Chullora Materials Recycling Facility

Environmental Impact Statement (SSD-10401)

Appendix L Water and Hydrology Impact Assessment

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

CHULLORA MATERIAL RECOVERY FACILITY

WATER QUALITY & HYDROLOGY IMPACT ASSESSMENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION (SSD 10401) APPENDIX L

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GLOSSARY OF TERMS

Table (i) Key terms

Key terms	Definition
The Applicant	SUEZ Recycling & Recovery Pty Ltd
The Chullora RRP	The Chullora Resource Recovery Park (RRP) to be developed across three stages at 21 Muir Road, Chullora in Sydney.
The previous Chullora RRC	The previous Chullora Resource Recovery Centre was the waste management infrastructure comprising a putrescible waste transfer station, a materials recovery facility, a glass processing facility and supporting infrastructure that was operated by SUEZ on the site from 1997 to 2017 when it was subject to a fire and subsequently demolished.
The Proposal	The development and operation of the first phase of the Chullora RRP as a Materials Recycling Facility (MRF) to process co-mingled and source separated recyclable from municipal sources and dry commercial and industrial (C&I) waste; with a material processing capacity of up to 172,000 tonnes per annum (tpa).
The Proposal site	The area occupied by Stage 1 of the Chullora RRP located at 21 Muir Road.

Table (ii) Glossary

Term	Definition
C&I	Commercial and industrial
CBD	Central Business District
CEMP	Construction Environmental Management Plan
Council	City of Canterbury-Bankstown Council
DA	Development Application
DP	Deposited Plan
DPIE	Department of Planning, Industry and Environment
e.g.	for example
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979

Term	Definition
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
ha	hectares
i.e.	that is
km	kilometre
LGA	Local Government Area
m	metres
m2	square metres
MRF	Materials Recovery Facility
MSW	Municipal solid waste
NSW	New South Wales
OEH	Office of Environment and Heritage
RRC	Resource Recovery Centre
RRP	Resource Recovery Park
SEARs	Secretary Environmental Assessment Requirements
SSD	State significant development
SUEZ	SUEZ Recycling & Recovery Pty Ltd
tpa	tonnes per annum

EXECUTIVE SUMMARY

SUEZ Recycling & Recovery Pty Ltd (SUEZ - the Applicant) are seeking to establish a state-of-the art Resource Recovery Park located at 21 Muir Road (Lot 2 DP1227526), Chullora in Sydney (the Chullora RRP). The Applicant are proposing to develop and operate the first phase of the Chullora RRP as a Materials Recycling Facility (MRF) (the Proposal) to process co-mingled and source separated recyclables from municipal sources and dry commercial and industrial (C&I) waste; with a material processing capacity of up to 172,000 tonnes per annum (tpa).

The Proposal would be considered State significant development (SSD) under Clause 23 (waste and resource management facilities) of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011*. Accordingly, an Environmental Impact Statement (EIS) has been prepared to support the SSD Application for the Proposal. This Water and Hydrology Assessment has been prepared by Costin Roe Consulting to support the preparation of the EIS and assess the Proposal's impact on the surrounding environment in relation to stormwater and stormwater management.

Proposal overview

SUEZ is seeking to establish the state-of the art Chullora RRP located at 21 Muir Road, Chullora in Sydney. The Applicant are proposing to develop and operate the first phase of the Chullora RRP as a MRF. The Proposal would comprise the construction and operation of a MRF with a material handling capacity of up to 172,000 tpa. Waste streams that would be processed at the MRF would all comprise dry recyclables from municipal and C&I sources, including:

- Co-mingled material collected from municipal and C&I sources
- Source separated paper and cardboard
- Mixed plastics.

General operational activities are proposed to occur concurrently with the MRF within designated operational activities area, including truck parking, container storage and other ancillary activities as required.

Purpose of this assessment

This Water and Hydrology Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) as they related to water and hydrology, including:

- Stormwater Management including stormwater quantity and quality;
- Flooding; and
- Erosion & Sediment Control.

Construction impacts

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Operational impacts

During the operational phase of the development, the proposed stormwater quality treatment system incorporating the use of a treatment train of GPT's and filtration is proposed to mitigate any increase in stormwater pollutant load generated by the

development. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Further it has been confirmed that the development meets flood planning requirements and does not impact or encroach on existing flood affected areas (as defined in separate approval to COUNCIL and associated TUFLOW flooding assessment completed by Costin Roe Consulting). This shows that local post development flows from the site, in conjunction with the flood management measures to be adopted in the flooding assessment demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

Conclusion

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by SUEZ to prepare this Water and Hydrology Impact Assessment in support of a proposed State Significant Development Application (SSDA 10401) to be lodged over the site.

SUEZ Recycling & Recovery Pty Ltd (SUEZ – the Applicant) are seeking to establish the state-of-the art Chullora Resource Recovery Park (Chullora RRP) located at 21 Muir Road (Lot 2 DP1227526), Chullora in Sydney. The Applicant are proposing to design build and operate the first phase of the Chullora RRP as a Materials Recycling Facility (MRF) (the Proposal) to process co-mingled recyclable municipal solid waste (MSW) and dry commercial and industrial (C&I) waste; with a material processing capacity of up to 172,000 tonnes per annum (tpa).

The Proposal would be considered a state significant development (SSD) under Clause 23 (waste and resource management facilities) of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* being a recycling facility that handles more than 100,000 tonnes of waste per year. Accordingly, an Environmental Impact Statement (EIS) has been prepared to support the SSD Application for the Proposal.

1.2 Location & Site Description

The Chullora RRP site boundary including the Proposal site, shown in **Figure 1.1**, comprises one parcel of land being 21 Muir Road, Chullora (Lot 2 in DP 1227526)). The Proposal site is located in the Canterbury-Bankstown Local Government Area (LGA) and is approximately 2.5 hectares (ha) in size and is located approximately 18 kilometres (km) west of Sydney Central Business District (CBD) and 10 km east of Parramatta CBD.

The Chullora site is bounded by Muir Road to the north, Anzac Street to the east and existing industrial development further east and to the south. A disused freight railway line forms the site's boundary to the west. The Proposal site forms the central portion of the Chullora RRP site.

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Nearby sensitive receivers to the Proposal site

Figure 1.1 Surrounding land uses and residential receivers

The Chullora site is located within the Chullora Technology Park, and surrounded by a range of industrial developments including PFD Storage Warehouse, Tip Top Bakery, News Limited, Fairfax, Volkswagen Distribution Centre, Bluescope Steel and Veolia transfer station. Directly to the west of the Proposal site is a narrow strip of land owned by the State Railway Authority, which formed part of the former railway through this

area. A number of other businesses are located further to the west, including a service station, fitness centre and a range of other industrial warehouses.

The closest residential receivers are located approximately 455 m to the southwest and 600 m to the east of the site.

The Chullora RRP site currently has two vehicular access points. The access point for heavy vehicles is via Muir Road, west of the roundabout at Muir Road / Dasea Street. A secondary access point for light vehicles is provided from Anzac Street. The Proposal site would utilise these existing access points. Primary access to the Proposal site from the north will remain via Muir Road from both directions, and egress is via left turn only. There are four major intersections along Muir Road including linkages to Rookwood Road (Metroad 6) and the Hume Highway:

- Two-lane roundabout at the intersection of Muir Road and Dasea Street
- Signalised intersection at Muir Road and Worth Street
- Signalised intersection at Muir Road and Rookwood Road
- Signalised intersection at Muir Road and Hume Highway.

A trunk drainage system is present on the Chullora RRP site consisting of an existing concrete drainage channel, unformed irregular open channel and closed box culvert system. This trunk drainage channel forms the upper reaches of the Cooks River.

The channel extends through the Chullora RRP site from south-west to north-east of the site at an average grade of 2.5% in the northern half. The surrounding land to the north and west of the system is relatively flat and drains to low points in the area and to the concrete channel.

The upstream bounds of the channel, from the railway crossing at the western end of the site to the concrete based and reinforced concrete wall channel at the south-east corner of the site, is a regular cross section and vegetated. The channel then continues downstream toward Muir Road as a lined channel approximately 6.1m wide and 1.22m deep. The channel has a concrete base and vertical brick walls with steep vegetated slopes in the overbank areas. There are three existing crossings of the main channel by brick culvert and slab on grade vehicle crossings. These can be seen to severely restrict flow in a flood situation.

At a point on the northern boundary of the development land, the open channel becomes closed, as a series of box culverts which convey the flow north under the PFD carpark, Muir Road and further to the north-east of the subject property as the Cooks River. These culverts terminate approximately 300m north of Muir Road to a wetland and flood storage area. The box culverts comprise three cells with two measuring 2.7m wide by 1.2m high and the third being 3.6m wide and 2.4m high. These culverts were extended to the current position during the recent construction of the PFD Facility on the neighbouring lot to the north of the Chullora RRP site.

It is noted that the current site was previously the former Chullora Waste Recovery Centre. A fire in 2017 halted operations and required demolition of the previously existing buildings on the land and halted operation of the facility.

As discussed in **Section 1.4**, the Chullora RRP Site is currently under assessment by Canterbury Bankstown City Council (Council) for an approval for earthworks and flood

mitigation works. The assessment includes consideration of an Infrastructure Early Works engineering package (including bulk earthworks and retaining wall). The earthworks application under assessment includes filling of the site to achieve flood planning compliance over the Proposal site, and to provide a flood storage and detention basin through the western portion of the Chullora RRP site.

This impact assessment has been completed based on condition where the early works application has been approved by Council and construction of these works has been completed – refer **Figure 1.4** for current assessed conditions.

1.3 Proposed Development

The Proposal would comprise the construction and operation of a MRF with a material handling capacity of up to 172,000 tonnes per annum (tpa), comprising:

- Up to 115,000 tpa of co-mingled recyclables collected from municipal and C&I sources
- Up to 50,000 tpa of source separated paper and cardboard for baling
- Up to 7,000 tpa of external mixed plastics for secondary processing.

Once operational the Proposal would receive waste from locally generated sources as well as the greater Sydney area. The total input in any year would not exceed 172,000 tpa, with the exact throughput from each source varying subject to the market conditions in that year and different Councils' recycling collection regimes.

The Proposal would represent a critical piece of waste management infrastructure which would mitigate significant capacity constraints currently impacting the Sydney region. The Proposal would provide advanced recycling processes to build resilience within the current network of recycling facilities as well as promote the principles of a circular economy through implementation of a pull-through model that conceives of the sorting, reprocessing and specified end uses of processed materials as an integrated, closed loop solution.

The key construction components of the Proposal would include:

- Establishment of a hardstand area and internal road network
- Construction of the enclosed MRF shed
- Installation and commissioning of fixed plant and equipment
- Installation of ancillary infrastructure, including weighbridges, pedestrian overbridge, and fire systems
- Installation and connection of site service infrastructure (electrical, water, sewer, gas and telecommunication services
- Installation of signage.

The key operational components of the Proposal would include:

- Operation of a MRF 24 hours per day, seven days per week (including processing and waste delivery and collection)
- Product storage.

The key components of the Proposal are shown in **Figure 1.2**.

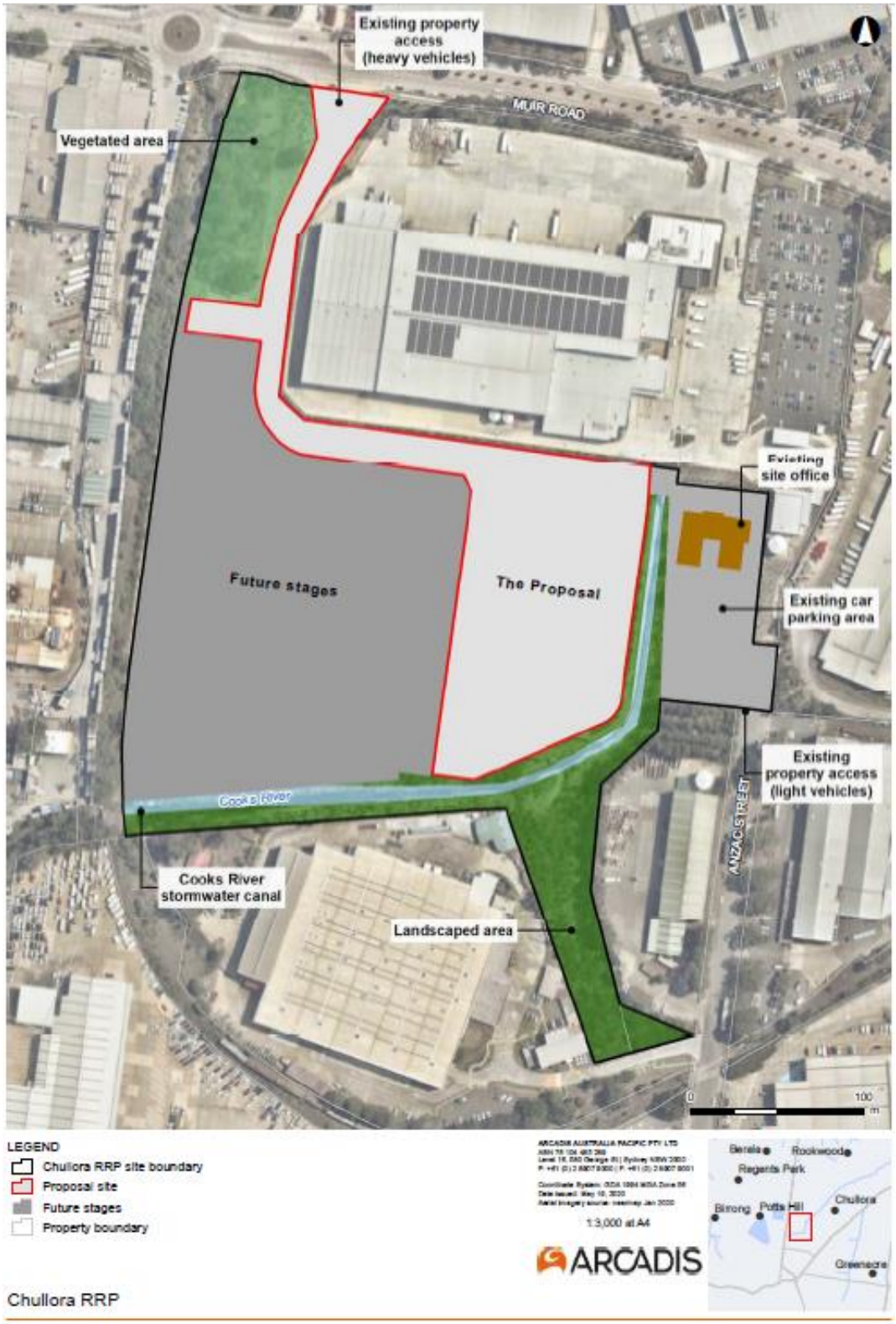


Figure 1.2. The Chullora RRP

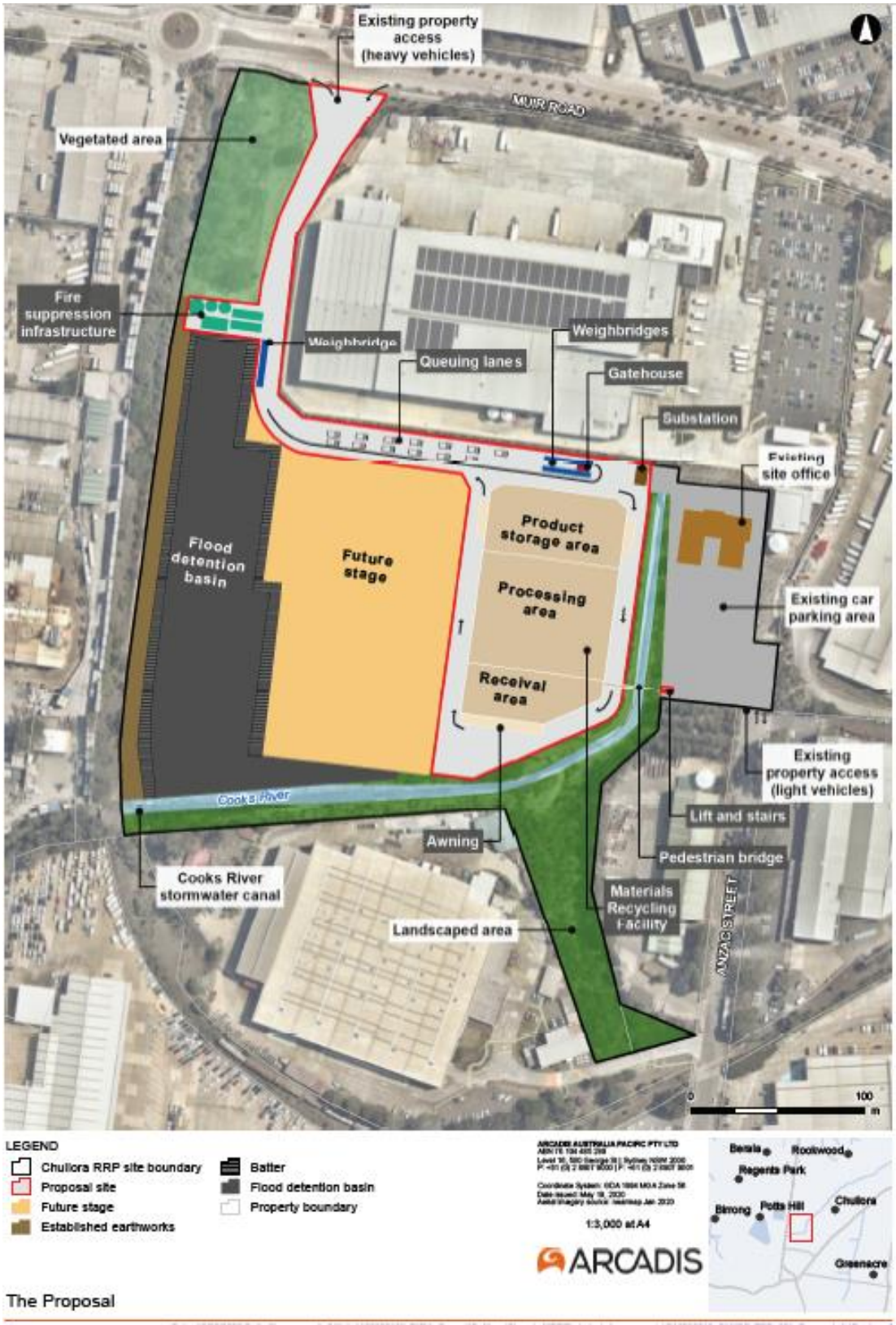


Figure 1.3. The Proposal

1.4 Site History

In 1996 the Waste Recycling and Processing Service of NSW took ownership of the Chullora RRP site and neighbouring site to the north (now occupied by the PFD storage warehouse). WSN Environmental Solutions, a State-owned corporation, operated the site in 1997 until 2011 when they were acquired by SITA Australia Pty Ltd (now SUEZ). From this time SUEZ, operated the previous Chullora RRC site which included a Transfer Station, MRF, Garden Organics platform and glass processing shed. In 2016, Frasers Property acquired both the Chullora RRP site and the site to the north, leasing the previous Chullora RRC back to SUEZ for ongoing use as a waste facility.

In 2017, the MRF component of the previous Chullora RRC, was subject to a fire and subsequently demolished, along with the former glass processing building and other waste infrastructure. At this time the site was subdivided with the northern portion developed as the PFD storage warehouse. Since demolition of the previous Chullora RRC, the Proposal site has been used for storage of residential waste bins, maintenance and parking of waste trucks, a heavy vehicle workshop, 5000 L diesel tank and wash bay to support truck maintenance activities.

In 12th May 2020 SUEZ lodged a development application (DA) (DA366/2020) with Council for the development of flood mitigation works across the Chullora RRP site (the flood mitigation works). The DA is seeking approval for early works and site establishment across the Chullora RRP site to provide flood immunity and stormwater infrastructure. The flood mitigation works include:

- Site clearance, including:
  - Demolition of temporary structures and general clean-up of the proposed site fill area and flood storage area
  - Removal of tress and other vegetation (within fill area and flood storage area)
  - Crushing of the existing concrete slab, temporary stockpiling of crushed material and reuse of it as a fill material
- Earthworks, including:
  - Cut and fill for the flood storage area
  - Construction of a flood detention basin and installation of stormwater infrastructure
  - Filling the area to the required level using existing crushed recycled concrete material and imported shale / sandstone material.

The commencement of the construction of the Proposal would occur following completion of the flood mitigation works. **Figure 1.4** shows the flood mitigation works; depicting the features of the Chullora RRP site upon commencement of the construction of the Proposal.

