Appendix G

Surface Water Management

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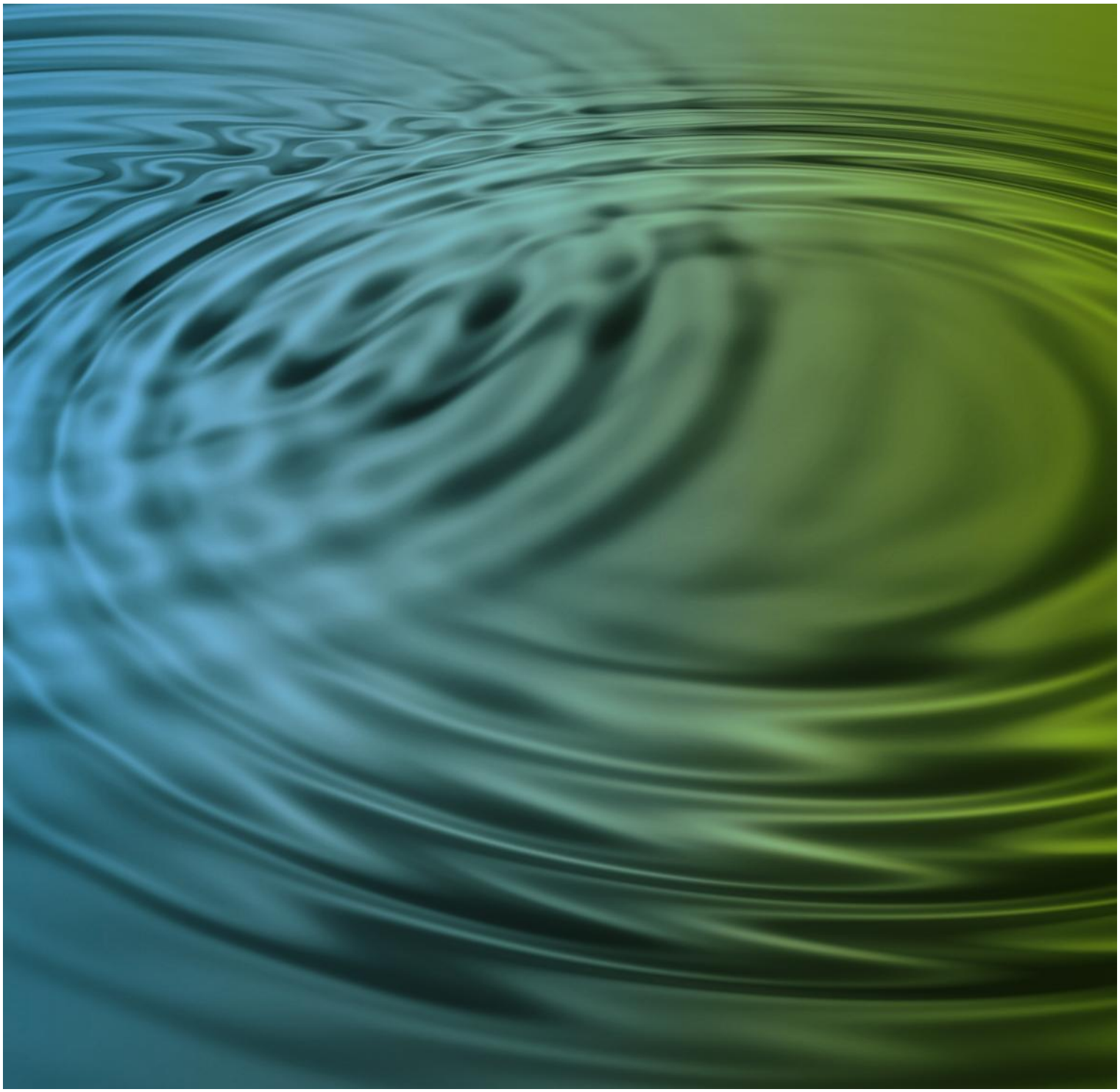
National Ceramics Industries Australia

26 February 2010

Expansion of Ceramic Tile Manufacturing Facility, Rutherford

Surface Water Management



Expansion of Ceramic Tile Manufacturing Facility, Rutherford

Surface Water Management

Prepared for

National Ceramics Industries Australia

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Executive Summary

National Ceramics Industry Australia (NCIA), a ceramic tile manufacturing facility located off Racecourse Road in Rutherford NSW is proposing an expansion of the existing facility. Currently the facility has approval for four production lines which would have the capacity to produce approximately 12.8 million square metres of ceramic wall and floor tiles per annum. The proposed expansion would see an additional four production lines constructed increasing the turnover to a maximum of approximately 25.6 million square metres of tiles per annum.

AECOM was engaged by NCIA to prepare the Environmental Assessment Report for the project, for an application to the Department of Planning under Part 3A of the *Environmental Planning and Assessment Act 1979*.

As part of the report AECOM has prepared a Surface Water Assessment of the site that includes the proposed expansion of the tile facility. This report outlines the assessment carried out and determines appropriate development controls and standards for the proposal. It also provides mitigation measures to reduce or avoid any negative impacts on surface water, such as increased stormwater runoff and transport of sediment, on the site.

Water management for the site was assessed in relation to stormwater and process water issues. With the proposed expansion, the development would increase the amount of impervious area on the site and hence increase the volume and peak flows of stormwater runoff. A conceptual stormwater management strategy has been designed to retard the peak flows from the developed site to match existing levels and to achieve adequate treatment before stormwater is discharged from the site. To achieve the required results, conceptual mitigation measures have been recommended for the proposed expansion in the form of additional wet detention basins, grass swales and rainwater storage tanks.

1.0 Introduction

1.1 Project Background

The NCIA facility at Rutherford, New South Wales, produces high quality ceramic wall and floor tiles utilising a number of raw products including clay, white granite, rhyolite and glazes.

The manufacturing process involves grinding and mixing of predominantly clay and feldspar, followed by a process of drying the mixture, adding dry glaze, roller pressing, additional dry glazing and decorating, additional pressing, cutting to size and firing in a kiln prior to packaging and dispatch.

NCIA has an existing development consent for four production lines (known as Stages One to Four) that allows production of up to 12.8 million square meters (m^2) of tiles per annum. NCIA propose to extend their current facility located at Rutherford, NSW. The expansion proposal is seeking approval to operate an additional four production lines (known as Stages Five to Eight). Approval to operate Stages Five to Eight would increase the maximum annual production to approximately 25.6 million m^2 of tiles.

The proposal includes:

- Construction of a second factory building adjacent to the current building to accommodate the proposed four additional production lines (Stages Five to Eight); and
- Development of associated infrastructure and services.

1.2 Objectives

AECOM was engaged by NCIA to prepare the Environmental Assessment Report for the project, for an application to the Department of Planning under Part 3A of the *Environmental Planning and Assessment Act 1979*.

This Surface Water Assessment has been prepared to form part of the Environmental Assessment Report and in response the Director-Generals Requirements issued by the Department of Planning.

The purpose of this stormwater assessment is to:

- Identify the current onsite water management system;
- Identify downstream receiving waterways;
- Determine the appropriate development controls and standards relating to water management for the proposal;
- Investigate the impacts of the proposed expansion; and
- Provide conceptual mitigation measures to reduce or avoid any negative impacts on stormwater in terms of volume and flows off-site.

2.0 Background Information

2.1 Previous Investigations

2.1.1 NCIA Environmental Impact Statement 2002

The existing NCIA facility was subject to an Environmental Impact Statement (EIS) prepared by Parsons Brinkerhoff (PB) in 2002, prior to approval and construction of the site. The EIS included a detailed assessment of water management and impacts titled *Proposed Ceramic Tile Manufacturing Facility, Technical Paper No. 4 Water Management* (PB, 2002b).

Data presented in the Technical Paper No. 4 (PB, 2002b) was used to replicate an XP-RAFTs model of the pre-developed and existing site as further discussed in **Section 3.2**.

2.1.2 Heritage Green Flood Investigation and Stormwater Management Plan 2008

This report was prepared by GHD in support of a development application to Maitland City Council for a residential redevelopment by the McCloy Group of the Heritage Green golf course adjacent to the existing NCIA facility. The development application includes the provision of up to 450 residential allotments and internal road network.

The scope of the GHD (2008) report included the following:

- A flood assessment of the local waterways within the Heritage Green site, which includes Stony Creek and a smaller unnamed tributary; and
- A conceptual stormwater management plan for the Heritage Green development.

The NCIA facility drains through the Heritage Green site to Stony Creek. The GHD report was reviewed to identify potential flooding issues related to the NCIA development as discussed in **Section 3.2.3**.

2.2 Existing Approvals and Licences

2.2.1 Development Consent

The existing development consent for the facility was issued by the Minister for Planning in 2003 (File Ref S02/01183). The conditions of this consent that apply to the existing facility relating to water quality and site drainage are provided in **Table 1**.

