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MORTLAKE CONSOLIDATED PTY LTD

# Majors Bay, Mortlake
# Part 3A Concept Application

## Stormwater Management and Flood assessment Report

301015-02438 – EN-REP-0001 [D]

20 January 2011

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# SYNOPSIS

This report details the conceptual stormwater management and flooding assessment for the proposed residential development on Majors Bay in Mortlake in support of a Part 3A Concept Application submission to the Department of Planning.

**Disclaimer**



**PROJECT 301015-02438 - MAJORS BAY, MORTLAKE**

| REV | DESCRIPTION | ORIG | REVIEW | WORLEY-PARSONS APPROVAL | DATE | CLIENT APPROVAL | DATE |
|---|---|---|---|---|---|---|---|
| A | DRAFT - Issued for client review | Matt Poon | James Hoang | N/A | | N/A | |
| B | Final Issue | Matt Poon | James Hoang | Peter Tow | 04-01-2011 | | |
| C | Incorporating comments from Mecone | Matt Poon | James Hoang | Peter Tow | 12-01-2011 | | |
| D | DGR amendments | Matt Poon | James Hoang | Peter Tow | 20-01-2011 | | |

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## Appendices

# 1. EXECUTIVE SUMMARY

This report details the conceptual stormwater management and flood assessment for the proposed residential development on Majors Bay in Mortlake and has been prepared in support of a Part 3A Concept Application to the Department of Planning (DoP).

The proposed stormwater management measures address both water quantity and quality aspects. Infrastructure upgrades are proposed which will rectify cases of non-compliance with Council standards and significantly improve drainage conditions. These upgrades involve works around existing local roads which need to tie in with existing adjacent development and services.

The Water Sensitive Urban Design and Ecological Sustainable initiatives incorporated into the proposed stormwater management strategy would result in substantial improvement from existing conditions and will comply with BASIX requirements for potable water consumption reductions and the Department of Environment and Climate Change and Water (DECCW - formerly Department of Environment and Conservation) objectives for water quality treatment.

The proposed development provides a minimum habitable floor level of RL 3.30 m AHD and as a result complies with the minimum habitable floor level required by the NSW Floodplain Development Manual and the NSW Coastal Planning Guideline – Adapting to Sea Level Rise (DoP 2010)

Details of servicing are provided in reports by others.

The proposed development has been identified by the Director General of New South Wales Department of Planning (DoP) as a significant project. The issues to be addressed in the Concept application (Director General's requirements) are listed in **Table 1** along with a summary of the compliance measures and the location of further detailed discussions in this report.

**Table 1 – Director General's Requirements**

| Issue | Location in this report |
|---|---|
| **8. Drainage and Stormwater Management** | |
| *The EA shall address drainage/groundwater/flooding issues associated with the development/site, including stormwater, drainage infrastructure and incorporation of Water Sensitive Urban Design measures.* | The groundwater issues are not covered in this report. For further details regarding groundwater refer to the geotechnical report prepared by Aargus (**Appendix 2**)<br>Piped drainage has been designed to carry the 10 year ARI flow in local, collector and sub-arterial roads, while a 20 year ARI capacity has been designed for the private system in medium density residential areas (**Section 5.4**). The proposed upgrades would improve existing drainage conditions surrounding the site.<br>The water quality strategy is to include treatment |

| Issue | Location in this report |
|---|---|
| | such as rainwater tanks and bioretention systems in combination with more traditional measures such as gross pollutant traps (GPTs) (**Section 4.4**). Each of the proposed treatment facilities have been designed and sized to achieve DECCW water quality treatment target objectives.<br>The Water Sensitive urban Design strategy is discussed in **Section 3**. |
| **10. Climate Change and Sea Level Rise** | |
| *The EA shall address climate change and sea level rise in accordance with the Draft Sea Level Rise Policy Statement (NSW government October 2009)* | Issues relating to flooding and climate change are discussed in **Section 5**. Investigations found no defined overland flow paths traversing either through or around the proposed site. The site is located above the 100 year flood level (RL 1.5 m AHD) and with minimum habitable floor levels of RL 3.30 m AHD, provides the minimum 500 mm freeboard as outlined in the NSW Floodplain Development Manual.<br>Further to this, an assessment has been undertaken to assess the impact of climate change on sea level rise. The assessment found that the minimum proposed habitable levels have been set to accommodate for the predicted 2100 year sea level rise as per the NSW Coastal Planning Guideline – Adapting to Sea Level Rise (DoP 2010). |

# 2. INTRODUCTION

## 2.1 Site Description

The proposed development is located in Mortlake within the City of Canada Bay Council Local Government Area (LGA). The development is comprised of three separate sites, located on Hilly, Bennett and Northcote Streets as shown in **Diagram 1**.

**Diagram 1 – Individual Site Locations**


The majority of the site is currently used for industrial purposes, with the exception of a row of houses along Edwin Street. As seen in **Diagram 1**, the majority of site surfaces are impervious (either roofs or sealed ground surfaces), leading to an impervious fraction in the order of 90%.

A breakdown of the site areas is given in **Table 2**.

**Table 2– Site Area Breakdown**

| Site | Area (ha) |
|---|---|
| Site 1 | 1.1 |
| Site 2 | 0.3 |
| Site 3 | 1.4 |
| **Total** | **2.7** |

The local topography falls to the west from a crest located generally parallel to and to the east of Tennyson Road towards Majors Bay. The crest falls from RL 20.00 to 10.00 m AHD as it passes the site from south to north. The fall from this crest to the bay thus results in relatively steep east-west grades of over 10% in some areas, becoming gentle towards the waterfront.

Sites 2 and 3 front Majors Bay, which lies on the lower reaches of the Parramatta River. The impact of Parramatta River flooding on these sites is minimal as discussed in **Section 5.1**. Due to the relative steepness of the site, local flooding is not predicted to form a major constraint.

Due to past industrial land uses, soil contamination issues exist for the sites, as discussed in reporting by Aargus. Remedial Action Plans for the sites would be prepared to accompany future development applications and the remediation carried out prior to development of any of the contaminated areas.

## 2.2 Proposed Development

The proposal for the site includes medium density residential development with associated roads, open space and water management infrastructure. It is proposed to upgrade some local roads owned by Council, in particular where they front the three privately owned sites. These upgrades would include pavement, drainage, water quality measures and landscaping and would represent a significant investment in the local amenity and benefit to the community.

## 2.3 This Report

This report details the conceptual stormwater management, water sensitive urban design (WSUD) and civil engineering issues in support of the Part 3A Concept Application for the proposed residential development at Majors Bay.

The Director General of the Department of Planning (DoP) has provided the issues to be addressed in the application in the Director General's Requirements (refer to **Appendix 1**).

The following reports have been consulted in preparing this report:

- City of Canada Bay Council, 2006, *Rainwater Reuse Policy*
- City of Canada Bay Council, 2006, *Specification for the Management of Stormwater*

Details of servicing can be found in the following reports:

- Hydraulic Services Scheme Development Report*, Majors Bay Residential Development, Lipscombe and Associates (water, sewer and gas); and*
- *Existing Authority Services and Establishment of Services to the Development For Majors Bay Redevelopment* prepared by ACOR Consultants Pty. Limited (electricity and telecommunications).

# 3. INTEGRATED WATER SENSITIVE URBAN DESIGN

## 3.1 General

Water is a vital element of the natural environment and runoff quality is a key factor in determining the health and sustainability of ecosystems that exist within it. It is widely acknowledged that water in natural systems can be detrimentally impacted by human induced changes to catchment characteristics. These changes include the use of fertilisers, building construction, changes to land form and the proliferation of hard surfaces. With this understanding, a water management strategy utilising best management practices has been developed to minimise potential impacts of urban development on runoff quality and thus sustain the health of our water resources.

The proposed development at Majors Bay includes a range of best practice measures to meet the following Water Sensitive Urban Design (WSUD) objectives:

- Reduction in potable water consumption;
- Utilisation of available rainwater;
- Minimisation of impacts on downstream receiving waters;
- Safe conveyance of stormwater; and
- Integration of water management measures with landscape design.

An overview of the WSUD strategy is presented in **Figure 1**.

## 3.2 BASIX

BASIX compliance is typically a requirement for Council Development Application approval for all new residential developments in New South Wales.

BASIX is an online tool used to calculate the energy and water efficiencies of new homes and apartments. The BASIX tool assess factors such as the installation of water fittings and rainwater tanks, and provides a numerical score, in terms of percentage reduction from the current average. Once a 40% reduction in water use is achieved, a certificate for BASIX compliance can be issued.

While BASIX is not a requirement as part of this Concept Application to the DoP, the BASIX targets for water consumption reductions would be adopted as part of the WSUD initiatives for the development.

It is proposed to use a combination of rainwater tanks and water saving devices to achieve the required 40% reduction in potable water use.

## 3.3 Rainwater Tanks

It is proposed to install rainwater tanks on all three sites to store rainfall runoff collected from the roof tops of the development. The stored water will be used for non-potable consumption including toilet flushing and outdoor uses such as garden irrigation. The use of rainwater reduces dependence on water mains and reduces potable water consumption.

The size of these rainwater tanks would ideally comply with BASIX requirements while optimising efficiency. To assess the optimum rainwater tank size, a water balance model was used.

A summary of the proposed rainwater tank design is as follows:

- A rainwater tank volume designed to collect roof runoff and store it for external uses (eg irrigation and car washing) and toilet flushing purposes only will be installed on each of the sites (for each individual lot);
- The tank is to incorporate a first flush device, inspection/cleanout hatch and cleanout valve;
- The tank is to incorporate an outlet tap for connection to an irrigation system driven by the tank head (where applicable);
- All tank overflow should be directed to the sites formal piped stormwater drainage systems (ie overflow to the street drainage system or water quality treatment measure where applicable) to prevent nuisance flooding;
- All rainwater tanks should be installed and maintained so as to prevent cross connection with the potable water supply;
- A “topping up” device (from the potable water supply) shall be provided to supplement roof runoff from the rainwater tanks;
- A “backflow prevention device” shall be installed on the potable water supply;
- All rainwater services shall be clearly labelled “Non Potable Water” with appropriate hazard identification; and
- Pipework used for rainwater services shall be coloured purple in accordance with AS1345. All valves and apertures shall be clearly and permanently labelled with safety signs to comply with AS 1319.

## 3.4 Water Balance Modelling

An in-house water balance model developed by WorleyParsons was used to determine the optimal size for the rainwater tanks to meet BASIX compliance with optimal efficiency.

The in-house water balance programme utilised in this assessment uses a dynamic analysis to represent the sites stormwater losses and gains over an historical rainfall period. The programme is a spreadsheet based daily rainfall model, which accounts for all inputs and outputs within a closed system. The spreadsheet was adapted to suit the specific circumstances of this development. Detailed modelling of irrigation demand was not undertaken.