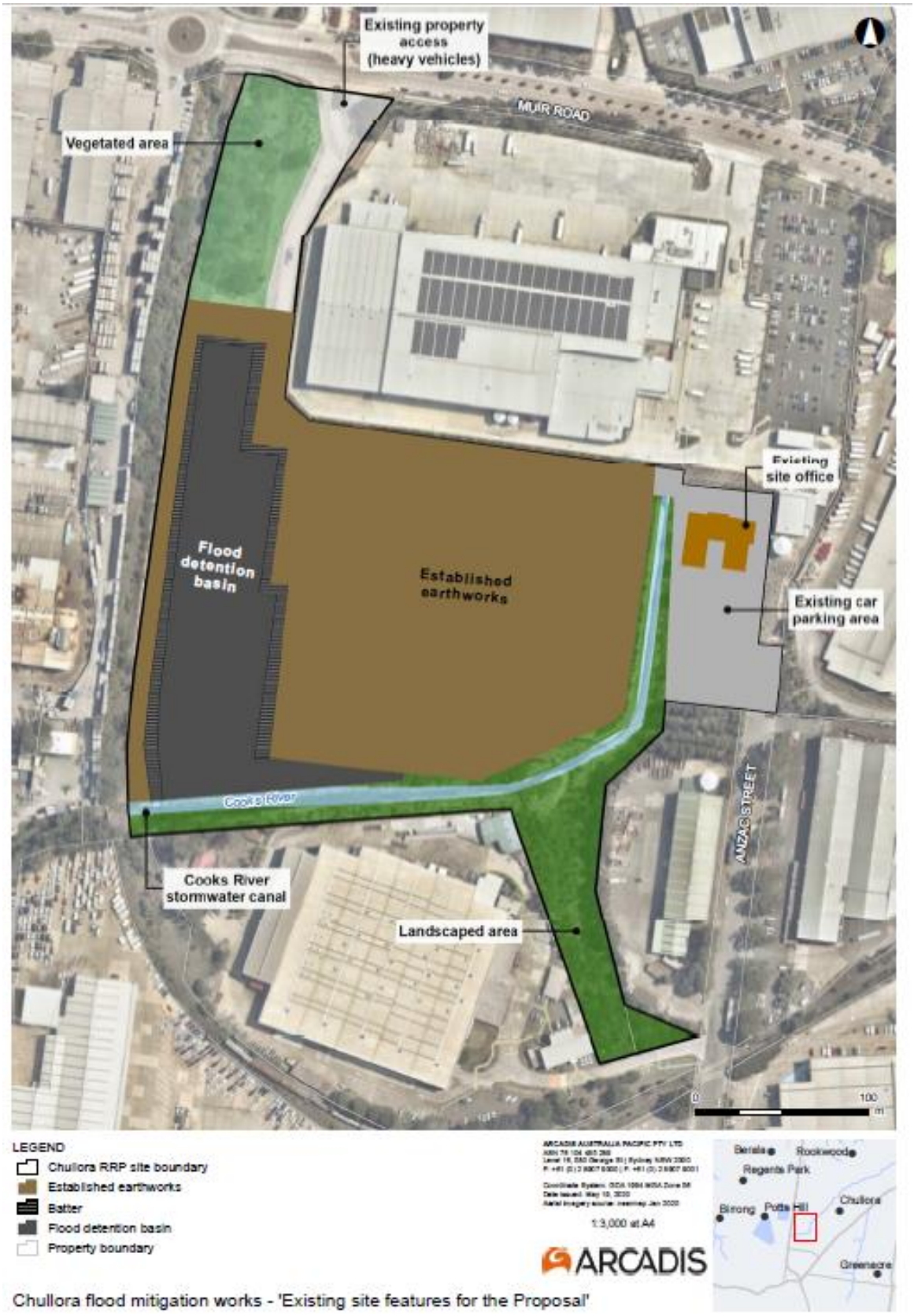


Figure 1.4. Chullora RRP Site – Current Conditions

1.5 Purpose of this report

This Water and Hydrology Impact Assessment has been provided to support the EIS in relation to impacts associated with the following components of the proposal:

- Stormwater Management including stormwater quantity and quality;
- Flooding; and
- Erosion & Sediment Controls during construction.

The objectives for the assessment are to ensure that potential for detrimental impacts on the environment are mitigated through provision of development which, based on the proposed Development Layout:

- responds to the topography and site constraints, considers flooding and flood planning requirements
- provides an appropriate and economical stormwater management system which incorporates best practice in water sensitive urban design consistent with and mitigates impact to receiving waters through provision of water quality improvement measures to reduce pollutants from stormwater runoff from the development.

A set of drawings have been prepared to accompany the impact assessment and show how the development and proposed civil engineering components (including site levels, stormwater drainage layout and water quantity and quality requirements) of the development can manage the potential for impact to the environment. These drawings are for development approval and impact assessment only and subject to change during detail design. Outcomes of the impact assessment would remain consistent in any future detail design process.

The consent authority is The NSW Department of Planning, Industry& Environment (DPIE) as the proposal considered a State Significant Development (SSD). However as the subject site is located within Canterbury-Bankstown City local government area (LGA), the requirements of the Bankstown City Council *Development Engineering Standards 2009* have also been considered in the setting proposed design and mitigation measures.

The DPIE has provided Secretary's Environmental Assessment Requirements (SEAR's) dated 20 December 2019, Ref: SSD10401. In addition to providing a general summary of civil engineering aspects of the proposal, this report addresses the Soil and Water items included in the SEAR's:

It is noted that this site is currently under assessment by Council for approval for earthworks and flood mitigation works. This impact assessment has been completed based on condition where the early works application has been approved by Council and construction of these works has been completed.

1.6 Purpose Of Report And Sears

This Water and Hydrology Impact Assessment supports the EIS for the Proposal and has been prepared as part of an SSD Application for which approval is sought under Part 4, Division 4.7 of the EP&A Act.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSD 10401) for the Proposal, issued by NSW Department of Planning, industry and Environment (DPIE) on 20 December 2019.

Table 1.1 provides a summary of the relevant SEARs which relate to water and hydrology, and where these have been addressed in this report.

Table 1.1. SEARs

SEARs	Where Addressed
6. Soil and Water	
An assessment of potential impacts to soil and water resources, topography, hydrology, groundwater, drainage lines, watercourses and riparian lands on or nearby to the site, including mapping and description of existing background conditions and cumulative impacts	Refer **Section 1** for background conditions relating to the development site. Refer **Sections 1, 2, & 3** for assessment of stormwater management including assessments of hydrology, watercourses and drainage lines. It is noted that no earthworks are proposed for this development hence impacts on groundwater, topography and or earthworks are not considered relevants.
A detailed site water balance including identification of water requirements for the life of the project, measures that would be implemented to ensure an adequate and secure water supply is available for the proposal and a detailed description of the measures to minimise the water use at the site	Refer **Sections 5** for assessment of water balance considerations.
Characterisation of water quality at the point of discharge to surface and/or groundwater against the relevant water quality criteria (including details of the contaminants of concern that may leach from the waste into the wastewater and proposed mitigation measures to manage any impacts to receiving waters)	Refer **Section 2** for assessment of stormwater quality and water quality criteria at discharge.

SEARs	Where Addressed
Details of stormwater/wastewater/leachate management systems including the capacity of onsite detention system/s, onsite sewage management and measures to treat, reuse or dispose of water	Refer **Sections 1, 2, 3 & 5** for assessment of stormwater management systems. Refer EIS relating to leachate containment and wastewater disposal systems.
Detailed flooding assessment	Refer **Section 4** for flooding considerations. It is noted that flood management and flood planning requirements for this site have been addressed through applications and assessments completed by Canterbury Bankstown City Council.

Further to the above, the Water Group of DPIE, Environment, Energy and Science Group of DPIE, the EPA and Sydney Water require further details on specific requirements relating to their authority. These requirements are discussed throughout the report as indicated in **Table 1.2**.

Table 1.2 Local and State authority requirements and relevant report sections

Water and Hydrology	Where Addressed
DPIE (Water and NRAR)	
The SEARs should include: The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.	Refer EIS.
A detailed and consolidated site water balance	Refer **Sections 5** for water cycle management.
Assessment of impacts on surface and ground water sources (both quality and quantity),	Refer **Sections 2, 3 & 5** for assessment of surface stormwater

Water and Hydrology	Where Addressed
related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts	management including assessments of hydrology, watercourses and drainage lines. It is noted that no earthworks are proposed for this development hence impacts on groundwater, topography and or earthworks are not considered relevant.
Proposed surface and groundwater monitoring activities and methodologies.	Surface and groundwater monitoring are not proposed or required for the proposed MRF. Refer **Appendix B** for DRAFT Maintenance and Monitoring recommendations associated with the specified drainage system and water quality measures.
Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).	No water sharing activities are proposed. The site and majority of works are located adjacent to concrete lined channel hence riparian corridors requirements are not required. Recent works on the short section of vegetated channel will be maintained and flood storage provided as part of separate Council approvals.
DPIE (Environment, Energy and Science)	
10. The EIS must describe background conditions for any water resource likely to be affected by the development, including: a) Existing surface and groundwater	Refer **Sections 2, 3 & 5** for assessment of surface stormwater management including assessments of hydrology, watercourses and drainage lines. It is noted that no earthworks are proposed for this development hence impacts on groundwater, topography and or earthworks are

Water and Hydrology	Where Addressed
	not relevant to the SSDA impact assessments.
b) Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.	Refer **Sections 2, 3 & 5** for assessment of surface stormwater management including assessments of hydrology, watercourses and drainage lines. It is noted that no water intake is proposed for the development.
c) Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.ciov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.	Refer **Section 2** for surface water quality objectives and modelling. It is noted that no earthworks are proposed for this development hence impacts on groundwater, topography and or earthworks are not relevant to the SSDA impact assessments.
d) Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.	Refer **Section 2** for water cycle management objectives including water quality and quantity criteria.
e) Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions http://www.environment.nsw.gov.au/research-andpublications/publications-search/risk-based-framework-for-considering-waterwayhealth- outcomes-in-strategic-land-use-planning	Refer **Section 2** for water cycle management objectives including water quality and quantity criteria.
11. The EIS must assess the impacts of the development on water quality, including: a) The nature and degree of impact on receiving waters for both surface and	Refer **Section 2** for water cycle management objectives including water quality and quantity criteria.

Water and Hydrology	Where Addressed
groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.	
b) Identification of proposed monitoring of water quality	Refer **Appendix C** for Maintenance and Monitoring requirements associated with the specified drainage system and water quality measures.
c) Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan).	Refer **Section 2** for water cycle management objectives including water quality and quantity criteria. It is noted that although the site is not within a certified Coastal Management Program, the Cooks River discharges into Botany Bay. The proposed water quality management measures for this development are noted to be consistent with the **Botany Bay and Catchment Water Quality Improvement Plan** (Sydney Metropolitan Catchment Management Authority 2011).
12. The EIS must assess the impact of the development on hydrology, including: a) Water balance including quantity, quality and source.	Refer **Sections 5** for water cycle management and supporting assessments.
b) Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.	Refer **Sections 5** for water cycle management objective and

Water and Hydrology	Where Addressed
	Section **2 & 3** for supporting assessments. Discharge is noted to be to an engineered channel (Upper Cooks River drainage channel) and discharge is consistent with discharge from the historic facility located on the site. As such there is no adverse effect on downstream rivers, wetlands, estuaries, marine waters and floodplain areas.
c) Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.	Refer **Sections 5** for water cycle management objective and Section **2 & 3** for supporting assessments. Discharge is noted to be to an engineered channel (Upper Cooks River drainage channel) and discharge is consistent with discharge from the historic facility located on the site. As such there is no adverse effect on downstream water-dependent fauna and flora including groundwater dependent ecosystems
d) Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).	Refer **Sections 5** for water cycle management objective and Section **2 & 3** for supporting assessments. Discharge is noted to be to an engineered channel (Upper Cooks River drainage channel) and discharge is consistent with discharge from the historic facility located on the site. As such there is no adverse impacts on natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape

Water and Hydrology	Where Addressed
	health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).
e) Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water.	There are no changes associated with water availability as a result of the MRF development.
f) Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.	Refer **Sections 5** for water cycle management objective and Section **2 & 3** for supporting assessments. There is no change to existing flow or discharge volumes or rates, hence no impact from the Proposal.
g) Identification of proposed monitoring of hydrological attributes.	Refer **Appendix C** for DRAFT Maintenance and Monitoring requirements associated with the specified drainage system and water quality measures.
13. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: a) Flood prone land.	Refer **Section 4**, noting flood management requirements have been approved by Council.
b) Flood planning area, the area below the flood planning level	Refer **Section 4**, noting flood management requirements have been approved by Council
c) Hydraulic categorisation (floodways and flood storage areas)	Refer **Section 4**, noting flood management requirements have been approved by Council
d) Flood hazard	Refer **Section 4**, noting flood management requirements have been approved by Council
14. The EIS must describe flood assessment and modelling undertaken in determining the	Refer **Section 4**, noting flood management requirements have

Water and Hydrology	Where Addressed
design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the probable maximum flood, or an equivalent extreme event.	been approved by Council for the Defined Flood Event (DFE) of th 1% AEP. In relation to PMF event and occupant safety, review of Councils Rookwood Road Flood Study shows that safe and easy egress from the Proposal to area which are not within flood prone land or affected by PMF.
15. The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: a) Current flood behaviour for a range of design events as identified in 14 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Refer **Section 4**, noting flood management requirements have been approved by Council
16. Modelling in the EIS must consider and document: a) Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.	Refer **Section 4**, noting flood management requirements have been approved by Council
b) The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.	Refer **Section 4**, noting flood management requirements have been approved by Council
c) Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories	Refer **Section 4**, noting flood management requirements have been approved by Council

Water and Hydrology	Where Addressed
d) Relevant provisions of the NSW Floodplain Development Manual 2005.	Refer **Section 4**, noting flood management requirements have been approved by Council
17. The EIS must assess the impacts on the proposed development on flood behaviour, including: a) Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.	Refer **Section 4**, noting flood management requirements have been approved by Council
b) Consistency with Council floodplain risk management plans.	Refer **Section 4**, noting flood management requirements have been approved by Council
c) Consistency with any Rural Floodplain Management Plans.	Refer **Section 4**, noting flood management requirements have been approved by Council
d) Compatibility with the flood hazard of the land.	Refer **Section 4**, noting flood management requirements have been approved by Council
e) Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	Refer **Section 4**, noting flood management requirements have been approved by Council.
f) Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.	Refer **Section 4**, noting flood management requirements have been approved by Council
g) Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	Refer **Section 4**, noting flood management requirements have been approved by Council. The receiving waters are noted to be a concrete lined drainage channel hence opportunity for erosion is nil.

Water and Hydrology	Where Addressed
h) Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSWSES and Council.	Refer **Section 4**, noting flood management requirements have been approved by Council
i) Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.	Refer **Section 4**, noting flood management requirements have been approved by Council
j) Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.	Refer **Section 4**, noting flood management requirements have been approved by Council
k) Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	Refer **Section 4**, noting flood management requirements have been approved by Council
EPA	
The EPA's key information requirements for the proposal include an adequate assessment of: • Water management including fire water management.	Refer **Sections 5** for water cycle management objective and Section **2 & 3** for supporting assessments. Refer **Section 2**and drawings in **Appendix A** for fire water containment controls. Refer EIS and associated assessments by Innova confirming overall firewater containment strategy.
Sydney Water	

Water and Hydrology	Where Addressed
1. The proponent of the development should determine service demands following servicing investigations and demonstrate that satisfactory arrangements for drinking water, wastewater, and if required, recycled water services have been made.	Refer EIS for wastewater and drinking water requirements. Refer **Section 5** for expected service demand and reductions to demand through rainwater reuse and non-potable water uses.
2. The proponent must obtain endorsement and/or approval from Sydney Water to ensure that the proposed development does not adversely impact on any existing water, wastewater or stormwater main, or any other Sydney Water asset, including any easement or property. When determining landscaping options, the proponent should take into account that certain tree species can cause cracking or blockage of Sydney Water pipes and therefore should be avoided.	Refer EIS for wastewater and Section 5 for drinking water requirements. Applications to Sydney Water will be made via a Sydney Water Service Coordinator as required following development consent as necessary.
3. Strict requirements for Sydney Water's stormwater assets (for certain types of development) may apply to this site. The proponent should ensure that satisfactory steps/measures been taken to protect existing stormwater assets, such as avoiding building over and/or adjacent to stormwater assets and building bridges over stormwater assets. The proponent should consider taking measures to minimise or eliminate potential flooding, degradation of water quality, and avoid adverse impacts on any heritage items, and create pipeline easements where required.	Applications to Sydney Water will be made via a Sydney Water Service Coordinator as required following development consent as necessary. It is noted that no works are proposed within the Upper Cooks River drainage channel as part of the proposal.
4. As this development creates trade wastewater, Sydney Water has trade wastewater requirements which need to be met. By law, the property owner must submit an application requesting permission to discharge trade wastewater to Sydney Water's sewerage system. The proponent must obtain Sydney Water approval for this permit before any business activities can commence. Given this development comprises industrial operations, wastewater may discharge into a	Applications to Sydney Water will be made via a Sydney Water Service Coordinator as required following development consent as necessary.

Water and Hydrology	Where Addressed
sewerage area that is subject to wastewater reuse. Please contact Sydney Water's Business Customer Services to send your permit application or to find out more information. They can be contacted at the following email address: businesscustomers@sydneywater.com.au.	
The proponent should outline any sustainability initiatives that will minimise/reduce the demand for drinking water, including any alternative water supply and end uses of drinking and non-drinking water that may be proposed, and demonstrate water sensitive urban design (principles are used), and any water conservation measures that are likely to be proposed. This will allow Sydney Water to determine the impact of the proposed development on our existing services and required system capacity to service the development.	Refer EIS for wastewater and drinking water requirements. Refer **Section 5** for rainwater reuse and reduction in non-potable water demand.

1.7 Structure of Report & Key Objectives

Water Cycle Management (WCM) is a holistic approach that addresses competing demands placed on a region's water resources, whilst optimising the social and economic benefits of development in addition to enhancing and protecting the environmental values of receiving waters.

Developing a WCMS at the SSDA stage of the land development process provides guidance on urban water management issues to be addressed for the estate and development as a whole. This assists urban rezoning and estate infrastructure planning for the industrial development proposed on the land.

This WCMS has been prepared to inform the DPIE and Council that the development is able to provide and integrate WCM measures into the stormwater management strategy for estate. It presents guiding principles for WCM across the precinct which includes establishing water management targets and identifying management measures required for future building developments to meet these targets.

Several WCM measures have been included in the WCMS and engineering design, which are set out in this report and the attached drawings. The key WCM elements and targets which have been adopted in the design are included in **Table 1.4** following.

Table 1.4. WCM Objectives

Element	Objectives	Reference
Surface Water & Water Quantity	Capturing and management of surface water so as to maintain natural flow variability, maintain natural rates of change in water levels, and minimise effects of weirs and other structures Maintaining or improving the volume of stormwater flows to Upper Cooks River drainage channel from this site. Council may require OSD to be provided "*to reduce the potential for local flooding and damage to existing properties by limiting runoff from new developments, to pre-development levels*". OSD will however "*not be required where it is proven that the lack of OSD will not have an adverse effect on downstream drainage systems"*.	Environment NSW Cooks River Water Quality and Flow Objectives *Section 10* of *Council Development Engineering Standards 2006*
Water Quality	Protection of aquatic ecosystems, visual amenity and secondary contact recreation. Load-based pollution reduction targets based on an untreated urbanised catchment: Gross Pollutants 90% Total Suspended Solids 85% Total Phosphorus 60% Total Nitrogen 45% Total Hydrocarbons 90%	Environment NSW Cooks River Water Quality and Flow Objectives Botany Bay & Catchment Water Quality Improvement Plan
Flooding	Buildings and habitable areas set 500mm above the 1% AEP storm event. No affectation to upstream downstream or adjoining properties as a result of development	Council *Development Engineering Standards 2006* NSW Floodplain Development Manual. Council *Development Engineering Standards 2006*
Water Supply	Reduce Demand on non-potable water uses. Provide rainwater tanks which result in a reduction in non-potable demand.	DPIE
Erosion and Sediment Control	Appropriate erosion and sedimentation control measures must be described in the environmental assessment for all stages of construction to mitigate potential impacts to Upper Cooks River Drainage Channel.	Landcom Blue Book Council DPIE

A summary of the how each of the WCM objectives will be achieved and where they are addressed in the report are described below. Reference to the relevant sections of the report should be made for further and technical details relating to the WCM measures:

- *Stormwater Quality Management (Refer **Section 2**)*

  There is a need to target pollutants that are present in stormwater runoff to minimise the adverse impact these pollutants could have on downstream receiving waters.

  The required pollutant reductions are included in **Table 1.4** of this document and MUSIC modelling has been completed to confirm the reduction objectives can be met for the development.

  A series of Stormwater quality improvement devises (SQID's) have been incorporated in the design of the proposal. The proposed management strategy will include the following measures:

  - Initial/ primary treatment via gross pollutant traps (GPT's).
  - Tertiary treatment via proprietary filtration system.

  Reference to **Section 6** of this document should be made for detailed Stormwater Quality modelling and measures.

  Management of stormwater measures are necessary to ensure effectiveness of the specified water quality treatment train. Refer to **Appendix C** for DRAFT Maintenance and Monitoring of water quality measures during operational period of the development.

- *Stormwater Quantity Management (Refer **Section 3**)*

  The intent of this criterion is to reduce the impact of urban development on existing drainage system by limiting post-development discharge within the receiving waters to the pre-development peak, and to ensure no affectation of upstream, downstream or adjacent properties.

  An assessment of detention and attenuation requirements has been made for the overall development, Upper Cooks River drainage channel and the approved flood management basin as a holistic approach. The assessment shows that, due to timing of discharge from the site in conjunction with the flow from the larger catchment within the Upper Cooks River and the provided flood storage system, that the provision of traditional OSD results in adverse affect. Further that negation of OSD results in improved combined peak flows within the Upper Cooks River drainage channel/ As such no OSD is proposed for the development. This is noted to be consistent with adjoining site which also discharge directly to the channel (i.e. PFD) and the approach is consistent with the discussions held with Council during consultation.

  Refer to **Section 3** of the document for further discussion on water quantity management.

- *Flood Management (refer **Section 4**)*

  The proposed development considered flooding and large rainfall events associated with the adjacent Upper Cooks River drainage channel. It is noted that the site in its current conditions (based on Council Early Works/ Flood Mitigation approval) is sited at a minimum of 0.5m above the 1% AEP flood level). The proposed development will not impact outcomes of Councils approval and associated approved flood mitigation works.