Table 1 Conditions of Consent

No.	Condition
	Water Quality Impacts
4.19	Except as may expressly provided by a licence under the *Protection of the Environment Operations Act 1997* in relation to the ceramic tile manufacturing facility, section 120 of that Act (pollution of waters) shall be complied with, in, and in connection with, the ceramic tile manufacturing facility
	Site Drainage and Stormwater
4.23	The construction and operation of the ceramic tile manufacturing facility shall not concentrate or lead to an increase in the rate of flow of stormwater discharged from the site over and above the pre-development flow conditions
4.24	The applicant shall design, construct, operate and maintain all stormwater infrastructure to direct all stormwater runoff to the site's stormwater detention basins. Such stormwater infrastructure shall be capable of handling all stormwater discharges up to and including a 1 in 100 year ARI storm event. *Note: This condition acknowledges that existing stormwater runoff from the site drains to the golf course and that the development is unlikely to affect the rate of flow of the point of discharge at that location, and therefore, no easement is required to legally drain the water.*
7.4	As part of the Operational Environmental Management Plan (OEMP) for the ceramic tile manufacturing facility, required under condition 7.3 of this consent, the applicant shall prepare and implement the following Management Plans:
7.4 (b)	A **Water Management Plan** to outline measures to control and manage surface water (including erosion and sedimentation), stormwater and process water associated with the operation of the ceramic tile manufacturing facility. The Plan shall be consistent with that outlined in the EIS and shall address the requirements of the EPA and Council, should there be any. The plan shall include, but not necessarily be limited to : ***Surface water, erosion and sedimentation management*** Measures to be implemented to minimise the potential for erosion from the site during the operation of the ceramic tile manufacturing facility and measures to maintain all erosion mitigating works at, or above design capacity; Demonstration that erosion and sedimentation control measures will conform with, or exceed, the relevant requirements and guidelines provided in DLWC's publication *Urban Erosion and Sedimentation Handbook*, the EPA's publication *Pollution Control Manual for Urban Stormwater*, and the Department of Housing's publication *Soil and Water Management for Urban Development*; and Measures to rehabilitate erosion-affected areas and areas the subject of excavation, including tree, shrub, and/or cover crop species and implementation. ***Stormwater management*** Details to the stormwater management infrastructure to be installed; Demonstration that the stormwater control infrastructure will conform with, or exceed all relevant requirements and guidelines contained within the stormwater management plan for the catchment, should one exist, or with the EPA's publication *Managing Urban Stormwater: Council Handbook* should a stormwater management plan for the catchment not exist; Description of the procedures for the installation and maintenance of the stormwater control infrastructure, including stormwater pollution control devices. ***Process water management*** Details of how site water consumption will be minimised through water reuse and recycling; Details of all process water treatment systems for the ceramic tile manufacturing facility, including discharge points, procedures for maintenance of the systems and water quality monitoring regimes, where relevant; and A program to monitor consumption of water at the site
7.4 (c)	An **Alternate Water Supply Strategy** with an aim to investigate and pursue options for the use of alternative sources of water, such as treated effluent from sewage treatment plants, as an alternative to the use of potable water to supply the facility.

2.3 Assessment Requirements

2.3.1 Director-General s Requirements

The Director-Generals Requirements for the environmental assessment were issued by the Department of Planning following the submission of the Environmental Assessment Scoping Report (ENSR AECOM, December 2008). The DGRs relating to soils and water are as follows:

> ***Soils and Water*** *– including the proposed erosion and sediment controls (during construction); water quality management; the proposed stormwater management system; water supply including consideration of the potential for rainwater harvesting / recycling; and wastewater disposal.*

2.3.2 Relevant Policies and Guidelines

The DGRs also requires the consideration of the following documents and guidelines:

- Guidelines for Water Savings Action Plans (DEUS);
- National Water Quality Management Strategy: Water quality management – an outline of the policies (ANZECC / ARMCANZ);
- National Water Quality Management Strategy: Implementation guidelines (ANZECC / ARMCANZ);
- National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC / ARMCANZ);
- Using the ANZECC Guideline and Water Quality Objectives in NSW (DECCW);
- State Water Management Outcomes Plan;
- NSW Government Water Quality and River Flow Environmental Objectives (DECCW);
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW);
- Managing Urban Stormwater: Soils and Construction (Landcom);
- Managing Urban Stormwater: Treatment Techniques (DECC); and
- Managing Urban Stormwater: Source Control (DECC).

Relevant aspects of the above guidelines to the proposed development are discussed below.

Guidelines for Water Savings Action Plans

The proposal lies outside the Sydney Water Corporation's area of operation and as such is not a designated water user. As such, the facility is not required by legislation to draft a Water Savings Action Plan under the *Energy and Utilities Administration Act 1987*.

National Water Quality Management Strategy: Water quality management – an outline of the policies

The National Water Quality Management Strategy (NWQMS) is part of a national program for ecologically sustainable development and aims to deliver a nationally consistent approach to water quality management.

This document (ANZECC / ARMCANZ, April 1994) outlines the objectives and policy framework of the overall strategy.

National Water Quality Management Strategy: Implementation guidelines and **National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting**

The aim of this document is to assist government agencies and the community to prepare and implement plans to manage the nation's water resources. The process under the strategy requires the establishment of state, regional and local water quality objectives. This process is largely complete for NSW and the local Stony Creek catchment is defined under the NSW Water Quality and River Flow Objectives (DECCW) as a waterway affected by urban development.

The water quality and river flow objectives for such waterways within the Hunter River catchment include:

- Water quality:
  - Protection of aquatic ecosystems
  - Visual amenity
  - Secondary contact recreation (medium-term objective, 5 – 10 years)
  - Primary contact recreation (longer term objective, >10 years)
- River Flow:
  - Maintain wetland and floodplain inundation
  - Mimic natural during in temporary waterways and wetlands
  - Maintain natural flow variability
  - Maintain natural rates of change in water levels
  - Minimise the effect of weirs and other structures

The NSW Water Quality Objectives are the environmental values and long-term goals for consideration when assessing and managing the impact of activities on waterways. They are not intended to be applied directly as regulatory criteria, limits or conditions (DECC June 2006).

Managing Urban Stormwater Series

This series has been developed to assist government agencies and developers improve stormwater management practices. A summary of the scope of each document and how it has been considered as part of this assessment is as follows:

- Managing Urban Stormwater: Soils and Construction (Landcom)
  - Describes techniques for soil and water management of construction activities
  - Discussion of this document and relevant management techniques to be implemented during construction of the new site facilities is provided in **Section 5.2**.
- Managing Urban Stormwater: Treatment Techniques (DECC)
  - Describes non-proprietary stormwater treatment techniques
  - Treatment techniques exist as part of the current site stormwater management framework and will be extended to address stormwater from the expanded site facility
- Managing Urban Stormwater: Source Control (DECC)
  - Describes techniques for managing stormwater quality near the source
  - Treatment techniques exist as part of the current site stormwater management framework and will be extended to address stormwater from the expanded site facility

The mitigation measures developed in this report have been prepared in consideration of the above documents.

3.0 Project Description

3.1 Site Context

The NCIA facility is located within an existing industrial estate at Rutherford (refer to **Figure 1**), which lies within the Maitland local government area (LGA) The site is accessed off Racecourse Road and is adjacent to other industrial developments to the north and west, with an existing golf course ("Heritage Green") to the south and east.

The site lies within the Stony Creek catchment which has a catchment area of 1500 hectares upstream of the Main Northern Railway.

Stony Creek passes to the south of the NCIA site through the Heritage Green golf course in an easterly direction. To the east of the NCIA site, a small tributary of Stony Creek travels north-south before joining Stony Creek and then passing to the southwest beneath the Main Northern Railway into Wentworth Swamp. Wentworth Swamp drains via Fishery Creek into Wallis Creek and subsequently to the Hunter River downstream of Maitland.

Upstream of the golf course, Stony Creek catchment drains rural land to the west and a proportion of the Rutherford industrial estate. The smaller unnamed tributary drains the remainder of the industrial estate as well as residential areas of Aberglasslyn and Rutherford and a proposed industrial estate north of the New England Highway. These watercourses travel through a number of dams as they pass through the golf course.

The allotment on which the NCIA facility is located has an area of 16.8 hectares (ha). The site is relatively flat with an average grade of 1%. The site falls towards the south east corner, at which point stormwater is discharged off-site through Heritage Green to Stony Creek. There is also an existing drain that runs from Rutherford Road, adjacent to and parallel with the western site boundary, to the south west corner of the site. The drain then continues south within a drainage easement to Stony Creek.

The existing facility (including roof areas, hardstand and landscaping) has an approximate footprint of 10.8 hectares, with the remainder of the site consisting of grassland. The existing site building houses the approved production lines. The site driveways and hardstand areas are located on the western side of the existing building.

The existing site water management system was designed to minimise the impact of the existing development on the flow regime from the site and improving the quality of water prior to discharge.

3.2 Proposed Development

A detailed project description of the development is contained with the Environmental Assessment prepared by AECOM, to which this report is an appendix. Key features of the proposal include:

- Construction of a new factory building to the east of the existing development;
- Construction of additional driveways and hardstand areas for the movement of delivery trucks, forklifts, fire fighting access etc; and
- Alteration of the existing site drainage and site levels.

A layout of the proposed facility is provided in **Figure 2**.