Inputs to the system include:

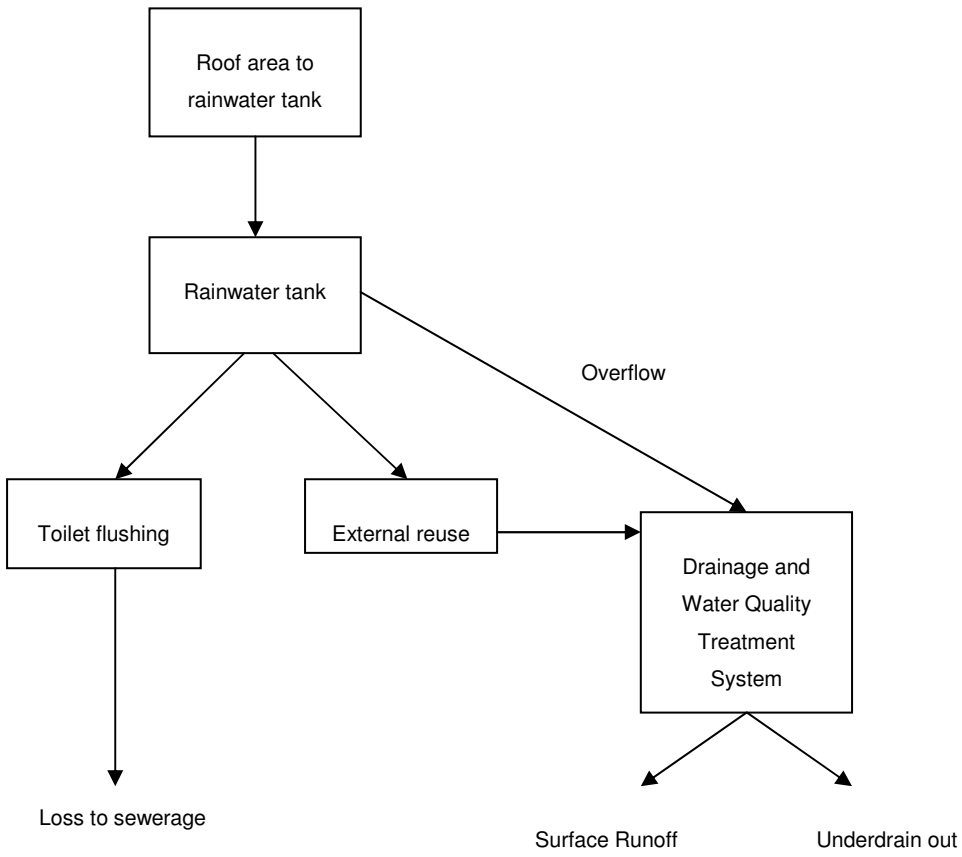
- rainfall; and
- potable water supply.

Outputs to the system include:

- depression storage;
- internal and external reuse.

Refer to **Diagram 2** for a schematic of the WorleyParsons water balance model used specifically for this analysis.

**Diagram 2 – Water Balance Schematic**




Rainfall data was collected from the Bureau of Meteorology (BoM) to be used in the WorleyParsons Water Balance Model. Daily rainfall data from the Concord Golf Course rainfall station (station number 66013) was used as it is the closest rainfall station to Majors Bay and provided 64 years of continuous daily rainfall data (January 1940 - December 2003). The average annual rainfall depth for this period was 1,142 mm.

Monthly average point potential evapotranspiration values were obtained from the BOM publication titles “Climatic Atlas of Australia – Evapotranspiration” 2001 and converted to daily evaporation rates to be used in the evapotranspiration component of the water balance analysis.

Depression storage was set at 1.5 mm for impervious areas.

It was assumed that the rainwater tanks were empty at the start of the simulation.

The estimated daily potable water demand is based on the NSW Planning average usage rate for toilet flushing and external uses such as irrigation and car washing, which can be found in **Table 2**. The demand used for the water balance model was the sum of the external demand plus the toilet flushing demand (accounting for the reduced demand of dual flush toilets).

**Table 2 - NSW Planning Average Water Use Rates (Apartments)**

| Internal | End Use | Calculated Usage (L/person/day) | Proportion of total water use | Best Practise Feature | Reduction - where possible | Reduction (L/person/day) | Reduction as a percectage of total use | Score | Adopted Reduction for Water Balance Modelling | Adopted Usage (L/person/day) | Adopted Rainwater Demand for Water Balance Modelling (L/person/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **a** | Kitchen Sink | 10.8 | 6.0% | Flow Regulator | 50% | 5.4 | 3% | **3** | **0%** | 10.8 | - |
| **b** | Bathroom Basin | 6.3 | 3.5% | Flow Regulator | 50% | 3.2 | 2% | **2** | **0%** | 6.3 | - |
| **c** | Laundry Trough | 7.2 | 4.0% | N/A | 0% | 0.0 | 0% | **0** | **0%** | 7.2 | - |
| **d** | Bath | 8.1 | 4.5% | N/A | 0% | 0.0 | 0% | **0** | **0%** | 8.1 | - |
| **e** | Shower | 51.1 | 28.3% | AAA-rated Showerhead | 55% | 28.1 | 16% | **16** | **55%** | 23.0 | - |
| **f** | Toilet | 40.4 | 22.4% | 6/3 L Dual Flush | 67% | 27.1 | 15% | **15** | **67%** | 13.3 | 13.3 |
| **g** | Washing Clothes | 36.8 | 20.4% | AAA rating best practice front loading washing machine | 63% | 23.2 | 13% | **13** | **0%** | 36.8 | - |
| **h** | Washing Dishes | 1.7 | 0.9% | Current AAA-rated dishwasher | 64% | 1.1 | 1% | **1** | **0%** | 1.7 | - |
| | TOTAL INDOOR | 162.4 | 89.9% | | | | | | | 107 | 13.3 |
| **External** | | | | | | | | | | | |
| **j** | Garden Irrigation | 16.6 | 9.2% | Controlled Irrigation System with Moisture Sensor | 50% | 8.3 | 5% | **5** | **5%** | 15.8 | 15.8 |
| **k** | Car Washing | 0.5 | 0.3% | Bucket Washing | 44% | 0.2 | 0% | **0** | **0%** | 0.5 | 0.5 |
| **l** | Swimming Pool | 1.1 | 0.6% | Pool Cover | 50% | 0.6 | 0% | **0** | **0%** | 1.1 | 1.1 |
| | TOTAL OUTDOOR | 18.2 | 10.1% | | | | | | | 17.4 | 17.4 |
| | GRAND TOTAL | 181 | | | | | | | | 125 | 30.8 |

Data from the Australian Bureau of Statistics on the average number of residents per one, two and three bedroom apartment was used to estimate the total number of residents per site and gave an average occupancy rate of 1.93 persons per apartment.

The water balance analysis was used to determine an efficient tank size that could meet the BASIX requirements, in combination with other water savings measures. The results indicate that 500 to 600 litres per apartment would be sufficient to meet the target 40% reduction in potable water consumption, in combination with water saving measures. This tank size provides a reliability of approximately 50%, which means that the tank would provide a significant contribution to water savings, but is not sized to meet the entire demand. Hence the tank is considered appropriately sized for this purpose.

The results of the modelling are shown in **Table 3**.

**Table 3– Water Balance Model Results**

| Site | Site Area (ha) | Roof Area (m2) | Number of Apartments | Rainwater Tank Size per Apartment (m3) | Total Rainwater Tank Size (m3) |
|---|---|---|---|---|---|
| 1 | 1.1 | 5191 | 200 | 0.6 | 120 |
| 2 | 0.3 | 756 | 20 | 0.5 | 10 |
| 3 | 1.4 | 5382 | 150 | 0.6 | 90 |
| **Total** | **2.7** | **11,329** | **370** | | **220** |

# 4. WATER QUALITY MANAGEMENT

## 4.1 Introduction

A range of best management practices for stormwater quality management are proposed. The principles for application of these best management practices include:

- At-source runoff control, such as bio-retention systems;
- Integration of water quality control measures with urban design features; and
- Minimum level of treatment for all runoff water (gross pollutant traps).

This section primarily deals with the permanent water quality management, while during the construction phase, sediment and erosion control facilities will be designed and installed in accordance with the Council's specifications and the requirements of the publication "Managing Urban Stormwater – Soils and Construction" (Landcom, 2004).

## 4.2 Water Quality Treatment Targets

The general requirement is for the development not to increase the runoff pollutant load compared to the existing conditions. The existing industrial landuse does not produce good quality runoff. As such there is an opportunity to improve runoff water quality and contribute to the long term improvement in the Parramatta River water quality. To this end, the objective adopted was to achieve industry best practice standards in terms of control of runoff quality.

The NSW Department of Environment, Climate Change and Water (DECCW – formerly DECC) recommend reduction targets in annual runoff pollutant loads for developments of:

- 85% for total suspended solids (TSS);
- 60% for total phosphorous (TP); and
- 45% for total nitrogen (TN).

## 4.3 Model Set-Up

A long-term MUSIC model was established to assess the potential water quality impact of the proposed development. The model was used to estimate the annual pollutant load that would be generated under developed conditions.

MUSIC is a continual-run conceptual water quality assessment model developed by the Cooperative Research Centre for Catchment Hydrology. MUSIC can be used to estimate the long-term annual average stormwater volume generated by a catchment as well as the expected pollutant loads. MUSIC is able to conceptually simulate the performance of a group of stormwater treatment measures (treatment train) to assess whether a proposed water quality strategy is able to meet specified water quality objectives.

MUSIC was chosen for this investigation because it has the following attributes:

- it can account for the temporal variation in storm rainfall throughout the year;
- modelling steps can be as low as 6 minutes to allow accurate modelling of treatment devices;
- it can model a range of treatment devices;
- it can be used to estimate pollutant loads at any location within the catchment; and
- is based on logical and accepted algorithms.

### 4.3.1 Subcatchment Characteristics

The site has been divided into subcatchments as shown on **Figure 2**. The total impervious percentage adopted for each subcatchment is shown below in **Table 4**. These impervious percentages are based on an assessment of the anticipated proportion of hard surfaces such as roads, roofs and paved areas across the different types of development across the site.

**Table 4 – Adopted areas and imperviousness**

| | **Area** *(ha)* | **Impervious Percentage** *(%)* |
|---|---|---|
| Site 1A - Remainder | 0.361 | 65% |
| Site 1A - Roof | 0.26 | 100% |
| Site 1B - Roof | 0.259 | 100% |
| Site 1B remainder | 0.203 | 54% |
| Site 2 - Remainder | 0.219 | 73% |
| Site 2 - Roof | 0.075 | 100% |
| Site 3A - Remainder | 0.233 | 67% |
| Site 3A - roof | 0.129 | 100% |
| Site 3B - road | 0.06 | 70% |
| Site 3C - Remainder | 0.445 | 69% |
| Site 3C - roof | 0.251 | 100% |
| Site 3D - Remainder | 0.16 | 60% |
| Site 3D - roof | 0.159 | 100% |
| Northcote St | 0.216 | 70% |
| Bennett St | 0.234 | 70% |
| **Total** | **2.814** | **78%** |

The composite value of approximately 78% impervious is considered reasonable, based on the medium density residential development proposed for the site.

