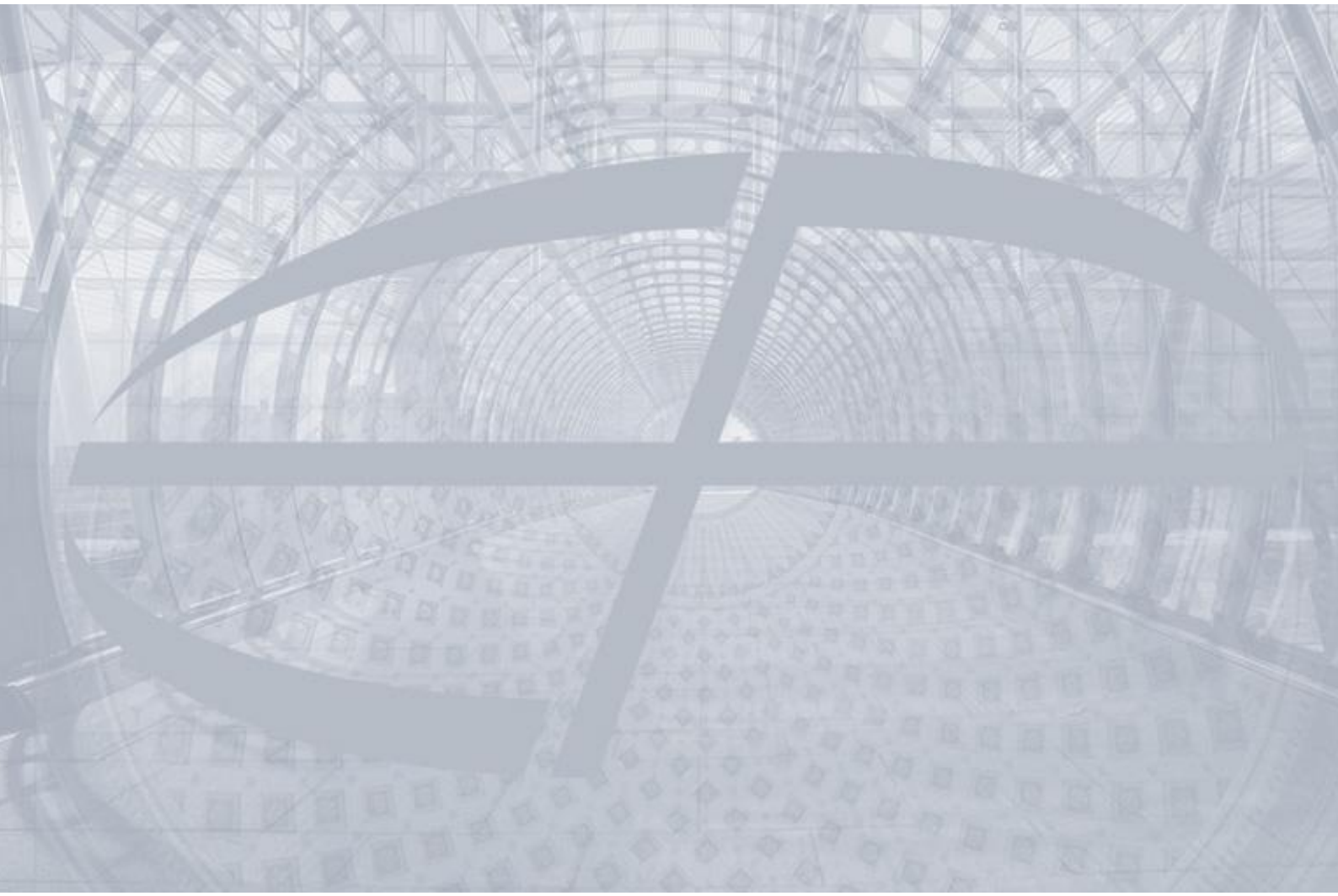
Appendix 7

Stormwater, Flooding and Water Balance Assessment



Materials Recycling Facility
Newbridge Road, Moorebank

Water Management and Pollution Control Assessment

December 2010

Table of Contents

List of Figures

List of Tables

List of Appendices

1 INTRODUCTION

1.1 Background

This report has been prepared to form an appendix to the Environmental Assessment Report being compiled by Nexus Environmental Planning for the proposed Materials Recycling Facility at Newbridge Road Moorebank. This report addresses the issues relating to site water management, pollution control and flooding. A detailed site history and description of the proposed development is included in the main Environmental Assessment Report.

An existing Development Application (1417/2005) for bulk earthworks at the site has been approved by Liverpool City Council. This report addresses the issues that arise from the works relating to the development of the site as a materials recycling facility following completion of the approved earthworks.

The NSW Minister for Planning is the consent authority. As such, the Director General has provided a list of requirements along with submissions from Liverpool City Council and DEC (now DECCW) regarding their requirements for the Environmental Assessment. This report covers the requirements relating to the water management and flooding aspects of the site (post DA earthworks); the potential impacts of the development; the mitigation measures that will be put in place to minimise or remove these impacts; and how these measures satisfy the relevant requirements of the Director-General of Planning, DECCW, and Liverpool City Council. The mitigation measures discussed in this report are presented in the form of an integrated site water management system that accounts for management of flood risk and measures to minimise site discharge and maximise stormwater reuse on the site. This report also addresses the flooding issues arising from the construction of an access road to the site and evacuation of the site in the event of a significant flood.

For purposes of this report, the "Site" refers to the area of land on which it is proposed to construct the facilities for materials recycling and associated support services such as car parking and staff amenities. The access road linking the Site to Brickmakers Drive is referred to as the "Access Road".

1.2 Site Location and Features

The Site is located adjacent to the George River, about 1km south of the Milperra Bridge, Moorebank. The Site rises from an elevation of 1.96m AHD at a location on the Access Road to 5.7m AHD near the northern end of the Site. **Figure 1** shows the position of the Site in relation to the Georges River together with the proposed layout of the Site for materials recycling. As shown on **Figure 1**, the area of the Site located to the north of the line "limit of surplus fill" (on which materials recycling operations are proposed) is located a minimum of 60 m from the bank of the Georges River.

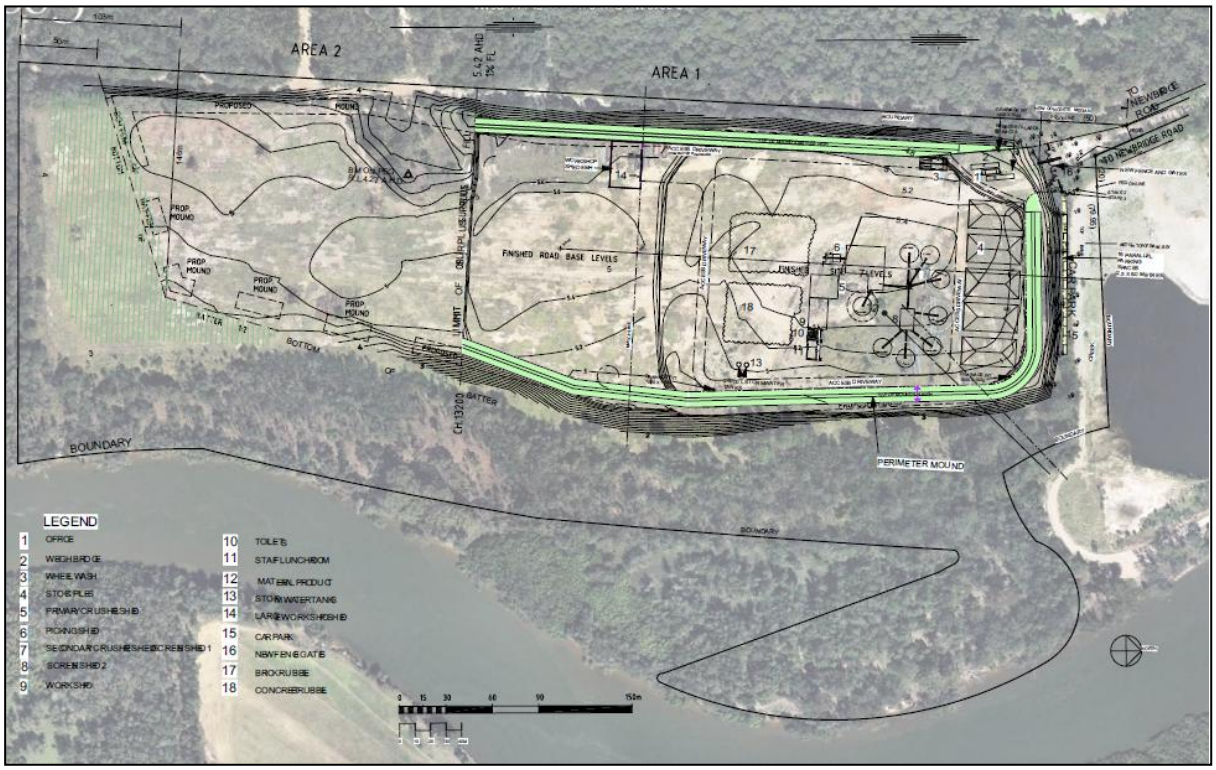


Figure 1 – Site Layout and Location in Relation to the Georges River

1.3 Approved Works

The works which have been approved to date (under a Liverpool Council Approved Earthworks Development Application (1417/05)) involve the excavation of approximately 40,000m^3 of spoil from the southern portion of the Site in order to reinstate the original natural ground levels which will allow natural exchange of floodwater between the Georges River and the riparian zone located immediately south of the Site during a relatively minor flood event (2 year ARI). Restoration of natural inundation in this area will restore wetland flooding; and improve water quality and habitat, all of which complement the *Georges River Water Quality and River Flow Objectives* (DECCW, 2006)

The excavated material from the southern end of the Site will be used to construct a series of perimeter mounds and to fill operational areas of the site, designated as "*Area 1*" and "*Area 2*" on **Figure 2**.