ENSR | AECOM

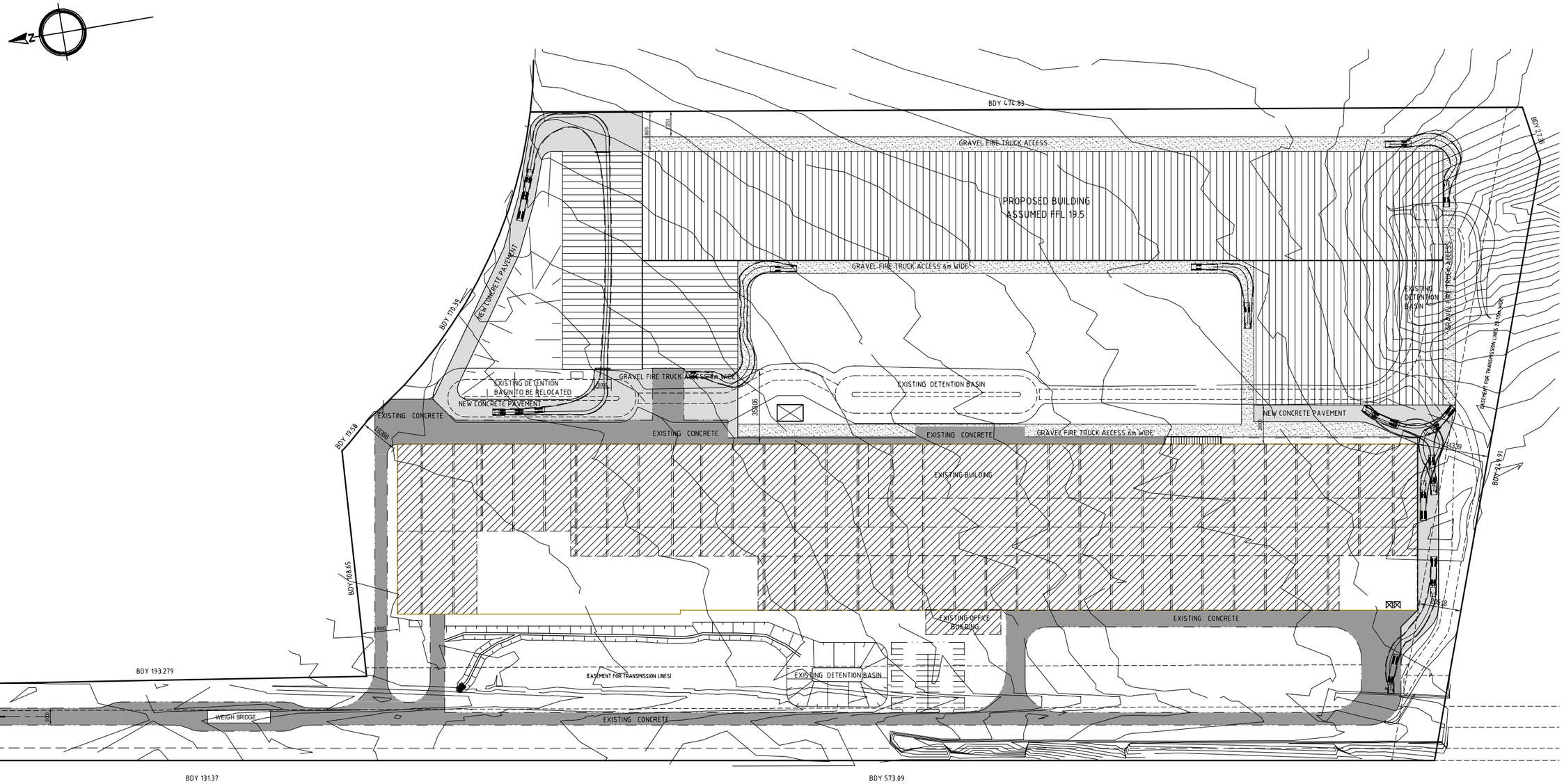
Figure 1 | **Site Location**

National Ceramic Industries Australia

Expansion of Ceramic Tile Manufacturing Facility

Rutherford

AECOM



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PROPOSED DEVELOPMENT LA OUT
NCIA TILE PLANT
175 RACECOURSE ROAD, RUTHERFORD

Figure 2

4.0 Hydrology

4.1 Existing Environment

4.1.1 Flooding

Studies investigating flood impacts of proposed urban development on the adjoining golf course by GHD (2008) indicate that flooding of the area is relatively confined to the local watercourses. The NCIA site is elevated above these creeks and tributaries and as such is not affected by 1 in 100 year flooding from local watercourses. The site is also not affected by regional flooding (PB 2002b).

However, land downstream, such as adjacent to Stony Creek, Wentworth Swamp and Hunter River, is subject to varying degrees of flooding.

4.1.2 Stormwater Management

Of the existing development area, approximately 5.8 ha is impervious. As part of the initial proposal, a stormwater management strategy was developed to minimise the impacts on flow regime from the site (PB, 2002b). This strategy consists of four wet detention basins connected by grass swales to reduce peak stormwater flows and improve water quality.

The stormwater management system on site has been designed to mimic the pre-development peak runoff characteristics of the existing site footprint (10.8ha). The pre-developed state therefore provides a baseline which the new development will also need to maintain.

An XP-RAFTS model was created to estimate stormwater runoff from the site prior to any development. Parameters for the model matched those used by PB (2002b) and the overall catchment areas were expanded to encompass the entire property. A summary of these parameters is provided in **Appendix A**. A pre-development catchment map is shown in **Figure 3**. The layout of the existing site water management system is shown in **Figure 4**.

Pre-development stormwater runoff estimated using XP-RAFTs for the 1 in 1 year, 10 year, and 100 year design storm events are summarise in **Table 2**, including a comparison to the PB results (2002b).

Table 2 Comparison of P-RAFTs results – pre-development flows

Study	1 in 1 year ARI		1 in 10 year ARI		1 in 100 year ARI	
	Peak Q (m^3/s)	Duration	Peak Q (m^3/s)	Duration	Peak Q (m^3/s)	Duration
Channel						
PB (2002b)	0.33	9hr	0.8	2hr	1.42	2hr
AECOM	0.295	9hr	0.741	2hr	1.322	2hr
Gully						
PB (2002b)	0.07	2hr	0.19	2hr	0.32	2hr
AECOM	0.068	1.5hr	0.188	1.5hr	0.296	1.5hr

Note: All results presented above are based on a 10.8ha catchment area.

Small differences in the results shown in **Table 2** are noted, despite the majority of input parameters being the same as those previously reported (PB 2002b). Potential reasons for differences in the results include differing rainfall input data (intensity-frequency-duration (IFD) information) which was not reported by PB and possible changes to the software routine. AECOM obtained IFD data from the Bureau of Meteorology website using the exact site coordinates. Furthermore, the differences were minor and therefore it is concluded that the XP-RAFTs model is consistent with the previous assessment by PB (2002b).

The catchment areas within XP-RAFTs were then expanded to encompass the full property size of 16.8 ha. The model was then used to determine the pre-development site discharge characteristics for the entire property. These results are presented in **Table 3**.

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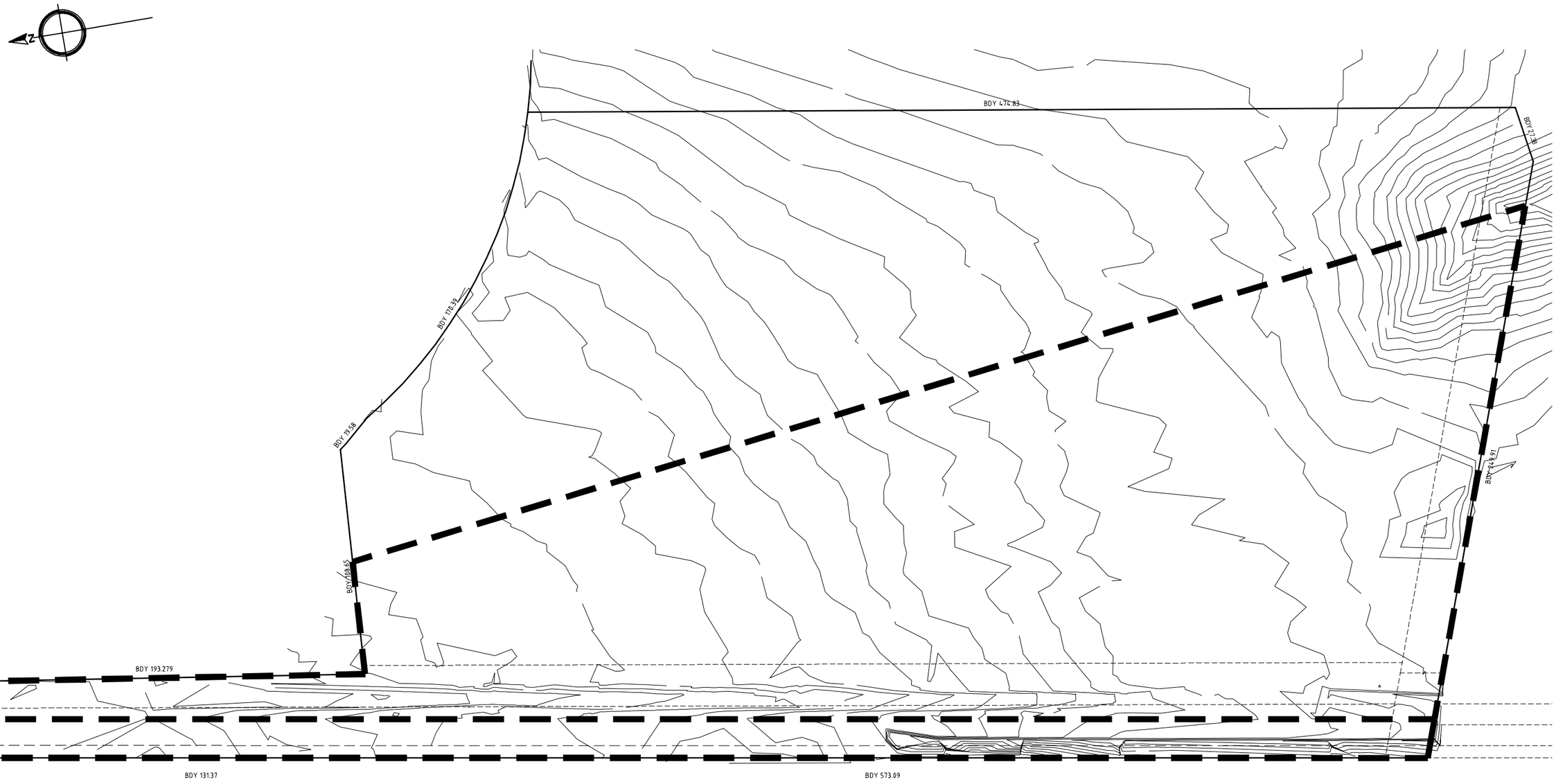