  The following measures have been incorporated in the design:

  - All buildings are sited 500mm above the 1% AEP design flood level of The Upper Cooks River drainage channel.
  - Development is clear of the 1% AEP flood extent;
  - Requirements of Council have been met regarding works in and around flooding areas; and
  - Overland flow paths to manage runoff in large storm events have been made including achieving at least 500mm freeboard to building levels from the flow paths.

- *Water Cycle Management/ Rainwater Reuse*

  Rainwater reuse measures will be provided as part of future building development designs. Rainwater reuse will be required to reduce demand on non-potable uses by at least 35%, with a target of 50%. The reduction in demand will target non-potable uses such as toilet flushing and irrigation. Refer **Section 5**.

- *Erosion and Sediment Controls (refer **Section 2 & Appendix C**)*

  An erosion and sediment control program will be employed during construction period to ensure that sediment laden runoff is contained on site and discharge runoff meets acceptable criteria. Measures will be provided in accordance with Landcom Blue Book. A DRAFT Soil and Water Management Plan has been included for information in **Appendix C**.

1.8 Policy Framework

The below sets out the legislation and planning instruments considered in the preparation of this sub plan.

Table 1.5 lists regulatory guidelines and documents relevant to the assessment.

Table 1.5. Regulatory Documents and Guidelines

Legislation	Description	Relevance to the assessment
Environmental Planning and Assessment Act 1979	This Act establishes a system of environmental planning and assessment of development Projects for the State.	Obligations issued under Part 4 of the EP&A Act are addressed in this plan.
Protection of the Environmental Operations Act 1997	The objectives of this Act relate to the protection of the environment through pollution prevention and cleaner production, among others.	Relevant sections of the Act, including duties to report pollution incidents and disposal regulations have been incorporated into this plan and incident response procedures. A key legislative requirement applicable to construction soil and water management is Section 120 of the Protection of the Environment Operations Act 1997 which relates to pollution of waters and the need to implement all reasonable and feasible measures to minimise the risk of pollution of waters. Part 5.7 of the Act requires that a pollution incident causing or threatening material harm to the environment be notified to EPA and other relevant authorities. Material harm constitutes actual or potential harm to the health or safety of humans and/or ecosystems that is not trivial, or results in actual or potential loss or property damage of amounts in excess of $10,000 in total.
Contaminated Land Management Act 1979	The general object of this Act is to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation under Division 2 of Part 3, and to ensure that contaminated land is managed with regard to the principles of ecologically sustainable development.	Contamination on site must be assessed and managed in accordance with this act. Division 2, Part 3, Section 11-17 of this Act details requirements for the Management of Contaminated Land.
Water Management Act 2000	The objects of this Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.	Although it is not envisaged that any construction activities would be undertaken on waterfront land, any waterfront activities that do occur would be conducted generally in accordance with the NSW Office of Water's Guidelines for Controlled Activities.
Fisheries Management Act 1994	The objectives of this Act seek to conserve fishery resources, fish stocks and key fish habitats.	This assessment has been prepared to maintain existing flow regimes surrounding the site and to contain water onsite within sediment basins until discharged with strict water quality requirements. No impacts to fisheries are

Legislation	Description	Relevance to the assessment
		envisaged as a result of Project construction.
Dangerous Goods Regulation (Road and Rail Transport) 2014	The main objects of this Regulation are to give effect to the standards, requirements and procedures of the Code so far as they apply to the transport of dangerous goods by land transport, and to promote consistency between the standards, requirements and procedures applying to the transport of dangerous goods by land transport and other modes of transport.	Provisions relating to the storage and transport of dangerous good, such as fuelling procedures and fuel storage, are to be considered in this plan.
Commonwealth Environmental Protection and Biodiversity Conservation Act 1999	The objectives of this Act seek to promote environmental protection, ecologically sustainable development, biodiversity conservation and the promotion of heritage, among others.	Requirements under EPBC Approval (No. 2011/6086) have been considered during the preparation of this CSWMP.

Additional guidelines and standards considered in relation to the management of soil and stormwater include:

- Managing Urban Stormwater – Soils and Construction Volume 1, 4th Edition (Landcom 2004);
- Managing Urban Stormwater: Soils and Construction − Installation of Services, Volume 2A (OEH 2008); and
- Australian Rainfall and Runoff – Volume 1 (2001), Engineers Australia.
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);
- Development Engineering Standards – 2009 (Bankstown City Council);
- Engineering and Drainage Standards Policy – 2009 (Bankstown City Council);
- Bankstown City Council Development Control Plan 2015 Part B4 Sustainable Development;
- Water Sensitive Urban Design – "Technical Guidelines for Western Sydney" by URS Australia Pty Ltd, May 2004;
- Botany Bay & Catchment Water Quality Improvement Plan – 2011 (Sydney Catchment Management Authority)

2 SURFACE WATER QUALITY

2.1 Objectives and Performance Targets

The objectives and performance targets for the Proposal have been derived from the following key documents:

- **Canterbury Bankstown City Council Development Engineering Guidelines** (Canterbury Bankstown City Council 2009)
- **Botany Bay & Catchment Water Quality Improvement Plan** (Sydney Catchment Management Authority 2011)
- **Cooks River Catchment 2013/2014 River Health Monitoring Technical Report** (CT Environmental/ Cooks River Alliance 2014)

2.1.1 Objectives

There is a need to provide a design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Council.

Council has nominated, in *Section 9.3.8* of their Development Engineering Guidelines 2009, the requirements for stormwater quality to be provided for all new developments with reference to such documents as the EPA's Manual on Managing Urban Stormwater (Treatment Techniques) and relevant Australian Standards.

The key objectives for stormwater management for the Proposal include:

- Maintain or improve existing water quality.
- To protect the aquatic environment of the downstream waterways including the Upper Cooks River.
- Prevent bed and bank erosion and instability of waterways.
- Provide sufficient flows to support aquatic environments and ecological processes.
- Incorporate a Water Sensitive Urban Design (WSUD) approach.

2.1.2 Performance Targets

The water quality objectives proposed to be adopted for the Proposal are based on the the objectives set out in the **Botany Bay & Catchment Water Quality Improvement Plan** (Sydney Catchment Management Authority 2011). These are presented in terms of annual percentage pollutant reductions on a developed catchment as follows:

Gross Pollutants	90%
Total Suspended Solids	85%
Total Phosphorus	60%
Total Nitrogen	45%
Total Hydrocarbons	90%

Stormwater treatment objectives for industrial sites in the Canterbury Bankstown LGA are noted to require the following key pollutants to be targeted:

- Coarse and fine sediments;
- Gross pollutants (including organic matter, leaves, rubbish and particles >5mm); and
- Hydrocarbons and oil.

While the percentage reduction targets contained in **Botany Bay & Catchment Water Quality Improvement Plan** (Sydney Catchment Management Authority 2011) are more stringent than the targets contained in Councils Development Engineering Guidelines, given that they have been developed specifically for the Botany Bay catchment (which includes the Upper Cooks River) it is considered appropriate to adopt these for the Proposal. .

Water quality for the catchment will require provision of a treatment train of water quality improvement devices. Proposed and constructed systems include gross pollutant traps to surface drainage systems and bio-retention filtration systems for final water polishing. Water quality measures will need to be provided for the whole of catchment in accordance with this document.

It is noted that although heavy metals are not included in the targets referenced in the **Botany Bay & Catchment Water Quality Improvement Plan** (Sydney Catchment Management Authority 2011), consideration to removal of these pollutants has been included in the assessment. Similarly to hydrocarbons, heavy metals are not modelled in MUSIC however discussion on expected removal efficiencies has been included in the report.

2.2 Operational Water Quality Management Features

2.2.1 Existing

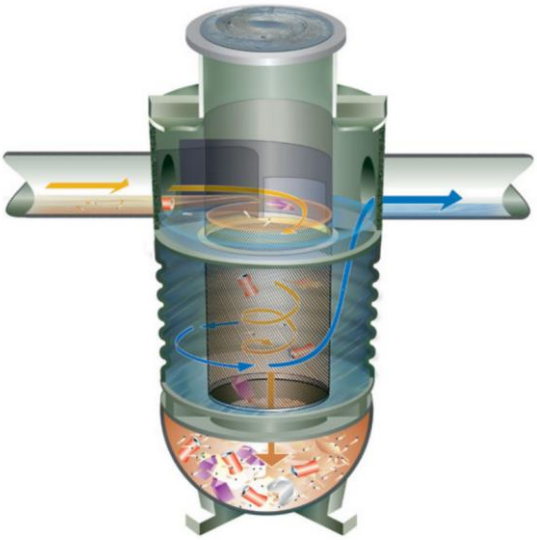
The existing site has residual drainage systems on site as part of previous operations. These include an existing interceptor on the north-east of the property at the existing (and proposed) discharge location.

2.2.2 Proposed

Roof, hardstand, car parking, roads and other extensive paved areas are required to be treated by the Stormwater Treatment Measures (STM). The STM shall be sized according to the whole catchment area of the Site. The STM's for the development are based on a treatment train approach as discussed in the NSW EPA document *Managing Urban Stormwater: Treatment Techniques* to ensure that all of the objectives above are met.

Treatment of the Proposal during operational phase is proposed to be made be via a vortech style GPT (Rocla CDS or similar) with oil baffle, in conjunction with a proprietary filtration device (Jellyfish). The existing interceptor described above is also proposed to remain in the Proposal.

Reference to drawing **Co13058.03-DA40 & Co13058.03-DA41** show the location of the proposed STM with visual representation shown in **Figure 2.1** below.



Typical *GPT*

Jellyfish Filtration System

Figure 2.1. Visual Representation of Treatment Measures

Additional measures to those nominated in this plan are required for the containment of firewater to avoid impact on the Upper Cooks River in the event of a fire.

In order to assist with the containment fire water runoff, provision of an automated shut off valve is proposed upstream of the discharge to the Upper Cook River drainage channel. The shut off valve will comprise a keystone or knife-gate valve with an electric actuator which is triggered by the fire alarm. The sizing of storage will be completed at Construction Certificate stage to meet a minimum 90minute sprinkler discharge storage volume. It is noted that storage is proposed to be made within the drainage system, and within bunded areas of the buildings.

2.3 Existing Environment

The existing environment and receiving waters are noted to be highly urbanised. Section 2.1 of the *Botany Bay & Catchment Water Quality Improvement Plan* describes the key water quality issues associated with urbanisation which affect this waterway as follows:

- Replacement of pervious surfaces with impervious which reduces filtration of nutrients, capture of sediments
- Increased sediment loading through urban activities;

- Increased gross pollutant and litter loading through urban activities
- Infrastructure such as sewer overflow which increase nutrients, sediment and pathogens in waterways;
- Destruction of riparian corridors.

The existing Upper Cooks River is described in **Section 1.4** of this plan is noted to comprise a vegetated open channel through the upper reaches to the south-west of the Proposal, concrete lined and block walled channel, in combination with landscaped overbank batters through reach to the south-east and east of the Proposal.

2.3.1 Upper Cooks River Health

Monitoring and assessment of the Cooks River Catchment, including the Upper Cooks River (the Proposals receiving water body) has also been completed for the Cooks River Alliance and included in the *Cooks River Catchment 2013/2014 River Health Monitoring Technical Report*. This document is referenced in the *Botany Bay & Catchment Water Quality Improvement Plan* and includes specific mention of the Upper Cooks River. The results of the 2014 assessment show the Upper Cooks River being described as D+, indicating a degraded waterway.

It is noted that when the neighbouring PFD Facility was constructed by Frasers Property in 2017-2018, that significant revegetation works were completed through the upper reach of the Upper Cooks River south of the Proposal site. It would be expected that the grading noted in the 2014 assessment may be improved through the Chullora RRP site.

It is to be further noted that the proposed location of stormwater discharge of the Proposal will maintain at the north-east corner of the Proposal site as per existing conditions. This location is noted to be within a section of the fully concrete lined channel located immediately prior to the open channel becoming an enclosed box culvert system. This is particularly relevant for waterway stability which is covered in later sections of the report.

Summary of the information in the *Cooks River Catchment 2013/2014 River Health Monitoring Technical Report* relating to the upper Cooks River and applied health grades are included as follows:

> *River Health Grades*
>
> *Calculation of River Health grades for the Cooks River catchment is based on methods applied by the South East Queensland Healthy Waterways Program (EHMP 2008). This program is widely recognised as the leading broad scale waterway assessment in Australia. Waterway health grades provide a snap shot of ecosystem condition at the time of sampling. Table 2 shows waterway health grades and corresponding ecological condition. Detailed methods for River Health data collection, grade calculation and data analysis can be found in section 3 of this report.*

Table 2. River Health grades, ecosystem condition and description.

Grade	Condition	Description
A^+	Excellent	All indicators comply with guideline values. Waterways have high ecological value and experience little to no human disturbance.
$A - B^+$	Good	Most indicators equivalent to reference conditions and comply with regional guidelines. Waterways have favourable water quality, complex habitat structure and support a diverse macroinvertebrate community.
$B - C^-$	Fair	Numerous indicators outside regional guideline limits and show signs of departure from reference conditions. Periodic episodes of degraded water quality are likely and the macroinvertebrate community and stream habitat are commonly degraded.
D^+-F^-	Poor	Most indicators non-compliant with guidelines and show significant departure from reference conditions. Waterways have degraded water quality and poor habitat reflected by a macroinvertebrate community dominated by pollution-tolerant species.

Upper Cooks River

The overall River Health grade for the Upper Cooks River is D+ indicating poor ecological health (Table 8.). This section of the Cooks River has undergone bank naturalisation in recent years however the river channel at this monitoring point is overgrown with aquatic vegetation and although some riparian vegetation is present, it is of low complexity and limited habitat value (Figure 6). During periods of intense and/or high rainfall this stretch of the Cooks River is subject to flooding and high velocity flows. Throughout the monitoring period occasional discoloration of river water was apparent and plastic debris and other litter was present along the river banks and channel. Results of water quality monitoring show most parameters complied with guidelines. However, at times, elevated nitrogen and phosphorous and low dissolved oxygen levels were recorded. Although results of water quality monitoring show conditions were often reasonable, the macroinvertebrate community at this site does not reflect these results. Reduced macroinvertebrate richness and biodiversity are reflected by a low SIGNAL score indicating periodic episodes of urban and/or industrial pollution affect this site. Similar results are common in urban waterways, as results of water quality monitoring provide only a snap shot of conditions at the time samples

were collected. However, the macroinvertebrate provide a longer term diagnosis of waterway condition.

Table 8.Overall River Health grade and River Health index grades for Upper Cooks River

OVERALL GRADE	WATER QUALITY	MACROINVERTEBRATES	VEGETATION
D+	A	C-	F-

2.4 Soil and Water Management (Construction Phase)

Section 1 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Erosion and sediment control installation.
- Grading of existing earthworks to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a significant sediment load. A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')(Landcom, 2004)*.

In accordance with the principles included in the Blue Book, a number of controls have been incorporated into a preliminary ESCP (refer to accompanying Drawings in **Appendix A**) and draft SWMP in **Appendix C**.

The sections below outline the proposed controls for management of erosion and sedimentation during construction of the Proposal.

Sediment Basins

Sediment basins have been sized (based on 5 day 85th percentile rainfall) and located to ensure sediment concentrations in site runoff are within acceptable limits. Preliminary basin sizes have been calculated in accordance with the Blue Book and are based on 'Type F' soils. These soils are fine grained and require a relatively long residence time to allow settling.

Sediment basins for 'Type F' soils are typically wet basins which are pumped out following a rainfall event when suspended solids concentrations of less than 50 mg/L have been achieved.

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

Stabilised Site Access

For the proposal, stabilised site access is proposed at one location at the entry to the works area. This will limit the risk of sediment being transported onto Muir Road and other public roads.

Other Management Measures

Other management measures that will be employed are expected to include:

- Minimising the extent of disturbed areas across the site at any one time.
- Progressive stabilisation of disturbed areas or previously completed earthworks to suit the proposal once trimming works are complete.
- Regular monitoring and implementation of remedial works to maintain the efficiency of all controls.

It is noted that the controls included in the preliminary ESCP are expected to be reviewed and updated as the design, staging and construction methodology is further developed for the Proposal.

2.5 Stormwater Quality Modelling (Operational Phase)

2.5.1 Stormwater Quality Modelling Methodology

A MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model has been utilised to model the effectiveness of the proposed water quality system. This model has been released by the Cooperative Research Centre for Catchment Hydrology (CRCCH) and is a standard industry model for this purpose. MUSIC is suitable for simulating catchment areas of up to 100 km^2 and utilises a continuous simulation approach to model water quality.

By simulating the performance of stormwater management systems, MUSIC can be used to predict if these proposed systems and changes to land use are appropriate for their catchments and are capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC and of relevance to this report include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria nominated in **Section 2.1.2** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

Two MUSIC models "*13058.03_Rev1.sqz*" was set up to examine the effectiveness of the water quality treatment train and to predict the load-based pollution reduction requirements have been achieved for development.

The models were set up using the NSW MUSIC Modelling Guide. The layout of the MUSIC model is presented in **Appendix D**.

It is noted that Canterbury Bankstown does not currently require confirmation of water quality measures via modelling or MUSIC. As such, parameters accepted for Sydney Catchment Management Authority and nearby Liverpool Council, including rainfall data, have been adopted in the assessment.

2.5.2 Rainfall Data

Six-minute pluviographic data was sourced from the Bureau of Meteorology (BOM) as nominated below for nearby Liverpool weather station. Evapo-transpiration data for the period was sourced from the Sydney Monthly Areal PET data set supplied with the MUSIC software.

Input	**Data Used**
Rainfall Station	67035 Liverpool (Whitlam)
Rainfall Period	1 January 1967 – 31 December 1976 (10 years)
Mean Annual Rainfall (mm)	857
Evapotanspiration	Sydney Monthly Areal PET
Model Timestep	6 minutes

2.5.3 Rainfall Runoff Parameters

Parameter	**Value**
Rainfall Threshold	1.40
Soil Storage Capacity (mm)	170
Initial Storage (% capacity)	30
Field Capacity (mm)	70
Infiltration Capacity Coefficient a	210
Infiltration Capacity exponent b	4.7
Initial Depth (mm)	10
Daily Recharge Rate (%)	50
Daily Baseflow Rate (%)	4
Daily Seepage Rate (%)	0

2.5.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are based on Sydney Catchment Authority land use parameters as per the **Table 2.1**.:

Flow Type	Surface Type	TSS (log_{10} values)		TP (log_{10} values)		TN (log_{10} values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	1.20	0.17	-0.85	0.19	0.11	0.12
	Roads	1.20	0.17	-0.85	0.19	0.11	0.12
	Landscaping	1.2	0.17	-0.85	0.19	0.11	0.12
Stormflow	Roof	1.30	0.32	-0.89	0.25	0.30	0.19
	Roads	2.43	0.32	-0.30	0.25	0.34	0.19
	Landscaping	2.15	0.32	-0.6	0.25	0.30	0.19

Table 2.1. Pollutant Concentrations

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in **Table 2.1** above and the catchments shown in **Appendix A**.

The relevant stormwater catchment sizes are shown figuratively in **Appendix A** .

2.5.5 Treatment Nodes

GPT, bio-retention basin and detention basin nodes have been used in the modelling of the interim and ultimate conditions. It is noted that an existing interceptor will remain on site however is not included in the modelling, hence the model is considered conservative. Typical visual representation of the treatment measures is shown in **Figure 2.1** below and MUSIC nodes in **Figure 3.2**.

2.5.6 Modelling Layout

The model layout is included in **Figure 2.2** below.

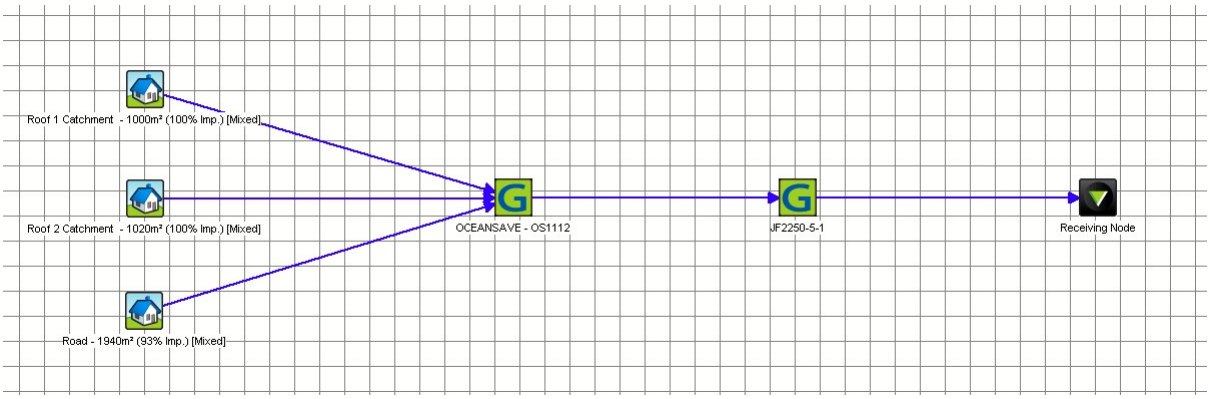


Figure 2.1. MUSIC Model Layout

2.5.7 Modelling Results

Table 2.3 shows the results of the MUSIC analysis for development.

The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment over the modelled catchment.

	Source	Residual Load	% Reduction	Target Met
Flow (ML/yr)	3.07	3.07	0	NA
Total Suspended Solids (kg/yr)	1900	67	96.5	Y
Total Phosphorus (kg/yr)	3.55	1.14	67.9	Y
Total Nitrogen (kg/yr)	17.3	9.08	47.5	Y
Gross Pollutants (kg/yr)	82.2	0	100	Y

Table 2.3. MUSIC analysis results

2.5.8 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements have been met.