As demonstrated in the flood analysis that supported DA-1417/2005, the approved earthworks will result in no loss of flood storage and will have no effect on flood levels in the Georges River.

The approved earthworks for Areas 1 and 2 have been taken into account in developing the operational drainage strategy for this Project. The operational working area of the Site (Area 1) will be protected from flooding in a 100 year ARI flood by means of site levels, surrounding mounds and a low bund at the southern end of Area 1. The Site will be contoured to direct overland flow to various low points or collection sumps from where the water will be pumped to holding tanks for reuse. Further details on the water management and drainage strategy for the Site are provided in **Section 4** below.

2 EXISTING ENVIRONMENT

2.1 Climate

The nearest active Bureau of Meteorology (BOM) station to the Site is Bankstown Airport (66137) where the rainfall and temperature recordings span a period from 1968 to 2010. Evaporation data was sourced from Prospect Dam (67019) for a period from 1965 to 2010. The climate records are summarised in **Table 1** below.

Table 1: Climate Statistics

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	28.1	27.7	26.2	23.6	20.4	17.7	17.2	18.9	21.5	23.7	25.2	27.3	23.1
Mean minimum temperature (°C)	18.0	18.0	16.1	12.7	9.6	6.6	5.1	6.0	8.6	11.8	14.2	16.6	11.9
Mean rainfall (mm)	93.3	108.8	97.6	84.7	70.2	73.5	44.6	49.7	44.6	61.9	76.1	67.0	870
Median rainfall (mm)	74.6	77.0	77.3	67.6	60.4	44.8	33.1	23.2	37.0	40.9	68.6	57.1	900
Mean number of days of rain ≥ 10 mm	2.7	2.9	2.8	2.4	2.2	2.0	1.3	1.1	1.2	1.9	2.3	2.1	24.9
Mean number of days of rain ≥ 25 mm	1.0	1.2	0.9	1.0	0.6	0.7	0.3	0.5	0.3	0.5	0.7	0.7	8.4
Mean pan evaporation (mm)	170	136	124	90	62	48	56	81	108	136	150	180	1,341

Table 1 shows that the mean annual rainfall is 870 mm, and mean annual pan evaporation is 1,341 mm. It also shows that there are 8.4 days per year on average with rainfall exceeding 25 mm.

2.2 Water Quality

The reach of the Georges River adjacent to the Site is a transition zone between the upper freshwater and lower estuarine (salty) water of the River. It is used for a number of water based activities including water skiing, boating and fishing. Public health and safety is an issue of high importance in this catchment along with environmental and aesthetic values (DECCW, 2006).

The water quality in this section of the Georges River is affected by both the level of development in the surrounding catchment and the degree of tidal flushing. Three sewage treatment plants occasionally discharge effluent to the River during wet weather; however this has been reduced during recent upgrades under the Sydney Water 'SewerFix' program. The influence of tidal flushing has a positive effect on water quality and faecal coniform levels usually return to levels acceptable for swimming within three days after a heavy rain event (DECCW, 2010).

The '*Georges River Data Compilation and Estuary Processes Study'* (prepared by SMEC for the Georges River Combined Councils Committee, February 2010) summarises and interprets water quality for the Georges River, including a reach of the river at Milperra, which is adjacent to the Site. The report draws on data collected by Bankstown Council between 1997 and 2009. The report also references water quality data collected between 1973 and 1992 by Chipping Norton Lake Authority. A summary of the study's findings are presented in **Table 2**. The findings show that water quality in this section of the River does not comply with the ANZECC default criteria for freshwater ecosystems up to 75% of the time for dissolved oxygen, 26% for pH, 64% for turbidity and over 76% of the time for faecal coliforms. These results indicate the water quality is generally poor.

Table 2: Water Quality Data for Georges River at Milperra

	DO (%)	pH	Turbidity (NTU)	Faecal Coliform (cfu/100 mL)
ANZECC default guideline (lower limit)	80	6.50	6	150
Percentage of water quality results beneath the ANZECC default guideline lower limit	67%	8%	44%	43%
ANZECC default guideline (upper limit)	110	8.00	50	1000
Percentage of water quality results above ANZECC default guideline upper limit	8%	18%	20%	33%
Total % outside ANZECC Default Guidelines	**75%**	**26%**	**64%**	**76%**

(Source: SMEC, 2010)

2.3 Flooding

A flood study prepared for the Bulk Earthworks DA 1417/2005 (Hughes Trueman, 2004) examined flood levels in the vicinity of the Site and the effect of the proposed earthworks (described in **Section 1.3**) on flood levels. **Table 3**, which has been extracted from the Flood Study, shows flood levels in the vicinity of the Site including the locations marked on **Figure 2**.

Table 3: 100 Year ARI Georges River Flood Levels

Cross Section Chainage Location (m)	100 Year ARI Flood Level (m AHD)
12,620	5.56
12,890	5.48
13,030	5.45
13,200	5.42
13,350	5.39
13,520	5.35
13,820	5.26

The data in **Table 3** shows that in a 100 year ARI flood there is a gradient from about 5.49m AHD at the northern boundary of the Site (approx CH 12,900) to 5.39m AHD at the southern boundary (CH 13,350).

Additional flood data has been obtained from the Manly Hydraulics Laboratory which maintains a continuous water level gauge at Milperra Bridge (operational since 1980). **Figure 3** shows the flood frequency curve for Milperra Bridge derived from a composite of the historic record and the 20, 50 and 100 year ARI flood level data derived from the hydraulic model study prepared by PWD (1991). The flood levels shown in **Figure 3** have been taken into account during the design of the access road between Brickmakers Drive and the Site, and in the preparation of a Site flood evacuation plan (see **Appendix 1**). The Site levels, perimeter mound and a low protective bund at the southern end of Area 1, ensure that the Site is flood free in a 100 year ARI flood.