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PRE-DEVELOPED CATCHMENT MAP
NCIA TILE PLANT
175 RACECOURSE ROAD, RUTHERFORD

Figure 3

Figure 4 Existing stormwater management system

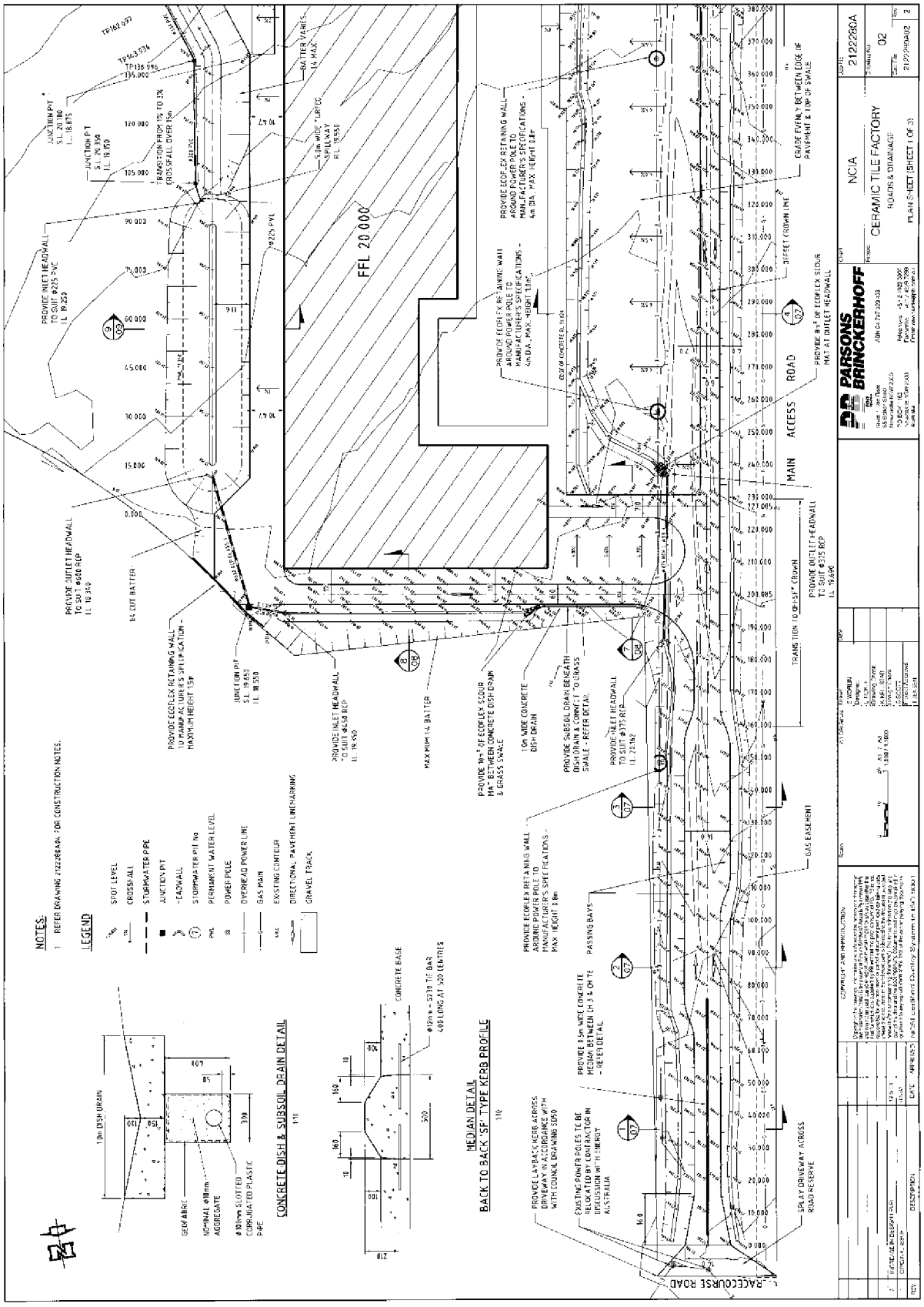

Figure 4b Existing stormwater management system (cont)

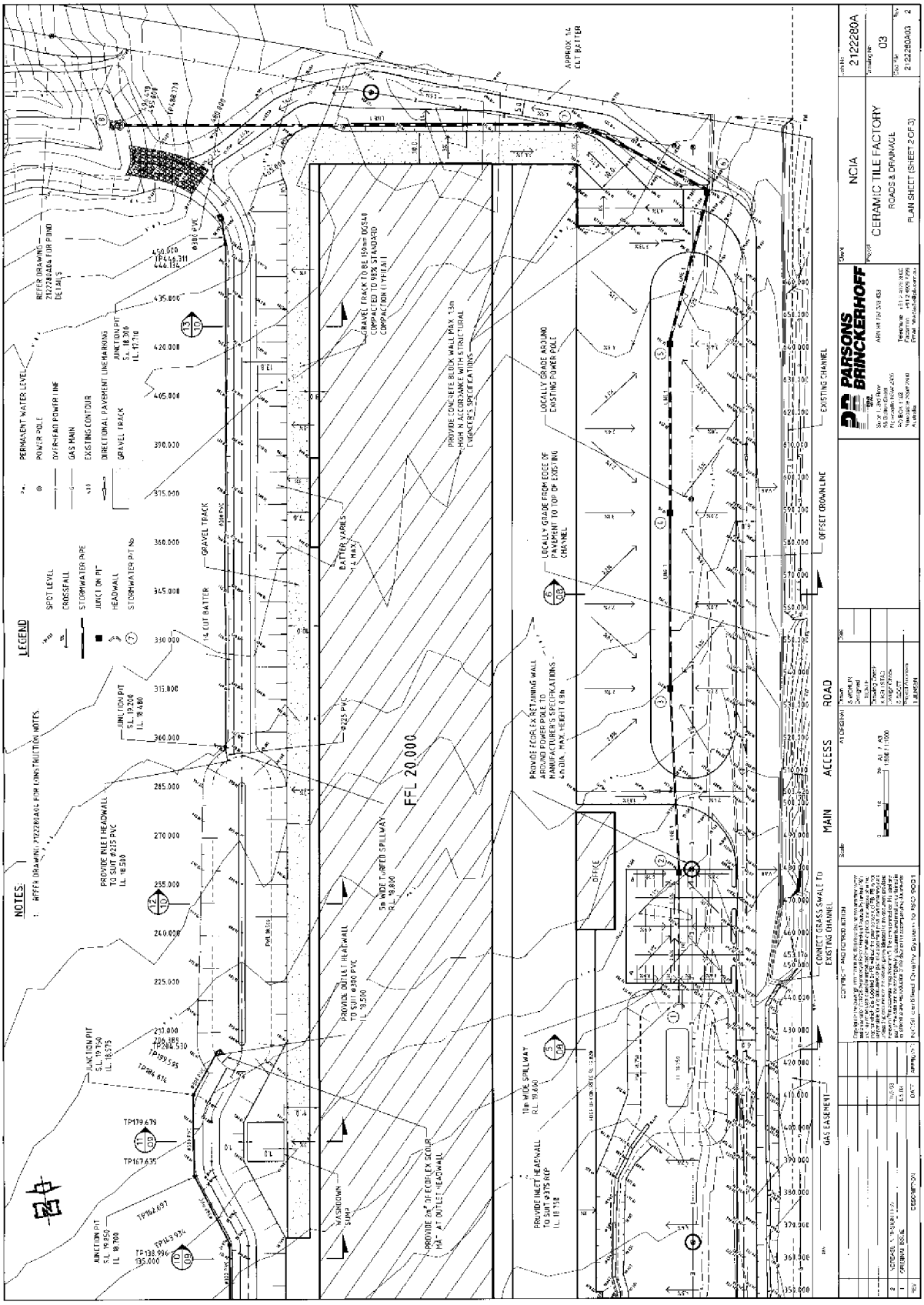

Figure 4c Existing stormwater management system (cont)