The model results in **Table 2.3** indicate that, through the use of the STM's in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the target reductions for both interim and ultimate conditions.

As can be seen, the proposed treatment train achieves reductions greater than the required pollutant reduction objectives. This will ensure any variance in assumed arrangements in the final building layouts will not affect the overall outcomes of the solution, and also to ensure overall reduction values are met.

Hydrocarbon reduction values, although not modelled, will achieve 90% reduction in the interim and ultimate conditions. Further discussion on hydrocarbon removal which is not readily modelled in MUSIC is provided in **Section 2.5.9** as follows.

2.5.9 Hydrocarbon Treatment Efficiency

The proposed MRF would be expected to produce relatively low source loadings of hydrocarbons. Potential sources of hydrocarbons would be limited to leaking engine sumps or for accidental fuel spills/leaks. The potential for hydrocarbon pollution is low and published data from the CSIRO indicates that average concentrations from Industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration as further discussed below.

Hydrocarbon removal cannot be readily modelled with MUSIC software however there is sufficient information on the expected source loads and treatment.

Hydrocarbon Sources

The average storm flow concentration of hydrocarbons in an industrial facility is 9.5mg/L (3 & 30mg/L 95% confidence limits) sourced from Fletcher T, Duncan H, Poelsma P & Lloyd S, 2004: *Stormwater Flow and Quality, and the Effectiveness of Non-Proprietary Stormwater Treatment Measures - A review and Gap Analysis. Cooperative Research Centre for Catchment Hydrology, Technical Report 04/8*;

Filtration Treatment

Removal of hydrocarbons within the filtration system is shown to occur due to several mechanisms.

Removal of oil, grease and hydrocarbons will take place due to entrainment to sediments.

Research by Hseih (2005) has also shown that 97% of hydrocarbons are trapped and contained in the first few centimetres of a filtration system (i.e. filter swales and bio-retention systems). These are then broken down via organic processes in a period of 2-3 days.

GPT Treatment

The vortech type GPT is reported to provide between 82-94% reduction in hydrocarbons and free oils.

The following information relating to the performance of a CDS GPT has been provided by the product suppliers, Rocla (noting similar equivalent subject to final detail design to be installed):

> *As with nutrient capture there is also a high correlation of oils and grease removal with sediment capture in CDS Units.*
>
> *UCLA have reported 50-80% of oil and grease may be attached to sediments.*
>
> *Hoffman 1982: "Our data confirm the observations of the workers in that hydrocarbons are primarily associated with particulate material (83 – 93%)".*
>
> *CRCCH 1999: "Colwill found 70% of oil and approximately 85% PAH to be associated with solids in stormwater. That study subsequently demonstrated that over a period of dry weather conditions, increasing concentrations of oil become associated with particulates with the highest oil content found in the sediment range of 200µm to 400µm.*
>
> *CSIRO 1999: In the category of "attached pollutants" CDS Units were the only GPT device to even be considered capable of capturing anything.*
>
> *CDS Units can also capture free floating oil spills. However, when most of the oil is associated with fine particulates and sediments, CDS Units remove very high levels of oils and greases due to their very high capture rate of those fine particles.*

Hydrocarbon Treatment Conclusion

Overall, when combining a treatment train of CDS and filtration systems, a reduction of greater than 90% of hydrocarbons is achieved. It is noted that the hydrocarbon removal could be achieved with the CDS alone.

Given the expected low source loadings of hydrocarbons and removal efficiencies of the treatment devices we consider that the requirements of the consent have been met for the Proposal.

2.5.10 Heavy Metal Treatment Efficiency

The proposed MRF would be expected to produce relatively low source loadings of heavy metals. Potential sources of hydrocarbons would be expected to be related to particles which are entrained to fine and some course sediments.

Heavy metal removal cannot be readily modelled with MUSIC software however there is sufficient information on the expected source loads and treatment.

Heavy Metal Sources

The average storm flow concentration of heavy metals (copper, zinc, lead & Chromium) in an industrial facility would typically be in the order of:

- Lead – 0.41mg/L
- Zinc – 0.73mg/L
- Copper – 0.17mg/L
- Cadmium – 0.0064mg/L
- Chromium – 0.014mg/L

Sourced from Duncan H, 1999: *Urban Stormwater Quality: A Statistical Overview, Cooperative Research Centre for Catchment Hydrology, Technical Report 99/3*;

Filtration Treatment

Removal and retainment of metals will normally be a result of entrainment of fine sediments.

Removal of heavy metals in the Jellyfish device has been shown through testing to achieve the following reductions:

- Lead – 81%
- Zinc – 70%
- Copper – 90%
- Chromium – 36%

GPT Treatment

The vortech type GPT is reported to provide between 80-90% reduction in heavy metals based on treatment of fine sediments.

Heavy Metal Treatment Conclusion

Overall, when combining a treatment train of CDS/ vortech type GPT and Jellyfish filtration systems, a reduction of around 90% of heavy metals could be expected. Please note, the TSS concentration, PSD and heavy metal concentrations on a particular site will impact the ability for a device to capture and retain metals.

Given the expected low source loadings of heavy metals and removal efficiencies of the treatment devices we consider that the proposed system addresses potential impacts relating to heavy metals for the Proposal.

2.6 Construction impact assessment

Section 2.4 discusses proposed soil and water quality measures to be provided during typical construction activities, site runoff to reduce significant sediment loads from leaving the site.

A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')(Landcom, 2004)*.

Based on the provision of noted measures it is concluded that potential for water quality impacts can be mitigated during construction and that any impacts would be minor.

2.7 Operational impact assessment

Section 2.2 and **2.5** discusses proposed soil and water quality measures to be provided during operational phase, and confirmation through MUSIC modelling that the proposed STM's meet recommended target pollutant reductions and water quality objectives for the Proposal

Based on the provision of noted measures it is concluded that potential for water quality impacts will be mitigated during operational phase of the Proposal.

3 SURFACE WATER QUANTITY MANAGEMENT

3.1 Water Quantity Objectives

Water quantity criteria has been based on the following key documents:

- **Development Engineering Standards 2006** *(Canterbury Bankstown Council 2006)*

Council adopts the principles of water quantity management. "On-site Detention (OSD)" may be required where an increase in stormwater runoff, from a new development site, has an adverse effect to the receiving stormwater system.

Section 10 of Councils *Development Engineering Standards 2006* sets out the requirements for water quantity management and OSD. Council may require OSD to be provided "*to reduce the potential for local flooding and damage to existing properties by limiting runoff from new developments, to pre-development levels*". OSD will however "*not be required where it is proven that the lack of OSD will not have an adverse effect on downstream drainage systems"*.

Waterway stability is also required to be considered in relation to discharge to the Upper Cooks River.

3.2 Existing Environment

The existing site comprises residual drainage associated with former uses on the site. Provision of a flood management basin is noted as part of currently under assessment application by Council.

It is to be further noted that the proposed location of stormwater discharge of the Proposal will maintain at the north-east corner of the Proposal site as per existing conditions. This location is noted to be within a section of the fully concrete lined channel located immediately prior to the open channel becoming an enclosed box culvert system. This is particularly relevant for waterway stability and scour potential at discharge. **Figure 3.1** shows the existing discharge from the site.

Figure 3.1. Existing Site Discharge

3.3 Consultation with Canterbury Bankstown Council & Flood Management

Discussions on the proposed management of local surface water flows from the site were made during meetings with council held in 2019 and 2020. It is noted that these discussions cantered both on the recent flood mitigation and the Proposal. The discussion concluded that due to the presence of the large scale flood management measures (flood storage of approximately 20,000m^3 within the western portion of the Chullora RRP site and the Upper Cooks River drainage channel), proposed in combination with the local site management, traditional on-site detention systems would not be required. The assessment included in **Section 3.6** confirms this.

3.4 Water Quantity Management Features

3.4.1 Existing

There is an existing flood management basin on the west of the Proposal site which provides flood storage for flood water associated with the Upper Cooks River and the Proposal.

There are no existing local runoff management measures or on-site detention systems.

The existing run-off is based on a developed impervious condition given the long period on which the contributing catchment has comprised almost 100% impervious surface

compared to the short-term period to which the "earthworks" conditions are present on the site. The earthworks conditions represent a surface condition which is somewhat between a pervious and impervious surface.

The existing discharge to the Upper Cooks River is located at the north-east of the Proposal site. The discharge comprises a 1050mm diameter reinforced concrete pipe and 825mm diameter reinforced concrete pipe directly into concrete lined portion of the Upper Cooks River drainage channel (refer **Figure 3.1**).

3.4.2 Proposed

There are no proposed water quantity measures based on the outcomes of the assessment included in **Section 3.6** and consultation with Council.

The existing discharge location is proposed to be utilised at the north-east corner of the Proposal. Refer drawings in **Appendix A** for discharge location and details.

3.5 Construction impact assessment

Section 2.4 discusses proposed mitigation measures to be provided during typical construction activities, site runoff to reduce significant sediment loads from leaving the site.

A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')(Landcom, 2004)*.

The ESCP includes provision of sediment control basin which will capture and manage runoff during construction to the 85th percentile rainfall event, prior to discharge of in a controlled manner.

Based on the provision of noted mitigation measures it is concluded that potential for water quantity impacts can be mitigated during construction.

3.6 Operational impact assessment

In relation to the water runoff assessment, as discussed in **Section 3.4.1**, the site can be considered to be predominately comprised of impermeable surfaces. Following construction of the Proposal, the extent of impermeable surface remains consistent with existing, hence the change in peak flows associated with the development is negligible.

An assessment of the proposal has been made in relation to the flood management measures including flows within the Upper Cooks River drainage channel system in conjunction with those locally from the site. The assessment is based on combining the developed site with the Villawood Drain hydrographs and comparing this to a developed site with runoff attenuated to pre-development flows. This has been included in **Figures 3.2 to 3.6** below.

The Proposal is located in the mid to lower end of the Upper Cooks River catchment. Local un-attenuated flows will peak in advance of the main flood hydrograph coming from the upstream catchments within the Upper Cooks River drainage channel. The combined hydrograph results in double peaks (small initial peak followed by larger extended peak) in the shorter duration storms, which reduces as the storm duration increases. The inclusion of traditional OSD shows that, although local flows would be reduced (2.45m^3/s to 2.02m^3/s as shown in **Figures 3.2** and **Figure 3.3** respectively), the peak of flow from the site is drawn out over a longer period which coincides with that of the larger and delayed peak flow within the Trunk Drainage Channel. This results in an overall increase in peak flows, hence an adverse effect results. With reference to **Figures 3.4 & 3.5**, it can be seen that peak flows at discharge of 66.4m^3/s without OSD compared to and 66.7m^3/s with OSD. Hence confirmation that there is no impact without OSD and an impact with OSD**.**

It is considered that the combined peak flow runoff (from the local catchment and larger Rookwood Road catchment) in the Trunk Drainage Channel will not increase as a result of the development (with the proposed flood management measures and without traditionally sized on-site detention). Hence the development will not adversely impact flooding upstream or downstream of the property.

Further, in relation to waterway stability, given there is no change in impervious surfaces, and hence peak flows, impact on receiving waterway is negligible. Potential for scour of receiving waters is also confirmed as no impact given discharge to the existing concrete lined and walls channel (refer **Figure 3.1**).

Based on the assessment it is concluded that additional mitigation measures are not required to mitigate impact associated with water quantity during operational phase of the Proposal.

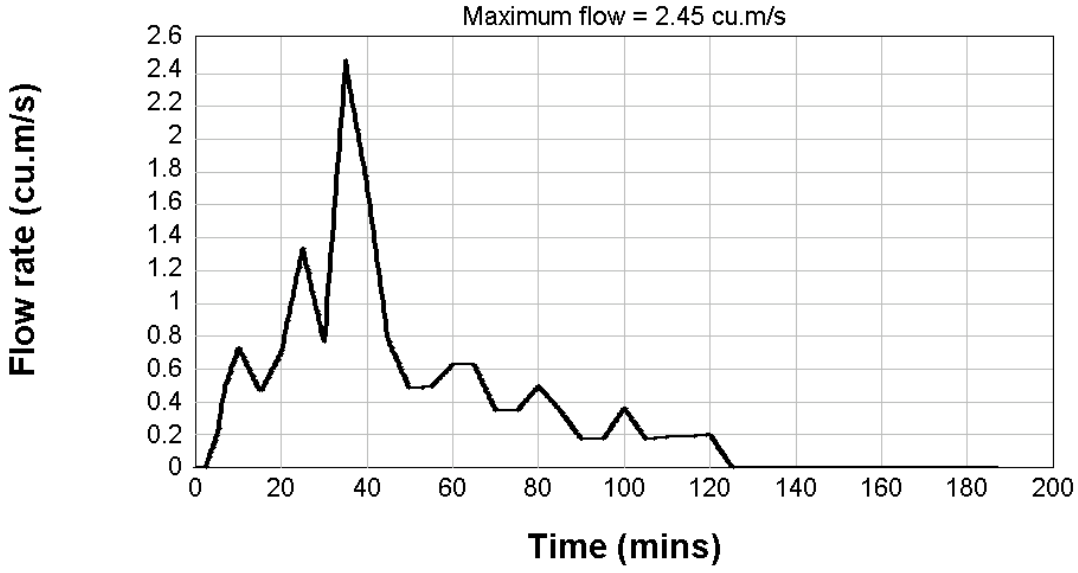


Figure 3.2. 1% AEP Flow Hydrograph – Proposed Site Without On-Site Detention

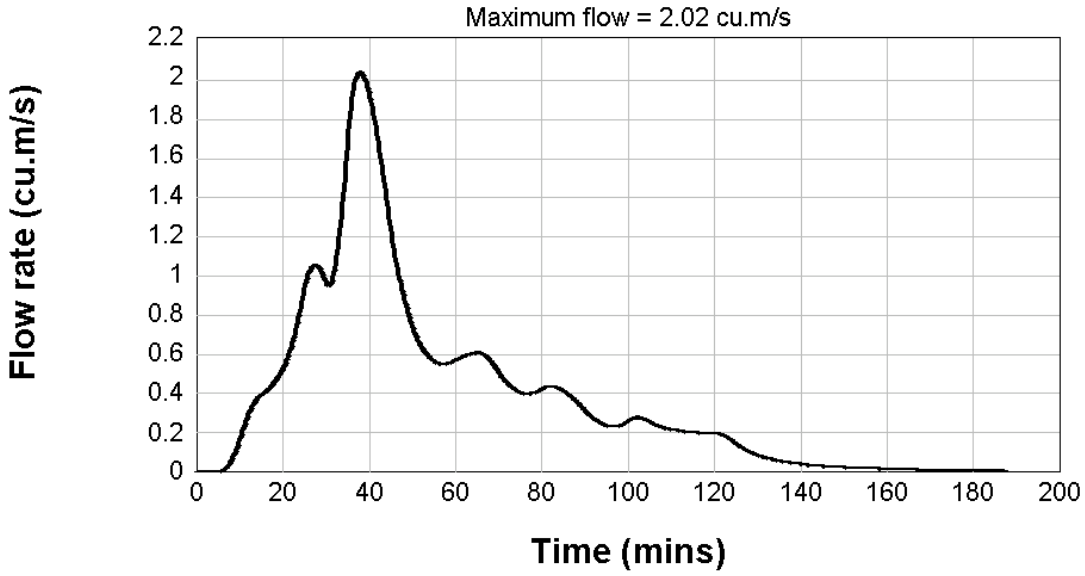


Figure 3.3. 1% AEP Flow Hydrograph – Proposed Site With On-Site Detention

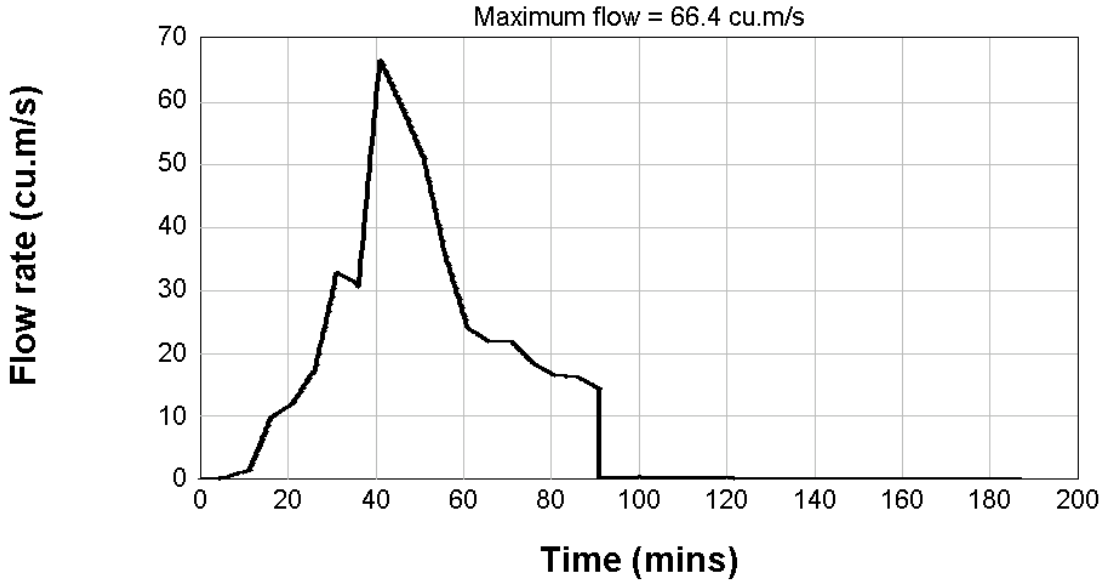


Figure 3.4. 1% AEP Flow Hydrograph – Upper Cooks River Without Site OSD

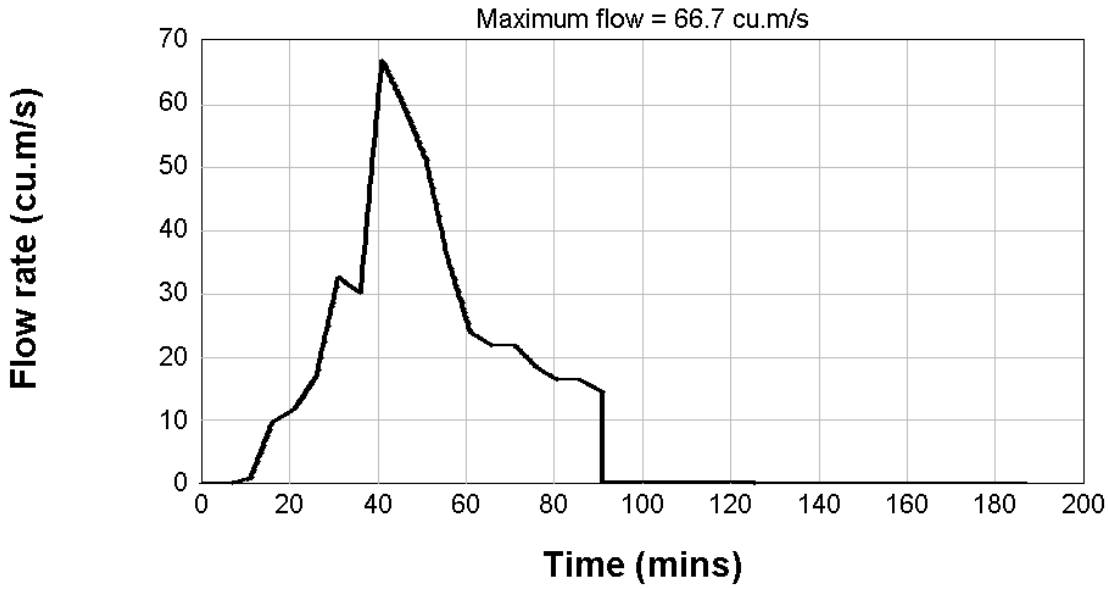


Figure 3.5. 1% AEP Flow Hydrograph – Upper Cooks River With Site OSD

4 FLOODING

4.1 Policy and Planning Controls

Clause 2.2 of the Bankstown City Council document *DCP2016 Part E3 Flood Risk Management* defines flood risk precinct for various land use categories.

The land is noted to be above the 1% AEP flood area however affected by larger storms up to the PMF. The site has no significant evacuation difficulties we would consider the site to be classed as "low risk".

As a property defined as "medium risk", development will be allowed under the provisions of *DCP2005 Part E3* given that appropriate site management practices are in place which minimise property damage and the potential for injury to occur to persons.

We also make reference to Section 9.5.1 of the Bankstown City Council document *Development Engineering Standards, June 2006* which reads "*Council may consider a rise up to 100mm in upstream or downstream, water surface level from the previous developed condition provided there is no significant adverse effect on adjoining properties with respect to existing levels of houses, garages, outbuildings, in-ground pools and other water-sensitive installations*."

A part of the recently proposed flood mitigation works a flood basin will have been established in the western portion of the Chullora RRP prior to the commencement of construction of the Proposal. As noted in Section 4.3, the 1% AEP flood level within the flood basin is noted to be RL 37.5m AHD. 1% AEP levels within the channel vary from RL 37.84m AHD to RL 36.77m. The flood planning level for the development is RL 38.0m AHD. This level is based on 0.5m freeboard to the level within the flood basin of RL 37.5m.

The proposed MRF is noted to be RL 38.0m and would be therefore be above the 1% AEP flood level, meeting the requirements of flood planning and immunity.

The Proposal site is noted to be clear of flood affected areas and overland flow paths.

4.2 Existing Environment

The site was previously identified by Bankstown City Council as being affected by overland flow from an external catchment associated with the Upper Cooks River/ Trunk Drainage Channel. This has been raised in Bankstown City Council Stormwater System Reports and the *Rookwood Road Catchment Flood Study Report (July 2010*) by BMT WBM on behalf of Bankstown City Council. This report will be referred to as the *Rookwood Flood Study* from hereon.