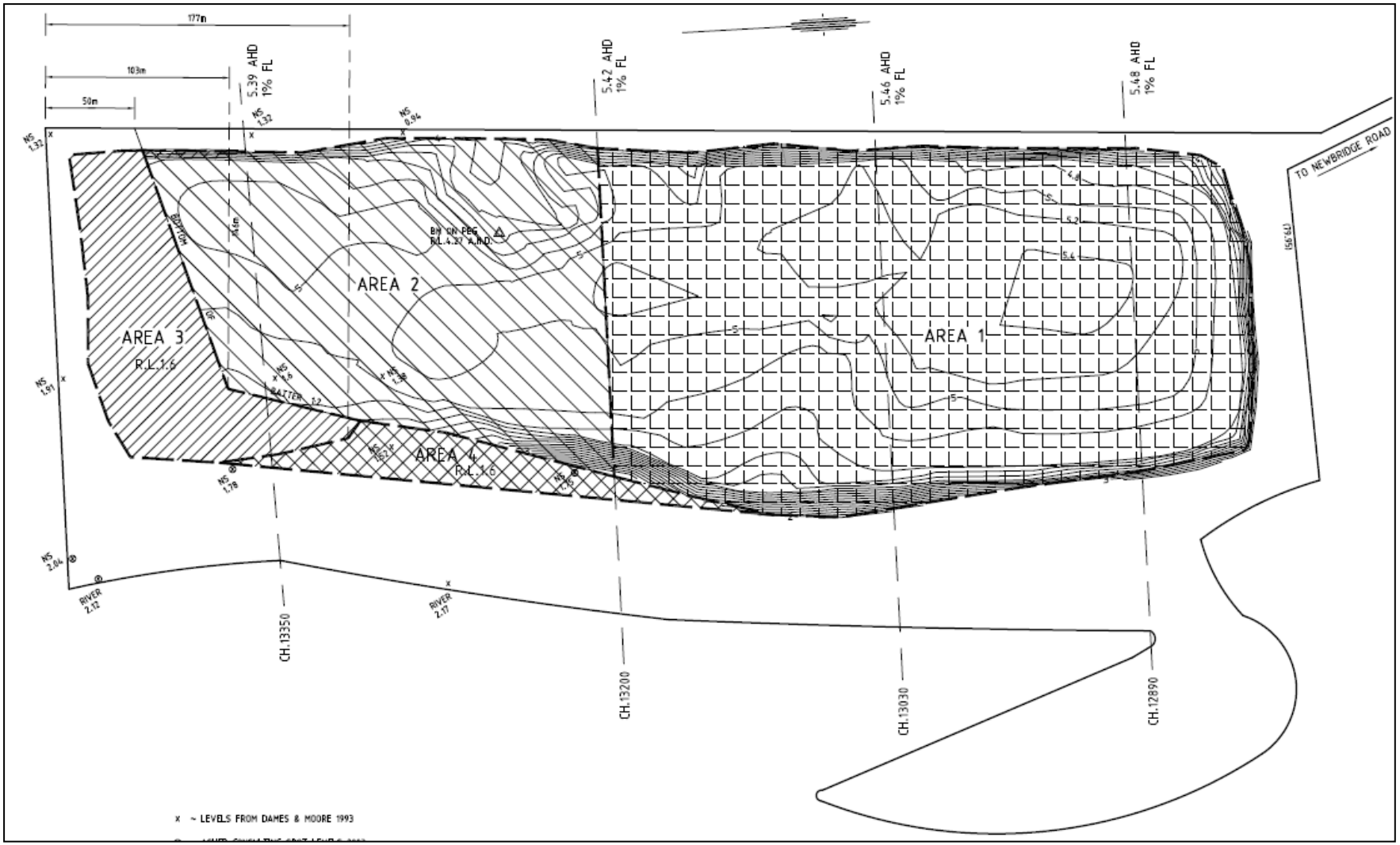


Figure 2 – Site Flood Levels

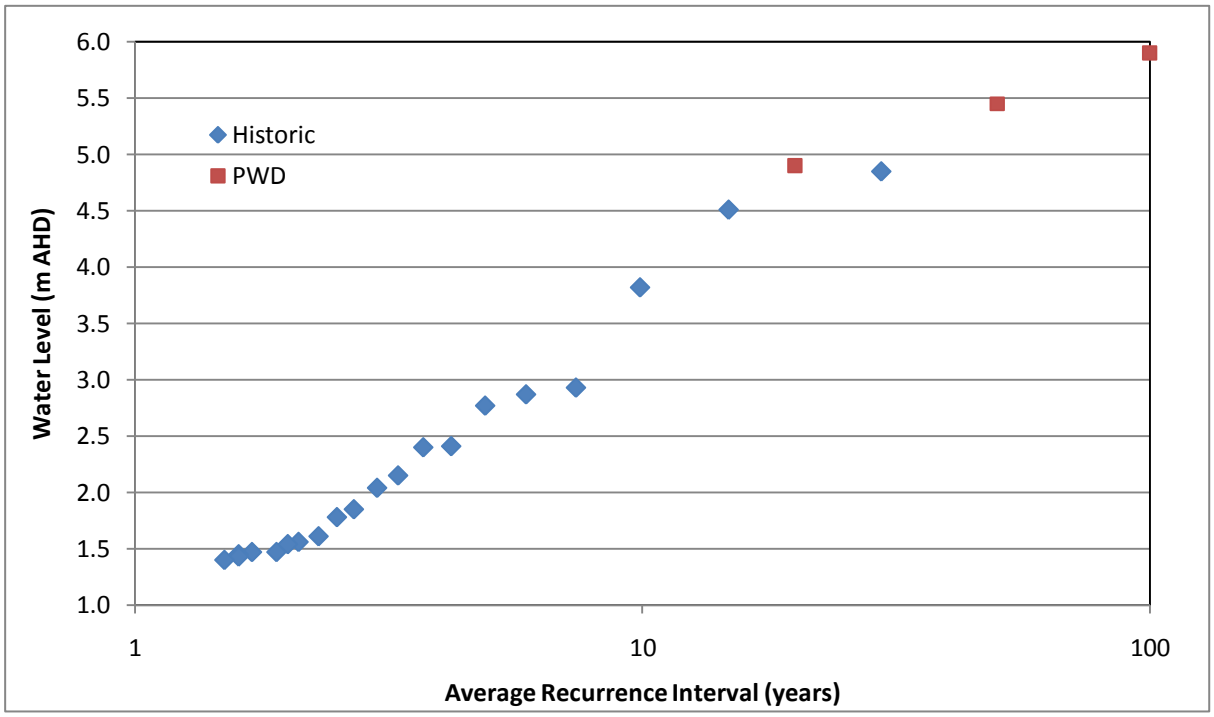


Figure 3 - Flood Frequency Curve at Milperra Bridge

2.4 Site Drainage

Once the approved earthworks are complete, there will be a slight fall (about 0.3%) from the northern end of the Site to the southern end. There will also be a slight ridge which will run north to south (approximately through the middle of the site). Consequently, runoff will drain towards the south east and to the south west. The perimeter mound will prevent runoff from moving directly down the embankment on both sides of the site. Following completion of the approved earthworks, runoff will be drain in a southerly direction along the toe of the perimeter mounds until it drains from the Site through the openings in the mound. Runoff on the south-eastern side will drain into the low lying riparian area adjacent to the Georges River while runoff on the south-western side will drain to the low lying area adjacent to the west of the Site from where it will be able to drain back to the Georges River by means of the connection provided at the southern end of the site.

3 OBJECTIVES AND AGENCY REQUIREMENTS

3.1 Water Management Objectives

The following objectives have been adopted in regard to water management for the project:

- Minimise potential impacts on water quality on the Georges River;
- Implement stormwater re-use to minimise the potable water requirements for the Site;
- Ensure no impacts on flooding; and
- Ensure an effective flood evacuation procedure is in place.

3.2 Authority Consultation and Requirements

The relevant objectives and requirements of the Department of Planning, Liverpool Council and DECCW are outlined in **Table 4**. Subsequent sections of this report outline how these requirements will be met by the Project.

Table 4: Authority Objectives and Guideline Requirements

Authority	Requirement	Comment / Reference
Department of Planning (DoP)	**Soil & Water** – description of the existing environment, assessment of the potential impacts and a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and / or monitor the impacts of the Project to be implemented including: Surface and groundwater impacts; stormwater management including detailed consideration of any potential offsite drainage impacts; flooding; wastewater disposal; erosion and sediment control; soil contamination; and salinity.	Section 2 and Section 4
DoP	Consultation with authorities (DECCW, RTA, Liverpool Council, Sydney Water) during EA preparation	Section 3.2 & Table 4
Liverpool Council	Evacuation procedures from the site in all flood events and the method of preventing the movement of stored material off site in extreme flood events	Section 4.2.1& Appendix 1
Liverpool Council	Drainage design and run-off control detail	Section 4
Liverpool Council	Acid Sulphate Soil management	Section 4.3.5
DECCW	General description of the proposal including: 2a) outline of the production process including environmental "mass balance" for the process including in-flow and outflow of materials, any points of discharge to the environment (stormwater)	Stormwater discharge described in Section 4
	2e) outline cleaner production actions, including water management system including all potential sources of water pollution, proposal for reuse	Section 4

Authority	Requirement	Comment / Reference
	Outline of the construction works in relation to erosion and sediment control	An ESCP will be developed for the construction phase
DECCW	Provide details of the Project that are essential for predicting and assessing impacts to waters including: a) Provide details on the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health (as defined by the NSW Water Quality and River Flow Objectives (Georges River) b) Management of discharges with potential for water impacts c) Drainage and associated infrastructure including water resources for the Project	Section 4 and Table 4
DECCW	Outline of site layout, demonstrating efforts to avoid proximity to water resources	Figures 1 & 2
DECCW	Outline how total water cycle considerations are to be addressed showing total water balances for the development. Include water requirements and proposed storm and wastewater disposal and reuse options	Section 4
DECCW	Describe baseline conditions	Section 2 (2.2)
DECCW	State any locally specific objectives, criteria or targets which have been endorsed by the government	Table 4
DECCW	**Georges River Water Quality and River Flow Objectives**. Including: Maintain wetland and floodplain inundation Restore natural inundation and allow for fish passage Improve water quality and reduce downstream flooding	N/A for proposed development – referenced in Section 1.1 Approved Works

4 WATER MANAGEMENT FACILITIES AND OPERATIONS

4.1 Key Water Management Issues

As the prime activities at the facility will include aggregate and materials handling (including crushing and processing) in an area close to the Georges River, the key issues in relation to water management include:

- Control and minimising sediment runoff from construction and operation activities;
- Response procedures to be in place to deal with any oil spills and hazardous substance emergency so as to ensure no discharge to waterways;
- No loss of floodplain storage;
- Preventing the movement of stored material off site in flood events; and
- Re-use of site runoff to minimise the requirement for use of potable water supply for dust suppression purposes.

4.2 Operational Site Layout and Flooding

The operational layout of the Site including the material stockpiling locations, associated handling facilities (crusher and screen facilities), workshop, site offices and the weighbridge etc is outlined in **Figure 4**. Once complete, the approved bulk earthworks will ensure all operational activities associated with the Materials Recycling Facility will be protected from flooding up to a 100 year ARI flood by means of perimeter mounds, site levels and a low bund at the southern end of Area 1 (see **Section 1.3**).

The Site access from Brickmakers Drive will require an embankment to transition between the level of Brickmakers Drive and the remainder of the access road, which will be substantially at existing ground level. The levels adopted for the Access Road have been designed to minimise the loss of flood storage. Notwithstanding, the earthworks associated with the access road will lead to a loss of flood storage of 3,500m^3 (see "*Traffic Report for Construction and Operation of a Materials Recycling Facility on Lot 6 DP1065574, Newbridge Road, Moorebank*", Lyle Marshall & Associates 2010). The loss of flood storage resulting from the construction of the access road will be offset by lowering the surface level of Area 2 by a minimum of 150 mm (see advice from Jeffery & Katauskas dated 9 December 2010 – **Appendix 3**).

