existing rural site.

Given the small volumes of liquids kept on site during construction, there is a negligible risk of spilt liquid wastes entering First Ponds Creek via either deliberate or accidental release. There is an increased chance of a spill reaching downstream water ways during heavy rainfall but the chance of occurrence is still low due to sedimentation ponds.

8.2 Hydrologic Impacts

The proposed RTRF site represents a small proportion of the upstream First Ponds Creek catchment and will not create a significant incremental increase in low flows during the construction phase.

Hydrologic impacts from the construction site are considered to be negligible with sediment basins in place.

8.3 Flooding

Proposed sediment and flood detention controls will ensure that the proposed RTRF site will not increase peak flood flow rates in First Ponds Creek during construction and there will be no incremental worsening of flooding.

9 CUMULATIVE IMPACTS OPERATIONAL PHASE

9.1 Surface Water Quality

The incremental change in stormwater pollutant loads from the proposed RTRF site during the operational phase is likely to result in an improvement of water quality in First Ponds Creek. Modelling shows that typical quality of stormwater discharges will exceed ANZECC trigger values during rain events but the ambient water quality of First Ponds Creek is likely to be improved.

Given the liquid storage requirements and the small volumes of liquid waste that will exist on site there is a negligible risk of liquid contaminants and hydrocarbons entering First Ponds Creek via either accidental release or negligence. There is an increased chance of a spill reaching downstream water ways during heavy rainfall but the chance of occurrence is still low due to bioretention basins acting as an environmental barrier.

9.2 Hydrologic Impacts

The operational phase of the proposed RTRF site will create an incremental increase in the magnitude of low flows within First Ponds Creek and an increased frequency of flow events due to reduced infiltration in the catchment. This increase is illustrated in the proposed water balance presented in Figure A3.

In the context of development occurring within the broader catchment, the contribution of impacts from the development of the RTRF will be minor and the environmental risk of developing the RTRF will be accordingly small. The development of the site meets local stormwater management targets and is therefore considered to be consistent with best practice stormwater management standards. The impacts are therefore considered to be acceptable.

9.3 Flooding

Proposed flood detention controls will ensure that the proposed RTRF site will not increase peak flood flow rates in First Ponds Creek during the operation phase.

9.4 Groundwater

The total volume of water seeping to groundwater within the proposed RTRF will not be significantly reduced.

There are no groundwater dependent ecosystems within the vicinity and the impacts are considered to be acceptable.

Stormwater infiltration will only occur after filtration of the stormwater through bioretention and this will not result in a degradation of groundwater quality.

10 ENVIRONMENTAL IMPACTS ASSESSMENT

Using the risk framework an environmental risk analysis has been undertaken for the project and is presented in Table 3.

Table 3 Environmental risk analysis

Potential Adverse Impacts	Consequence	Likelihood	Risk Rating	Proposed Mitigation	Residual Consequence	Residual Likelihood	Residual Risk Rating
Pollution of water courses from sediment laden surface water runoff	Major	Possible	High	Sediment and erosion control	Major	Unlikely	Low
Change to in stream environment from alteration in water flow	Moderate	Likely	High	Infiltration, stormwater harvesting, detention	Insignificant	Likely	Low
Contamination of water through spills of fuels or chemicals	Major	Possible	High	Stormwater filtration	Major	Unlikely	Low
Increased flood levels from temporary construction sites and completed Tallawong Road facilities	Major	Possible	High	Flood detention basins	Major	Unlikely	Low
Change to groundwater levels from a reduction in infiltration	Moderate	Likely	High	Infiltration via basins and landscape areas	Insignificant	Likely	Low