### 4.3.2 Rainfall

In order to develop a model that could comprehensively assess the performance of water quality treatment devices such as bioretention systems, the use of 6 minute interval pluviograph data was considered necessary.

The nearest pluviometer (i.e. 6 minute interval data instrument) station to the site is the Sydney Observatory Hill station, the data for which is provided with the MUSIC model. The average annual rainfall depth for this station is 1217 mm.

For this study, the pluviograph record from the 1st January 1981 through until the 31st December 1984 was selected for the MUSIC modelling because this period had an annual average rainfall of 1247 mm, which is marginally wetter than average. This period also contains a wet and a dry year as shown in **Table 5**. The selection of wet, dry and average years provides a more rigorous analysis of the treatment measures than an average year alone.

**Table 5 - Adopted rainfall data**

| Year | Annual Rainfall (mm) |
|---|---|
| 1981 | 1038 |
| 1982 | 840 |
| 1983 | 1343 |
| 1984 | 1765 |
| **Average** | **1247** |

### 4.3.3 Evaporation

The monthly areal potential evapotranspiration values for Sydney Observatory Hill supplied with the MUSIC software were adopted and are shown in **Table 6**.

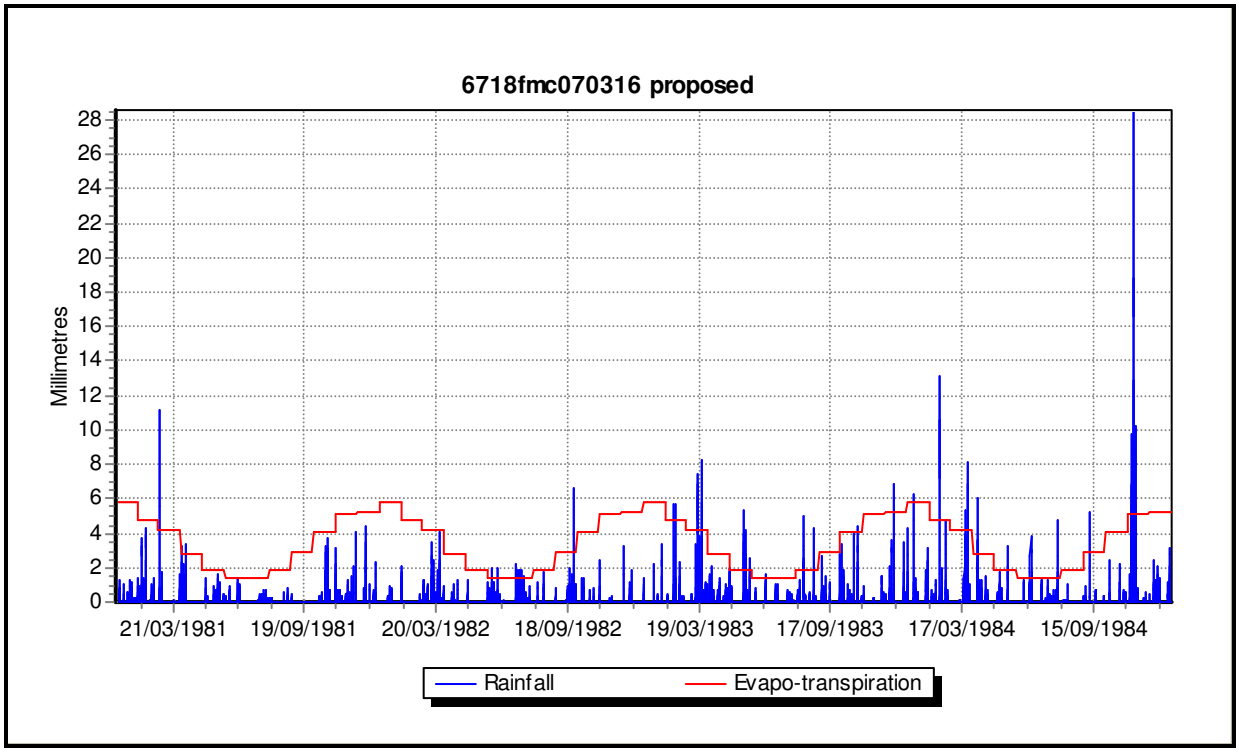
**Table 6 - Monthly Areal Potential Evapotranspiration**

| Month | Areal Potential Evapotranspiration |
|---|---|
| January | 180.11 mm |
| February | 134.96 mm |
| March | 128.03 mm |
| April | 84.9 mm |
| May | 57.97 mm |
| June | 42.9 mm |

| Month | Areal Potential Evapotranspiration |
|---|---|
| July | 43.09 mm |
| August | 57.97 mm |
| September | 87.9 mm |
| October | 127.1 mm |
| November | 152.1 mm |
| December | 163.06 mm |
| **Total** | **1260 mm/annum** |

The rainfall and evaporation data is represented graphically on **Diagram 3**.

**Diagram 3 – Rainfall and Evaporation data**




### 4.3.4 Model Calibration

Calibration of the runoff-rainfall parameters within the MUSIC model was completed to achieve an appropriate runoff co-efficient for the site. The MUSIC default and adopted rainfall run-off parameters along with the resulting run-off co-efficient are presented in **Table 7**. The Soil Storage Capacity and Field Capacity were changed to the values recommended for Sydney in the MUSIC User Manual.

Previous investigations (Managing Urban Stormwater: Council Handbook) present a runoff co-efficient of 0.65 for nearby Powells Creek, Homebush (at 99% urban).The adopted rainfall run-off parameters achieved a run-off co-efficient of 0.76 for a site of 78% imperviousness, which is

considered acceptable based on the gauged catchment described above. The site runoff co-efficient with rainwater tanks and other treatment measures was 0.62.

It should be noted that the model is "*significantly more sensitive to the accurate definition of the fraction impervious and the selection of simulation time step*" MUSIC Manual (CRCCH, 2002).

**Table 7 – Adopted rainfall run-off parameters**

| | Default Parameters | Adopted Parameters |
|---|---|---|
| ***Impervious Area Properties*** | | |
| Rainfall Threshold (mm/day) | 1 | 1 |
| | | |
| ***Pervious Area Properties*** | | |
| Soil Storage Capacity (mm) | 120 | 200 |
| Initial Storage (% of capacity) | 30 | 30 |
| Field Capacity (mm) | 80 | 170 |
| Infiltration Capacity Coefficient (a) | 200 | 200 |
| Infiltration Capacity Exponent (b) | 1 | 1 |
| | | |
| ***Groundwater Properties*** | | |
| Initial Depth (mm) | 10 | 10 |
| Daily Recharge Rate (%) | 25 | 25 |
| Daily Baseflow Rate (%) | 5 | 5 |
| Daily Deep Seepage Rate (%) | 0 | 0 |
| | | |
| | | |
| ***Runoff Co-efficient*** | | |
| 100% Pervious | 0.31 | 0.22 |
| 78% Impervious | 0.79 | 0.76 |
| | | |

### 4.3.5 Pollutant Concentrations

Each catchment was divided into roads, roofs and general urban areas to allow runoff from each area to be directed to specified treatment measures, for instance runoff from roads has been directed to tree pits. Road reserves were measured from the survey, roof areas were taken from proposed

development data and general urban areas were designated as the remaining area. The expected pollutant load from the catchment was determined by applying the pollutant concentrations or Event Mean Concentrations (EMCs).

The adopted EMCs for total suspended solids (TSS), total phosphorus (TP) and total nitrogen (TN) are given in **Table 8** and are sourced from the findings of a comprehensive review of stormwater quality in urban catchments undertaken by Duncan (1999) and adopted by the DECCW in March 2004. Analysis by Duncan (1999) found event mean concentrations of TSS, TP and TN to be approximately log-normally distributed for a range of different urban land-uses.

**Table 8 - Pollutant Event Mean Concentrations**

| Land Use | TSS | TP | TN |
|---|---|---|---|
| | *mg/L* | *mg/L* | *mg/L* |
| Roads | 270 | 0.5 | 2.2 |
| Roofs | 20 | 0.13 | 2.0 |
| General Urban | 140 | 0.25 | 2.0 |

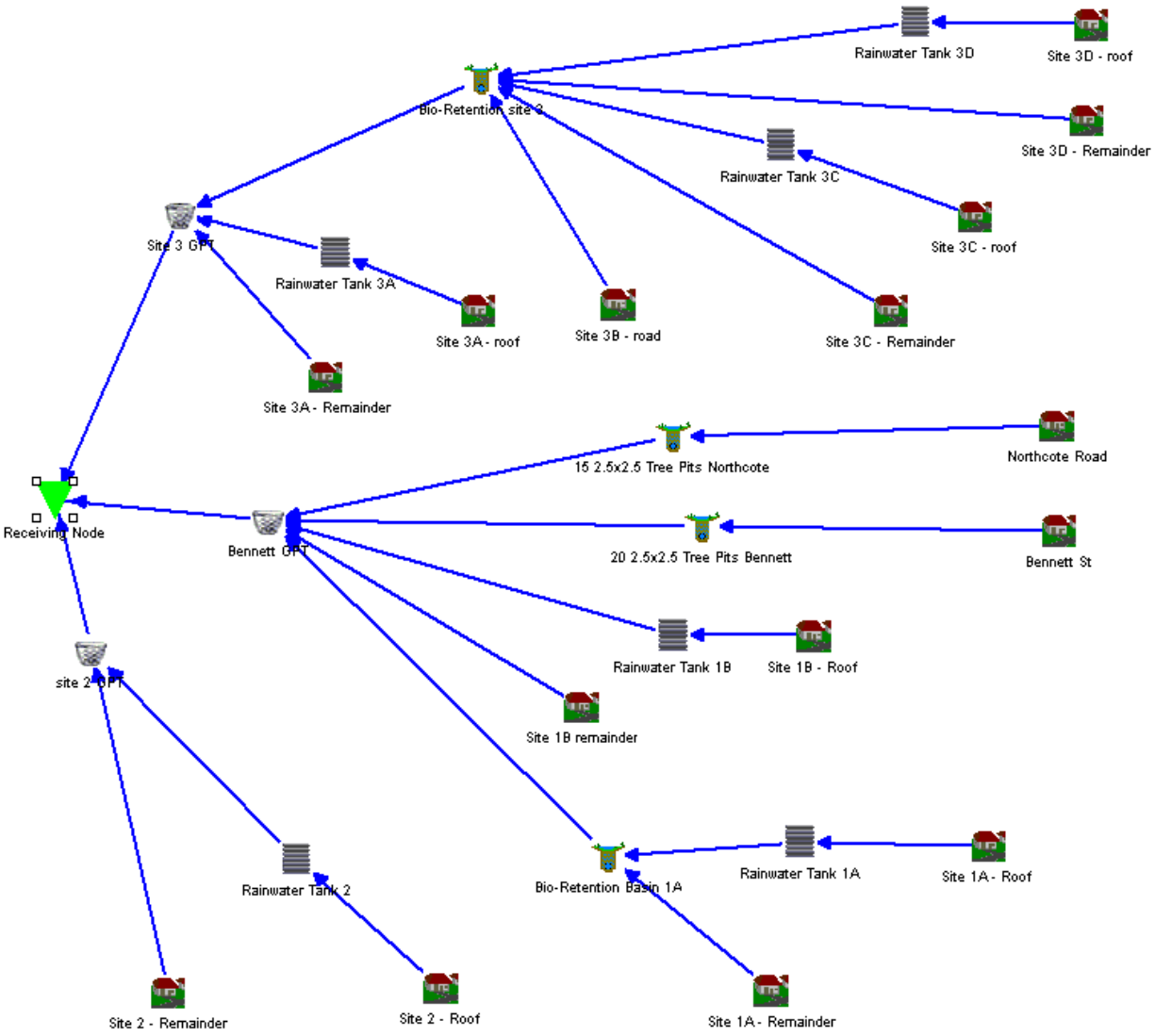
## 4.4 Proposed Treatment Measures

The stormwater management strategy to be implemented on the site would incorporate best practice water sensitive urban design (WSUD) measures. The water quality aspect of this strategy is to include treatment close to the source with measures such as rainwater tanks and bioretention systems in combination with more traditional measures such as gross pollutant traps (GPTs) near the outlets of the catchments. Due to the existing development at the site including existing allocation of road reserves and carriageway widths and existing underground services, bioretention swales are not considered feasible for this site. Measures that may be incorporated include rain gardens, tree pits and buffer strips. These measures are described in more detail in the following sections.