As part of recently submitted earthworks and flood mitigation works application, a site filling and flood strategy has been prepared in consultation with Council, as noted in earlier sections of this report.

The flood mitigation measures comprise a 22,100m^3 flood storage basin located on the western extent of the site, as well as filling of the Proposal site to at least 0.5m above the 1% AEP storm event. The flood basin will have been installed prior to commencement

of the construction of the Proposal and will ensures compensation of flood storage for the filling works over the eastern extent of the site shown in **Figure 1.3 & 4.2**.

The flood management measures recommended in the flood assessment have been maintained in the layout and site development. It is noted that the flood measures include management of stormwater quantity from the local drainage catchment The proposed management of stormwater quantity is based on the local storms discharging without attenuation so that these stormwater flows enter the trunk drainage system prior to the larger flood within the trunk drainage system.

4.3 Methodology

4.3.1 Hydrological Assessment of Existing Catchment

The site is located adjacent to a Sydney Water trunk drainage channel and culvert system which forms the upper reaches of the Cooks River. The upstream contributing catchment is approximately 174 Ha and located to the south and south west of the site. The location of the overland flow path and upstream catchment has been shown in **Figure 4.1** below. The upstream catchment comprises both industrial development and residential/ urban land.

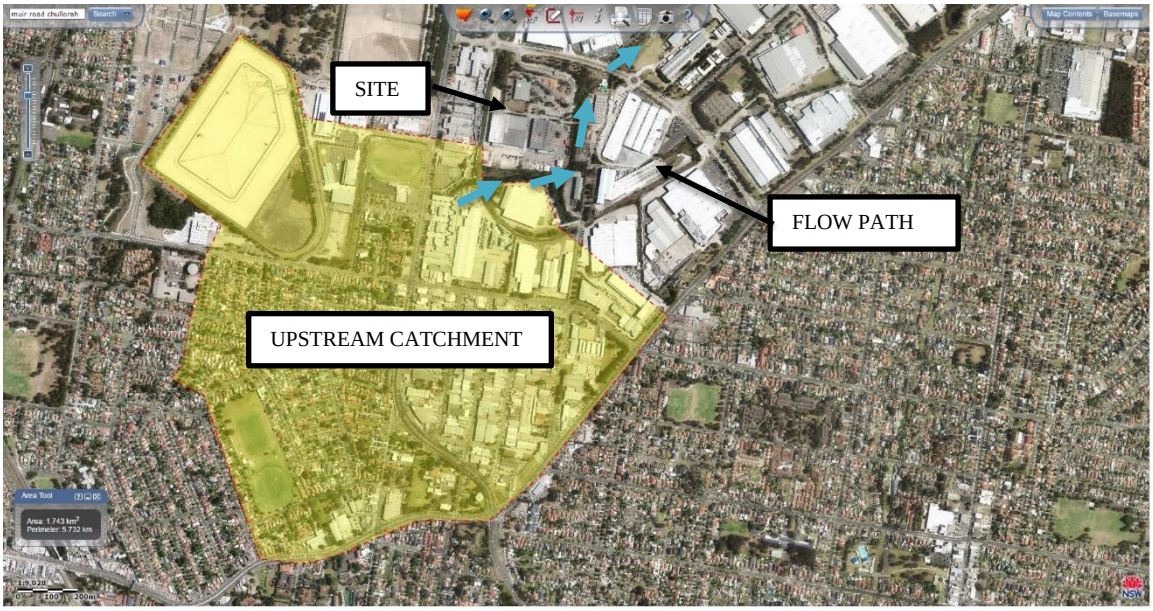


Figure 4.1. Upstream Contributing Catchment and Upper Cooks River

4.3.2 Existing Flood Conditions

The current flood conditions have been determined based on the completion of the recently proposed flood mitigation works, as described in **Section 1.3** of this report as agreed with council. The works include the provision of a flood storage basin which will meet pre-development flood storage on the property.

The water surface profile for the 1% AEP event, post-development, has been presented in **Figure 4.2**.

The existing flood conditions can generally be described as follows, for the 1% AEP storm event:

- Flow enter the development area from the Cooks River drainage channel at the south-east of the site. Further flow entry points are located within the study area on the southern side of the channel;
- The 1% AEP design flow has a peak of 67.0m^3/s and critical duration of 2 hours;
- At the north of the site (southern boundary of PFD Facility), the open drainage channel reverts to a closed culvert consisting of 2x 2.7m wide by 1.2m deep and existing 3.6m by 2.4m culverts reinforced converte box culvert. These culverts extent from the site to north of and under Muir Road. The culverts show peak flowrates of 12.5m^3/s, and 20.5 m^3/s respectively. The existing culverts were modelled at 50% blockage as requested of Council.
- An overland flow path is present at the downstream end of the Chullora RRP site (ie where the open channel reverts to reinforced concrete box culverts noted above) through the PFD Carpark to Muir Road;
- The 1% AEP flood level within the flood basin is noted to be RL 37.5m AHD. 1% AEP levels within the channel vary from RL 37.84m AHD to RL 36.77m.
- The flood planning level for the development is RL 38.0m AHD. This level is based on 0.5m freeboard to the level within the flood basin of RL 37.5m.
- The flood storage strategy was concluded to be acceptable in terms of the criteria for filling within flood affected land defined in the Bankstown Council Development Control Plan, as we are not increasing flood levels, and the proposed works will not cause any adverse effects to Muir Road or surrounding developments.

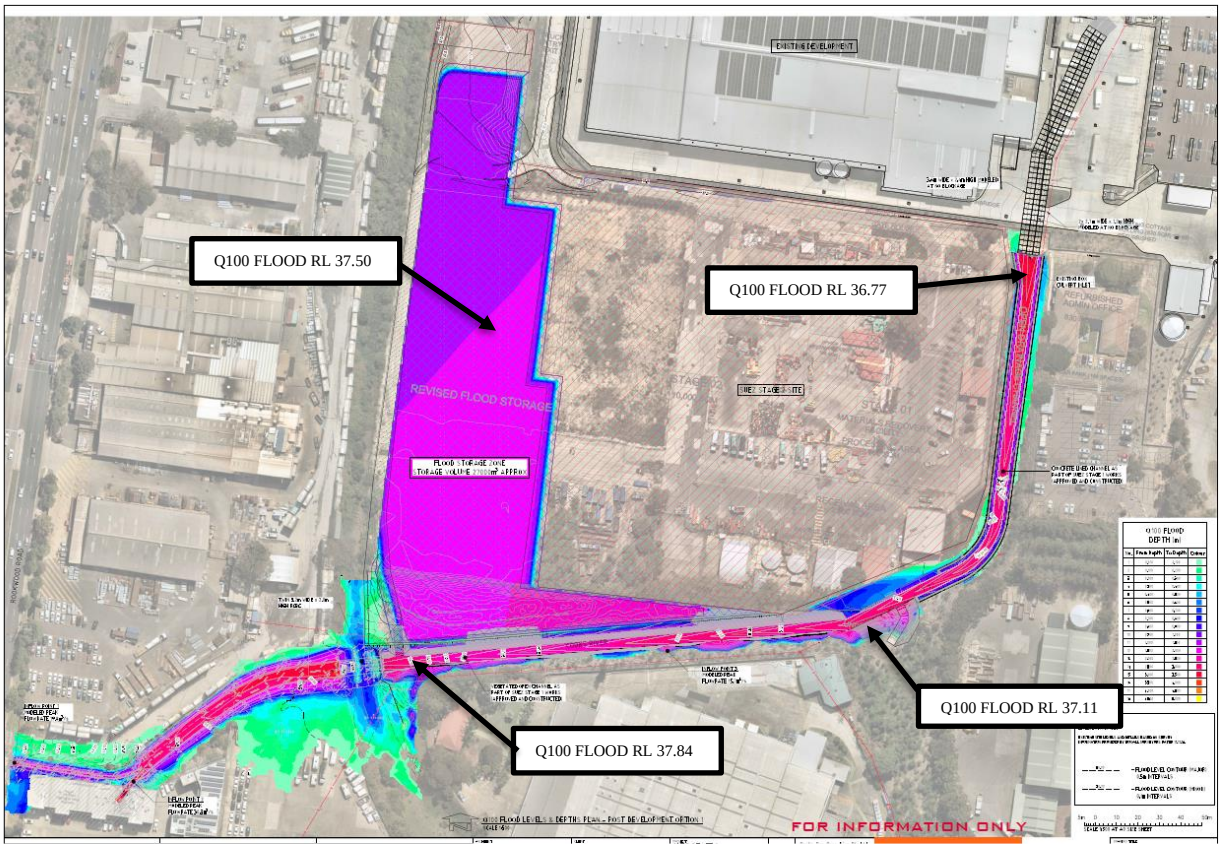


Figure 4.2. 1% AEP Flood Extent and Levels

4.3.3 Flood Planning Level

The 1% AEP flood level within the flood basin is noted to be RL 37.5m AHD. 1% AEP levels within the channel vary from RL 37.84m AHD to RL 36.77m.

The flood planning level for the development is RL 38.0m AHD. This level is based on 0.5m freeboard to the level within the flood basin of RL 37.5m.

The proposed building is noted to be RL 38.0m hence meets requirements of flood planning and immunity.

The development footprint is noted to be clear of flood affected areas and overland flow paths.

4.3.4 Safety and Egress

Figure 4.3 shows an excerpt of the PMF flood extent as represented in the Council **Rookwood Road Catchment Flood Study 2010** completed by BMT WBM. The Council study, although it does not reflect the current built form and flood storages is considered representative of the extent of PMF flooding in the area, and relevant to occupant safety and egress.

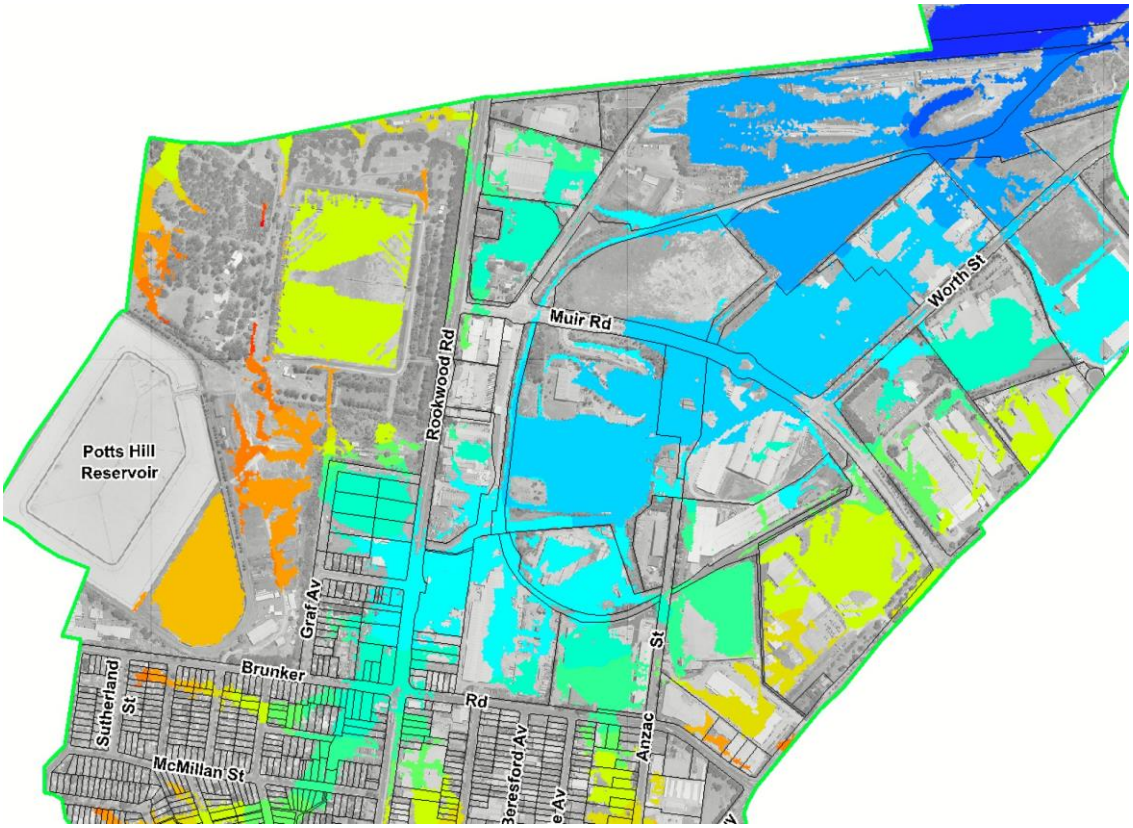


Figure 4.3. PMF Flood Extent and Levels (Excerpt from Rookwood Road Catchment Flood Study 2010)

Noting that the Proposal will be sited at the 1% AEP plus 0.5m of freeboard. The probability of inundation is very low and would require a very significant rainfall event for additional safety concerns for occupants to be required. Given that the proposal is however within PMF flood zone, due consideration to occupant safety will be necessary during the operation of the MRF.

The proposed MRF should have a specific flood management plan which sets out flood warden, evacuation zones and responsible persons. The plan of management should be completed in conjunction with relevant Council and SES sub plans as required.

The NSW SES Local Controller is responsible for monitoring the flood risk over the area and for issuing flood warnings to the community. Any person or group occupying the precinct at the time of flood danger should adhere to any warnings issued. The warning message will normally be issued via SMS (phone text) by the SES. During periods of heavy or forecast heavy rainfall it is important that one or some of the occupants of a facility should be able to receive such messages. The occupants must then immediately follow the flood evacuation plan in this report or the instructions of the SES controller in the area.

It is noted that egress from the site to areas of the Chullora RRP on the north-west which are not affected by PMF flooding can be easily made, in minutes and on foot.

4.4 Construction Impact Assessment

All construction works are noted to be clear of the 1% AEP flood extent.

As noted in **Section 2.4**, a SWMP and ESCP will be employed during construction that will ensure runoff is contained on site in accordance with the Blue Book and minimise impact to receiving waters.

Given that works are proposed clear of 1% AEP flooding and SWMP and ESCP measures will be employed, it is concluded that impact associated with flooding during construction can be mitigated.

4.5 Operational Impact Assessment

As shown in **Sections 4.1 to 4.3** of this report, the development does not encroach on nor impact any flood affected areas. As such there will be no changes or impacts to existing flood conditions or impact as a result of the development. The assessment shows that there is no detrimental effect on surrounding properties due to flooding and the development.

The building is noted to be sited at 0.5m above the 1% AEP flood level, hence impact from flooding on the Proposal is considered to be low, and in accordance with local and regional flood policy.

We consider the effects of flooding from the proposed development to be within the bounds of the Bankstown Council flood risk management policy and allowances of the engineering standards noted. Impact associated with the development relating to flooding is considered to be negligible.

5 WATER CYCLE MANAGEMENT

5.1 Water Balance Objectives

A daily water balance analysis was undertaken to determine the feasibility of the proposed rain and stormwater harvesting scheme and in particular the effects of various storage sizes for stormwater harvesting along with changes to demand.

The water balance utilised flows generated using a simple runoff calculation using historical rainfall data, analysed for various rainfall patterns including dry, mean and wet rainfall years. The purpose for modelling dry, mean and wet years was to assess the performance of various tank sizes given the changes to rainfall patterns.

5.2 Water Use Management Features

5.2.1 Existing

Existing water use features comprise Sydney Water Mains supply.

There are no existing rainwater harvesting systems, or water extractions as the Proposal site is currently vacant.

There are no current irrigated landscaped areas

5.2.2 Proposed

Proposed management measures for water use are as follows:

- Existing Sydney Water mains supply is proposed to be maintained throughout the duration of the Proposal;
- Stormwater harvesting through rainwater reuse to reduce demand on non-potable water uses;
- Sprinkler water storage via Sydney Water mains.

A concept diagram for the proposed re-use scheme on site is shown in **Figure 5.1** below.

It is noted that although there is no landscaping proposed for the Proposal, it is proposed that an allowance to irrigate up to 500m^2 of existing landscape areas will be included in the proposal.

In relation to wastewater provisions The MRF is a dry plant with no internal taps provided. Under usual running conditions the plant is clean down with air and brushes and is not washed. Misters are used but are designed to provide an atomised spray meaning no moisture reaches the floor.

Spill from containers in the waste may cause a generation of liquids and so a sump of 1m3 in size is requested in the north-eastern corner of the plant hall next to a roller shutter door. Any container spills will be plumbed to this sump for containment and removal.

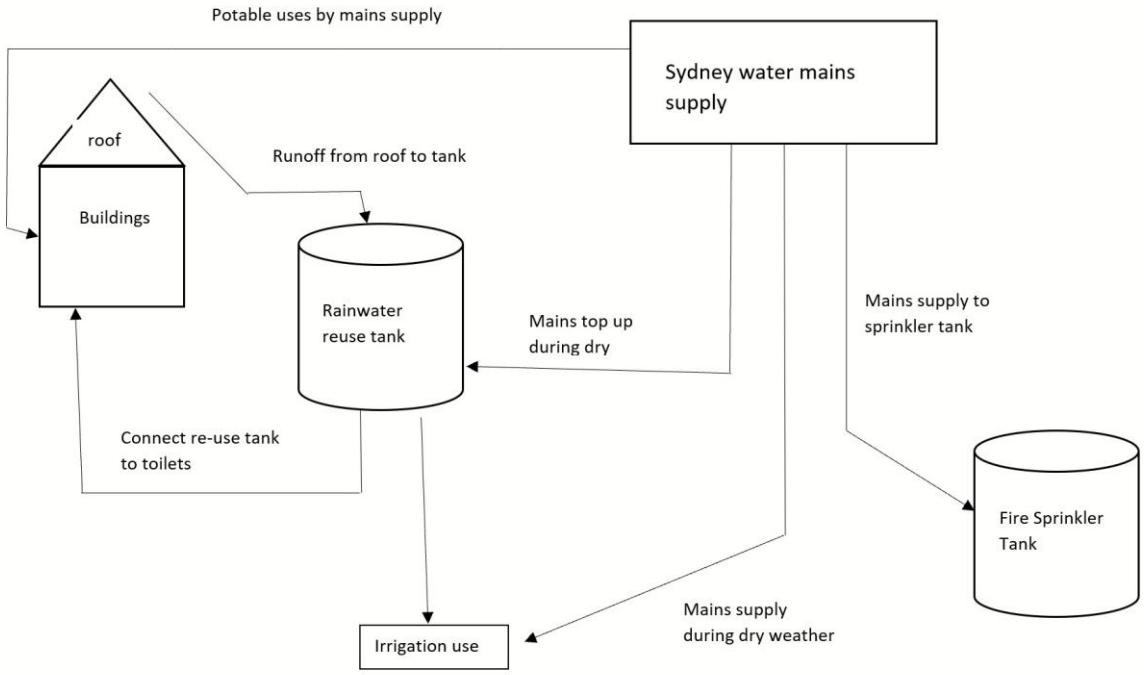


Figure 5.1. Water Cycle Management Schematic

A short description of the expected stormwater harvesting for the development is described below.

Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater, where the flow is from roof areas only, or stormwater where the flow is from all areas of the development.

Rainwater harvesting is proposed for this development, and will be rainwater tank sizing will be designed during detail design stage by the hydraulic consultant via a water balance assessment. Rainwater tanks are to be sized with reference to the NSW Department of Environment and Conservation document *Managing Urban Stormwater: Harvesting and Reuse*, using a simple water balance analysis to balance the supply and demand, based on the base water demands and the requirements of Council.

The water balance assessment will be based on local rainfall data and specific utilisation rates for the facility for re-use of non-potable applications. The expected reuse applications include internal uses such as toilet flushing, and external applications including irrigation. The aim is to reduce the water demand for the development and to satisfy the requirements of COUNCIL.

In general terms the rainwater harvesting system will be comprised the following elements:

- In-line tank for the collection and storage of rainwater.

- Overflow to the in-ground stormwater drainage system sized to cater for the catchment being drained to the tank. This will operate at times when the rainwater storage tank is full so that rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system.
- Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system to toilets and external irrigation areas, and any other uses as defined in the Construction Certificate stage of the design.
- Mains top up to Sydney Water system for prolonged periods of dry weather.
- First flush diverter and filters to ensure adequate quality of reuse water.
- Tank material will be steel or polymer and appropriately located to minimise visual impact.

Refer drawings in **Appendix A**.

5.3 Water Balance Assessment

5.3.1 Internal Base Water Demand

As confirmed by SUEZ the proposed operations require 20 persons on shift during the night shift and 25 persons on day shifts.

Potable water demand is based on each employee using 25 litres per day for showering and inside tap use.

These rates give the following internal potable demand:

Potable Water	45 People	1.125 kL/day

Indoor non-potable water demand has been based on each employee using 15 litres of potable water per day for toilet flushing which is typical of an office environment which uses energy efficient flushing devices.

These rates give the following internal non-potable demand:

Toilet Flushing	45 People	0.675 kL/day

5.3.2 Fire Services Base Demand

Based on the preliminary fire services report, sprinkler and fire service tanks require a total storage of 3072 kL. These are expected to be serviced twice yearly, hence total yearly demand of 6144 kL has been allowed.

Fire Services	16.8 kL/day

5.3.3 Irrigation Base Water Demand

External water consumption within each landscaping system varies depending upon the nature of the irrigation system, species of planting, and the prevailing climate. For this development, the base case outdoor potable water demand has been modelled using a simple rainwater balance. The proposed irrigation system will be a drip-fed system with

application rates averaging 10 l/m^2 (i.e. 10 mm/m^2). For the purposes of our analysis the average of this application rate has been used, in conjunction with the application regime shown in **Table 5.1**, to determine the monthly and total yearly demand.