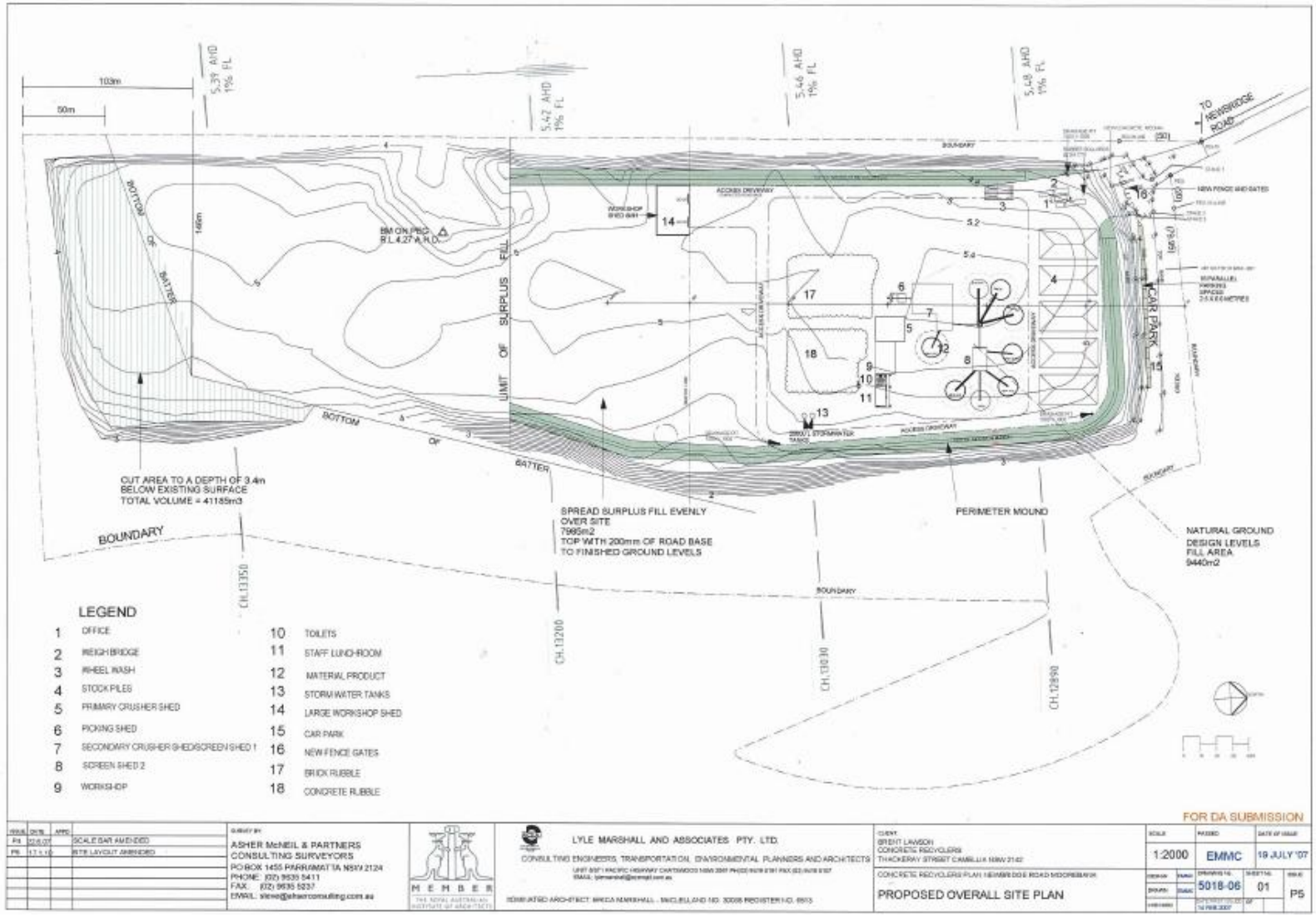


Figure 4 – Site Layout

4.2.1 Flood Evacuation

The Site itself will be flood free up to a 100 year ARI flood. However, the access road has a minimum level of 1.96m AHD and would be subject to the depths of flooding shown in **Table 5** for moderate frequency floods. Accordingly, a flood management strategy has been developed for the Project. The plan "*Warning System and Site Emergency Response Flood Plan: Rev 1*" is attached as **Appendix 1**.

Table 5: Maximum Depth of Floodwater Over the Access Road

Flood ARI (years)	Depth (m)
2	0
3	0.10
4	0.45
5	0.80

4.3 Water Management and Pollution Control Strategy

To ensure potential sediment laden runoff is controlled and potable water use for site operations is minimised, all runoff from the Site will collected at four appropriately sized collection sumps, from where it will be pumped to holding tanks for re-use.

Figure 5 is a schematic diagram that illustrates the main features of the proposed water management system that are described in further detail below:

- The Site will be subdivided into four drainage catchments;
- Primary stormwater pollution control will be achieved by directing runoff to collection sumps from where it will be pumped to re-use holding tanks;
- Water in the re-use holding tanks will be utilised for dust suppression purposes throughout the site;
- The collection sumps will provide for sediment settling and retention of any free oil;
- Overflow from the sumps will discharge from the Site via a series of grass swales or a bio-retention swale which will provide a secondary means to reduce sediment concentrations;
- Stormwater runoff from the car park will be directed to a bio-retention swale for treatment before discharge to the existing drainage channel that runs along the northern boundary of the site before discharging to the Georges River.

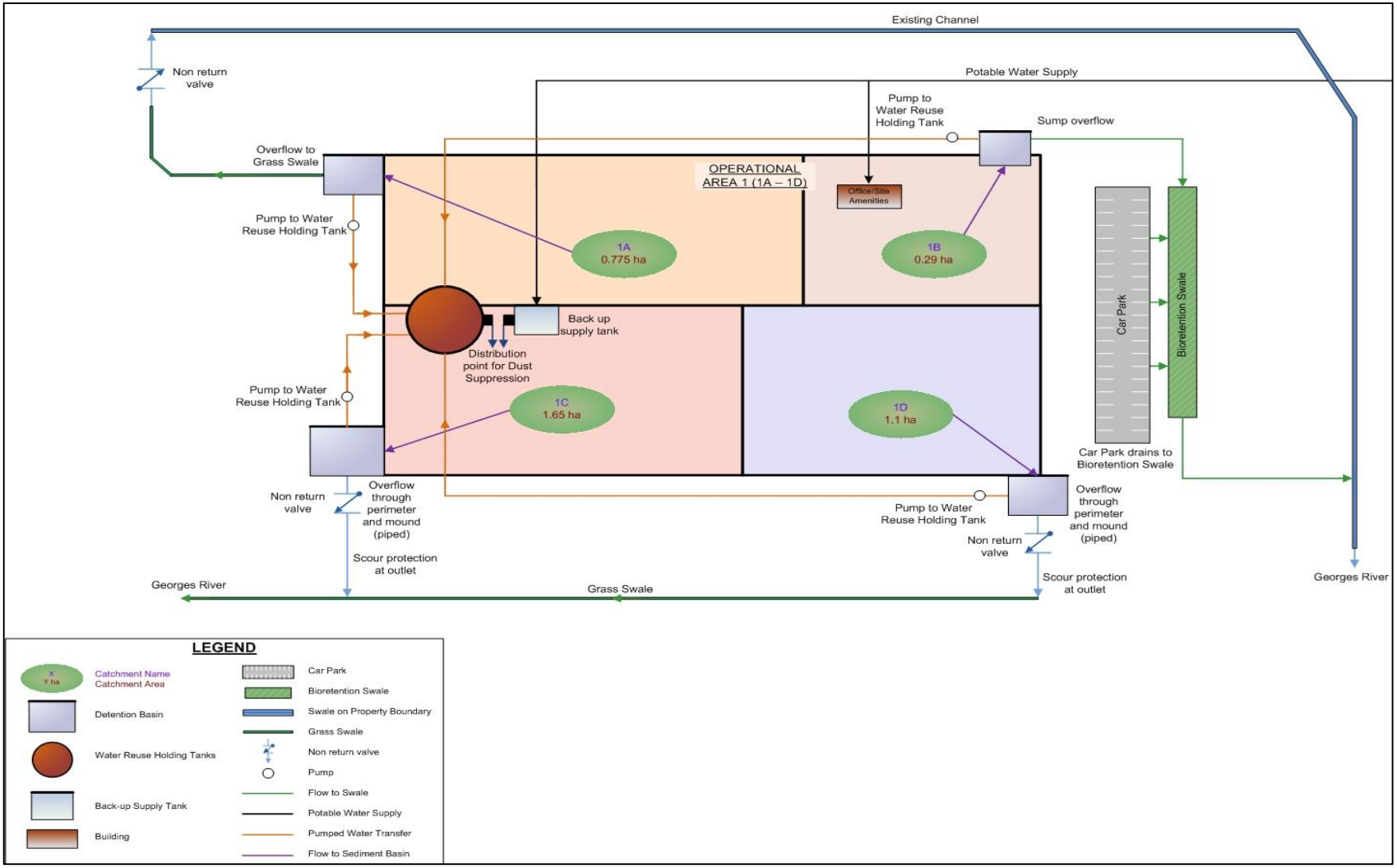


Figure 5 – Water Management System Schematic

4.3.1 Collection Sumps

The operations on the Site will be similar to those on a quarry and the crushing process is expected to give rise to sediments with less than 33% finer than 0.02mm. According to the criteria in *Managing Urban Stormwater: Soils & Construction* (Landcom 2004), such sediments would be classified as coarse (Type C) which settle relatively quickly and that acceptable water quality can be achieved by providing adequate residence time for settlement. For finer sediments (Type F), basins are designed on the basis of their ability to capture and retain all runoff from the design storm. Although the sediments derived from site operations are expected to conform to Type C classification, basin designs based on Type F sediments have been adopted because they are designed to retain both coarse and fine sediments. For a site with an operational life in excess of three years that drains to a sensitive environment, Table 6.1 in "*Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and Quarries*" (DECC, 2008) specifies that sediment basins for Type F sediments should be designed to retain all runoff from a 95th percentile storm of 2, 5, 10 or 20 days duration. For this site, the collection sumps and pumps have been designed to achieve equivalent performance to basins designed and operated in accordance with this standard.

The collection sumps will operate in the following manner:

- Coarse sediment will be retained in the bottom of the sump. Accumulated sediment will be removed regularly;
- A float controlled pump will be set to operate as soon as any water drains into the sump. Water will be pumped to one of the holding tanks;
- Because of the nature of the operation, temporary ponding of water within the work area up to a depth of 200 mm will not inhibit work activities and has been allowed for in the analysis;
- In the event that the volume of runoff exceeds the design storm volume, overflow from the sump will discharge from the Site via an outlet that ensures oil is retained within the sump (see **Section 4.5**);
- Overflow discharge from all sumps will be via non-return valves to ensure that external floodwater does not enter the site; and
- All overflow will be directed into a grass swale or a bio-retention swale for supplementary treatment before discharging from the site.

Table 6 sets out the key features of the collection sumps for each of the catchments designated in **Figure 5** based on the 95th percentile rainfall data for Bankstown and runoff coefficient set out in *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).