The proposed treatment measures presented herein create a framework of best management practices to achieve the treatment targets. The development of individual sites and stages in accordance with this report will thus culminate to the attainment of these targets. However, there remains the flexibility for individual areas to vary the proposed treatment measures from those presented, provided the overall treatment targets are still met.

The MUSIC model layout is shown in **Diagram 4**.

**Diagram 4 – MUSIC model layout**




### 4.4.1 Rainwater Tanks

Rainwater tanks are proposed to be installed, as detailed in the previous section. Rainwater tanks reduce the volume of runoff through storage and re-use, which consequently reduces the export of pollutants in runoff.

### 4.4.2 Bioretention Systems

Bioretention systems promote the detention and passage of stormwater through a prescribed subsurface filter medium. Runoff is forced to pond on the surface of the bio-retention systems, and then percolate through the filter media. Typical bioretention systems include swales, rain gardens and tree pits.

The type of filter medium determines the effectiveness of the pollutant removal. Material of lower hydraulic conductivity provides the most efficient pollutant removal through higher retention time and a greater filtering effect.

The ponding depth for tree pits would be 100 mm, while the ponding depth would be 300 mm for other measures, with maximum side slope of 1(v) in 3(h). Small rainfall events will pond and filter through the media, while during larger rainfall events water will initially infiltrate the trenches before also spilling into a collection pit or along a designated overland flowpath.

For this investigation it was assumed that bioretention systems would consist of the following:

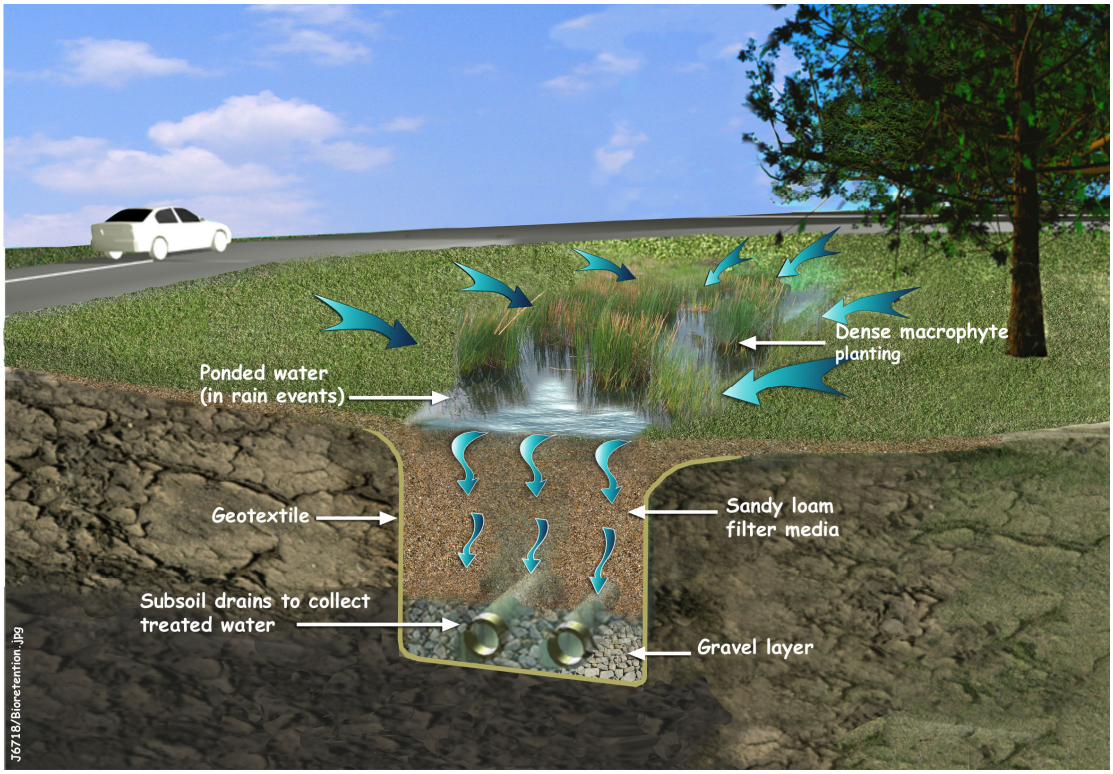
- subsurface bio-filter material consisting of sandy-loam,
- an impermeable liner (if required to prevent infiltration to groundwater),
- a subsoil drainage pipe system with a medium gravel surround,
- A transition layer of medium – coarse sand. The sizing of the sand and gravel is critical to prevent the overlying material including the bio-retention filter media from moving into the subsoil drain,
- plantings generally consisting of native sedge plants, grasses or trees (for tree pits), and
- a concrete pipe to accommodate trunk drainage requirements, where necessary.

The purpose of bioretention is to remove pollutants typically found in urban runoff (i.e. TN, TP and TSS) by sedimentation, filtering and biological action. Low flows are maintained as much as possible on the surface (i.e. not piped) which would be exposed to sunlight, with turbulence introducing oxygen to the flows.

The role of the bioretention systems is not to promote infiltration into the surrounding subsoils but to maintain it below the surface in the drainage media incorporated at the base of the swale.

A typical bioretention system schematic is shown in **Diagram 5**.

**Diagram 5 – Typical Bio-retention System Schematic**




Rain gardens or bio-retention basins are proposed to be located on Site 1 and Site 3 in the public open space areas and would consist of vegetated local depressions. Runoff would pond in these localised depressions before ultimately being collected in a pit and conveyed in the pipe drainage network. Filter media would be provided beneath the base of the rain garden.

Tree pits are proposed to be located intermittently along local roads, as shown on **Figure 1**. Tree pits would consist of a local depression, which would capture road runoff for treatment.

The default and adopted bio retention swale parameters are presented in **Table 9**.

**Table 9 - Bioretention parameters**

| | Default Parameters | Adopted Parameters |
|---|---|---|
| ***Inlet Properties*** | | |
| Low Flow By-Pass ($m^3/s$) | 0.00 | 0.00 |
| High Flow By-Pass ($m^3/s$) | 100.00 | 3 month ARI flow from contributing catchment |
| | | |
| ***Storage Properties*** | | |
| Extended Detention Depth (m) | 1.00 | 0.30 for basins<br>0.10 for tree pits |
| Surface Area ($m^2$) | 20.00 | Site Specific |
| Seepage Loss (mm/hr) | 0.00 | 0.00 |
| | | |
| ***Infiltration Properties*** | | |
| Filter Area ($m^2$) | 20.00 | Site Specific |
| Filter Depth (m) | 1.00 | 0.60 |
| Filter Median Particle Diameter (mm) | 5.00 | 1.00 |
| Saturated Hydraulic Conductivity (mm/hr) | 100.00 | 100.00 |
| Depth Below Underdrain Pipe (% of filter depth) | 0.00 | 0.00 |
| | | |
| ***Outlet Properties*** | | |
| Overflow Weir Width (m) | 2.00 | Site Specific |
| | | |

These adopted bioretention swale parameters have been selected based on our engineering experience with the construction of these water quality treatment devices.

Bioretention systems have been located in areas that would provide the most benefit in terms of water quality. The proposed locations of bioretention systems are shown on **Figure 1**, which provides an indicative diagrammatic summary of treatment measures. The key parameters for bioretention systems to be adopted are presented in **Table 9**.

The total surface area of the proposed bioretention systems for the site represents approximately 2% of the total developable area on the site.

### 4.4.3 Gross Pollutant Traps

A Gross Pollutant Trap (GPT) captures litter, coarse sediment, some nutrients, oils and greases. While the pollutant capture efficiency of various traps may vary, the paper "Removal of Suspended Solids and Associated Pollutants by a Gross Pollutant Trap" (*Cooperative Research Centre for Catchment Hydrology, 1999*) suggests the following efficiencies for a CDS ("*Continuous Deflective Separation*") unit, or similar:

- gross pollutants — majority
- sediments — up to 70%
- total phosphorous — up to 30%
- total nitrogen — up to 13%

These removal efficiencies have been adopted for all GPT's in the MUSIC model.

It is proposed to treat flows up to and including the 3 month average recurrence interval (ARI) flows for each GPT. The 3 month ARI flows generated by the associated catchments were estimated and input into the MUSIC model as the high flow bypass flow for each of the GPTs, i.e. flows greater than the 3 month ARI flow bypass the GPTs.

The locations of the proposed GPT's are shown on **Figure 1**.

### 4.4.4 Maintenance Programme

The proposed maintenance program for the sites water quality control measures will consist of the following:

- Periodic (*6 monthly*) inspection and removal of any gross pollutants & coarse sediment that is deposited in the bio-retention basins and replacement of vegetation as necessary;
- Periodic (*3 monthly*) and episodic (*post storm greater than 1 yr ARI*) inspection and removal of trapped pollutants from all GPTs; and

## 4.5 Model Results

The results indicate that the proposed treatment measures can achieve the targets set out by DEC, as shown in **Table 10**.

**Table 10 – MUSIC Model Results**

| | TSS | TP | TN |
|---|---|---|---|
| Pollutants Generated (kg/year) | 3230 | 7.31 | 61.9 |
| Outflow to Receiving Node (kg/year) | 460 | 2.66 | 32.4 |
| ***Percent Reduction*** | ***85 %*** | ***63 %*** | ***47 %*** |

Although the existing site was not modelled in MUSIC, it is considered that the existing site would generate more pollutants than the proposed development (without treatment), due to the higher percentage impervious (90% under existing conditions compared to 78% under proposed conditions). Hence, the water quality improvements provided by the development compared to existing conditions are even greater than those listed in **Table 10**, representing a significant public benefit.