As noted although there are no proposed landscaped areas in the proposal an allowance to irrigate existing landscaped areas has been made.

Table 5.1. External Irrigation Application Schedule

Month	No. of Applications
January	12
February	12
March	10
April	9
May	8
June	4
July	4
August	4
September	8
October	9
November	10
December	12

The above regime for the landscaped area for the site gives the following yearly outdoor water demands:

Proposed Development	Area=500m^2	510 kL/year
		1.4 kL/day

5.3.4 Rainwater Tank Sizing

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainwater tanks have been designed, using a simple water balance calculation to balance the supply and demand, based on the calculated base water demands and proposed roof catchment areas. Allowances in the calculation have been made for efficiency of collection, absorption/ evaporation losses. Refer **Appendix D** for details of calculations.

Table 5.2. Rainwater Reuse Requirements

Tank	Roof Catchment to Rainwater Tank (m2)	Tank Size (kL)	Predicted Non-Potable Demand Reduction (%)
1	2500	50	50

The water balance assessment predicts 50% reduction in non-potable will be met for the development with the provision of a minimum 50 kL rainwater tank.

We note that the final configuration and sizing of the rainwater tanks is subject to detail design considerations and optimum site utilisation.

5.3.5 Overall Water Cycle Management

The following **Table 5.3** shows overall water cycle and each water source.

Table 5.3. Overall Water Cycle

Area	**Daily Demand (kL/ Day)**	
	Via Harvesting/ Reuse	**Via Mains**
Internal	0.34	1.46
External	0.7	0.7
Fire	-	16.8
Total	**1.04**	**18.96**

5.4 Construction Impact Assessment

Construction works will require minimal water demand to service site sheds, dust suppression and other construction related operations.

Water supply for these activities during the construction period will be made via existing Sydney Water supply.

It is considered that impact associated with water use during construction is limited and an existing supply is available through the whole of the construction works period.

5.5 Operational Impact Assessment

Rainwater harvesting is proposed to reduce demand on non-potable applications.

An existing and reliable water supply is available during operations.

Impact on environment from water use is considered to be acceptable.

6 ADDITIONAL MITIGATION MEASURES

This report describes a number of design features that will be incorporated into the Proposal to manage water quality and hydrology impacts. The features are considered suitable to suitable mitigate all construction and operation impacts related to the Proposal. Notwithstanding this, the below measure will be incorporated into the CEMP and OEMP to mitigate any residual impacts.

6.1 Construction

A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP), or equivalent, will be incorporated into the CEMP for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book') (Landcom, 2004)* and Volume 2 (DECC 2008) and consider the Preliminary ESCPs (**Appendix C**). The following aspects will be addressed within the SWMP and ESCPs:

- Construction traffic restricted to delineated access tracks, and maintained until construction complete
- Appropriate sediment and erosion controls to be implemented prior to soil disturbance
- Stormwater management to avoid flow over exposed soils which may result in erosion and impacts to water quality •
- Location of stockpiles outside of flow paths on appropriate impermeable surfaces
- Inspection of all permanent and temporary erosion and sedimentation control works prior to and post rainfall events and prior to closure of the construction area

6.2 Operation

An OEMP will be prepared for the Proposal to minimise water and hydrology impacts and will include the following: Emergency response and incident management protocols will cover the following types of emergency or incident:

- On-site spills or leaks
- Off-site discharges
- Flooding

7 CONCLUSION

This impact assessment has been prepared to support the Proposal for the development and operation of the first phase of the Chullora RRP as an MRF.

An assessment of the impacts relation to soil and water has been prepared which provides a best practice solution within the constraints of the existing landform and proposed development layout. Within this strategy a stormwater quantity and quality management strategy has been developed to reduce both peak flows and pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with *Bankstown City Council's Development Engineering Standards 2009* and *Engineering and Drainage Standards Policy 2005*.

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

During the operational phase of the development, the proposed stormwater quality treatment system incorporating the use of a treatment train of GPT's and filtration is proposed to mitigate any increase in stormwater pollutant load generated by the development. Stormwater quality modelling was undertaken which demonstrated that implementation of the WSUD measures would result in improved water quality outcomes consistent with the Botany Bay Catchment Water Quality Improvement Plan and that stormwater runoff is not detrimental to the receiving environment.

Further it has been confirmed that the development meets flood planning requirements and does not impact or encroach on existing flood affected areas (as defined in separate approval to Council and associated TUFLOW flooding assessment completed for the recent flood mitigation works completed across the Chullora RRP site). This shows that local post development flows from the site, in conjunction with the flood management measures to be adopted in the flooding assessment demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

8 REFERENCES

- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);
- Development Engineering Standards – 2009 (Bankstown City Council);
- Engineering and Drainage Standards Policy – 2009 (Bankstown City Council);
- Bankstown City Council Development Control Plan 2015 Part B4 Sustainable Development;
- Water Sensitive Urban Design – "Technical Guidelines for Western Sydney" by URS Australia Pty Ltd, May 2004; and
- Managing Urban Stormwater, Soils and Construction (1998) – The Blue Book, Landcom

Appendix A

DRAWINGS BY COSTIN ROE CONSULTING

SUEZ MATERIAL RECOVERY FACILITY

21 MUIR ROAD, CHULLORA, NSW

SSD APPLICATION CIVIL DRAWINGS

LIST OF DRAWINGS

DRAWING NO.	DRAWING TITLE
C013058.03-DA10	DRAWING LIST & GENERAL NOTES
C013058.03-DA20	EROSION SEDIMENT CONTROL PLAN
C013058.03-DA25	EROSION SEDIMENT CONTROL DETAIL
C013058.03-DA40	DRAWINNG KEY PLAN & PIT SCHEDULE
C013058.03-DA41	STORMWATER DRAINAGE PLAN - SHEET 1
C013058.03-DA42	STORMWATER DRAINAGE PLAN - SHEET 2
C013058.03-DA45	STORMWATER DRAINAGE DETAILS
C013058.03-DA51	FINISHED LEVELS PLAN - SHEET 1
C013058.03-DA52	FINISHED LEVELS PLAN - SHEET 2
C013058.03-DA53	FINISHED LEVELS PLAN - SHEET 3
C013058.03-DA70	WATER QUALITY CATCHMENT PLAN

LOCALITY PLAN
NOT TO SCALE

GENERAL NOTES:

G1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

G2 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.

G3 ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE.
ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS.
ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT.
REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.

G4 DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.

G5 UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.

G6 ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

ELECTRONIC INFORMATION NOTES:

1. THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
2. THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
4. THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.

STORMWATER DRAINAGE NOTES:

1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3:2003 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
3. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
4. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
5. ALL STORMWATER PIPES Ø375 OR GREATER SHALL BE CLASS 2 REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
6. ALL PIPES UP TO AND INCLUDING Ø300 TO BE uPVC GRADE SN8 UNO.
7. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
8. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c 25 MPA. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
9. IN ADDITION TO ITEM 6 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
10. PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
11. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 uPVC TO EACH SIDE OF PIPE.
12. ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
13. ALL PIPE GRADES 1 IN 100 MINIMUM UNO.
14. PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
15. MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
16. PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY', THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' U.N.O.
17. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
18. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
19. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.

FINISHED LEVELS PLAN NOTES :

1. LEVELS DATUM IS A.H.D.
2. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
3. THE MAJOR CONTOUR INTERVAL IS 0.5m
4. THE MINOR CONTOUR INTERVAL IS 0.1m.
5. MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
6. MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) IN CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
7. MAXIMUM RAMP GRADES ARE TO BE 1:12 (8.3%) U.N.O. ON PLAN
8. PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGES GRADE EXCEDE 1:20 (5%).
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H.
10. ALL BATTER SLOPES WITH GRADES AT OR EXCEDING 1V:6H ARE TO BE TURFED IMMEDIATELY, OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. THE ACCESS ROAD TO THE HARDSTAND AREA IS TO HAVE A CROSSFALL OF 2% AS INDICATED ON PLAN.
12. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
13. ALL PAVEMENTS ARE TO BE SET AT 50mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS.

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	03.08.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT suez

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA10

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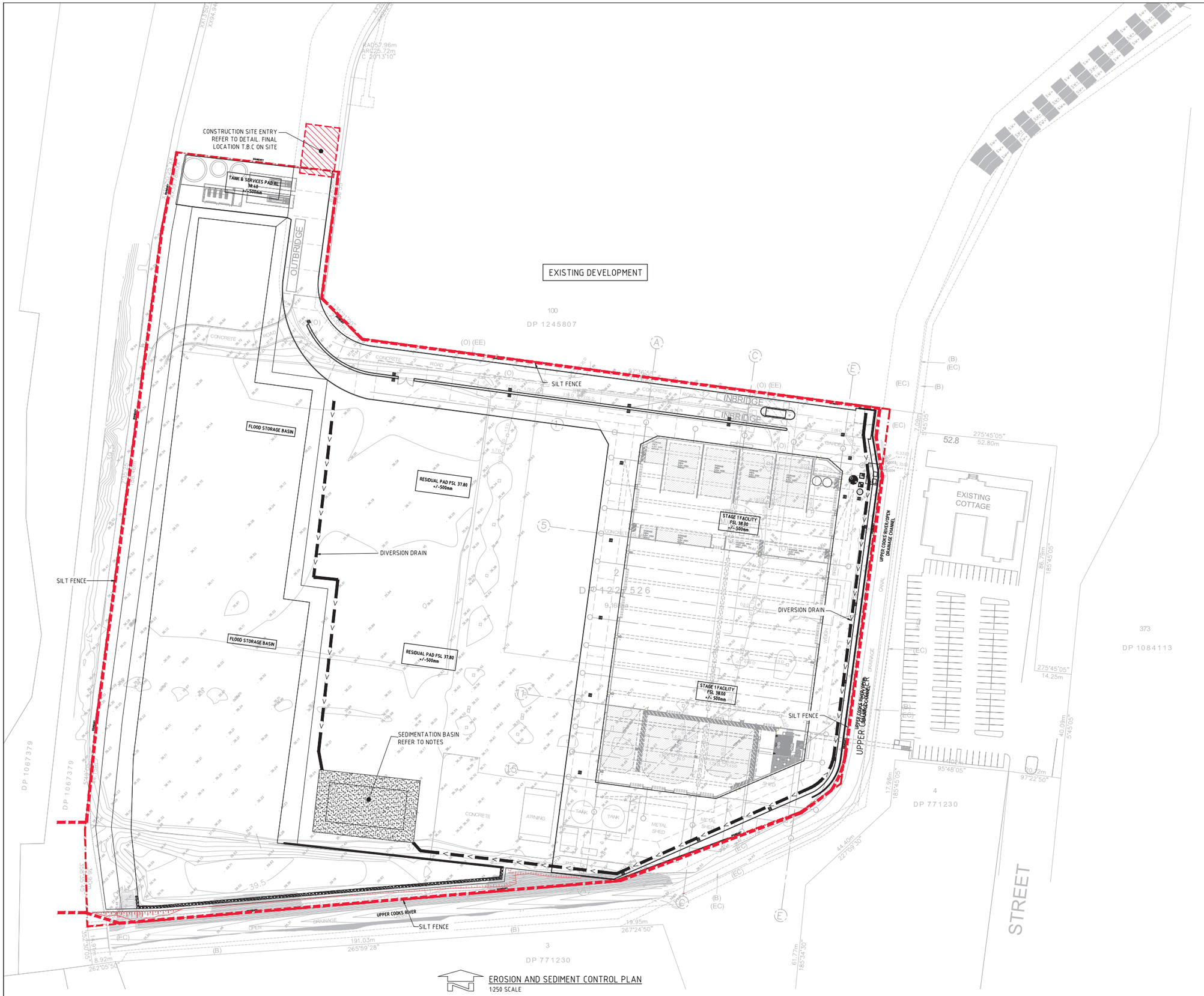
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
DRAWING LIST AND GENERAL NOTES

DRAWING No C013058.03-DA10 ISSUE C



EROSION AND SEDIMENT CONTROL PLAN
1:250 SCALE

LEGEND:

PROVIDE 1m RETURNS TO SILT FENCE AT 30m MAX. INTERVALS.
TYPICAL (N.S.O.P.)

- DENOTES DIRECTION OF OVERLAND FLOW
- DENOTES SILT FENCE WITH CATCH DRAIN
- DENOTES SILT FENCE ONLY
- DENOTES DIVERSION DRAIN

SEDIMENTATION BASIN NOTE:

FOR SEDIMENT & EROSION CONTROL DETAILS REFER TO DRAWING C013058.03-DA25.
SEDIMENTATION BASIN SIZING BASED ON RECOMMENDATIONS OF 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER-THE BLUE BOOK'.
CAPACITY BASED UPON 5 DAY RAINFALL DEPTH AT 85th PERCENTILE INTENSITY (32.2mm).

APPROXIMATE AREA OF DISTURBED SITE = 3.96ha

SEDIMENT BASIN 1:

CATCHMENT AREA	= 4.0ha
REQUIRED BASIN VOLUME	= 966m³
BASE DIMENSIONS (L X W)	= 15.0m x 30.0m
TOP DIMENSIONS (L X W)	= 24.0m x 39.0m
MAX SIDE SLOPE	= 1V:3H
DEPTH	= 1.5m
PROVIDED BASIN VOLUME	= 1017m³

SEDIMENTATION BASINS TO COLLECT RUN-OFF IN EXTREME RAINFALL EVENTS. COLLECTED RUN-OFF TO BE ASSESSED BY A QUALIFIED LABORATORY FOR DOUSING RATES OF ALUM OR GYPSUM TO ENSURE COAGULATION OF SEDIMENTS PRIOR TO WATER BEING DISCHARGED TO COUNCIL STORMWATER SYSTEM.

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

NOTES:
1. ASSUME TYPE D SOIL (CLAY/SILTY CLAY)
2. ASSUME GROUP D SOIL (HIGH PLASTICITY AND SHRINK/SWELL PROPERTIES)

EROSION CONTROL NOTES

ALL CONTROL WORK INCLUDING DIVERSION BANKS AND CATCH DRAINS, V-DRAINS AND SILT FENCES SHALL BE COMPLETED DIRECTLY FOLLOWING THE COMPLETION OF THE EARTHWORKS.

1. SILT FENCES AND SILT FENCE RETURNS SHALL BE ERECTED CONVEX TO THE CONTOUR TO POND WATER.
2. HAY BALE BARRIERS AND GEOFABRIC FENCES ARE TO BE CONSTRUCTED TO TOE OF BATTER, PRIOR TO COMMENCEMENT OF EARTHWORKS, IMMEDIATELY AFTER CLEARING OF VEGETATION AND BEFORE REMOVAL OF TOP SOIL.
3. ALL TEMPORARY EARTH BERMS, DIVERSION AND SILT DAM EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
4. CLEAR WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM.
5. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION.
6. ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS FOR STRUCTURAL DAMAGE OR CLOGGING, TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
7. ALL FINAL EROSION PREVENTION MEASURES INCLUDING THE ESTABLISHMENT OF GRASSING ARE TO BE MAINTAINED UNTIL THE END OF THE DEFECTS LIABILITY PERIOD.
8. ALL EARTHWORKS AREAS SHALL BE ROLLED ON A REGULAR BASIS TO SEAL THE EARTHWORKS.
9. ALL FILL AREAS ARE TO BE LEFT WITH A BUND AT THE TOP OF THE SLOPE AT THE END OF EACH DAYS EARTHWORKS. THE HEIGHT OF THE BUND SHALL BE A MINIMUM OF 200MM.
10. ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND HYDROMULCHED WITHIN 10 DAYS OF COMPLETION OF FORMATION.
11. AFTER REVEGETATION OF THE SITE IS COMPLETE AND THE SITE IS STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SILT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
12. ALL TOPSOIL STOCKPILES ARE TO BE SUITABLY COVERED TO THE SATISFACTION OF THE SITE MANAGER TO PREVENT WIND AND WATER EROSION.
13. ANY AREA THAT IS NOT APPROVED BY THE CONTRACT ADMINISTRATOR FOR CLEARING OR DISTURBANCE BY THE CONTRACTOR'S ACTIVITIES SHALL BE CLEARLY MARKED AND SIGN POSTED, FENCED OFF OR OTHERWISE APPROPRIATELY PROTECTED AGAINST ANY SUCH DISTURBANCE.
14. ALL STOCKPILE SITES SHALL BE SITUATED IN AREAS APPROVED FOR SUCH USE BY THE SITE MANAGER. A 6m BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES APPROVED IN THE EROSION AND SEDIMENTATION CONTROL PLAN.
15. ACCESS AND EXIT AREAS SHALL INCLUDE SHAKE-DOWN OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FORM MOTOR VEHICLES.
16. THE CONTRACTOR IS TO ENSURE RUNOFF FROM ALL AREAS WHERE THE NATURAL SURFACE IS DISTURBED BY CONSTRUCTION, INCLUDING ACCESS ROADS, DEPOT AND STOCKPILE SITES, SHALL BE FREE OF POLLUTANTS BEFORE IT IS EITHER DISPERSED TO STABLE AREAS OR DIRECTED TO NATURAL WATERCOURSES.
17. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SLOPES, CROWNS AND DRAINS ON ALL EXCAVATIONS AND EMBANKMENTS TO ENSURE SATISFACTORY DRAINAGE AT ALL TIMES WATER SHALL NOT BE ALLOWED TO POND ON THE WORKS UNLESS SUCH PONDING IS PART OF AN APPROVED ESCP / SWMP.

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SIZE SHEET

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA20

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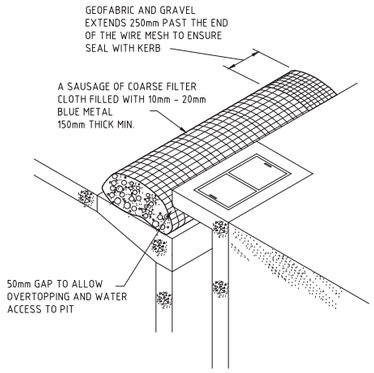
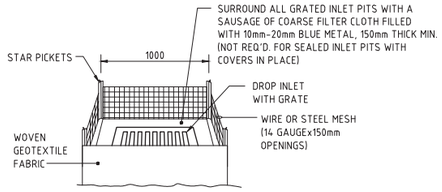
Costin Roe Consulting
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
EROSION AND SEDIMENT CONTROL PLAN

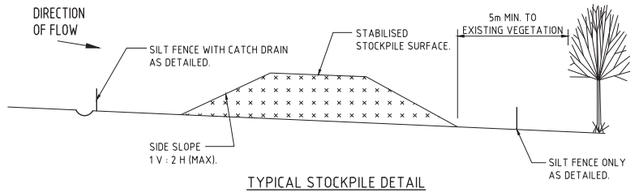
DRAWING No C013058.03-DA20 ISSUE C



KERB INLET CONTROL
NTS



GRATED INLET PIT FILTER DETAIL
N.T.S

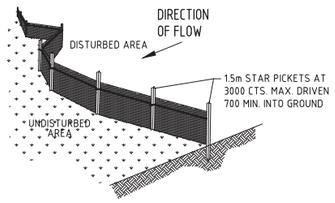


TYPICAL STOCKPILE DETAIL
N.T.S.

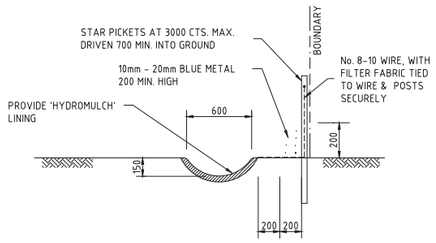
STOCKPILE NOTES

1. PLACE ALL STOCKPILES IN LOCATIONS MORE THAN 5m FROM EXISTING VEGETATION, ROADS & HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT ELONGATED MOUNDS. SIDE SLOPE TO BE 1 V: 2 H MAX.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE STOCKPILES ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE USING WOOD CHIP MULCH - 16 TONNE/Ha.
5. CONSTRUCT SILT FENCE WITH CATCH DRAIN ON UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES & SILT FENCE ONLY 1 TO 2m DOWNSLOPE AS SHOWN.

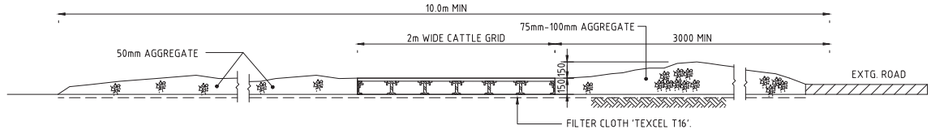
NOTE : ADOPT ABOVE DETAILS AROUND ALL PITS WITHIN AREA ENCOMPASSED BY SILT FENCE & TO PITS ON THE ROAD ADJACENT TO SITE BOUNDARY.