Table 6: Collection Sump Features

Catchment	Area (ha)	2 Day 95th Percentile Runoff (m^3)	Sump Volume (m^3)	Minimum Pump Rate (L/s)
1A	0.775	257	25	1.3
1B	0.29	96	25	0.4
1C	1.65	547	200	2.0
1D	1.1	365	35	1.9

4.3.2 Overflow Discharge from Collection Sumps

Figure 6 illustrates the functioning of the collection sumps. In order to eliminate any risk of oil being discharged during an overflow, the collection sumps will be fitted with a custom designed baffle / riser outlet which will only discharge from below the water surface. The customised outlet is based on the standard RTA pollution control design that is configured to prevent any oily surface waters from being discharged. The discharge pipes will penetrate through the perimeter mound and will allow overflow from the collection sumps in the event of rainfall greater than design event. Any oil floating on the surface of the collection sump will be cleaned up after a storm.

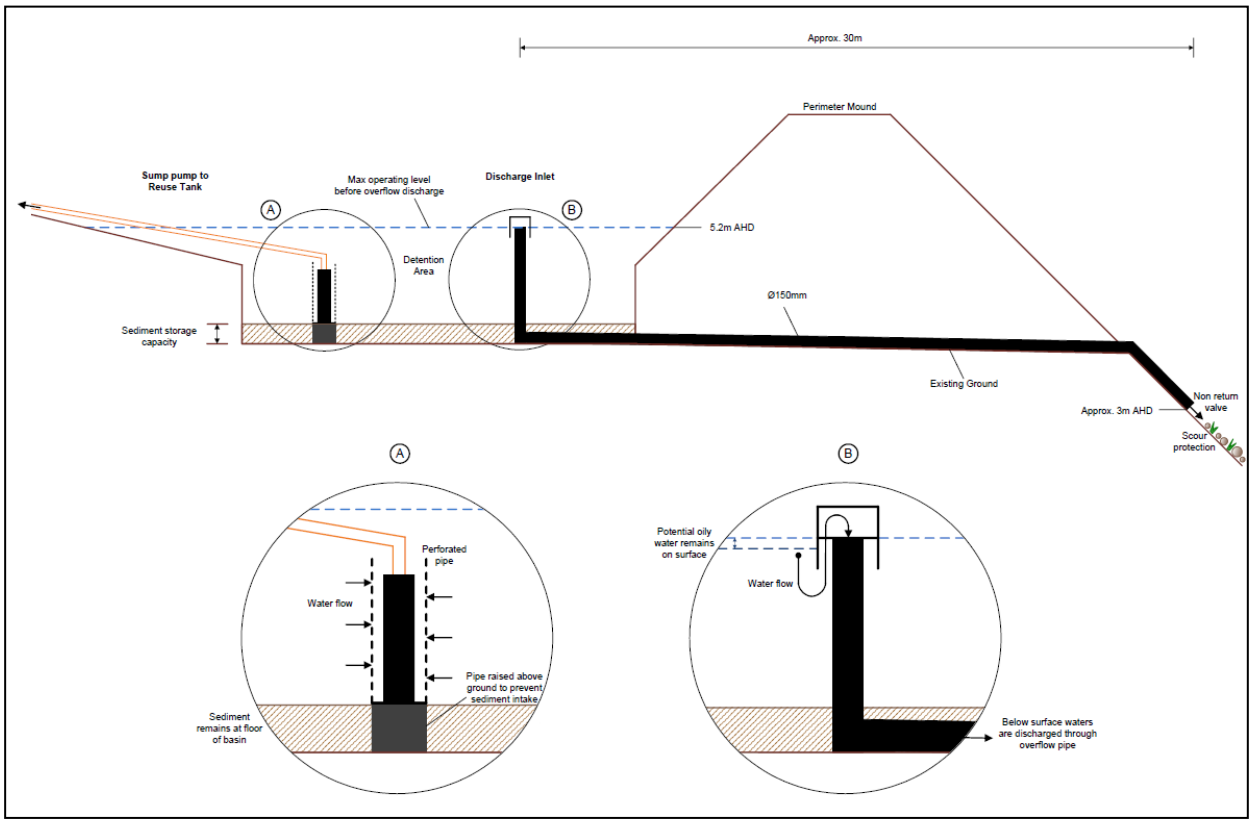


Figure 6 - General Arrangement for Stormwater Collection Sump

As the pipe outlets will be below the level of the 100 year ARI flood, non-return valves will be placed on each outlet to ensure flood waters do not backflow into the collection sumps and the operational area. All overflows will be directed to a grass swale or a bio-retention swale with scour protection at the outlet. Further detail of these treatment systems are provided in **Section 4.3.3** and **Section 4.3.4** below.

4.3.3 Grass Swales

Overflow discharge from the collection sumps for Catchments 1C and 1D (see **Figure 5**) will be directed to a natural grassed depression that runs along the eastern side of the landfill mound. This natural drainage depression runs in north-south direction along the foot of the landfill embankment and is separated from the Georges River by a natural terrace. The drainage depression, which is located between 60m and 100m from the banks of the Georges River has a lateral grade of about 0.3% towards the south.

Overflow from the sumps for Catchments 1C and 1D will be piped to the foot of the embankment by means of a 150mm diameter pipe which has been sized to regulate the flow rate from the collection sump. Analysis based on *Managing Urban Stormwater: Treatment Techniques* (DECC and Sydney Metro CMA, 2007) indicates that the swale will provide further reduction of suspended solids in the range of 70-75% (see **Appendix 2**).

A 130m long grassed swale will also be established on the existing ground surface to the south of the Workshop Shed. Overflow from the collection sump for Catchment 1A will be directed into this swale and will drain in a southerly direction towards an existing natural depression on the site boundary. The grassed swale will provide an approximate 70% reduction in suspended solids concentration in the overflow from Catchment 1A (see **Appendix 2**). A pipe with a non-return valve will convey flow from the swale through the bund and into the existing depression on the western side of the fill area (see **Figure 4**). Runoff collected in the depression will drain into an existing drainage line that runs in a northerly direction along the western side of the site. The drainage line eventually joins the channel which runs to the Georges River along the northern boundary of the site.

4.3.4 Bio-retention Swale

Overflow from Catchment 1B (see **Figure 5**), will be directed to a bio-retention swale which will be located adjacent to the car park. Runoff from the car park will also be directed to the bio-retention swale which will discharge into the drainage line adjacent to the northern boundary of the site. Analysis based on *Managing Urban Stormwater: Treatment Techniques* (DECC and Sydney Metro CMA, 2007), indicates that the bio-retention swale has the capability of removing up to 75-80% of suspended solids from the runoff from Catchment 1B and the car park (see **Appendix 2**).

4.3.5 Soil Contamination and Acid Sulfate Soils

The works necessary to develop the Site as a materials recycling facility following the bulk earthworks (covered by approval of DA 1417/2005 from Liverpool Council) will be minimal and will only require excavation of the collection sumps. These works will not disturb any of the material beneath the capping layer or natural soil which could have the potential to expose acid sulphate soils. Therefore no mitigation measures are required for acid sulphate or contaminated soils.

4.3.6 Erosion and Sediment Control

Temporary erosion and sediment controls will be implemented prior to the construction of the facilities that comprise the water management system. A combination of localised controls including silt fencing and temporary sediment basins, etc will be used. Following project approval, a detailed Erosion and Sediment Control Plan will be prepared in accordance with the requirements of *Managing Urban Stormwater: Soils & Construction* (Landcom, 2004).

4.3.7 Waste Water

Wastewater will be held in a septic tank and periodically pumped out by a licensed contractor. The septic tank will be protected from flooding in a 100 year ARI flood event. These measures will minimise the potential for any wastewater pollution from the septic holding system.

4.4 Water Volume and Balance

As noted in **Section 4.3**, the primary mechanism for stormwater pollution control will be by means of the capture and re-use of stormwater runoff from the site. A water balance model has been prepared to assess what portion of the site water requirements can be met from on-site runoff and to quantify the volume and frequency of overflow discharge.

Based on experience at an existing operating site at Camellia, a maximum of 130kL/day of water will required for dust suppression on stockpiles and internal work areas. Initially, water will also be required for establishing landscaping.

The water balance model accounts for all the flows in the water management system (as illustrated in **Figure 5)** on a daily basis using 33 years of local rainfall and evaporation data (see **Section 2.1**). The model accounts for:

- Areas of different surfaces (stockpiles, work area, roofs, landscaping, etc) based on the site layout in **Figure 4**;
- Runoff from different surfaces (the model uses a simple initial and continuing loss model with the parameters as set out in **Table 7**);
- Runoff held in the collection sumps is pumped to storage tanks at the rates set out in **Table 6**;
- Water from the storage tanks is used on a daily basis and allowance is made for the variation of daily evaporation. The model assumes that, after accounting for rainfall and evaporation, sufficient water is required to maintain a moist surface on the working area and stockpiles, with a maximum daily requirement of 130kL;
- Overflow from the collection sumps to the swales occurs as described in **Section 4.3.3** and **Section 4.3.4**; and
- Any shortfall of water from the stormwater runoff storage tanks is assumed to be supplied by reserve tanks that will be either filled using approved industrial waste water imported by tanker or, as a last resort, topped-up over-night from the mains supply.

Table 7: Adopted Site Runoff Characteristics

Surface	Area (m^2)	Initial Loss (mm)	Runoff Coefficient	Overall Volumetric Runoff
Roofs	2,000	0.5	0.95	89%
Stockpiles	7,750	10.0	0.5	22%
Roadways and parking	6,150	2.0	0.8	65%
Grass and landscaping	3,100	5.0	0.3	19%
Other operating areas	19,150	2.0	0.8	65%

The water balance model keeps account of:

- The volume of water that overflows because it cannot be retained in the storage tanks or sumps;
- The number of overflow events, where any occasion on which overflow occurs on consecutive days due to persistent rainfall is counted as a single event; and

- The volume of supplementary supply required to meet the full water requirements for dust suppression on the site.