The assessments undertaken to develop this stormwater management strategy for the proposed development has shown that the proposed stormwater management plan and WSUD initiatives successfully achieve and address point 8 of the DGR's for the concept.

# 5. DRAINAGE AND FLOODING

The local topography falls to the west from a crest located generally parallel to and to the east of Tennyson Road towards Majors Bay. The crest falls from RL 20.00 to 10.00 m AHD as it passes the site from south to north. The fall from this crest to the bay thus results in relatively steep east-west grades of over 10% in some areas, becoming gentle towards the waterfront.

Sites 2 and 3 front Majors Bay, which lies on the lower reaches of the Parramatta River.

## 5.1 Flooding

There are no defined watercourses or waterways traversing either through or around the site. Hence, localised flooding is not considered to pose a significant constraint on the site. Flood impact is more likely to occur as a result of flood and sea levels within Parramatta River.

According to the Lower Parramatta River Flood Study by Willing & Partners Pty. Ltd, 1986, the 100 year ARI flood level in the bay is RL 1.50 m AHD.

The crest of foreshore wall is generally in the order of RL 1.60 to 1.80 m AHD and therefore above the 100 year ARI flood level. However there are a few areas immediately behind the wall that fall marginally, but not below RL 1.40 m AHD, according to recent detailed ground survey.

Due to the relative steepness of the site, local flooding is not predicted to form a constraint. The extent of the 100 year ARI flood level in Parramatta River within the site is illustrated in **Figure 4**.

## 5.2 Freeboard

The NSW Floodplain Development Manual (DIPNR 2005) specifies the required typical freeboard for habitable floor levels of 500 mm above 100 year ARI flood level.

This would equate to a minimum habitable floor level of RL 2.00 m AHD (RL 1.50 m AHD 100 year ARI flood level + 0.5 m Freeboard).

As the proposed minimum habitable floor levels of RL 3.30 m AHD sits well above the minimum required, the proposed development complies with the minimum freeboard requirements.

## 5.3 Climate Change Impacts

The developer is required to undertake a risk management assessment of climate change impacts in accordance with DoP NSW Coastal Planning Guidelines - Adapting to Sea Level Rise (2010), Draft Flood Risk Management Guide – Incorporating Sea Level Rise Benchmarks in Flood Risk Assessment (2009) and Practical Consideration of Climate Change (2007).

The NSW Coastal Planning Guideline: Adapting to Sea Level Rise (2010) outlines the need to consider the effects of sea level rise due to climate change. The guideline refers to the *NSW Sea Level Rise Policy Statement* published in 2009 by the NSW Department of Environment, Climate

Change and Water (DECCW) which lists the sea level rise planning benchmarks as an increase above 1990 mean sea levels of 400 mm by 2050 and 900 mm by 2100.

Following the 2009 policy statements, and taking into consideration the flood levels near the site is RL 1.50 m AHD (**Section 5.1**), the predicted 2100 year flood level would be RL 2.40 m AHD. This level is taken from adding the expected sea level rise of 0.9 m to the existing flood level of RL 1.50 m AHD. As a result, the minimal required habitable floor level would need to be RL 2.90 m AHD to take into account for the 0.9 m sea level rise due to climate change and the 0.5 m minimum freeboard requirement.

With proposed minimal habitable floor levels at RL 3.30 m AHD, the habitable floor levels of the proposed development would not be inundated by the predicted 100 year ARI flood event in 2010. However, it is worth mentioning that under this predicted flood condition, the majority of the site would be inundated by the Parramatta River flood levels. As a result, all entries to basement car parks within the development would need to be set as high as possible above the 100 year ARI flood event.

The extent of the predicted 2100 100 year ARI flood level in Parramatta River within the site is illustrated in **Figure 4**.

In 2007, DECCW published a guideline entitled *Floodplain Risk Management Guideline: Practical Consideration of Climate Change,* which discusses the potential impact of climate change on flood levels. The report recommends that flood studies incorporate a sensitivity analysis for an increase in rainfall intensity on top of increases in sea level rise.

The guidelines refer to a maximum 30% rainfall intensity increase by 2100. This is an upper limit and can range from 10% to 30% depending on sensitivities, and should only be used for comparative purposes only.

Due to the small catchment size and the lack of defined watercourse or waterways traversing either through or around the site, the increase in rainfall intensity, as a result of climate change, is expected to have minimal impacts on local flooding. Any significant flood impacts are more likely to occur from sea level rises within the Parramatta River. For this reason, the impact of increased rainfall intensities on flood levels have not been assessed and should in no way be used for specifying floor levels.

Based on the above comment WorleyParsons believe the proposed development adequately addresses issue 10 of the DGR's.

## 5.4 Drainage

The existing pipe drainage network is aged and non-existent in some areas. The current system would not comply with Council's current specifications. Piped drainage is required to carry the 10 year ARI flow in local, collector and sub-arterial roads, while a 20 year ARI capacity is required for the private system in medium density residential areas. Flows in excess of the 10 year ARI up to the 100 year ARI event are to be safely conveyed within roadways and designated overland flowpaths.

It is proposed to upgrade the pipe drainage concurrently with the road upgrades.

Modelling of piped drainage networks for this development has been undertaken using DRAINS software, which "performs design and analysis calculations for urban stormwater drainage systems and models the flood behaviour of rural and urban catchments" (DRAINS user manual, December 2002). DRAINS has been used for this analysis because it has the following attributes:

- It provides calculation procedures for design and analysis of urban stormwater drainage systems, involving pipes, open channels and other components;
- It provides outputs in a variety of formats that enable results to be easily transferred to reports and drawings;
- It allows hydrological calculations in the ILSAX model and the Rational Method;
- It allows hydraulic grade line analysis of stormwater drainage systems
- It allows integrated analysis of pipe and open channel networks, including culvert and bridge analysis;
- It provides help and checking systems; and
- It is based on logical and accepted algorithms.

### 5.4.1 Existing Drainage System

The existing DRAINS model of the area was used to make and assessment of the current drainage infrastructure. The model indicates that the 10 year ARI flows cannot be conveyed by the existing system, resulting in significant overland flows. The current system is not compliant with Council standards.

While there are catchments upstream of each of the three sites, these are not external catchments contributing runoff to the sites, as local roadways bordering the sites function as overland flowpaths, diverting flows around these private properties.

### 5.4.2 Proposed Drainage System

The roof drainage for the development would be conveyed via gutters and downpipes to the proposed rainwater tanks for reuse. Overflow from these tanks would be conveyed to either a water quality treatment measure, the street drainage system or an outlet to the bay.

The pipe drainage network has been designed for:

- 10 year ARI flow in local, collector and sub-arterial roads, and
- 20 year ARI for the private system in the proposed medium density residential areas.

Minimum pipe sizing, grading and minimum pit spacing will be adopted to comply with Council's standards.

Major overland flowpaths would be provided to convey overland flows up to and including the 100 year ARI event.

It is not expected that stormwater drainage easements over other properties would be required for this development, as two of the three sites drain directly to Majors Bay and the third site is fronted by public roadways on its downslope boundaries. However, it may be preferable to create easements within the land holdings, depending on the final development layout and any proposed subdivision or boundary adjustments.

The existing drainage outlets to Majors Bay generally include flap gates to prevent the ingress of water in high tides. Where possible, the proposed layout will attempt to minimise the number of outlets, where necessary.

The proposed drainage outlet will consist of 3 major drainage corridors. The first major corridor will run along Hilly Street between Edwin Street and Whitaker Street, collecting storm water runoff from external catchments up to the catchment boundary on Tennyson Road. The second corridor runs down Bennet Street collecting runoff from Bennet Street and Site 2. The third major corridor will run down Northcote Street receiving runoff from Northcote street and the Hilly Street and Bennet Street drainage corridors. The water collected will be discharged from Northcote Street into Majors Bay via two 600 mm diameter pipes. Two more minor drainage corridors will exist on Site 1 and Site 3 of the development to convey run off out into Majors Bay.

The proposed drainage layout is shown on the Stormwater Drainage Concept Plan in **Figure 3**.

Further detail design would be undertaken at a later stage of the development to account for the predicted increase in rainfall intensity due to climate change as discussed in **Section 5.3**.

### 5.4.3 Scour and Erosion Control

Inspection of the existing stormwater outlets at the site indicates that scouring and erosion are not likely to be significant issues on this site. This is largely due to the configuration of the outlets, which drain directly to Majors Bay. It is proposed to maintain existing outlets where possible. Where this is not feasible, outlet scour protection will be provided where necessary. It is considered that velocities of less than 2.00 m/s in the minor design storm event (i.e. 10 year ARI) would not warrant scour protection.

## 5.5 On-Site Detention

It is not proposed to provide any on-site detention (OSD) as part of this development for reasons discussed below.

OSD is typically required for developments along the majority of watercourses to mitigate the impacts of increased flows caused by hard surfaces. OSD limits the maximum permissible discharge from each property in order to maintain flows in drainage lines or watercourses. However, due to the increased volume of stormwater runoff, the maximum discharge is maintained for a much longer period than if it were not detained. Hence, for sites on lower reaches of catchments, it is preferable to allow flows to discharge undetained, in effect releasing these flows quickly before bulk of the flow (the peak) arrives.

Similarly, OSD would not perform its intended function on sites discharging directly to large open water bodies, such as oceans, seas, harbours, lakes and embayments, where the water level is generally independent of the magnitude of incoming flows.

These two scenarios are foreseen specifically in the Council Specification for the Management of Stormwater.

For this development, Sites 2 and 3 can directly discharge flows to Majors Bay, while Site 1 is also close to the bay. Hence it is not proposed to provide any OSD for the development. It should be noted that the provision of rainwater tanks provides a much more sustainable outcome in this case.

The pipe drainage from Site 1 to Majors Bay is proposed to be upgraded as part of the Northcote Street upgrade works, hence the system can be designed to convey the undetained peak flows without impacting on other properties.

# 6. CONCLUSION

This report has been produced for Mortlake Consolidated Pty Ltd in support of the proposed development of the Majors Bay site which is located in Mortlake within the City of Canada Bay Council LGA. Mortlake Consolidated Pty Ltd, which is seeking concept plan approval from the Department of Planning, proposes to demolish the existing industrial buildings and develop medium density residential apartments along with associated roads and open space.

DGRs relating to drainage and stormwater management as well as climate change and sea level rise have been received and addressed in this report.

The stormwater management strategy to be implemented on the site incorporates a water sensitive urban design (WSUD) approach with emphasis on a treatment train throughout the development. The NSW Department of Environment, Climate Change and Water reduction targets in annual runoff pollutant loads for developments are met by implementation of a stormwater treatment train that incorporates the use of rainwater tanks, bioretention, tree pits and GPTs.

It is understood that OSD would not be required as part of this development as the site sits on the lower reaches of the catchment, and this complies with Council's Specification for the Management of Stormwater.