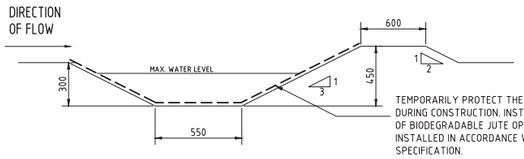
TYPICAL SILT FENCE DETAIL
N.T.S.
PROVIDE 1m RETURNS AT 30m INTERVALS.
TYPICAL



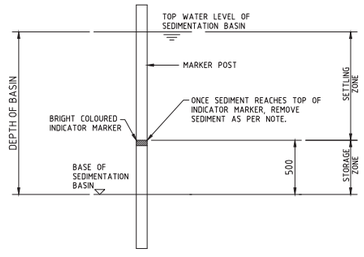
TYPICAL OPEN DRAIN & SILT FENCE
SCALE 1 : 20



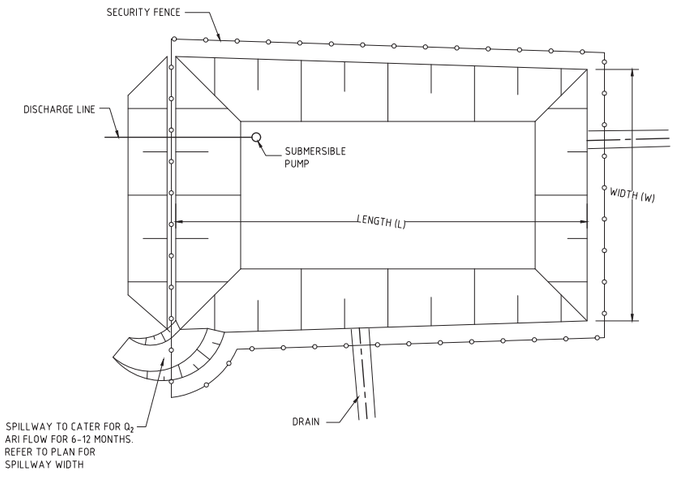
SECTION 1:20 (1 / EW20) : STABILISED CONSTRUCTION ENTRANCE 'TRUCK SHAKER'



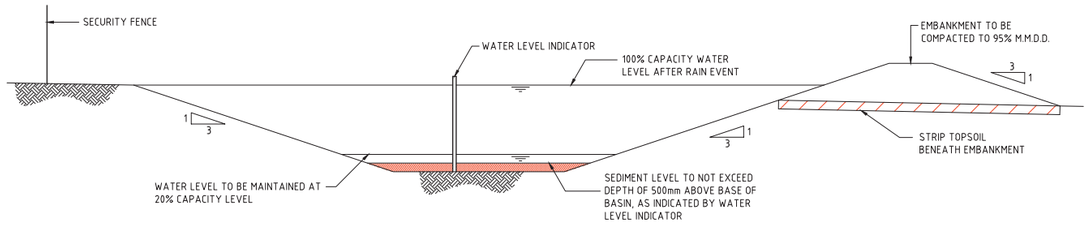
DIVERSION DRAIN SECTION
SCALE 1:20



SEDIMENT STORAGE MARKER
SCALE 1:20



TYPICAL SEDIMENT CONTROL POND PLAN
SCALE 1:250



TYPICAL SEDIMENT CONTROL BASIN SECTION
SCALE 1:50

NOTES:

ALL EROSION & SEDIMENT CONTROL MEASURES TO BE INSPECTED & MAINTAINED DAILY BY SITE MANAGER.

MINIMISE DISTURBED AREAS.

ROADS & FOOTPATHS TO BE SWEPT DAILY.

1.2m TURF TO BE PLACED BEHIND KERBS.

DUST MINIMISATION CONTROL BY WATERING TO BE IMPLEMENTED BY SITE MANAGER AS REQUIRED OR AS DIRECTED BY THE EPA.

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE

500mm 0 1 2 3 4 5m
SCALE 1:50 AT A0 SHEET SIZE

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA25

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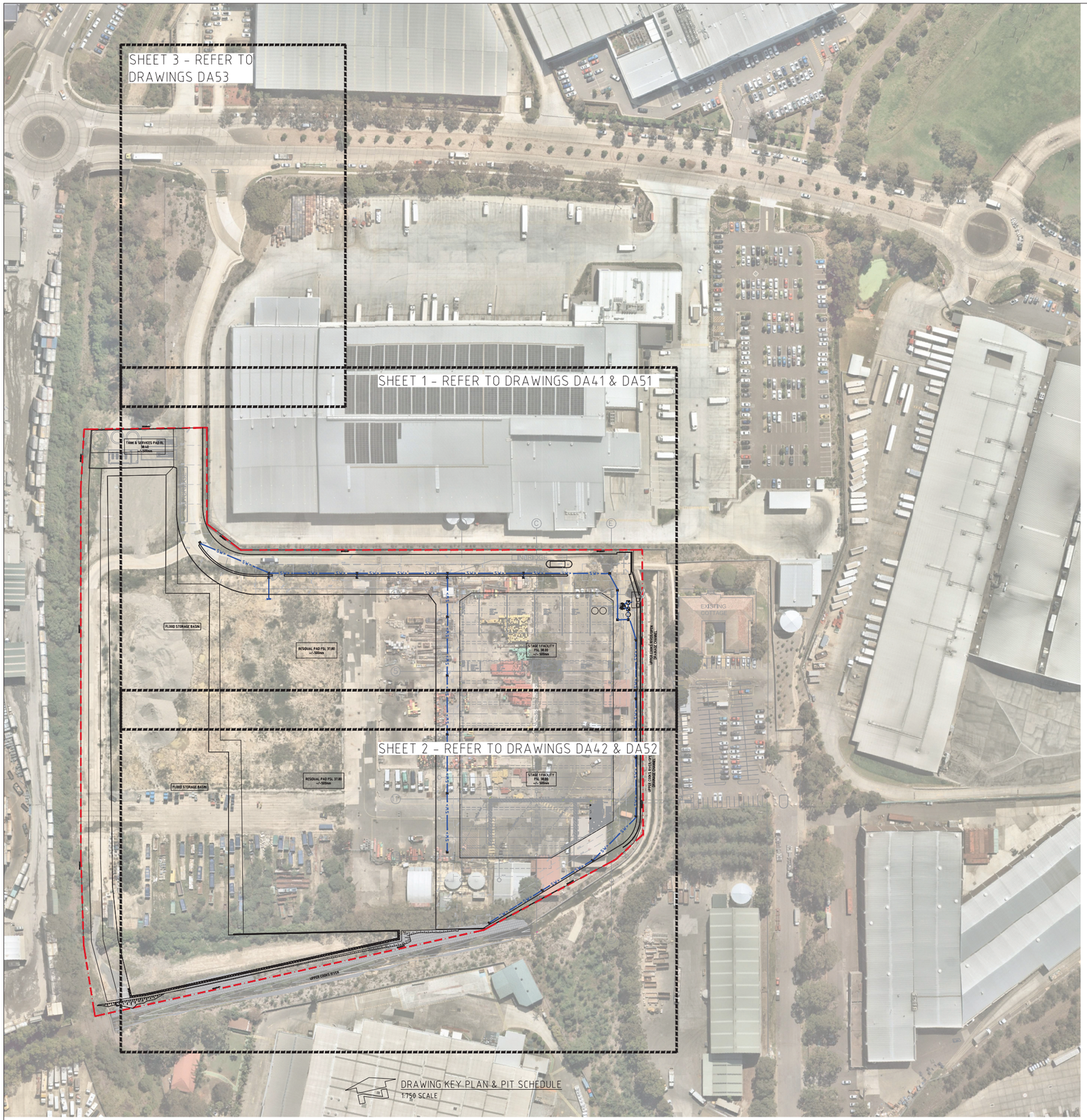
DRAWING TITLE
EROSION AND SEDIMENT
CONTROL DETAILS

DRAWING No C013058.03-DA25 ISSUE B



PIT SCHEDULE

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT 1	NOT USED			
PIT 2	NOT USED			
PIT 3	NOT USED			
PIT 4	NOT USED			
PIT 5	NOT USED			
PIT 6	NOT USED			
PIT 7	NOT USED			
PIT 8	NOT USED			
PIT 9	NOT USED			
PIT 10	37.70	SGGP	1200x1200	
PIT 11	37.70	SGGP	1200x1200	
PIT 12	37.70	SGGP	1200x1200	
PIT 13	37.70	SGGP	1200x1200	
PIT 14	37.70	SGGP	1200x1200	
PIT 15	37.85	SGGP	1200x1200	
PIT 16	37.85	SGGP	1200x1200	
PIT 17	37.88	SGGP	1500x1500	
PIT 18	37.88	SGGP	1500x1500	
PIT 19	37.90	SGGP	1200x1200	
PIT 20	37.80	SGGP	900x900	
PIT 21	NOT USED			
PIT 22	37.70	SGGP	900x900	
PIT 23	37.80	SGGP	900x900	
PIT 24	37.80	SGGP	900x900	
PIT 25	37.80	SGGP	900x900	
PIT 26	37.80	SGGP	900x900	
PIT 27	37.80	SGGP	900x900	
PIT 28	37.80	SGGP	900x900	
PIT 29	37.80	SGGP	900x900	
PIT 30	37.65	SGGP	900x900	
PIT 31	37.65	SGGP	900x900	
PIT 32	37.65	SGGP	900x900	
PIT 33	37.65	SGGP	900x900	
PIT 34	37.65	SGGP	900x900	
PIT 35	37.65	SGGP	900x900	
PIT 36	37.65	SGGP	900x900	

LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- DP, DOWNPIPE LOCATION
- DRAINAGE LINE
- SUBSOIL LINE
- ROOFWATER LINE
- EXISTING SEWER LINE
- FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- OVERLAND FLOW DIRECTION

6m 0 15 30 45 60 75m

SCALE 1:750 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA40

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PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
STORMWATER KEY PLAN & PIT SCHEDULE

DRAWING No C013058.03-DA40

ISSUE C

LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- DP, DOWNPIPE LOCATION
- DRAINAGE LINE
- SUBSOIL LINE
- ROOFWATER LINE
- EXISTING SEWER LINE
- FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- OVERLAND FLOW DIRECTION

FLOOD PLANNING NOTE:

WAREHOUSE FINISHED FLOOR LEVEL IS FLOOD PLANNING LEVEL OF THE 1 IN 100 YEAR ARI LEVEL (Q100=37.5m) + 500mm FREEBOARD. 1 IN 100 YEAR ARI FLOOD LEVELS BASED ON INFORMATION REPORT 13058.03-04.rpt BY COSTIN ROE CONSULTING

PIT SCHEDULE NOTE:

REFER TO DRAWING C013058.03-DA40 FOR PIT SCHEDULE. REFER TO DRAWING C013058.03-DA10 FOR STORMWATER DRAINAGE NOTES.

TANK & SERVICES PAD RL 38.40 +/-500mm

EXISTING ROAD

BOUNDARY

SITE BOUNDARY

DP 1245807

PIT 20 PIT 10 PIT 9 PIT 11 PIT 22 PIT 12 PIT 28 PIT 13 PIT 29 PIT 14 PIT 19 PIT 18 PIT 17 PIT 16 PIT 15 PIT 27 PIT 26 PIT 36 PIT 35

Φ450 Φ675 Φ750 Φ900 Φ1050 Φ600 Φ525

PROVIDE CAPPED STUB FOR FUTURE DRAINAGE CONNECTION

FLOOD STORAGE BASIN

RESIDUAL PAD FSL 37.80 +/-500mm

PROVIDE POLLUTION ISOLATION SHUT OFF VALVE AT END-OF-LINE IN PIT 18. FINAL DETAIL TO BE PROVIDED DURING DETAILED DESIGN

PROVIDE ABOVE-GROUND RAINWATER TANKS WITH FIRST FLUSH DEVICE. FINAL LOCATION T.B.C DURING DETAILED DESIGN

PROVIDE OCEANSAVE OS1112 G.P.T AND JELLYFISH JF2250-5-1 TERTIARY TREATMENT PRIOR TO DISCHARGE TO INTERCEPTOR

STAGE 1 FACILITY (M) FSL 38.00 +/-500mm

EXISTING DISCHARGE PIPES ARE TO BE MAINTAINED AND USED FOR THE PROPOSED STORMWATER SYSTEM

DISCHARGE TO EXISTING INTERCEPTOR UNIT AS PART OF THE CURRENT SUEZ FACILITY. INTERCEPTOR TO REMAIN AS PER EXISTING.

UPPER COOKS RIVER/OPEN DRAINAGE CHANNEL

CONCRETE SLAB

GARDEN

BRIDGE

CANAL

DP 1227526 9.168ha

REFER TO DRG. C41 (SHEET 1) FOR CONTINUATION

CONCEPT STORMWATER DRAINAGE PLAN - SHEET 1
1:250 SCALE

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

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PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA41

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DRAWING TITLE
CONCEPT STORMWATER DRAINAGE PLAN - SHEET 1

DRAWING No C013058.03-DA41 ISSUE C

REFER TO DRG. C42 (SHEET 2) FOR CONTINUATION

FLOOD STORAGE BASIN

RESIDUAL PAD FSL 37.80
+/-500mm

STAGE 1 FACILITY
FSL 38.00
+/- 500mm

DP 1227526
9.168ha

UPPER COOKS RIVER/OPEN DRAINAGE CHANNEL

UPPER COOKS RIVER CANAL

DRAINAGE OPEN

DP 771230

PIT 23
PIT 24
PIT 25
PIT 30
PIT 31
PIT 32
PIT 33
PIT 34
PIT 35

Φ525
Φ450
Φ300
Φ375
Φ900

BOUNDARY

WEIGH

FOYER

METAL SHED

TANK

AWNING

CONCRETE

191.05m
265°59'28"

19.95m
267°24'50"

44.40m
227°09'30"

17.98m
185°45'05"

LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- DP, DOWNPIPE LOCATION
- SW> DRAINAGE LINE
- SS> SUBSOIL LINE
- RW> ROOFWATER LINE
- S EXISTING SEWER LINE
- FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- OVERLAND FLOW DIRECTION

FLOOD PLANNING NOTE:

WAREHOUSE FINISHED FLOOR LEVEL IS FLOOD PLANNING LEVEL OF THE 1 IN 100 YEAR ARI LEVEL (Q100=37.5m) + 500mm FREEBOARD. 1 IN 100 YEAR ARI FLOOD LEVELS BASED ON INFORMATION REPORT 13058.03-04.rpt BY COSTIN ROE CONSULTING

PIT SCHEDULE NOTE:

REFER TO DRAWING C013058.03-DA40 FOR PIT SCHEDULE.
REFER TO DRAWING C013058.03-DA10 FOR STORMWATER DRAINAGE NOTES.

CONCEPT STORMWATER DRAINAGE PLAN - SHEET 2

1:250 SCALE

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT suez

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA42

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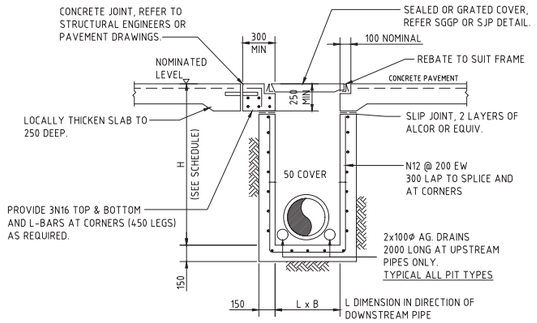
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
CONCEPT STORMWATER DRAINAGE PLAN - SHEET 2

DRAWING No C013058.03-DA42 ISSUE C

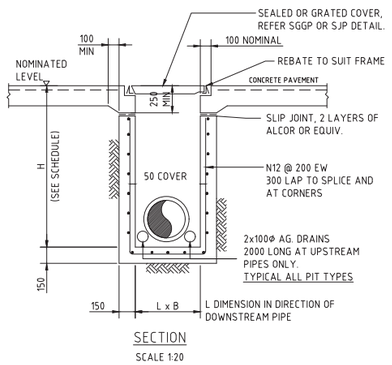


SECTION

SCALE 1:20

SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL GRATE/COVER SUPPORT CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENT FOR SGGP's & SJP's, WHERE PITS ARE LOCATED IN THE CORNER OF SLAB PANELS OR ADJACENT TO SLAB PANEL JOINTS)

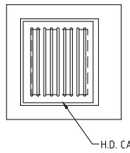


SECTION

SCALE 1:20

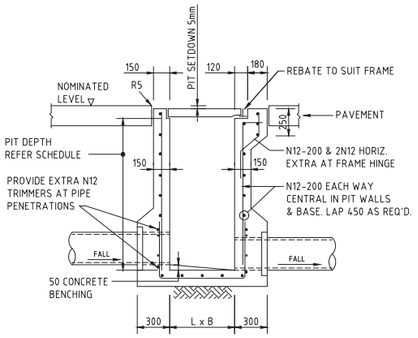
SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL GRATE/COVER SUPPORT CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENTS FOR SGGP's & SJP's, WHERE JOINTS ARE NOT LOCATED WITHIN PROXIMITY OF THE GRATE)



PLAN

SCALE 1:20



SEE SCHEDULE

L DIMENSION IN DIRECTION OF DOWNSTREAM PIPE

SECTION

SCALE 1:20

SINGLE GRATED GULLY PIT - SGGP

NOTES:

1. WHERE GULLY PIT IS LOCATED ON KERB RETURNS OR BULB OF CUL-DE-SACS PROVIDE CURVED PRECAST CONCRETE LINTELS.
2. SAG PITS SHALL HAVE LINTEL PLACED CENTRALLY ABOUT THE GRATE.
3. ALL REINFORCING TO HAVE 30 MIN. CLEAR CONCRETE COVER.
4. FOR PITS DEEPER THAN 1200mm CLIMB RAILS SHALL BE PROVIDED.

CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F'c (MPa)
PIT	80	20	GP	NIL	25

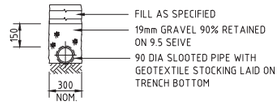
BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE	WEIGHT PASSING(%)
19	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE	WEIGHT PASSING(%)
75	100
9.5	100 TO 50
2.36	100 TO 30
0.60	50 TO 15
0.075	25 TO 0

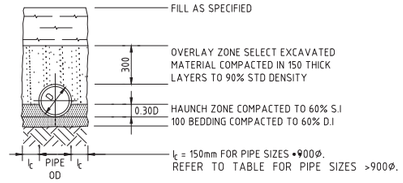
SELECT FILL MATERIAL IN ACCORDANCE WITH TABLE 1 AS 3725

SIDE ZONE WIDTH	
PIPE SIZE	l_t (mm)
•900ø	150
1050ø	175
1200ø	200
1350ø	225
1500ø	250
1650ø	275
1800ø	300

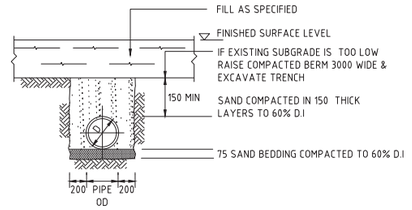
REFER TO ENGINEER FOR TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800ø



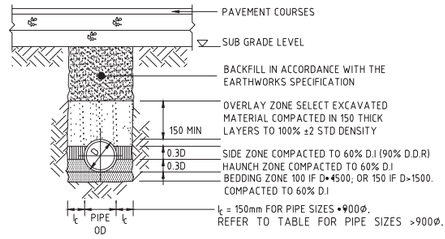
SUPPORT TO AG. DRAIN



TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS



SUPPORT TO uPVC PIPES



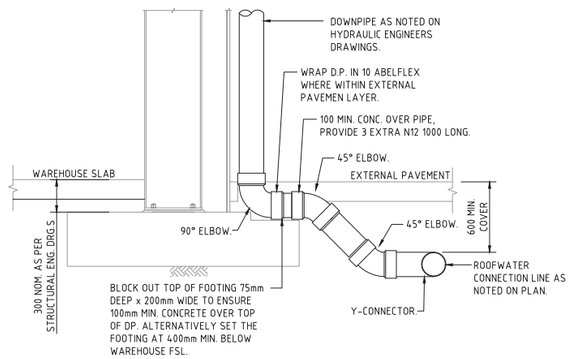
TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT

D•1350, MAX FILL = 4.0m

D> 1350, MAX FILL = 3.0m

PIPE LAYING DETAILS

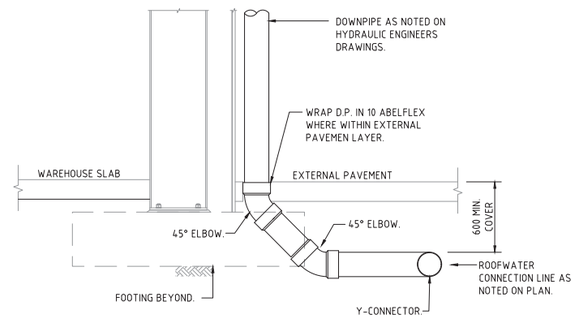
SCALE 1:20



DOWNPIPE TURN-UP DETAIL A

(AT FOOTING LOCATION)

SCALE 1:20



DOWNPIPE TURN-UP DETAIL B

(CLEAR OF FOOTING)

SCALE 1:20

200mm 0 500 1000 1500 2000mm

SCALE 1:20 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA45

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DRAWING TITLE
STORMWATER DRAINAGE DETAILS

DRAWING No C013058.03-DA45

ISSUE B

REFER TO DRG. C53 (SHEET 3) FOR CONTINUATION

REFER TO INSET PLAN FOR CONTINUATION

EXISTING ROAD

EXISTING ACCESS ROAD TO REMAIN AND BE USED FOR NEW FACILITY. EXISTING ROAD ACCESS LEVELS T.B.C DURING DETAILED DESIGN

MATCH LEVELS TO EXISTING ACCESS ROAD AT INTERFACE. EXISTING ACCESS ROAD LEVELS T.B.C DURING DETAILED DESIGN

& SERVICES PAD RL 38.40 +/-500mm

TANK & SERVICES PAD RL 38.40 +/-500mm

INSET PLAN
1:250 SCALE

LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- EXISTING SEWER LINE
- FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS

FLOOD PLANNING NOTE:

WAREHOUSE FINISHED FLOOR LEVEL IS FLOOD PLANNING LEVEL OF THE 1 IN 100 YEAR ARI LEVEL (Q100=37.5m) + 500mm FREEBOARD. 1 IN 100 YEAR ARI FLOOD LEVELS BASED ON INFORMATION REPORT 13058.03-04.rpt BY COSTIN ROE CONSULTING