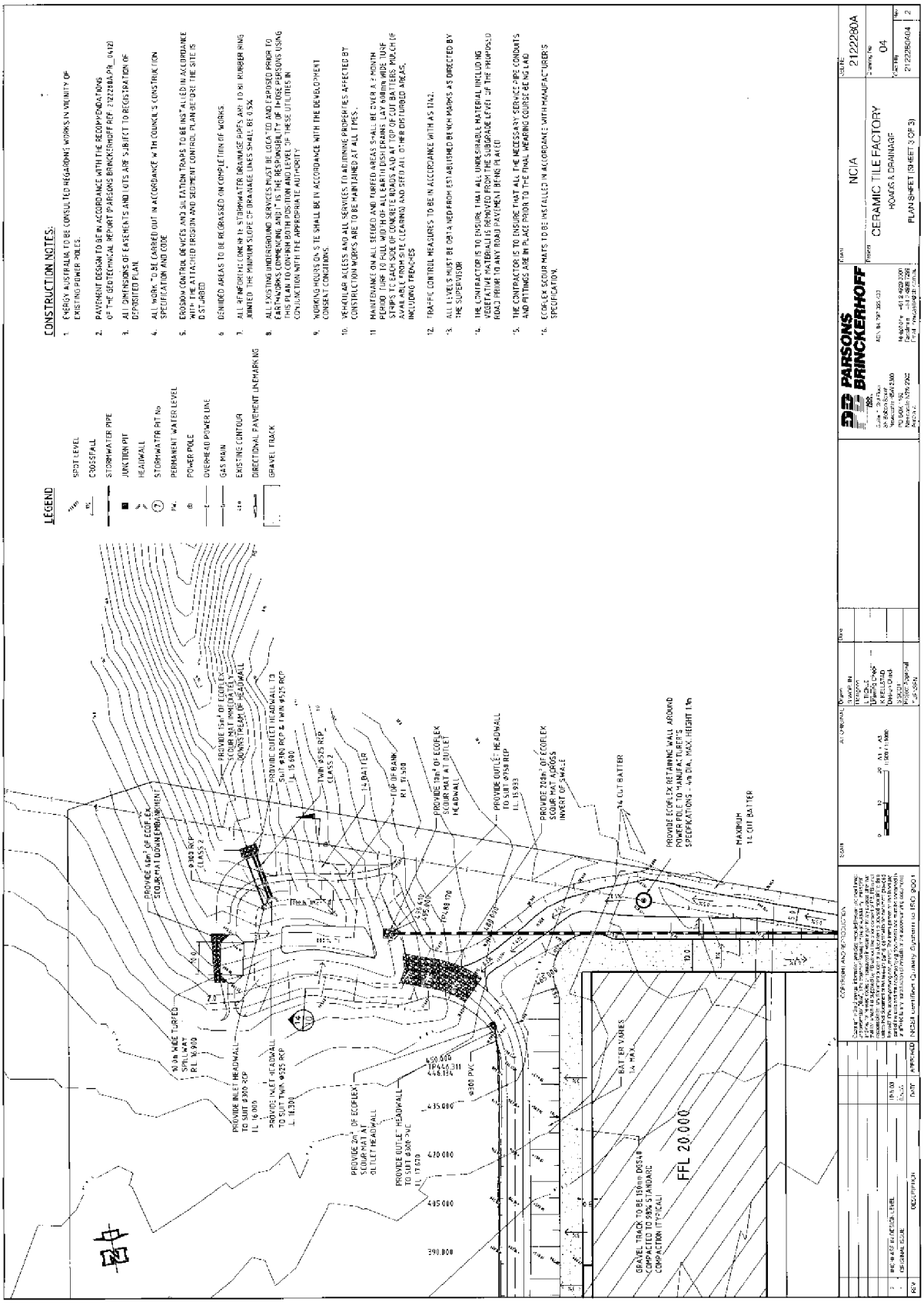

Table 3 Pre-development Site Peak Discharge

Location	1 in 1 year ARI		1 in 10 year ARI		1 in 100 year ARI	
	Peak Q (m^3/s)	Duration	Peak Q (m^3/s)	Duration	Peak Q (m^3/s)	Duration
Gully	0.068	1.5hr	0.188	1.5hr	0.296	1.5hr
Channel	0.462	9hr	1.145	6hr	1.989	2hr
Total Site	0.514	9hr	1.255	6hr	2.205	2hr

The existing stormwater management system aims to mitigate the impact of the site impervious areas on peak site discharge and provide stormwater quality improvement prior to discharge. Water from the existing building, hardstand and landscape areas is directed to a series of four wet detention basins which are connected by grass swales to convey overland flows. The majority of stormwater on site is conveyed overland as there is no guttering on the building or kerb and gutter on the roadways and car parks.

The wet detention basins consist of a permanent storage zone to assist with the improvement of water quality through settling of potential pollutants and a detention zone to attenuate the peak site discharges. Discharge from each basin is via an outlet pipe at the permanent water level, or a spillway for larger flows. The grass swales also provide pollutant removal.

It is understood that discharge from the site is currently conveyed in underground stormwater pipes beneath two golf fairways and connected directly to an existing artificial wetland within the adjacent golf course. However, it appears that no drainage easement currently exists for discharge from this point.

4.2 Impacts

The XP-RAFTS model was used to simulate the impact of the proposed expansion on stormwater runoff from the site. Key changes to the site that were modelled in XP-RAFTS to simulate the proposed development (with no mitigation measures) included:

- Alteration of site sub-catchments to include impervious areas and changes in flow paths/connections; and
- Removal of two existing wet detention basins.

The XP-RAFTS model of the proposed development is shown in **Figure 5**.

The expansion of the site facilities will result in the alteration of the remaining undeveloped areas of the site, and in particular will involve the introduction of large impervious areas. Therefore, it is expected that the development would result in a potential increase in stormwater runoff generated from the site and a corresponding reduction in soil infiltration and evapo-transpiration. These impacts have the potential to impact on downstream property and waterways by increasing inundation and total velocity and discharge. The hydrological changes can also result in an increased frequency of runoff which can impact on the hydrological regime and function of wetlands and waterways.

A concept stormwater management strategy has been developed to address these impacts as described in **Section 4.3**.

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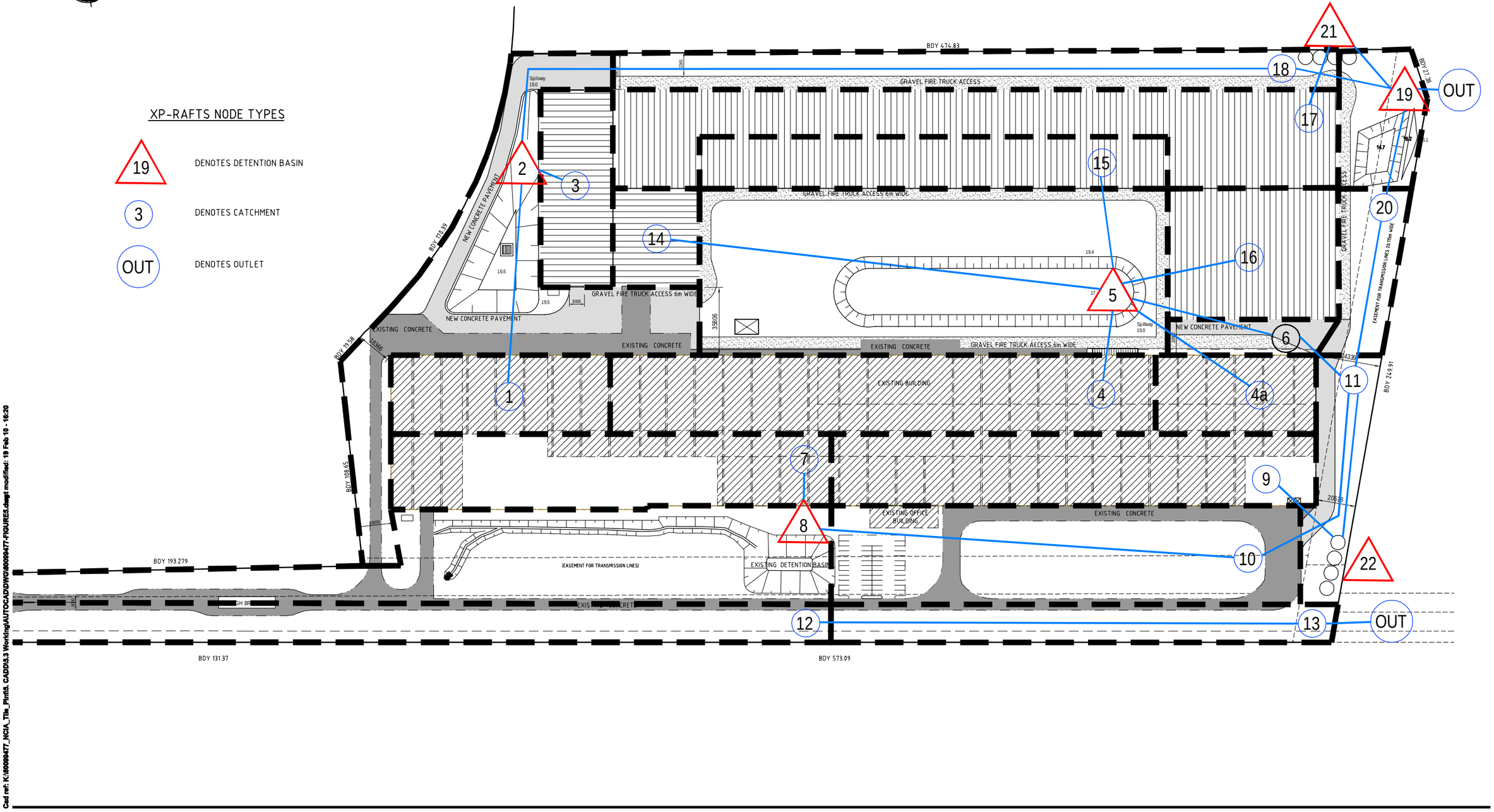
XP-RAFTS NODE TYPES

19 DENOTES DETENTION BASIN

3 DENOTES CATCHMENT

OUT DENOTES OUTLET



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P-RAFTS MODEL LA OUT
NCIA TILE PLANT
175 RACECOURSE ROAD, RUTHERFORD
Figure 5

4.3 Mitigation Measures

4.3.1 Concept Stormwater Management System

The existing site stormwater management system will require alteration to allow for the increased stormwater as a result of the expansion. Two of the four existing wet detention basins will be directly impacted by the proposed layout and will need to be removed.

Therefore the new site mitigation measures have been developed to:

- Compensate for the loss of detention provided for the existing facility; and
- Minimise the changes to the flow regime from the site as a result of the proposed site expansion.