Flooding at the site would not have any adverse effects on the proposed development. The Lower Parramatta River Flood Study (1986) found peak 100 year ARI flood levels to be approximately RL 1.50 m AHD at the subject site. As a result it is believe that flooding in the Parramatta River under existing conditions will not impact the site, as it sits well above the 100 year ARI flood level.

When taking into consideration the impacts of climate change, as per the *NSW coastal Planning Guideline* (DoP, August 2010), it was found that the proposed development would be partially inundated by a 100 year ARI flood event in the year 2100. However, habitable floor levels have been set to RL 3.30 m AHD which sits above the predicted 100 year ARI flood level. The proposed minimal habitable floor level takes into account sea level rise, due to climate change, of up to 0.9 m and the minimum 0.5 m freeboard required.

It is proposed to upgrade the pipe drainage concurrently with road upgrades. The pipe drainage network has been designed for the 10 year ARI flow in local, collector and sub-arterial roads, and the 20 year ARI for the private system in the proposed medium density residential areas (please refer to the Stormwater Drainage Concept Plan, **Figure 3**).

The stormwater management, water sensitive urban design, and civil engineering proposals included with the development represent substantial improvements on existing conditions and generally comply with relevant standards and the DGRs.

# 7. REFERENCES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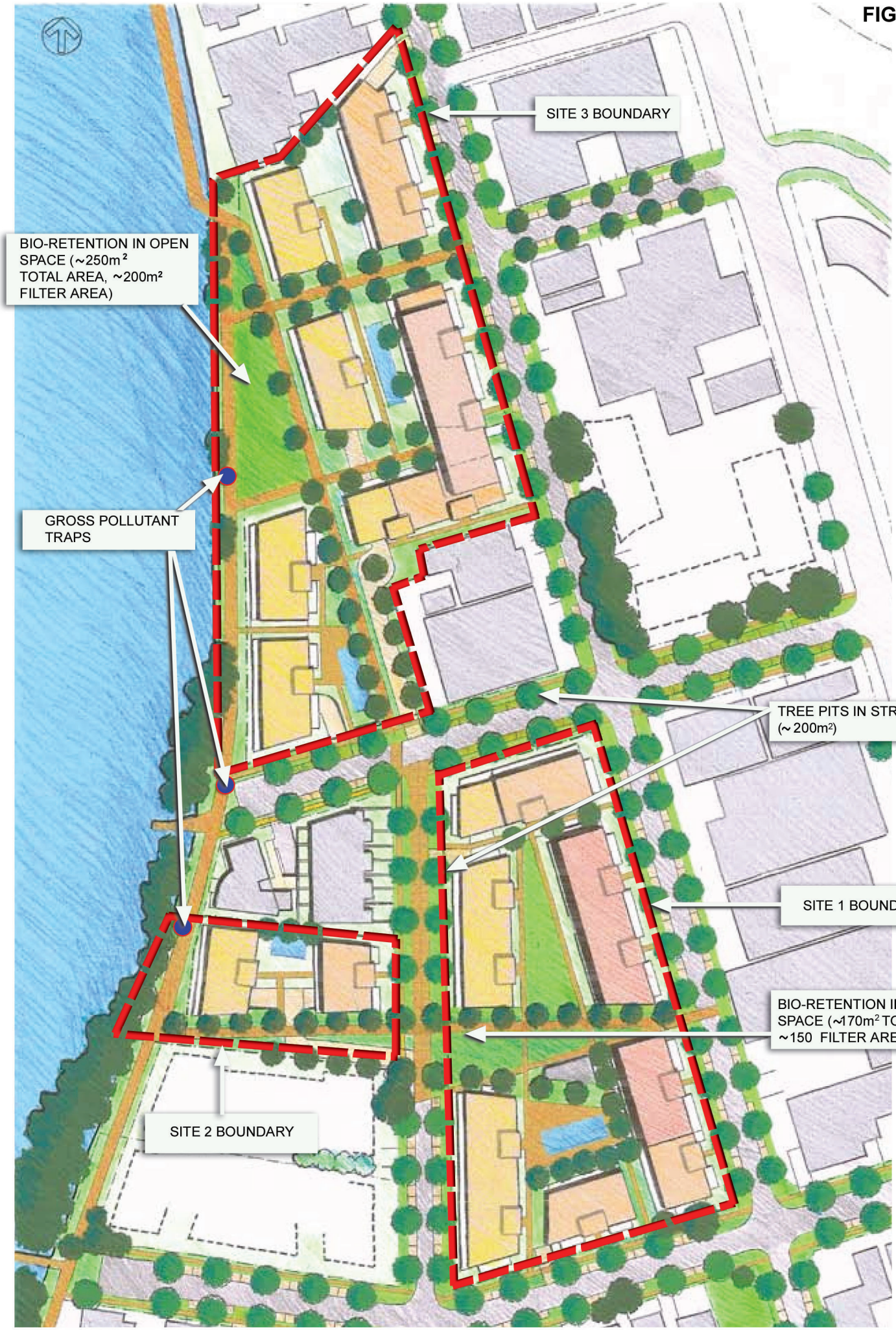
- Willing & Partners Pty. Ltd, 1986, Lower Parramatta River Flood Study

# Figures

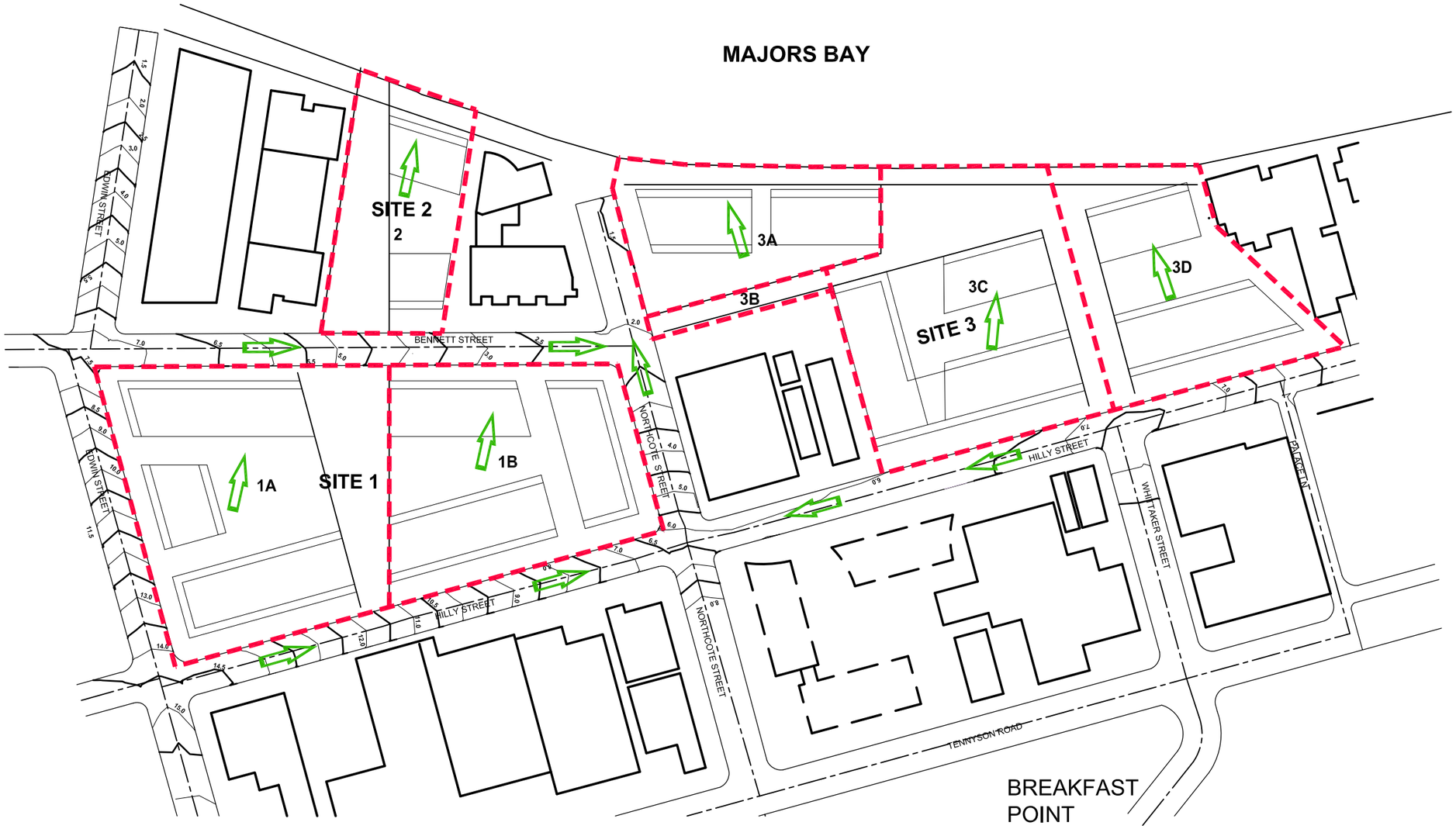
FIGURE 1




**MAJORS BAY MORTLAKE**
**WATER SENSITIVE URBAN DESIGN**

J6718/FIG1_WaterSensitiveUrbanDesign.jpg

# MAJORS BAY




5.5 Existing Surface Levels

3C Subcatchment Name

Subcatchment Boundaries

Direction of Stormwater Flow

15 0 15 30 45 60 75m

1:750 (A1) 1:1500 (A3)