OUTBRIDGE

INBRIDGE

DP 1245807

EXISTING PFD FACILITY

GATEHOUSE FFL 38.10 +/- 500mm

FLOOD STORAGE BASIN

RESIDUAL PAD FSL 37.80 +/-500mm

STAGE 1 FACILITY FSL 38.00 +/-500mm

RETAINING WALL AS PART OF EARLY WORKS. SUBJECT TO SEPARATE APPLICATION

UPPER COOKS RIVER/OPEN DRAINAGE CHANNEL

DP 1227526
9.168ha

REFER TO DRG. C51 (SHEET 1) FOR CONTINUATION

FINISHED LEVELS PLAN - SHEET 1
1:250 SCALE

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

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PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA51

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DRAWING TITLE
FINISHED LEVELS PLAN
SHEET 1

DRAWING No C013058.03-DA51 ISSUE C

REFER TO DRG. C52 (SHEET 2) FOR CONTINUATION

FLOOD STORAGE BASIN

RESIDUAL PAD FSL 37.80
+/-500mm

STAGE 1 FACILITY
FSL 38.00
+/- 500mm

RETAINING WALL AS PART OF EARLY WORKS. SUBJECT TO SEPARATE APPLICATION

RETAINING WALL AS PART OF EARLY WORKS. SUBJECT TO SEPARATE APPLICATION

2
DP 1227526
9.168ha

3
DP 771230

UPPER COOKS RIVER/OPEN DRAINAGE CHANNEL

UPPER COOKS RIVER CANAL

DRAINAGE OPEN

BOUNDARY

WEIGH

FOYER

METAL SHED

TANK

AWNING

CONCRETE

17.98m
185°45'05"

44.40m
227°09'30"

191.03m
265°59'28"

19.95m
267°24'50"

FLOOD PLANNING NOTE:

WAREHOUSE FINISHED FLOOR LEVEL IS FLOOD PLANNING LEVEL OF THE 1 IN 100 YEAR ARI LEVEL (Q100=37.5m) + 500mm FREEBOARD. 1 IN 100 YEAR ARI FLOOD LEVELS BASED ON INFORMATION REPORT 13058.03-04.rpt BY COSTIN ROE CONSULTING

LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- EXISTING SEWER LINE
- FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- 50.00 FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE

FINISHED LEVELS PLAN - SHEET 2
1:250 SCALE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.07.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT suez

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA52

Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7900 Fax: (02) 9241-5721
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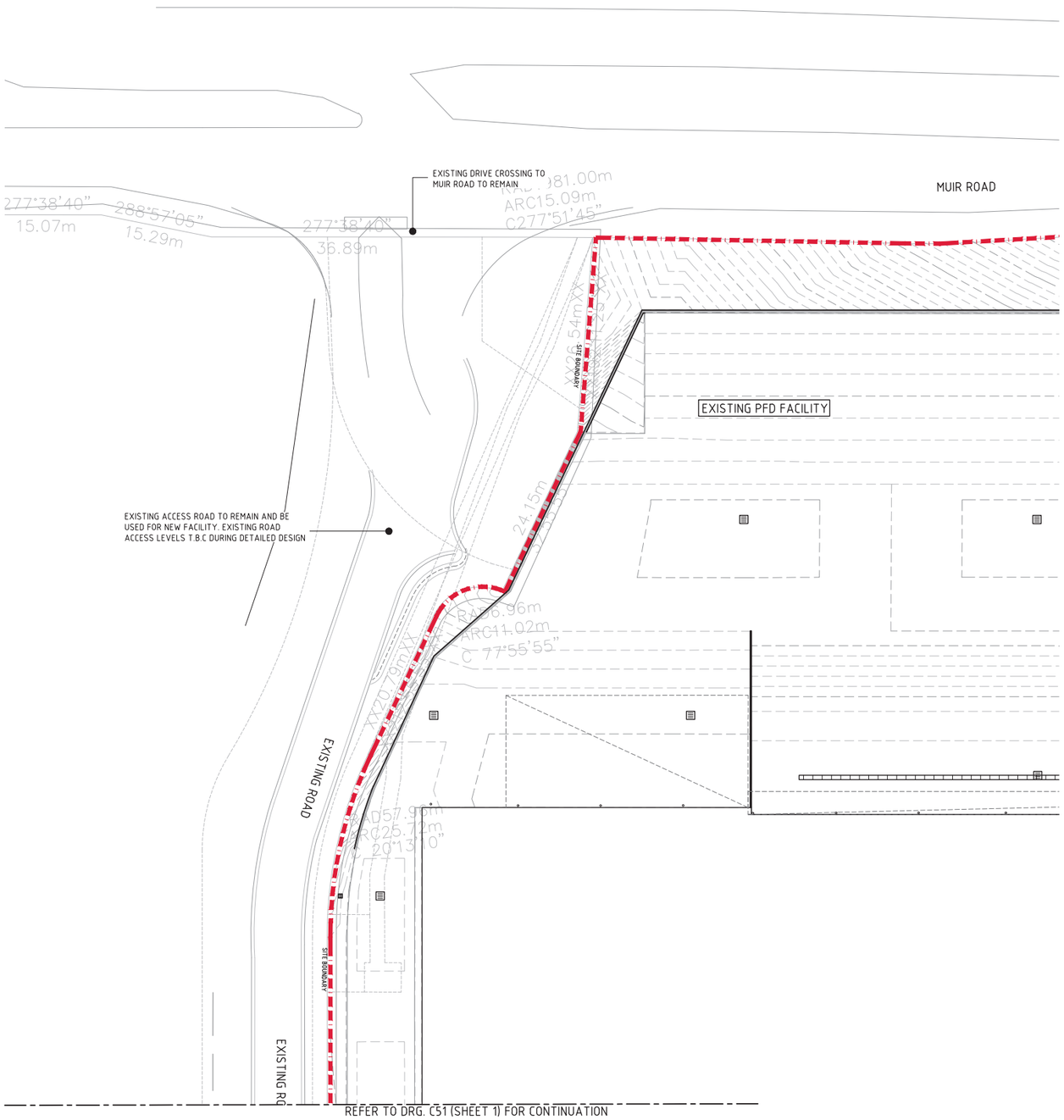
Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
FINISHED LEVELS PLAN
SHEET 2

DRAWING No C013058.03-DA52 ISSUE C



LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- S — EXISTING SEWER LINE
- 48.50 — FINISHED PAVEMENT SPOT HEIGHT (mAHD)
- 50.00 — FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 — FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS

FLOOD PLANNING NOTE:

WAREHOUSE FINISHED FLOOR LEVEL IS FLOOD PLANNING LEVEL OF THE 1 IN 100 YEAR ARI LEVEL (Q100=37.5m) + 500mm FREEBOARD. 1 IN 100 YEAR ARI FLOOD LEVELS BASED ON INFORMATION REPORT 13058.03-04.rpt BY COSTIN ROE CONSULTING

FINISHED LEVELS PLAN - SHEET 3

1:250 SCALE

2m 0 5 10 15 20 25m

SCALE 1:250 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA53

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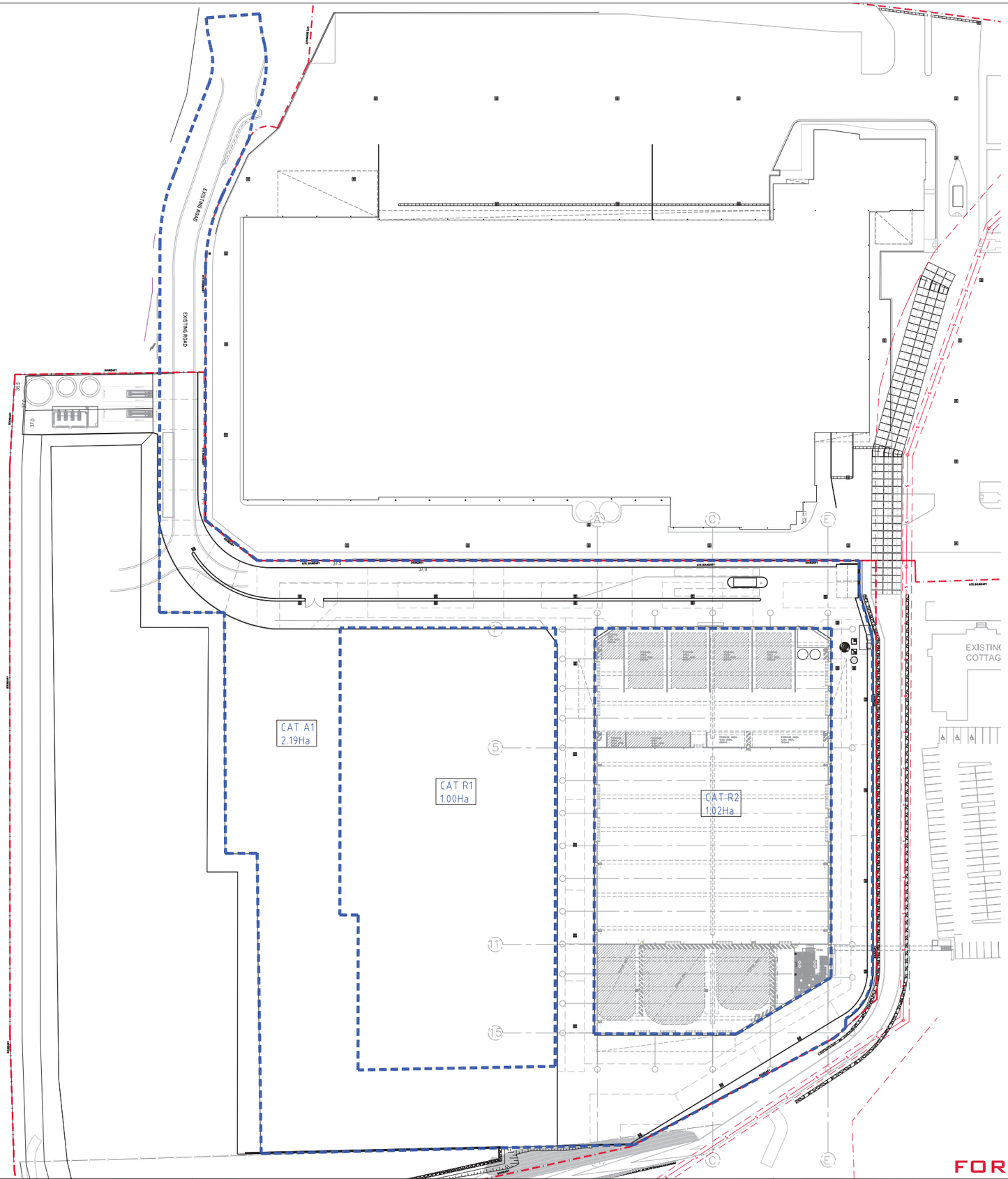
Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
FINISHED LEVELS PLAN
SHEET 3

DRAWING No C013058.03-DA53 ISSUE B



WATER QUALITY CATCHMENT PLAN
1:500 SCALE

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	03.08.20	C
ISSUED FOR DEVELOPMENT APPLICATION	28.05.20	B
ISSUED FOR INFORMATION	22.04.20	A

ARCHITECT

CLIENT suez

PROJECT
PROPOSED DEVELOPMENT
21 MUIR ROAD
CHULLORA NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	16.04.2020		A0	AS SHOWN	C013058.03-DA70

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DRAWING TITLE
WATER QUALITY CATCHMENT PLAN

DRAWING No C013058.03-DA70 ISSUE C

Appendix B

DRAFT

STORMWATER MAINTENANCE AND MONITORIING RECOMMENDATIONS

1 MAINTENANCE AND MONITORING

It is important that each component of the water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared (refer to **Table B.1** below).

Note that inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the maintenance requirements below it is also recommended that inspections are made following heavy rainfall or major storm events. Event heavy rain inspections should be carried out as soon as practicable following an intense period of rainfall, (i.e. greater than 100mm over 48 hours), as measured at Prospect Dam Weather Station No. 67019.

1.1 Types of Maintenance

Water Sensitive Urban Design (WSUD) assets require both proactive and reactive maintenance to ensure long term system health and performance.

Proactive maintenance refers to regular scheduled maintenance tasks, whereas reactive maintenance is required to address unscheduled maintenance issues. If an asset is not functioning as intended, then rectification may be required to restore the asset back to its intended functionality.

The preferred and recommended approach is for proactive maintenance.

1.1.1 Proactive Maintenance

Proactive maintenance is a set of scheduled tasks to ensure that the WSUD asset is operating as designed.

Proactive maintenance involves:

- Regular inspections of the WSUD asset;
- Scheduled maintenance tasks for issues that are known to require regular attention (e.g. litter removal, weed control); and
- Responsive maintenance tasks following inspections for issues which require irregular attention (e.g. sediment removal, mulching, and scour management).

Proactive maintenance in the first two years after the establishment period (construction and planting phases) are the most intensive and important to the long-term success of the treatment asset.

Proactive maintenance is a cost-effective means of reducing the long-term costs associated with operating stormwater treatment assets.

Maintenance activities specific to each WSUD asset type are detailed in the inspection and maintenance schedules and checklists provided in the report. The frequency of scheduled maintenance depends on the asset type and the issue being managed.

As a general guide, scheduled maintenance should be completed on a three to four-month cycle. The checklists provided should be used as a minimum guide to scheduled

maintenance tasks and should be amended to suit site conditions and maintenance requirements.

Treatment assets should also be inspected at least once a year during or immediately after a significant rainfall event. This is important to confirm that the treatment system is functioning correctly under wet conditions.

A higher level of scheduled maintenance may be arranged for some treatment assets. This is often the case for treatment assets which are located in high profile locations (e.g. streetscapes and parklands), and where public amenity is considered to be a high priority. In these cases, a more frequent maintenance regime may be required to remove litter and weeds and to ensure vegetation health and cover is maintained to a high level.

1.1.2 Reactive Maintenance

Reactive maintenance is undertaken when a problem or fault is identified that is beyond the scope of proactive maintenance. Reactive maintenance may occur following a complaint about the WSUD asset (e.g. excessive odours or litter). Reactive maintenance often requires a swift response and may involve specialist equipment or skills.

1.1.3 Rectification

Rectification of a WSUD asset is undertaken when the system is not functioning as intended, and proactive and reactive maintenance activities are unable to return the asset to functional condition.

The lack of functional performance and therefore failure of a stormwater treatment asset may be related to many factors including inappropriate design, poor construction, and lack of regular maintenance or end of life cycle. In many cases, the design of assets has not included adequate consideration of the maintenance requirements, in terms of the system's ability to cope with catchment pollutant loads (i.e. sediments) and the frequency of maintenance required to maintain the system at a functional level.

Maintenance planning at the design phase is therefore crucial to both the long-term operating costs and the expected life cycle of the treatment system. In general, the expected lifecycle of a stormwater treatment asset (e.g. a bio-retention system) that has been well designed and constructed and is regularly maintained should be at least 15-20 years.

However, the lifecycle for each treatment system will be different and related to:

- whether the system has been designed, constructed and maintained according to best practice;
- catchment characteristics (influences the quality of the stormwater);
- the age and general health of the system; and
- the type of plants that have been used in the system.

Regular asset condition assessments should be undertaken to monitor the system condition and to inform where an asset is in terms of its expected lifecycle. Renewal of a system refers to replacing the main elements of the system including:

- infrastructure;
- removing deposited sediment, removing and replacing the topsoil (or filter media in the case of a bio-retention system) and profiling the topsoil level back to the design levels;
- re-planting; and
- pavement and sub-layers (in the case of permeable pavements).

A WSUD specialist may be required to assess whether a treatment system has reached the end of its life cycle and to provide advice on the renewal works.

Asset condition assessments can also identify assets that need to be rectified. The decision to continue with an increased maintenance regime or to rectify an asset, and over what timeframe, can be a difficult one to make. This is because certain maintenance items are more important to overall system function than others. For example, extended ponding on the surface of a bio-retention system or persistent scouring of a swale should be addressed more rapidly than recurrent weed problems.

1.2 Routine Inspections and Maintenance Schedule for General Stormwater System

Routine inspections are to be carried out to assess the need for maintenance and are primarily concerned with checking the functionality of the stormwater drainage facilities; items such as drains, drainage pits, box culverts, detention tanks and rainwater reuse tank systems. Maintenance of these items is vitally important for the ongoing drainage and treatment of stormwater.

Should the inspection reveal that maintenance of any item is required, this is to be reported to the building management for action.

Items that are to be subject to Routine Inspections for Maintenance may comprise, but not be limited to those listed in the table below. This table is to be read in conjunction with the Stormwater design drawings.

It is vitally important that each component of the stormwater system is properly operated and maintained. In order to achieve the modelled and design treatment outcomes, a maintenance schedule has been prepared (below) to assist in the effective operation and maintenance of the various drainage and water quality components.

Table B.1. Indicative Maintenance Schedule

MAINTENANCE ACTION	FREQUENCY RANGE	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Between six months and one year	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Between six months and one year	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three to six Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Between six months and one year	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
RAINWATER TANK			
Check for any clogging and blockage of the first flush device	3 Monthly/ After Major Storm	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet - leaf/litter screen	Between six months and one year	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable

MAINTENANCE ACTION	FREQUENCY RANGE	RESPONSIBILITY	PROCEDURE
			depth as specified by the hydraulic consultant
INLET & JUNCTION PITS			
Inside Pit	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of Pit	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.
WATER QUALITY DEVICE ROCLA CDS GPT			
Refer to manufacturer operation and maintenance manual.	Refer to manufacturer operation and maintenance manual.	Maintenance Contractor	Refer to manufacturer operation and maintenance manual.

Appendix C

DRAFT

SOIL AND WATER MANAGEMENT PLAN DURING CONSTRUCTION

1 EROSION & SEDIMENT CONTROLS

An erosion and sediment control plan (ESCP) is shown on drawing **Co13058.03-DA20** with details on **DA25**. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

1.1 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in Managing Urban Stormwater, Soils and Construction (1998) and Bankstown City Council specifications.
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

1.2 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in **Table C.1**.

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

Table C.1 Limitations to access

1.3 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.
3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas
7. Earth batters during temporary works shall be constructed in accordance with the Geotechnical Engineers Report (Refer PSM Report) or as general requirement, a gradient as practical but not steeper than:
    - 2H:1V where slope length is less than 7 meters
    - 2.5H:1V where slope length is between 7 and 10 meters
    - 3H:1V where slope length is between 10 and 12 meters
    - 4H:1V where slope length is between 12 and 18 meters
    - 5H:1V where slope length is between 18 and 27 meters
    - 6H:1V where slope length is greater than 27 meters
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

1.4 Pollution Control Conditions

1. Stockpiles will not be located within 5 meters of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways. Silt/ sediment fences and appropriate stabilisation of stockpiles are to be provided as detailed on the drawings.

2. Sediment fences will:
   a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
   b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and
   c) Provide a return of 1 meter upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20 year t_c discharge.
3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

1.5 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

1.6 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:
   - At least weekly.
   - Immediately before site closure.
   - Immediately following rainfall events in excess of 5mm in any 24 hour period.

The self audit will include:

- Recording the condition of every sediment control device
- Recording maintenance requirements (if any) for each sediment control device
- Recording the volumes of sediment removed from sediment retention systems, where applicable
- Recording the site where sediment is disposed

- Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information

2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall complete a short monthly written report with records kept on site as part of the contractor Quality Assurance Documentation. The responsible person will ensure that:

   - The plan is being implemented correctly
   - Repairs are undertaken as required
   - Essential modifications are made to the plan if and when necessary

The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,

   - No low points exist that can overtop in a large storm event
   - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams of installing additional diversion upslope.
   - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).

5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:

   a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them

   b) Degradable products to ensure they are replaced as required, and

   c) Sediment removal, to ensure the design capacity or less remains in the settling zone.

9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.

10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e. make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.
11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

Appendix D

RAINWATER TANK ASSESSMENT

RAINWATER RE-USE WATER BALANCE CALCULATION

Project No: 13058.02 SUEZ MRF Date:

DATA		**WATER DEMAND**		
A - The efficiency of collection (%)	0.9	Internal Water Demand		
B - The loss associated with absorption (mm)	2	Water demand per person (litres)	25	
Total Roof Catchment Areas	10000	No. of people	45	
% Roof Catchment Area	25	**Monthly People Demand**	**33.75**	kL
Modelled Roof Catchment Area (sq.m)	2500	=	**1.125**	**kL/day (MUSIC in**
		External Water Demand		
Min tank size =	5.625 kL	Landscaping Area	500	m2
Sydney Water Approx Size	(5kL/ 100sqm roof)	Application Rate	10	l/m2
	62.5 kL	**Volume/ Application**	**5**	kL/application
Modelled Tank Size (litres)	50 kL		**510**	**kL/year (MUSIC**
Demand Reduction	50 %			

				Consumption				
	MONTH	**RAINFALL**	**Collected Run-off**	Internal	External		Total	**Volume Remaining (Vt)**
					No. Apps			33
	January	100	220.5	33.75	12	60	46.875	50
	February	114	252	33.75	12	60	46.875	50
	March	102	225	33.75	10	50	41.875	50
	April	73	159.75	33.75	9	45	39.375	50
	May	71	155.25	33.75	8	40	36.875	50
	June	78	171	33.75	4	20	26.875	50
	July	43	92.25	33.75	4	20	26.875	50
	August	55	119.25	33.75	4	20	26.875	50
	September	46	99	33.75	8	40	36.875	50
	October	72	157.5	33.75	9	45	39.375	50
	November	82	180	33.75	10	50	41.875	50
	December	70	153	33.75	12	60	46.875	50
	Annual	**906**						

Initial Volume
OK
OK
OK
OK
OK
OK
OK
OK
OK
OK
OK
OK