Constraints to be considered in developing the stormwater design for the site include:

- Site is relatively flat with longitudinal grades of 1%. As a result provision of an underground pipe network stormwater system is constrained by minimum grades and associated potential issues with sedimentation and blockage.
- Use of infiltration devices on-site is not feasible due to the presence of clay soils.
- The construction of the additional facility considerably constrains the area available for the provision of wet detention basins.

In response to these constraints, the concept stormwater management strategy aims (to the extent possible) to employ similar methodology to the existing site development, namely:

- Use of wet detention basins with the dual function of reducing peak stormwater flows and improving water quality;
- Use of grass swales to collect runoff from beside roadways and to provide connection between the wet detention basins to reduce runoff velocities, provide some infiltration of water, and for water quality improvement.

In addition to the above, large underground rainwater tanks are proposed to provide additional stormwater detention. These tanks are required due to the lack of available room for a large wet detention basin at the downstream extent of the site, and also provide the additional benefit of allowing for onsite stormwater harvesting and reuse.

Wet Detention Basins

Three additional wet detention basins are proposed throughout the site to replace the two existing basins being removed and to provide additional detention storage for the additional stormwater generated by the proposal. The basins include a permanent water storage zone for water quality improvement (refer to **Section 5.3.2**) above which detention storage is provided.

Rainwater Tanks

Roof water from limited roof catchment areas will be collected in guttering and directed to a series of large 105kL underground rainwater tanks. The remaining roof areas, where they can be drained to a detention basin, will be allowed to discharge onto the surrounding ground surface before flowing into grass swales or wet detention basins.

To provide a dual function as stormwater detention and stormwater harvesting, 25% of each tank will be dedicated to water harvesting, which will be recovered and reused within the site using an outlet pipe and pump at the base of the tank. The remaining upper 75% of the tank will be dedicated to provide stormwater detention. This will be achieved by placing an outlet pipe at the 25% storage level within the tank to allow for controlled discharge from the tank during rain events.

The inlet of each tank will be fitted with a “first flush” device. Typically the first few minutes of runoff, the “first flush” contains the accumulated sediment and debris from the roof catchment. A first flush device acts to divert this initial runoff away from the tank and therefore protect the quality of the water available for reuse.

A conceptual layout of the proposed stormwater management system is provided in **Figure 6**.

AECOM

NEW DETENTION BASIN
APPROX. VOLUME 835m³.
ø450 HEADWALL OUTLET
SPILLWAY RL = 16.2m
BASE RL = 14.7m

FOUR OSD TANKS
TOTAL VOLUME 470m³
1 x ø150 ORIFICE OUTLET

NEW WET DETENTION BASIN
APPROX. VOLUME 4800m³
PWL 17.85m
SPILLWAY 19.00m
BASE R.L 16.5m

SW PIT WITH ø100
ORIFICE OUTLET

PROPOSED BUILDING
ASSUMED FFL 19.5

NEW DETENTION BASIN
APPROX. VOLUME 15,900m³.
ø225 HEADWALL OUTLET
SPILLWAY RL = 19m
BASE RL = 17m

BDY 474.83
BDY 27.39
BDY 115.39
BDY 79.58
BDY 108.65
BDY 193.279
BDY 131.37
BDY 573.09
BDY 249.91

GRAVEL FIRE TRUCK ACCESS
GRAVEL FIRE TRUCK ACCESS 6m WIDE
NEW CONCRETE PAVEMENT
EXISTING CONCRETE
EXISTING BUILDING
EXISTING OFFICE BUILDING
EXISTING DETENTION BASIN
EASEMENT FOR TRANSMISSION LINES 24.75m WIDE
EASEMENT FOR TRANSMISSION LINES
WEIGH BRIDGE
RACECOURSE ROAD

FOUR OSD TANKS.
TOTAL VOLUME 470m².
1 x ø150 ORIFICE OUTLET

DP 869834
SITE AREA (LOT 101) = 16.83ha

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60099477

CONCEPTUAL STORMWATER MANAGEMENT S STEM
NCIA TILE PLANT
175 RACECOURSE ROAD, RUTHERFORD
Figure 6

General Design Considerations

In addition to the wet detention basins and rainwater tanks, key design features or considerations in the final stormwater engineering design for the site will include:

- No kerb and guttering is proposed for roads within the site with sheet flow from these surfaces captured and conveyed within adjoining grass swales;
- Floor levels of both the existing and proposed building will be at least 300mm above the 1 in 100 year water level in the adjacent wet basins and grass swales;
- Spillways from wet detention basins will be capable of conveying the 1 in 100 year ARI storm event;
- Batters on grass swales and wet detention basins will not exceed 1 in 4;
- Any pit and pipe network will be designed to capture and convey the 1 in 10 year ARI storm event;
- All overland flow paths and grass swales will be designed to convey the 1 in 100 year storm event; and
- Allowance between the two buildings will be made to ensure safe overland flow during the 1 in 100 year event, including allowance for blockages of any underground stormwater pipes in that location.

4.3.2 Stormwater Management System Performance

XP-RAFTs was used to assess the performance of the proposed stormwater management system shown in **Figure 6**.

A comparison of peak site discharge for a range of storm durations for the 1 in 1, 1 in 10, and 1 in 100 year ARI events is shown in **Figures 7**, **8**, and **9** respectively.