WorleyParsons
resources & energy

OneWay
to zero harm

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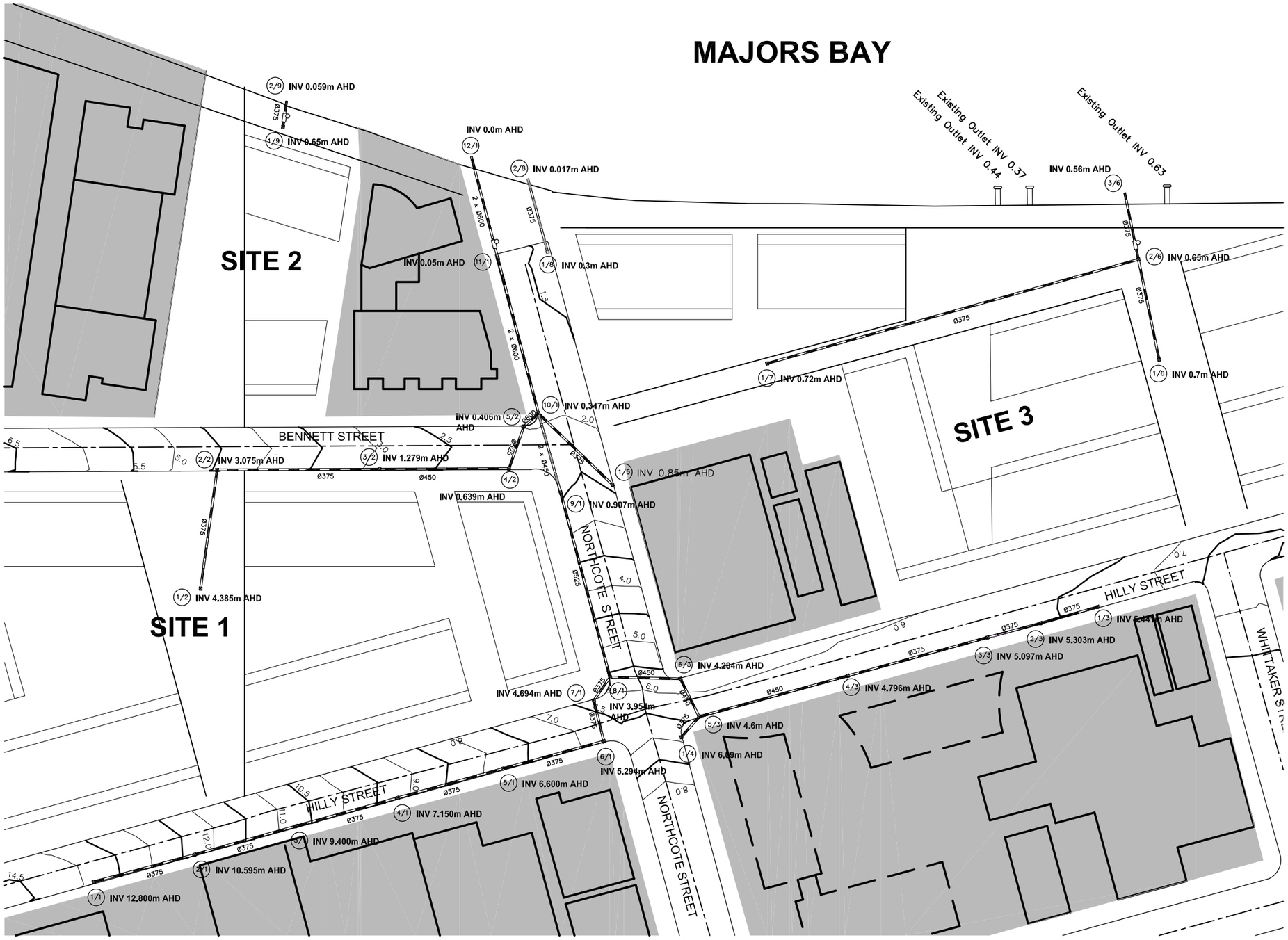
NORTH

**MAJORS BAY, MORTLAKE**
**CATCHMENT PLAN**

**FIGURE 2**


PLOT DATE & TIME: 21/12/2010 12:26:58 PM USER NAME: costa.miroforidis LOCATION: \\AUSYDWPFILCLU\WORLEY_INFRASTRUCTURE\PROJECTS\300105\XXXX - MORTLAKE MAJORS BAY\10.0 ENGINEERING\10.01 CI-CIVILS\FROM ARCHIVE\DRAWINGS\6718 F1 JNH FIGURE 2.DWG
SAVE DATE & TIME: 21/12/2010 12:26:06 PM CTB FILE: __00-WP-Syd-std.ctb Plotter=\\ausyd4wppr10\v\L10SYDRICOH3500RPCS

# MAJORS BAY




Private Development External to site

Existing Stormwater Pipe

Proposed Stormwater Pipe

Stormwater Pit

Gross Pollutant Trap

5.865m AHD Upstream Pipe Invert Level

Ø450 Pipe Diameters

Existing Outlets

5.5 Existing Surface levels

10 0 10 20 30 40 50m

1:500 (A1) 1:1000 (A3)

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| ISSUE | DATE | ISSUE DESCRIPTION |
|---|---|---|
| A | 21.12.10 | ISSUED FOR INFORMATION |

NORTH

**MAJORS BAY, MORTLAKE**
**STORMWATER DRAINAGE CONCEPT PLAN**

**FIGURE 3**

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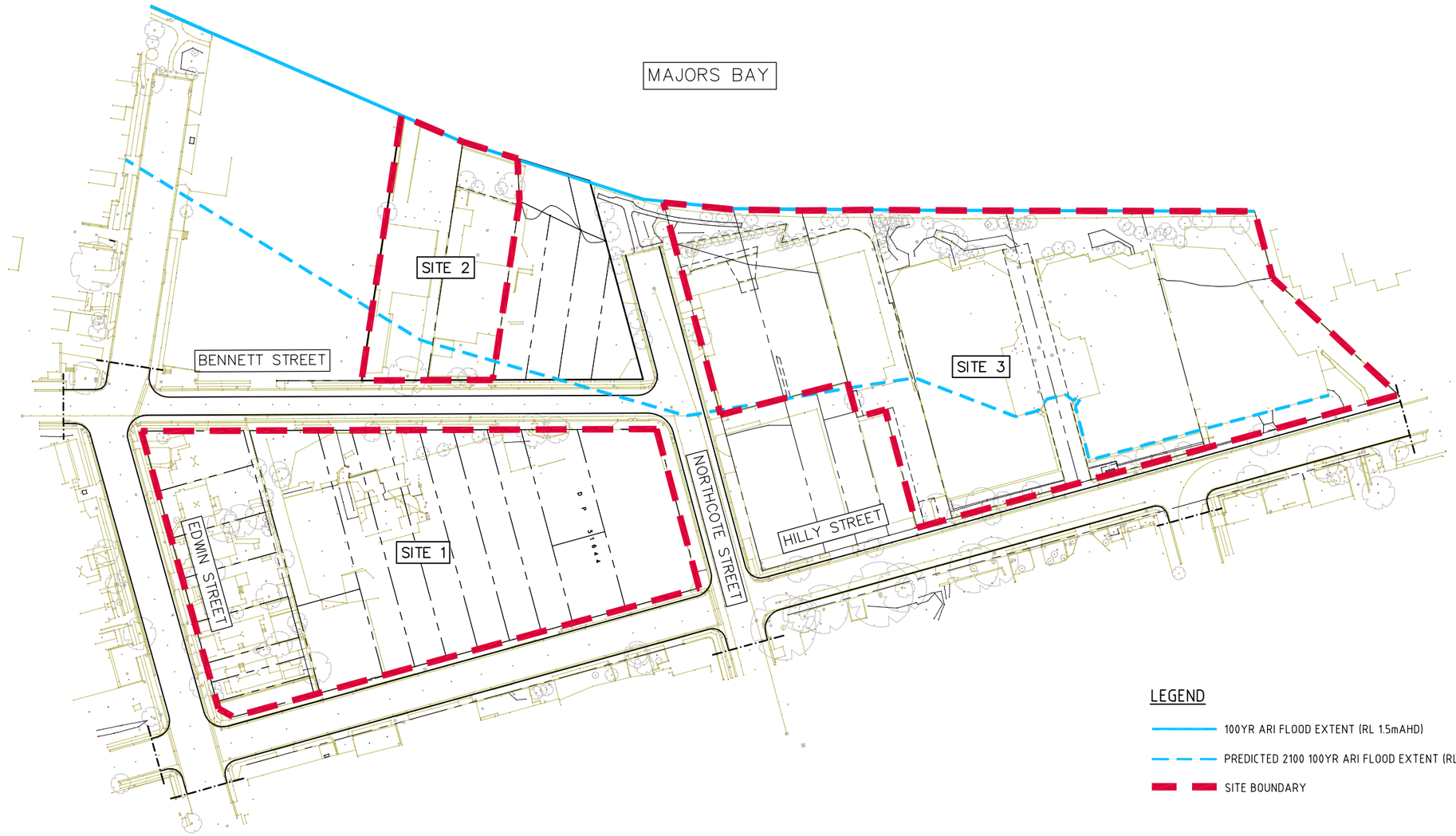
SAVE DATE & TIME: 21/12/2010 12:17:33 PM CTB FILE: _00-WP-Syd-std.ctb Plotter:\\ausydwppr101v\LT0SYDRICOH3500RPCS




## LEGEND

- 100YR ARI FLOOD EXTENT (RL 1.5mAHD)
- PREDICTED 2100 100YR ARI FLOOD EXTENT (RL 2.4mAHD)
- SITE BOUNDARY

## NOTE:

FLOOD EXTENT INTERPOLATED FROM LIMITED SURVEY (PART TOPOGRAPHIC DETAIL SURVEY BY WILLIAM L. BACKHOUSE PTY LTD)

15 0 15 30 45 60 75m

1:750 (A1) 1:1500 (A3)

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resources & energy

OneWay™ to zero harm

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| A | 21.01.11 | FINAL ISSUE |

NORTH

# MAJORS BAY, MORTLAKE
# FLOOD EXTENT PLAN

**FIGURE 4**

LOCATION: N:\47I7 SHELL COVE STAGE 3\EMP FIGURES\47I7-3-FIGURE 3C.DWG
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# Appendix 1 - Director General's Requirements

NSW GOVERNMENT | Planning

**Director-General Environmental Assessment Requirements**
**Section 75F of the *Environmental Planning and Assessment Act 1979***

| | |
|---|---|
| **Application number** | MP 10_0154 |
| **Project** | **Concept Plan** for a residential redevelopment and associated streetscape and public domain works. |
| **Location** | Hilly Street, Northcote Street, Bennet Street and Edwin Street, Mortlake (City of Canada Bay LGA). |
| **Proponent** | Mecone obo Mortlake Consolidated Pty Limited |
| **Date issued** | 10/1/2011 |
| **Expiry date** | If the Environmental Assessment (EA) is not exhibited within 2 years after the date of issue, the applicant must consult further with the Director-General in relation to the preparation of the environmental assessment. |
| **Key issues** | The Environmental Assessment (EA) must address the following key issues:<br><br>**1. Relevant EPI's policies and Guidelines to be Addressed**<br>Planning provisions applying to the site, including permissibility and the provisions of all plans and policies are contained in **Appendix A**.<br><br>**2. Built Form and Urban Design Impacts**<br>• The EA shall address the height, bulk, scale and visual impact of the proposed development within the context of the locality, and give consideration to the desired future character contemplated by the *Canada Bay Council Mortlake Point DCP*. In particular, detailed envelope/height and contextual studies should be undertaken to ensure the proposal integrates with the local environment.<br>• The EA shall also provide the following documents:<br>  • Comparable height study to demonstrate how the proposed height relates to the height of the existing/approved developments surrounding the subject site; and<br>  • View analysis to and from the site from key vantage points, in particular views from the Harbour and from the nearby Breakfast Point development.<br>• The EA shall address the design quality of the development with specific consideration to building mass, height, setbacks, articulation, landscaping, and public domain, including an assessment against the CPTED Principles.<br><br>**3. Public Domain/ Open Space/Foreshore Land and Accessibility**<br>The EA must explain the type, function and landscape character of the various open spaces and foreshore links, including proposed areas of public and private open space. The EA should address pedestrian circulation and linkages between various open areas, including the foreshore, and should be demonstrated in a schematic form, with provision of details regarding access rights, accessibility for able and disabled persons, and legibility of the proposed public open space, private space and foreshore links. |

**4. Isolated sites**

- The EA shall address the failure to amalgamate the subject land with adjoining sites. In this regard, the EA shall provide details of steps taken to incorporate adjoining sites, either through purchase or joint venture.
- The EA shall address the impact on the development potential of isolated sites. The proposal must demonstrate that these sites can be developed independently in accordance with Canada Bay LEP 2008.