11 REFERENCES

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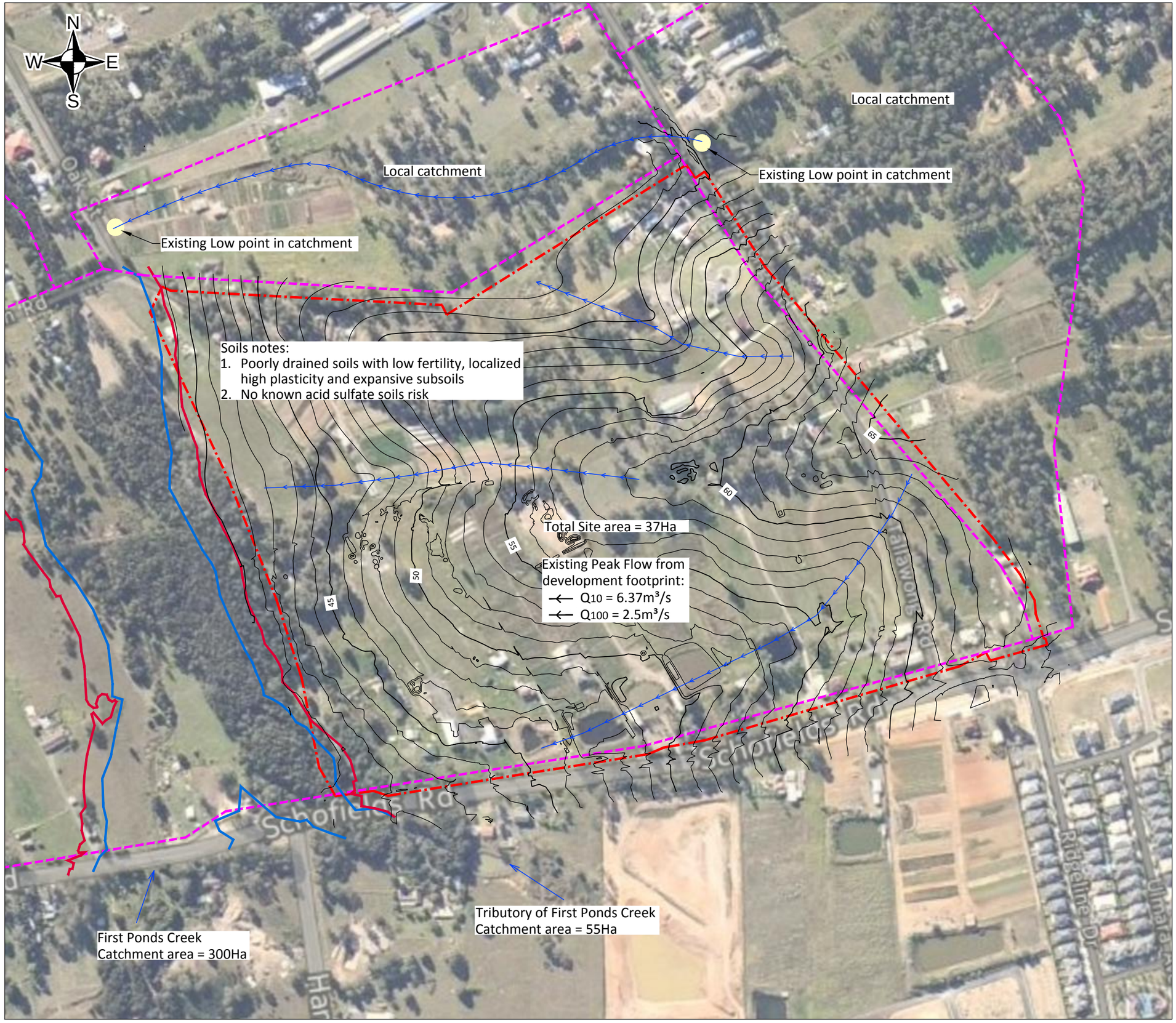
APPENDIX A

Figure A1 - Hydrologic Constraints Mapping

Figure A2 - Hydrologic Mitigation Mapping

Figure A3 - Water Balance Impacts



NOTES

Contours are in intervals of 1m.

LEGEND

- Site Boundary
- Catchment areas
- PMF Flood Extent
- 100yr ARI Flood Extent
- Main overland flow paths