For comparative purposes, a water balance analysis was carried out for the Site for a hypothetical situation in which the Site drained to a series of sediment basins that were designed and operated in accordance with the requirements for 'Type F' sediment basins that retained all runoff from a 2 day 95th percentile rainfall event as set out in Chapter 6 of *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) (see column 3 of **Table 6** for details of the volume of runoff from the design rainfall event). This element of the water balance model assumes that the water retained in the basins would be treated and discharged within 2 days of the end of a runoff event, in accordance with the operational requirements. The model assumes that any runoff in excess of the capacity of the sediment basins would overflow from the site. An account is kept of the volume of overflow and the number of overflow events.

The water balance model was run to identify the optimal size of the holding tanks that would provide for cost-effective retention of stormwater runoff while achieving overflow frequency that was comparable with that which would be achieved if the Site pollution control was based on treating all runoff from a 2 day 95th percentile storm. Key performance characteristics of the Site water management system based on 33 years of daily climate data for three different sizes of storage tank volume are set out in **Table 8**.

Table 8: Performance of the Stormwater Capture and Re-use System

Characteristic			
Runoff storage tank volume (m^3)	500	1,000	1,500
Percentage of runoff captured	67%	72%	75%
Percentage of demand met from runoff	55%	56%	57%
Average annual site overflow (m^3)	5,470	4,690	4,150
Average annual overflow events	4.2	3.3	2.9
Average annual overflow events from a basin designed to capture runoff from a 2 day 95th percentile storm	3.0	3.0	3.0

The water balance model results in **Table 8** show that:

- For an increase in storage tank volume from 500m^3 to 1,500m^3 there is only a small increase in the percentage of runoff that could be captured and re-used. The marginal additional proportion of water provided by larger storage tanks does not warrant consideration of tanks of greater than 1,500m^3 capacity;
- Similarly, the average annual volume of overflow does not reduce significantly with the increase of storage tank size. This occurs because overflow occurs as a result of periods of persistent heavy rainfall over several days when large volumes of runoff occur; and
- The range of tank storage sizes set out in **Table 8** would provide for frequency of overflow from the Site that is comparable to that which would be achieved if stormwater pollution was achieved by a system that relied only on sediment basins that were designed and operated in accordance with the requirements for a site with an operational life in excess of three years that drained to a sensitive environment.

On the basis of the modelling results in **Table 8**, storage tanks with a total capacity of 1,000m^3 are proposed. This will provide a system that, on average, would have slightly more overflow events per year than if pollution control was provided by sediment basins. However, the marginal increase in the number of overflow events will be more than offset by the secondary treatment systems comprising grass swales or a bio-retention swale. These will provide significant additional reduction in the residual suspended solids concentrations before water leaves the Site (see **Sections 4.3.3** and **4.3.4**). The 1,000m^3 tanks would also ensure that about 55% of water required for site operations would be from stormwater runoff. This would equate to a potential saving of approximately 14,000m^3 of potable water annually.

5 MONITORING, MANAGEMENT AND PERFORMANCE ASSESSMENT

5.1 Monitoring Program

Ongoing environmental monitoring will be undertaken to assess the performance of the water management system during construction and operation of the Materials Recycling Facility. The following monitoring and inspections will be undertaken:

Construction

- Monitoring will include a daily site inspection of sediment controls and machinery.
- Samples of water retained in the sumps will be collected for analysis in line with the water quality monitoring during the operational phase (see below).

Operation

- Water retained in the sumps will be collected for analysis four times per year. Water will be sent to a NATA registered laboratory for analysis of the parameters listed in **Table 9**.
- Inspections of collection sumps will be undertaken on a weekly basis and after storm events. Sediment will be removed from the sumps as necessary to maintain the water holding capacity.
- Weekly inspections will also be undertaken on the pumping system and holding tanks.
- Daily start-up inspections will be undertaken on all machinery for OH&S and environmental purposes (oil leaks etc).

Table 9: Water Quality Monitoring Parameters

Analyte	Units
pH	pH
EC	µs/cm
Total Suspended Solids	(mg/L)
Total Dissolved Solids	(mg/L)
Oil & Grease	(mg/L)

5.2 Continual Improvement Program

Results obtained during monitoring will be used to assess performance and refine the monitoring program and management measures as required. Formal reporting will occur annually as part of the requirements of the Environment Protection Licence.

6 REFERENCES

Australian and New Zealand Environment and Conservation Council, (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

DECC, (2008), *Managing Urban Stormwater: Soils and Construction, Volume 2e Mines and Quarries.*

DECC & Sydney Metro Catchment Authority, (October 2007), *Managing Urban Stormwater: Treatment Techniques*: Consultation Draft.

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Landcom (2004), *Managing Urban Stormwater: Soils & Construction.*

Lyle Marshall & Associates (2010), *Traffic Report for Construction and Operation of a Materials Recycling Facility on Lot 6 DP1065574, Newbridge Road, Moorebank*.

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SMEC, (Feb 2010), *Georges River Data Compilation and Estuary Processes Study* for the Georges River Combined Councils Committee.

Appendix 1 Flood Evacuation Plan

Moorebank Recyclers Pty Ltd

FLOOD EVACUATION PLAN

Warning System and Site Emergency Response

Moorebank Recyclers Site
Newbridge Road, Moorebank

This copy to be kept at:

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15 December 2010

Table of Contents

Annexure

Tables

Figures

1 PURPOSE

Access to the Moorebank Recyclers' Site and surrounding local areas are relatively low lying and prone to flooding from the Georges River. The direct access road to the Site is subject to minor inundation during a 3 year ARI flood. This *Warning System and Site Emergency Response Flood Plan* (the Plan) has been developed to ensure the safe, orderly and timely evacuation of all persons from the Moorebank Recyclers' Site during times of flood, without the need for rescue by the State Emergency Service (SES) or other authorized emergency services personnel.

The Plan has been developed using the SES *Business Floodsafe Toolkit* as a guide, and is consistent with the report *Georges River Floodplain Risk Management Study and Plan* (2004) prepared by Bewsher Consulting and adopted by Liverpool City Council.

The Plan is site specific for Moorebank Recyclers' property at Newbridge Road Moorebank.

2 BACKGROUND INFORMATION

Moorebank Recyclers' Site is located about 1km south of Newbridge Road, Moorebank (Lot 6 DP 1065574) as shown in **Figure 1**. Entry to the Site from Newbridge Road is via Brickmakers Drive and a low-lying access road (elevation of 1.96m to 2.46m AHD). Levels on the Site vary with a large area above 5.0 m AHD and a smaller area above 5.5 m AHD (the 100 year ARI flood level).

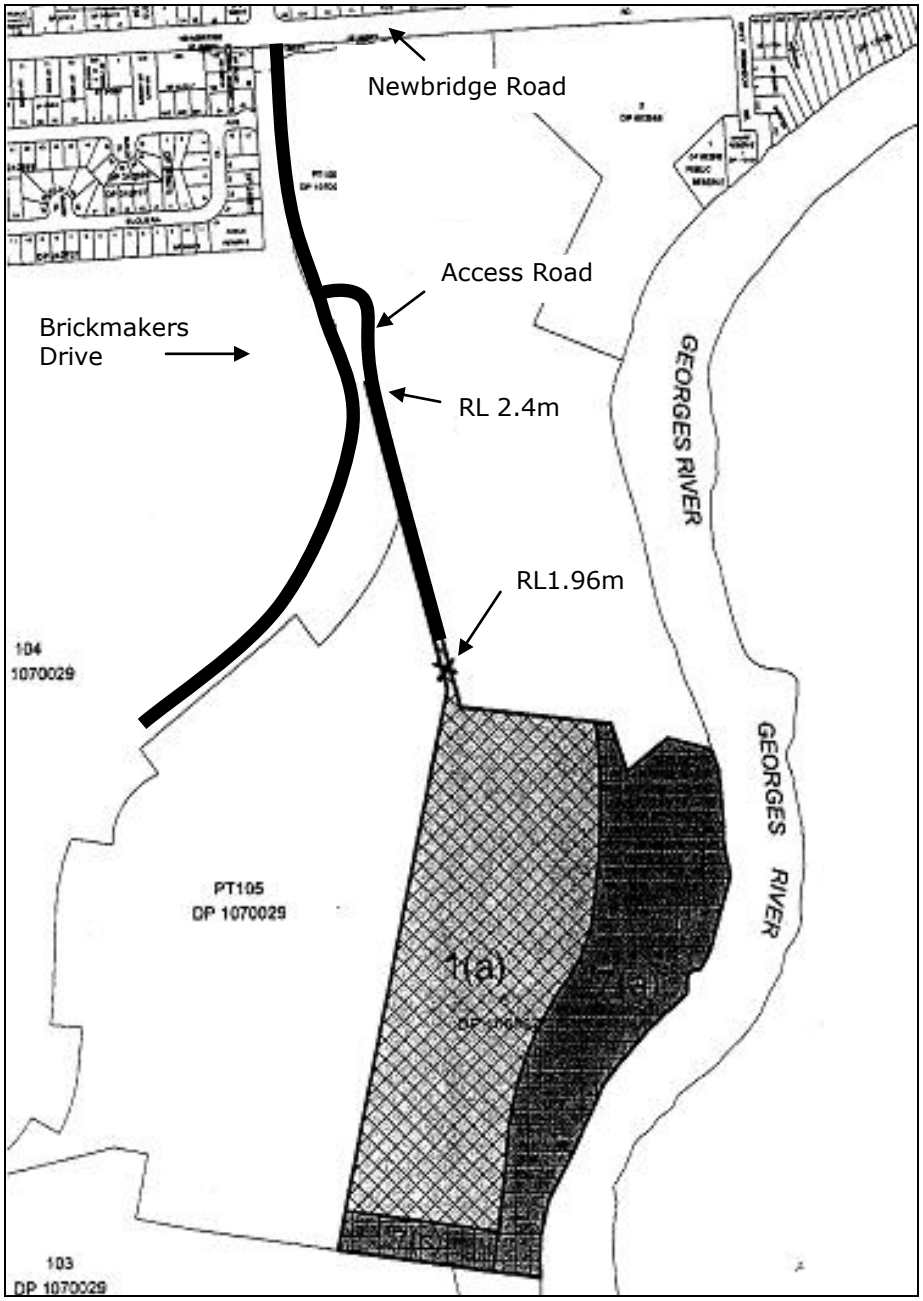


Figure 1 Location of Moorebank Recyclers' Property

3 FLOOD BEHAVIOUR AND WARNINGS

Georges River water levels are measured at various locations. The nearest continuous water level gauge is at the Milperra Bridge (Newbridge Road), just upstream of Moorebank Recyclers' Site and access road.