**5. Environmental and Residential Amenity**

- The EA must address solar access, acoustic privacy, visual privacy, view loss and microclimate issues, such as wind, that may be generated around tall buildings and identify mitigation measures necessary to achieve a high level of environmental and residential amenity.
- The EA shall address any potential environment impacts on riparian areas (including all foreshore areas) and provide recommendations to safeguard and mitigate potential impacts on riparian areas. Appropriate management plans for the remediation and rehabilitation of riparian areas in the event of potential adverse impacts should be provided.

**6. Transport and Accessibility (Construction and Operational)**

The EA shall address the following matters:

- Provide a Traffic and Accessibility Impact Study prepared in accordance with the RTA's Guide to Traffic Generating Developments, considering current traffic conditions and proposed traffic generation in the immediate locality, any required road/intersection upgrades, access, car parking arrangements, measures to promote public transport usage and pedestrian and bicycle linkages. The key roads and intersections to be examined / modelled shall be undertaken in accordance with relevant correspondence dated 22.11.2010 from Canada Bay Council. The study shall also address the findings and recommendations of:
  - Mortlake Redevelopment traffic Impact Assessment, August 2010 prepared by Transport and Urban Planning; and
  - Peer Review of Traffic Impacts (prepared by Transport and Traffic Planning Associates) for proposed medium residential development at Hilly St precinct, Mortlake, September 2010, prepared by Transport Urban Planning.
- Provide an assessment of the implications of the proposed development for non-car travel modes (including public transport, walking and cycling), in particular an assessment on the current bus services available to the site, including frequency and load. A Travel Access Guide (TAG) shall be developed for the future residents and visitors of the site.
- Consult with STA with regards to opportunities for upgrades to existing infrastructure at Whittaker Street terminus, and provide evidence that consultation has been undertaken.
- Identify measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project; and
- Demonstrate the provision of sufficient on-site car parking for the proposal having regard to the sites accessibility to public transport, local planning controls and RTA guidelines. (**Note**: the Department supports reduced car parking rates in areas well-served by public transport). Parking provision for shared cars should also be specifically addressed.

**7. Ecologically Sustainable Development (ESD)**

- The EA shall detail how the development will incorporate ESD principles in the design, construction and ongoing operation phases of the development.
- The EA must demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.

**8. Drainage/Stormwater/Flooding Management**

The EA shall address drainage/groundwater/flooding issues associated with the development/site, including stormwater, drainage infrastructure and incorporation of Water Sensitive Urban Design measures.

**9. Contamination and Human Health Risk Assessment**

Contamination and potential human health risks associated with the proposal should be identified and addressed in accordance with SEPP 55 and other relevant legislation and guidance and should consider the impact on human health. This assessment should also include an analysis of any risks/hazards associated with urban salinity.

**10. Climate Change and Sea Level Rise**

The EA shall address climate change and sea level rise in accordance with the *Draft Sea Level Rise Policy Statement* (NSW Government, October 2009).

**11. Contributions**

The EA shall address the provision of public benefit, services and infrastructure having regard to Council's Section 94 and 94A Contribution Plans, and provide details of any Planning Agreement or other legally binding instrument proposed to facilitate this development.

**12. Consultation**

The EA shall demonstrate that an appropriate level of consultation in accordance with the Department's *Major Project Community Consultation Guidelines October 2007* is to be undertaken and a comprehensive Community Consultation Strategy shall be provided.

**13. Geotechnical & Hydrological Requirements**

The EA shall provide a Geotechnical and Hydrological assessment addressing the proposed excavation methods and support (particularly to Council roads and infrastructure and the adjoining properties and structures), construction, impact on groundwater, likely vibrations and any requirements for vibration monitoring, and any recommendations for a dilapidation survey.

**14. Utilities**

In consultation with relevant agencies, the EA shall address the existing capacity and requirements of the development for the provision of utilities including staging of infrastructure works and provide an Integrated Water Management Plan.

**15. Statement of Commitments**

The EA must include a draft Statement of Commitments detailing measures for environmental management, mitigation measures and monitoring for the project.

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| | **16. Staging**<br>The EA must include details regarding the staging of the proposed development, including construction and access to areas of private and public open space/ harbour foreshore. |
| **Deemed refusal period** | 60 days |

# Appendix A

**Relevant EPI's and Policies to be addressed:**

- NSW State Plan 2010;
- Draft Inner West Subregional Strategy;
- Metropolitan Transport Plan 2010;
- Urban Transport Statement;
- Canada Bay Local Planning Strategy 2010;
- Canada Bay Local Environmental Plan 2008 and other relevant Development Control Plans;
- SEPP (Building Sustainability Index: BASIX) 2004;
- SEPP 55 - Remediation of Land;
- Contaminated Land Management Act 1997;
- SEPP 65 - Design Quality of Residential Flat Development (SEPP 65) and the Residential Flat Design Code (RFDC);
- SEPP (Infrastructure) 2007;
- SREP (Sydney Harbour Catchment) 2005;
- Draft Sea Level Rise Policy Statement (NSW Government, October 2009);
- Acid Sulphate Soil Assessment Guidelines (Acid Sulphate Soil Management Advisory Committee 1998);
- NSW Groundwater Policy Framework Document and other relevant Groundwater policies; and
- Nature and extent of any non-compliance with relevant environmental planning instruments, plans and guidelines and justification for any non-compliance.

# Appendix B

**Plans and Documents to accompany the Application**

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| **General** | The Environmental Assessment (EA) must include:<br>1. An executive summary;<br>2. A thorough site analysis including site plans, aerial photographs and a description of the existing and surrounding environment;<br>3. A thorough description of the proposed development:<br>4. An assessment of the key issues specified above and a table outlining how these key issues have been addressed;<br>5. An assessment of the potential impacts of the project and a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project;<br>6. The plans and documents outlined below;<br>7. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading;<br>8. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project (in accordance with the definition contained in the Major Projects SEPP); and<br>9. A conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest. |
| **Plans and Documents** | The following plans, architectural drawings, diagrams and relevant documentation shall be submitted;<br>1. **An existing site survey plan** drawn at an appropriate scale illustrating;<br>• the location of the land, boundary measurements, area (sq.m) and north point;<br>• the existing levels of the land in relation to buildings and roads;<br>• location and height of existing structures on the site;<br>• location of and height of existing trees;<br>• location and height of adjacent buildings and private open space; and<br>• all levels to be to Australian Height Datum.<br>2. **A Site Analysis Plan** must be provided which identifies existing natural elements of the site (including all hazards and constraints), existing vegetation, footpath crossing levels and alignments, existing pedestrian and vehicular access points and other facilities, slope and topography, utility services, boundaries, orientation, view corridors and all structures on neighbouring properties where relevant to the application (including windows, driveways, private open space etc). Adjoining land uses and activities, sources of nuisances and heritage features of the surrounding locality and landscape shall also be shown. |

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| | 3. **A locality/context plan** drawn at an appropriate scale should be submitted indicating:<br>• significant local features such as parks, community facilities and open space, Majors Bay shoreline and riparian land including areas to be protected and enhanced, and heritage items;<br>• the location and uses of existing buildings, precincts, shopping and employment areas;<br>• traffic and road patterns, pedestrian routes and public transport nodes.<br><br>4. **Architectural Drawings** at an appropriate scale illustrating:<br>• the location of any existing building envelopes or structures on the land in relation to the boundaries of the land and any development on adjoining land;<br>• detailed floor plans, sections and elevations of the proposed buildings;<br>• elevation plans providing details of external building materials and colours proposed;<br>• fenestrations, balconies and other features;<br>• accessibility requirements of the Building Code of Australia and the Disability Discrimination Act;<br>• the height (AHD) of the proposed development in relation to the land;<br>• the level of the lowest floor, the level of any unbuilt area and the level of the ground; and<br>• any changes that will be made to the level of the land by excavation, filling or otherwise.<br><br>5. **Massing Model** of the proposed development at an appropriate scale which clearly identifies all works proposed on and off site.<br><br>6. **Visual and View Analysis** demonstrated through visual aids, such as a photomontage, to demonstrate visual impacts of the proposed building envelopes. In particular the view analysis must consider siting, bulk and scale relationships from key areas.<br><br>7. **Shadow Diagrams** showing solar access to the site and adjacent properties at summer solstice (Dec 21), winter solstice (June 21) and the equinox (March 21 and September 21) at 9am, 12 midday and 3pm.<br><br>8. **Landscape Plan/Public Domain/Foreshore Concept Plan** illustrating treatment of open space areas on the site and foreshore, screen planting, retaining walls and fencing along common boundaries and tree protection measures both on and off the site. Details of any trees to be removed, existing and proposed planting (for proposed planting documentation on the type of species and growth at full maturity is needed). Any concepts for works on the existing public domain should be separately identified.<br><br>9. **Staging Plan** illustrating how the development will be staged for implementation.<br><br>10. **Drainage/Stormater/Flooding Concept Plan** illustrating the concept for stormwater management and designed in accordance with the Council's Stormwater guidelines. |

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| | 11. **Traffic and Transport Study** addressing the RTA Guide to Traffic Generating Developments including a Transport Map detailing current and proposed public transport, cycling and walking routes in the surrounding area.<br><br>12. **Heritage Impact Report** prepared in accordance with the NSW Manual and illustrating the impact of the proposed development on any heritage items in the vicinity of the site.<br><br>13. **Contamination Report** including a Preliminary Contamination Investigation (Stage 1) in accordance with the NSW EPA Guidelines for Consultant Reports on Contaminated Sites.<br><br>14. **Construction Management Plan** to address impacts arising from the construction of the proposed development on the surrounding land uses.<br><br>15. **Geotechnical Report** prepared by a recognised professional who assesses the risk of Geotechnical failure on the site and identifies design solutions and works to be carried out to ensure the stability of the land and structures and safety of persons.<br><br>16. **Groundwater Assessment** identifying groundwater issues and potential degradation to the groundwater source that may be encountered during excavation. The assessment should identify contingency measures to manage any potential impacts and identify the presence of any Groundwater Dependent Ecosystems along with the impact of the proposal and suitable safeguard measures. |
| **Documents to be submitted** | • 1 copy of the EA, plans and documentation for the **Test of Adequacy** (TOA);<br>• **Once the EA has been determined adequate** and all outstanding issues adequately addressed, the following should be submitted for exhibition;<br>• Two (2) sets of architectural and landscape plans to scale in A1 size;<br>• Seven (7) sets of plans to scale in A3 size; and<br>• 7 copies of the Environmental Assessment and plans on CD-ROM (PDF format), each file not exceeding 5Mb in size.<br><br><u>NOTE:</u><br>**All files must be titled and saved in such a way that it is clearly recognisable without the file being opened. If multiple PDF's make up one document/report each must be titled in sequential order.** |

# Appendix 2 - Aargus Environmental Site Assessment Reports