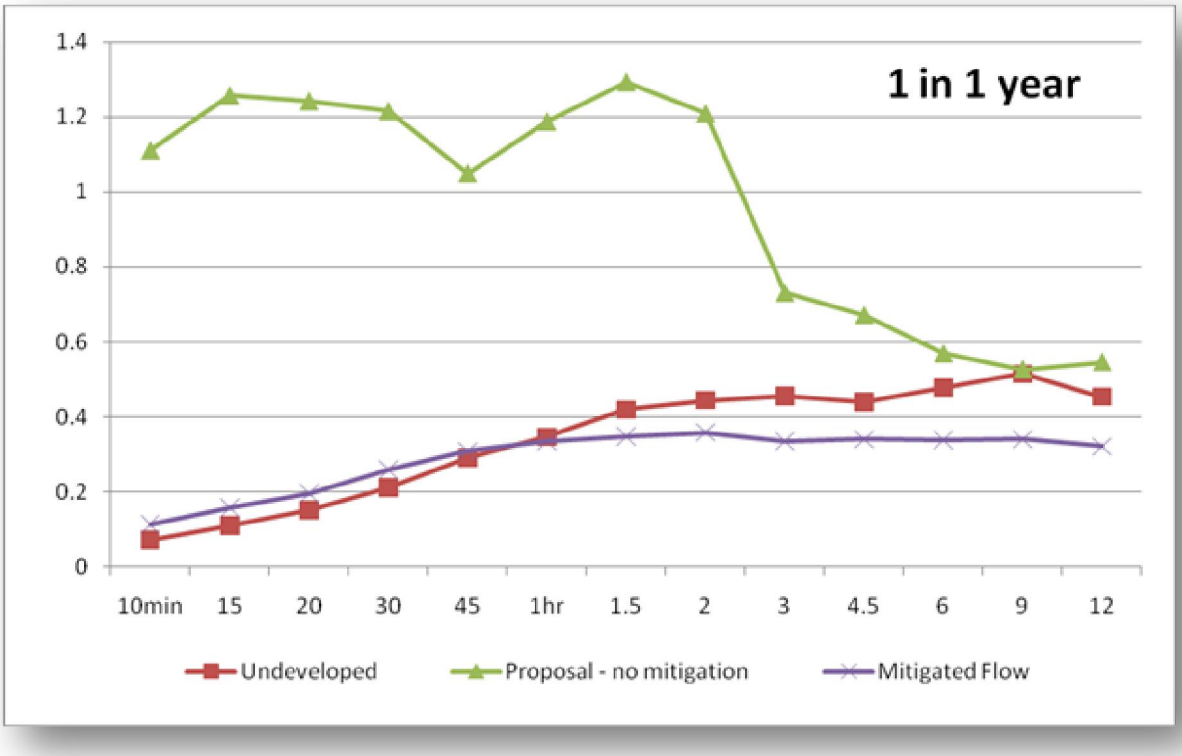

Figure 7 Peak Site Discharge – 1 in 1 year ARI storms

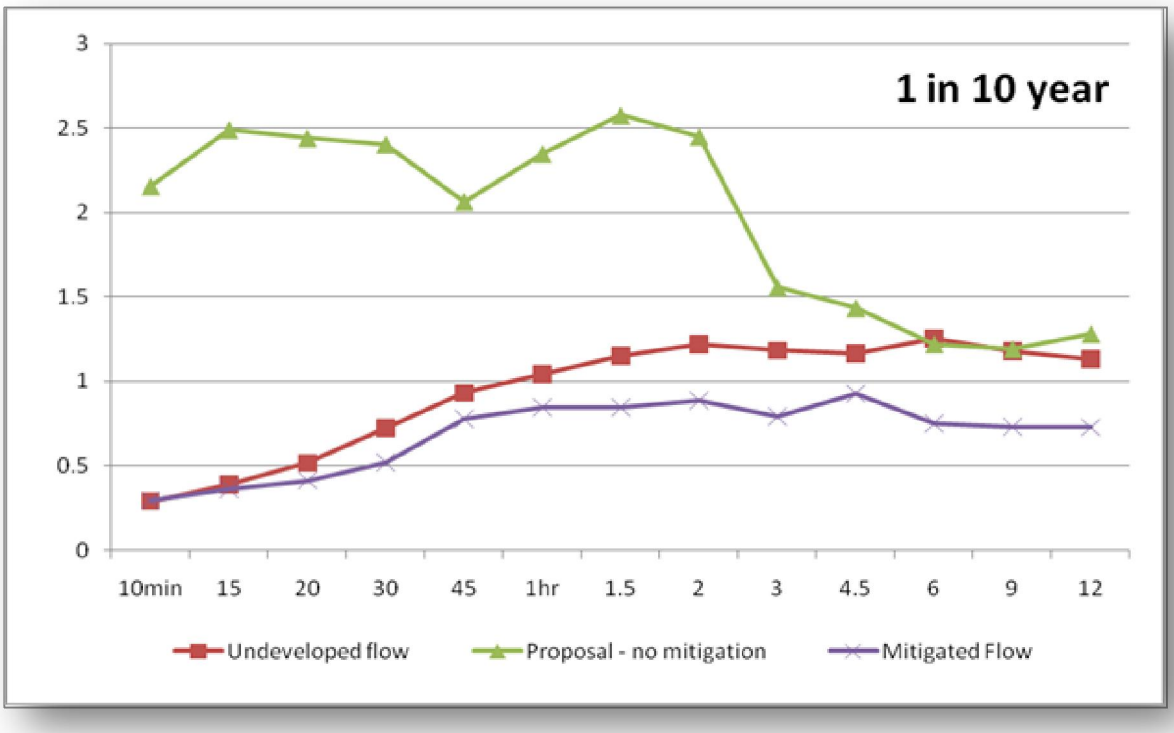

Figure 8 Peak Site Discharge – 1 in 10 year ARI storms

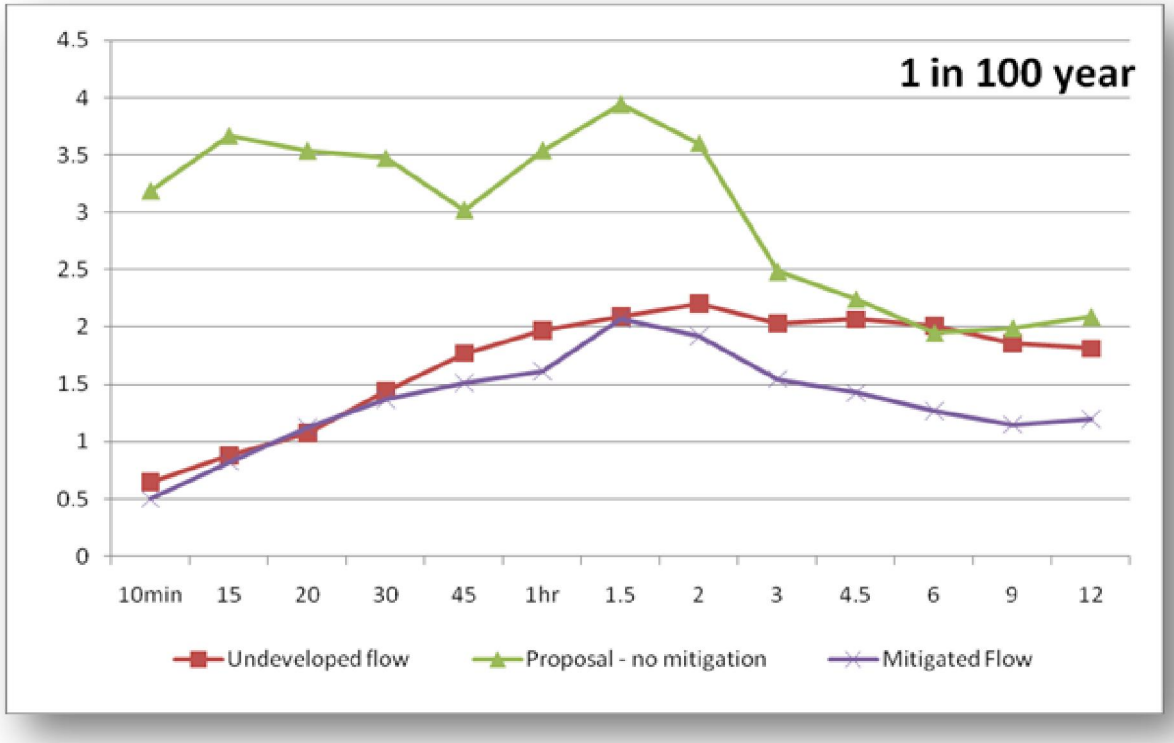

Figure 9 Peak Site Discharge – 1 in 100 year ARI storms

It can be seen from **Figures 7**, **8**, and **9** that the on average, proposed stormwater management strategy is effective in attenuating the developed peak site discharge. Given the complexity of the site, matching the undeveloped site discharge for each stormwater event was only possible by providing substantial amounts of onsite storage.

Also, not reflected in the modelling results is any additional benefit that may be achieved if additional storage is available in the rainwater tanks (model assumes the reuse volume of each tank is fully utilised). Also, the proposed stormwater harvesting will particularly assist to reduce low flows in minor events less than 1 in 1 year ARI, which are a key issue for downstream wetlands and mimicking natural catchment behaviour.

5.0 Water Quality

5.1 Existing Environment

Current potential water pollutants generated within the site include heavy metals, oils and grease from roadways and car parks. Roof water within the site is generally considered free of pollutants with the exception of any atmospheric deposition (i.e. very fine and suspended sediments). Handling of raw materials is conducted within the building and therefore potential sedimentation from the clays is not a potential water quality issue.

Stormwater within the site is treated through a series of wet detention basins and grassed swales. The wet detention basins include a permanent water storage area for the capture of low flows.

5.1.1 Construction Phase

Construction of the facility will require earthworks and civil works, such as excavation/levelling and construction of the building foundations, installation of underground services, and construction internal roads and carpark areas.

Areas of disturbed land may be subject to erosion and downstream transport of mobilised sediment. If allowed to enter the natural waterway system, this sediment would affect water quality, particularly turbidity, cause sedimentation and affect aquatic life.

5.1.2 Operational Phase

Once construction is complete, potential sources of water pollution include an increase in the generation of heavy metals and hydrocarbons (oils and grease) from roadways and carparks, nutrients from site landscaping, and low levels of sediment from landscape areas. Very low levels of gross pollutants such as litter are expected and all raw material handling would occur within the building and will not provide a potential source of sediment.

5.2 Mitigation Measures

5.2.1 Construction Phase

Construction works will be undertaken in a manner that minimises the potential for soil erosion and sedimentation in accordance with measures outlined in *Managing Urban Stormwater: Soils and Construction* (Landcom 2004), such as the following:

- Minimising area of disturbance required at any one time and progressive rehabilitation/ landscaping of completed areas;
- Minimising the volumes of water required to be handled by diverting clean water around all disturbed areas;
- Treating the surface of all areas required for construction traffic, parking, storage and amenities to provide adequate drainage and prevent soil loss (i.e. temporary seal or gravel pavement);
- Provision of sedimentation traps and fencing to capture and treat runoff from all disturbed areas, including a regime for inspection and removal of accumulated sediment;
- Storage of potential contaminants (i.e. fuels, oils or chemicals) offsite or within bunded, covered and lined areas; and
- Use of the wet detention basins for settling of sediment prior to discharge.

5.2.2 Operation Phase

The existing stormwater management system to address water quality includes grass swales and wet detention basins. This system is proposed to be extended to cater for the expanded facility.

Wet detention basins are effective at removing sediment particles and particulate-bound contaminants. Typical pollutant removal efficiencies for wet detention basins and grass swales are shown in **Table 4**. It is noted that these efficiencies are based on annual yields and not individual runoff events.

Table 4 Pollutant Removal Efficiencies

Pollutant	Vegetated Swale[1]	Wet Detention Basin[2]
Litter	> 90%	-
Total Suspended Particles	60 – 80%	10 – 50%
Total Nitrogen	25 – 40%	30 – 50%
Total Phosphorus	30 – 50%	30 – 50%
Coarse Sediment	> 90%	80 – 100%
Heavy Metals	20 – 60%	30 – 50%

Sources: 1. (Wong 2006: Table 10.1)
2. (WBM Oceanics 2003:41)

The combined used of grass swales and wet detention basins will provide a treatment train for the improvement of stormwater quality prior to discharge from the site. Both the grass swales and wet detention basins will be landscaped appropriately to maximise pollutant capture. Landscape planting would include macrophytes within the wetlands and small native shrubs and sedges within the grass swales.

6.0 Process Water

6.1 Existing

The existing facility currently uses mains water for the tile manufacturing process and washdown requirements. Water is also required for staff amenities, landscaping and fire fighting. At present, all water is supplied by the Hunter Water Corporation supply network.

The 2007-2008 Annual Environmental Management Report (AEMR) for NCIA indicated that the average weekly water usage for the reporting period was 459 kilolitres (kL). Similarly, 443 kL per week was recorded in the 2006-2007 AEMR. On the completion of approved Stages Three and Four it is estimated that water consumption would increase by a factor of four from the 2006-07 AEMR reporting period (where only Stage One was operational) to approximately 1,772 kL per week (approximately 92ML per annum).

Upon completion of Stage Four, the 2002 EIS estimated that 110.8 ML per annum (2131 kL per week, 304 kL per day) of mains water would be needed in the manufacturing process and for wash down requirements. It is evident that the 2002 EIS slightly over estimated the quantity of potable water required.

Approximately 98% of the annual mains water demand is used for tile manufacturing, with all of this process water leaving the plant as steam. The second largest demand (19% annual water demand) is used for washdown. However 95% of washdown water is recirculated to the mill for use as process water. The remaining water is used for:

- Preparation of tile glaze (not recoverable); and
- Ancillary water use for staff amenities, watering of landscaping and fire fighting purposes if required.