Flood levels for the 100 year, 50 year and 20 year floods have been obtained from the report *Georges River Flood Study*, PWD Report N^{o} 91066 prepared by the Water Research Laboratory, University of NSW for the Public Works Department (December 1991). These are plotted on the figures in **Annexure A** and show that the access road and parts of the Site are inundated for these flood events. Flood levels at the site for the 2 year, 5 year and 10 year average recurrence interval (ARI) floods have also been derived from the historic data collected at Milperra Bridge.

The flood levels and maximum depth of inundation of the access road at the peak of the flood are also shown in **Table 1**.

Table 1 - Flood Levels and Depth of Inundation

Flood ARI (years)	Flood level at Milperra Bridge (m AHD)	Estimated flood level along access road (m AHD)	Road level (m AHD)	Depth of flood water over access road (m)
2	1.5	1.3 – 1.2	1.96 – 2.4	N/A
5	2.85	2.65 – 2.55	1.96 – 2.4	0.25 - 0.6
10	3.9	3.7 – 3.6	1.96 – 2.4	1.3 – 1.6
20	4.9	4.7 – 4.6	1.96 – 2.4	2.3 – 2.6
50	5.45	5.3 – 5.2	1.96 – 2.4	2.9 – 3.2
100	5.9	5.75 – 5.65	1.96 – 2.4	3.3 – 3.7

The river water levels at Milperra Bridge are influenced by tidal behaviour, and generally rise and fall by around one metre daily. The tide level can be up to 1m AHD and the rate of rise or fall can be around 0.2 m/hr. In times of flooding, the rate of water level rise at Milperra Bridge is around 0.3 m/hr for historic floods, and can be up to 0.5 m/hr for the 100 year flood (Bewsher Consulting 2004).

A flood warning scheme for the Georges River is operated by the SES based on advice issued by the Bureau of Meteorology (BoM). The BoM issues a number of different types of weather and flood warnings, as described in the document *New South Wales State Flood Sub Plan* (SES, 2008) and below:

1. Severe Thunderstorm Warnings – Sydney/Newcastle/Wollongong – (Cell - Based)

When severe thunderstorms are actually occurring or are about to move into the heavily populated region around Sydney, Newcastle and Wollongong, the BoM will issue a more detailed Severe Thunderstorm Warning for people in the affected region. High quality, full-time weather radar coverage for this region allows these warnings to illustrate the current location of individual thunderstorms, and the places likely to be affected within the next 30 to 60 minutes. The radar image shows the location of the severe thunderstorms and the forecast path of the storm. These warnings are distributed widely to the media and emergency services, and are available to the public via the internet and various telephone and fax based services.

2. Severe Weather Warnings

These are issued when severe weather is expected to affect land-based communities within the next 24 hours. They are not directly the result of severe thunderstorms, nor are they covered by tropical cyclone or fire weather warnings. Severe Weather Warnings aim to provide advance notice of very heavy rainfall or strong winds which can lead to flash flooding or storm surge which can sometimes be exacerbated by abnormally high tides. These warnings are distributed to the media by the BoM and are available to the public via the internet and various telephone and fax based services.

3. Flood Watches

These are targeted at large catchments and can provide up to 24-36 hours advance warning of large-scale weather systems that have the potential to cause flooding. They are issued prior to Flood Warnings for most river valleys that are covered by flood warning services. They are not distributed directly to the media by the BoM, however they must be incorporated in Region Flood Bulletins released by the SES. Flood Watches are published on the BoM website.

4. Preliminary Flood Warnings

These warnings usually predict which class of flooding (minor, moderate or major) will occur rather than providing quantitative forecasts. They are the first in a series of warnings and will typically be followed by more detailed flood warnings. These warnings are disseminated directly to media outlets by the BoM and are published on the BoM website.

For the Georges River below Milperra Bridge, the flood classification levels are:

- 2.0m (minor)
- 3.3m (moderate)
- 4.2m (major)

The BoM is required to give 6 hours notice for river heights between 2.0m and 3.9m and 12 hours notice for river heights 4.0m and above (although only 9 hours is generally available).

5. Flood Warnings

These normally predict flood heights at a particular gauge (location) which will be reached at a specified time in the future. After the issuing of a Preliminary Flood Warning, Flood Warnings are renewed at frequent intervals until the relevant waterway drops to below the minor flood level. Flood Warnings are not distributed directly to the media by the BoM, however they are incorporated in Region Flood Bulletins and released by the SES. Flood warnings are published on the BoM website.

Because the access road is likely to be inundated relatively early in a flood event on the Georges River, a combination of these different weather and flood warnings form part of this Plan.

4 PLAN STAGES AND TRIGGERS

There are six stages of the Plan:

4.1 Flood Proofing and Preparation

The actions listed in **Section 5** will be taken during site development to minimise the potential risk of flood impact to buildings and their contents to flooding.

4.2 Preparation

Section 6 includes the flood "readiness" actions to ensure the site is appropriately prepared for flood. The "readiness" actions will be undertaken by Moorebank Recyclers during business establishment and operation.

4.3 Response – When a Flood is Likely

Section 7 lists the actions Moorebank Recyclers will take when a flood is likely.

The actions will be triggered by one of the following warnings issued by the BoM (**Section 3**):

- Severe Thunderstorm Warning:
- Severe Weather Warning; or
- Flood Watch.

These triggers will give Moorebank Recyclers at least 24 hours notice of flooding and the possible need for evacuation.

4.4 Response – During a Flood

The trigger for evacuation is the issue of a "Preliminary Flood Warning" of "minor" flooding by the BoM (see **Section 3**). Such a warning means that the flood level at Milperra Bridge is predicted to reach 2.0 m AHD in 6 hours. The access road to the property would be inundated shortly after 6 hours.

As Newbridge Road is also low-lying, the evacuation actions in **Section 8** should be commenced as soon as the preliminary flood warning is issued by the BoM.

4.5 Recovery

The Georges River can flood relatively quickly, however the duration of flooding is relatively short-lived. The report by Bewsher Consulting (2004) indicates that in a 100 year flood event, the water level would be above 2 m AHD at Milperra Bridge for around 35 hours. Moorebank Recyclers could thus have access to the property within two days of evacuation.

Recovery actions to help restore operations are listed in **Section 9**.

4.6 Maintain and Implement the Plan

Actions to maintain, implement and review the Plan are listed in **Section 10.**

5 FLOOD PROOFING

The following actions will be undertaken during site development to improve the resistance of buildings and their contents to flooding:

- To the extent practical, the site office and facilities will be set up with a floor level above 6.0 m AHD. This level is 500mm above the 100 year flood level and will help minimise the risk of damage to furniture, floor coverings and fittings;
- All electrical wiring and outlets will be located at least 1.0 m above the 100 year flood level, ie above 6.5m AHD;
- Office equipment including electrical equipment, eg computers etc, will be kept as high above the floor as practical, or can be easily lifted or removed if a flood occurs;
- Furniture, floor coverings and fittings will be made of flood resistant materials such as metal and ceramic tiles. Where possible, timber composites such as pine board, chip boards and masonite will be avoided;
- Wherever practical, the site storage sheds and equipment will be located above 5.5 m AHD;
- All chemicals, empty drums or any floatable equipment will be locked in a storage shed whenever the site is unoccupied. The shed floor will be at a minimum of 5.5 m AHD;
- Control panels for security control, air conditioning, etc will be located as high as practical above ground level, preferably at a minimum of 1.5 m above the floor level of the site office; and
- Drains and gutters will be regularly cleaned.

6 PREPARATION

The following flood "readiness" actions will be undertaken by Moorebank Recyclers prior to the commencement of site operations and will be reviewed regularly:

- Assemble and maintain a flood emergency kit (**Table 2**);
- Obtain and update staff and other emergency contact numbers in **Table 3;**
- Document Occupational Health and Safety (OH&S) procedures for a flood in **Table 4**;
- Include flood evacuation procedures in mandatory site safety induction for all employees;
- Regularly back-up records, accounts and computer files, and store them off-site and out of the floodplain;
- Identify what critical functions, such as payroll and banking, must be maintained during and after flooding;
- Make call diversion arrangements to be able to continue some business operations off-site; and
- Maintain site attendance register.