Revision	By	Chk'd By	Date	Comments
A	A.B.	A.B	JUNE 13	

SLR

2 LINCOLN STREET
LANE COVE
NEW SOUTH WALES 2066
AUSTRALIA
T: 61 2 9427 8100
F: 61 2 9427 8200
www.slrconsulting.com

Site
Tallawong Road TRTF

Project
Surface Water & Hydrology
610.12637

Drawing Title

HYDROLOGIC CONSTRAINTS PLAN

Scale	Date	Drawing Number	Revision
1:4,000	JUNE 2013	FIG A1	A

Figure A1.dwg

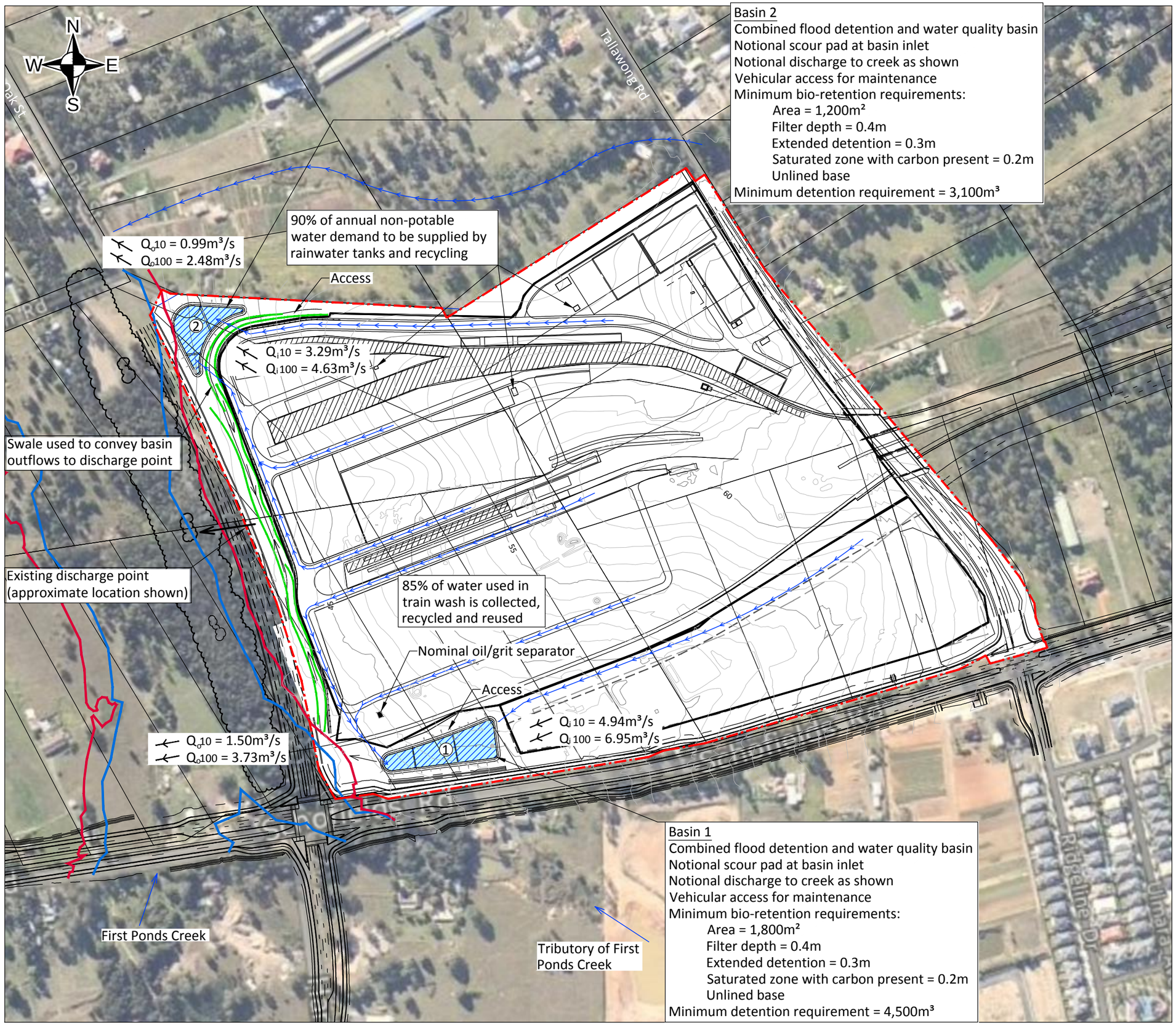


Figure A2.dwg

NOTES

1. Contours are in intervals of 1m.
2. An oil and grit separator would be required in the event of stabling any diesel trains used for track maintenance works.

LEGEND

- Site Boundary
- PMF Flood Extent
- 100yr ARI Flood Extent
- Main overland flow paths
- $Q_{i\ ARI}$ Inflow to Basin
- Q_{oARI} Outflow from Basin
- Batter slopes
- Swale

Revision	By	Chk'd By	Date	Comments
A	A.B.	A.B	JUNE 13	

SLR

2 LINCOLN STREET
LANE COVE
NEW SOUTH WALES 2066
AUSTRALIA
T: 61 2 9427 8100
F: 61 2 9427 8200
www.slrconsulting.com

Site
Tallawong Road RTRF

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Surface water & Hydrology
610.12637

Drawing Title
HYDROLOGIC IMPACTS & MITIGATION PLAN

Scale	Date
1:4,000	JUNE 2013

Drawing Number	Revision
FIG A2	A

Figure A3 – Hydrologic balance for existing site and RTRF