No process water is discharged from the site into drainage easements of the natural creek system.

A schematic diagram of the site process water cycle is shown in **Figure 7**.

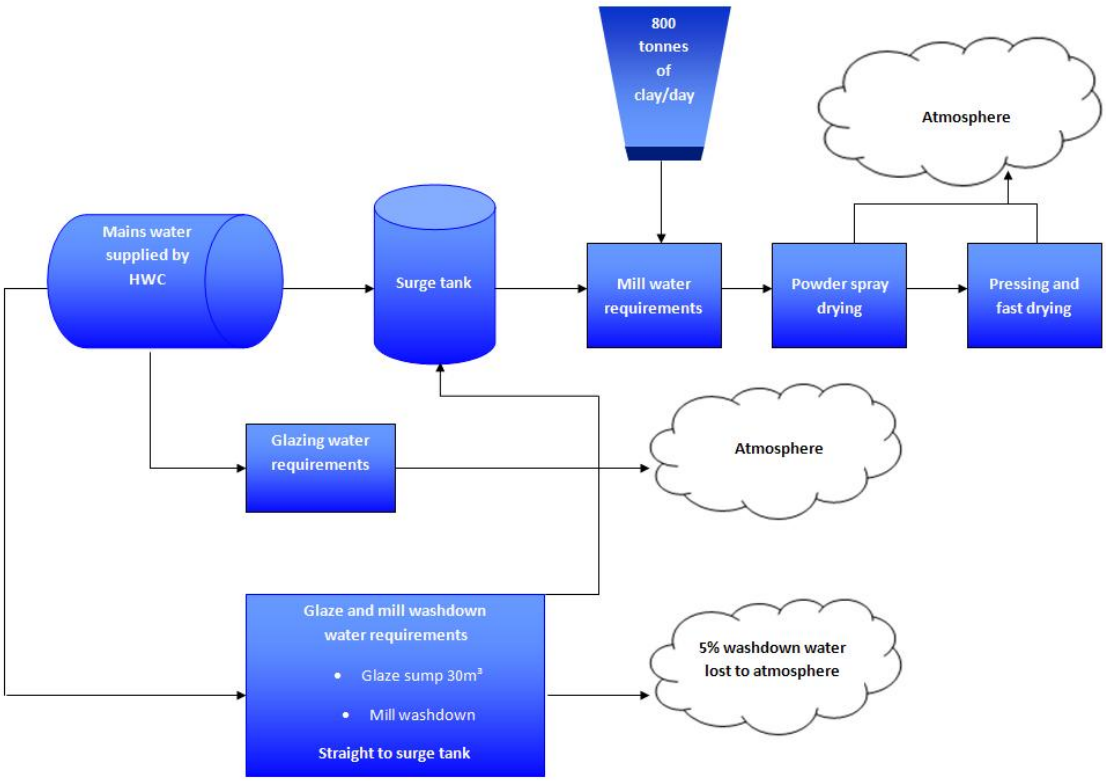

Figure 10 Schematic Process Water Diagram

6.2 Impacts and Mitigation

The proposed expansion (Stages Five to Eight) would be expected to use an equivalent volume of potable water as the approved Stages One to Four. This is approximately 1,772 kilolitres per week, or 92ML per annum. As noted in **Section 6.1**, the majority of this demand is required for tile manufacturing, with all of this process water leaving the site as steam.

The cumulative demand for Stages One to Eight for potable water would be expected to be approximately 3544 kilolitres per week (184ML per annum). Consultation with Hunter Water has commenced regarding additional water requirements.

The proposed development will continue to utilise recycled washdown water and will adopt new technology (i.e. dry glazing) to minimise total potable water demand.

The 2007-2008 AEMR indicates that during the reporting period NCIA commenced investigating alternative water supply, as stated in the existing Operational Environmental Management Plan. The AEMR reported that initial investigations have focussed on the potential suitability for use of the storm water captured in the water retention basins onsite. AECOM was commissioned to carry out water quality monitoring of the stormwater contained in the water retention basins. This investigation is ongoing, the results of which can be utilised to assess the suitability of the storm water for use in plant processes.

Furthermore, the proposed stormwater management system includes the implementation of rainwater harvesting infrastructure to reduce reliance on potable town water. Multiple, large rainwater tanks (105kL each) will be placed to capture some of the roof water runoff. The key objective of the tanks will be to provide stormwater detention, however each of the proposed rainwater tanks (refer to **Section 4.3**) includes 25% of the total volume dedicated to the capture and storage of roof runoff for reuse purposes. This equates to approximately 210 kL available storage for stormwater reuse on site. Evidently these rain water tanks could be insufficient to meet the process water needs of the facility (either current for proposed) however they would supplement NCIA's potable water requirements in relation to staff amenities and irrigation of existing and proposed site revegetation and landscaping

These rainwater tanks will be connected to a pump system and the water will be available for reuse within the site for irrigation of landscaping, and potentially reuse within the site amenities or operations. The inlet of each tank will be fitted with a 'first-flush' device to divert initial rainfall runoff and therefore optimise the quality of the water available for reuse.

7.0 Conclusion

The conceptual stormwater management strategy has been developed with mitigation measures to address the negative impacts found due to the proposed expansion of the tile manufacturing facility.

Impacts found include:

- Potential increase in stormwater runoff generated from the site;
- A corresponding reduction in soil infiltration and evapo-transpiration on the site;
- Erosion and downstream transport of mobilised sediment during construction. This sediment would affect water quality, particularly turbidity, cause sedimentation and affect aquatic life; and
- Potential sources of water pollution during operation phase.

Mitigation measures recommended to reduce or avoid the above negative impacts on the surface water include:

- Use of wet detention basins with the dual function of reducing peak stormwater flows and improving water quality by settling of sediment prior to discharge;
- Use of rainwater tanks with the function of reducing peak stormwater flows;
- Use of grass swales to collect runoff from beside roadways and to provide connection between the wet detention basins to reduce runoff velocities, provide some infiltration of water, and for water quality improvement;
- Minimising area of disturbance required at any one time and progressive rehabilitation/ landscaping of completed areas
- Minimising the volumes of water required to be handled by diverting clean water around all disturbed areas;
- Treating the surface of all areas required for construction traffic, parking, storage and amenities to provide adequate drainage and prevent soil loss ;
- Provision of sedimentation traps and fencing to capture and treat runoff from all disturbed areas, including a regime for inspection and removal of accumulated sediment; and
- Storage of potential contaminants (i.e. fuels, oils or chemicals) offsite or within bunded, covered and lined areas.

The mitigation measures recommended for the proposed expansion have been prepared in consideration with the Director-General's requirements and relevant policies and guidelines as shown in **Section 2.3**. By incorporating these measures into the proposed expansion, the negative impacts on the surface water on the site will be reduced or avoided.

8.0 References

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Appendix A

Summary of XP-RAFTs Input Parameters

Appendix A Summary of XP-RAFTs Input Parameters

Table 5 Intensity-Frequency-Duration (IFD) data

Duration	1 ear	2 ears	5 ears	10 ears	20 ears	50 ears	100 ears
5 mins	73.9	95.7	125	142	165	195	219
6 mins	69.2	89.6	117	133	154	183	205
10 mins	56.4	73.1	95.1	108	125	148	166
20 mins	41.0	53.1	68.7	78.0	90.3	107	119
30 mins	33.3	43.0	55.6	63.0	72.8	85.9	95.9
1 hr	22.5	29.0	37.5	42.5	49.1	57.8	64.5
2 hrs	14.6	18.9	24.5	27.9	32.3	38.1	42.6
3 hrs	11.2	14.6	19.0	21.6	25.1	29.7	33.3
6 hrs	7.14	9.28	12.2	14.0	16.3	19.4	21.8
12 hrs	4.60	6.00	7.94	9.12	10.7	12.7	14.3
24 hrs	3.03	3.94	5.20	5.96	6.96	8.30	9.33
48 hrs	1.98	2.57	3.35	3.82	4.44	5.27	5.91
72 hrs	1.49	1.93	2.51	2.86	3.32	3.93	4.41

Table 6 Undeveloped catchment Information

Node	Land Type	Area (ha)	Impervious ( )
11	Grass	15.406	0
13	Existing track	0.226	100
	Grass	1.198	0
	Total	16.83	

Table 7 Catchment Parameters

Catchment Type	Subcatchment n	Catchment Slope ( )	Impervious ( )	Initial Loss (mm)	Continuing Loss (mm/hr)
Grass / landscape	0.040	1	0	5	1
Existing track	0.020	1	100	2	0.5
Road / hardstand	0.015	1	100	1.5	0
Roof	0.010	10	100	0.5	0

Table 8 Developed catchment areas

	Subcatchment Type – Area (ha)			Total Catchment
Node	Roof	Roads/carpark	Landscape	(ha)
1	0.4816			0.4816
2		0.5783	0.6269	1.2052
3	0.3988			0.3988
4	1.1867			1.1867
4A	0.3122			0.3122
5		0.6322	1.7021	2.3343
6		0.1586		0.1586
7	0.9547			0.9547
8		0.2283	1.2744	1.5026
9	0.9951			0.9951
10		0.4588	0.7878	1.2466
11		0.1049	0.2415	0.3464
12		0.1954	0.7384	0.9337
13		0.0939	0.4597	0.5536
14	0.2380			0.238
15	0.6479			0.6479
16	0.6246			0.6246
17	1.3587			1.3587
18		0.2717	0.4984	0.7701
19		0.0399	0.2706	0.3105
20		0.0605	0.2193	0.2798

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