Table 2 Flood Emergency Kit

Portable radio with spare batteries (to listen for flood warnings)
Torch with spare batteries
First aid kit and manual
Waterproof bags for storage
Emergency contact numbers
Waterproof footwear with non-slip soles
Water and puncture resistant gloves
Cleaning products for clean-up after the flood
Boxes for storage

Table 3 Emergency Contacts

Staff emergency contact telephone numbers		
Name	**Emergency Number**	**Alternative Number**
Telephone Numbers of Other Emergency Contacts		
Need	**Name**	**Number**
Flood or storm	State Emergency Service	132 500
Site Manager		
Security		
Electricity	Energy Australia	
Telephone		
Medical		

Table 4 Occupational Health and Safety

OH&S procedures to be followed during and after a flood. This procedure is to be added to the site OH&S plan.

DURING A FLOOD

Risk	Actions to manage risks
Evacuation – ensure workers have enough time to evacuate safely to a location beyond the reach of flood waters.	
Manual handling of plant and equipment to be removed.	
Darkness – ensure adequate light if flood preparations have to be made at night or in overcast conditions.	
Protective clothing – solid non-slip footwear is an essential minimum.	
Slips, trips and falls, particularly in wet conditions	
Avoid entering floodwaters on foot or in vehicles – risk of electrocution, drowning, injury from submerged objects or uneven ground	
Other risks	

AFTER A FLOOD

Only enter premises after floodwaters have completely subsided and the SES advises that it is safe to do so.

Undertake an OH&S risk assessment (below) before entering buildings.

During clean-up, all workers should:

- Wear protective clothing, including enclosed, waterproof, non-slip footwear and waterproof, puncture-resistant gloves;
- Use safe manual handling procedures when moving stock, plant or equipment; and
- Wash thoroughly after cleaning premises to remove any potential flood borne contaminants.

Risk	Assessment
Structural safety of buildings	
Safety of electrical and gas supplies	
Slips, trips and falls, particularly with mud and water	
Contamination – sewage, chemicals and disease in floodwaters	
Safety of plant and equipment – checked by a qualified tradesperson	
Sharp debris	
Venomous animals – snakes and spiders in buildings and debris	
Manual handling and lifting	
Other risks	

7 RESPONSE – WHEN A FLOOD IS LIKELY

Any one of the following warnings issued by the BoM (**Section 3**) will give Moorebank Recyclers at least 24 hours notice of possible flooding and the need to prepare for evacuation:

- Severe Thunderstorm Warning:
- Severe Weather Warning; or
- Flood Watch.

The following actions are the responsibility of the Site Manager:

- Tune the radio to a local radio station, and ensure it has spare batteries;
- Maintain awareness of weather forecasts and be alert for BoM warnings in the event of forecasts of bad weather;
- Have the flood emergency kit ready for use;
- Inform all workers and sub-contractors (including suppliers and known haulage clients) of the likelihood of flooding;
- Allocate responsibilities to move and/or secure plant, equipment and floatable items;
- Regularly remove waste generated to landfill (picking station waste, office and amenities putrescibles waste) and the recycling depot off-site (scrap steel, waste oil and office paper);
- Move hazardous materials/chemicals into safe storage or off-site to a location above the predicted flood peak;
- Move plant and equipment to a location above the predicted flood peak;
- Secure objects that are likely to float or cause damage, eg open fridges, to prevent them floating;
- Divert calls to an appropriate alternative number, eg Site Manager's mobile;
- Back-up computer files and critical records and take them off-site;
- If practical, make arrangements to temporarily continue business office operations from another location; and
- Maintain critical business functions if possible.

8 RESPONSE – DURING A FLOOD

The trigger for evacuation is the issue of a preliminary flood warning of minor flooding on the Georges River by the BoM (**Section 3**). This means that the flood level at Milperra Bridge is predicted to reach 2.0 m AHD within about 6 hours. The access road to the site would be inundated shortly after 6 hours.

As Newbridge Road is also low-lying, the following evacuation actions (which are the responsibility of the Site Manager), should be commenced as soon as the preliminary flood warning is issued by the BoM:

- Keep the radio tuned to a local radio station for flood warnings including updates on forecast flood heights and timings;
- Inform all personnel including contractors and haulage operators of flood warning details;
- Remind staff of the OH&S procedures related to flooding (**Table 4**);
- Move mobile plant including any on-site diesel stored in a mobile fuel truck to a location above the predicted peak flood level;
- Move staff vehicles to a flood free location;
- Allow staff with their own property at risk to leave;
- Evacuate all staff before the access road is flooded;
- Postpone supply deliveries;
- Before leaving, turn off all services (electricity, gas, water); and
- Lock the site when leaving, and notify security.

9 RECOVERY

Georges River flooding can occur relatively quickly, however the duration of flooding is relatively short-lived. The report by Bewsher Consulting (2004) indicates that the 100 Year flood event is above 2 m AHD Milperra Bridge for around 35 hours. Moorebank Recyclers could thus have access to the site within two days of evacuating it.

Recovery actions to help restore site works are the responsibility of the site manager and include:

- Keep the radio tuned to a local radio station and return to the site only after the SES has advised it is safe to do so;
- Carry out an OH&S risk assessment listed in **Table 4** before entering flood-damaged premises;
- Clean up premises using the flood emergency kit (**Table 2**);
- Carry out clean up in accordance with the OH&S procedures in **Table 4**;
- Ensure proper personal washing after cleaning any flood-damaged facilities;
- Remove debris and clean and repair premises;
- Salvage, clean and dry equipment;
- Return any equipment, etc that was moved off-site;
- Replace any lost or equipment when and if feasible; and
- Advise customers and suppliers that the business is reopened.

10 MAINTAIN AND IMPLEMENT THE PLAN

The Plan is part of the Moorebank Recyclers business continuity planning.

The Site Manager is responsible for implementing and maintaining the plan.

The Plan will be located in the on-site office, and another copy kept off-site out of the floodplain.

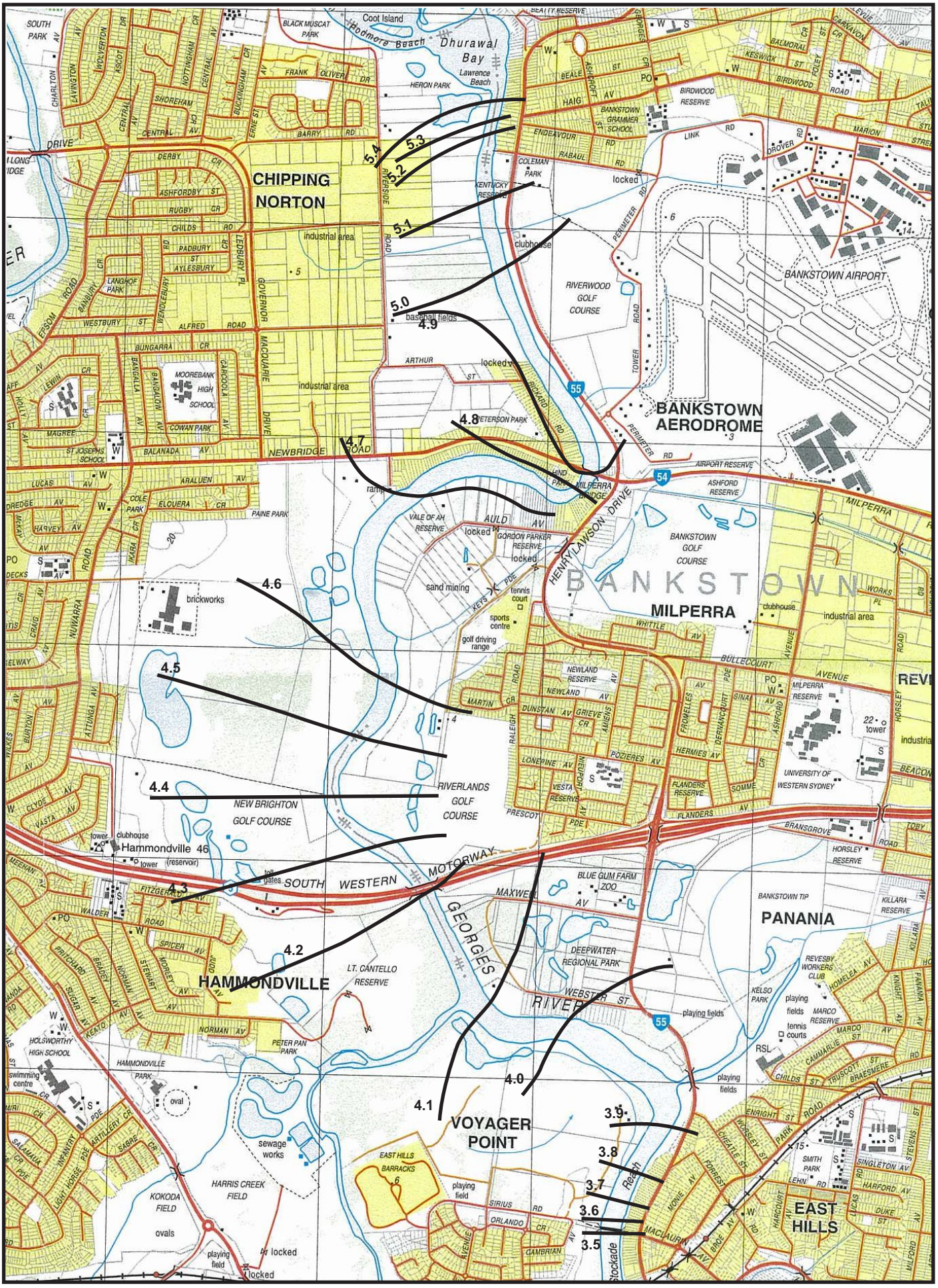
Employees will be trained in understanding this Plan and their roles in its implementation. Training will be conducted regularly, and new staff trained during their induction.

The SES *Don't Let Your Business Go Under* poster and SES *FloodSafe Georges River Business* brochure will be displayed in the staff lunch room.

This Plan will be maintained by keeping all details up-to-date and by ensuring that the flood emergency kit and other elements needed for flood preparation are in place.

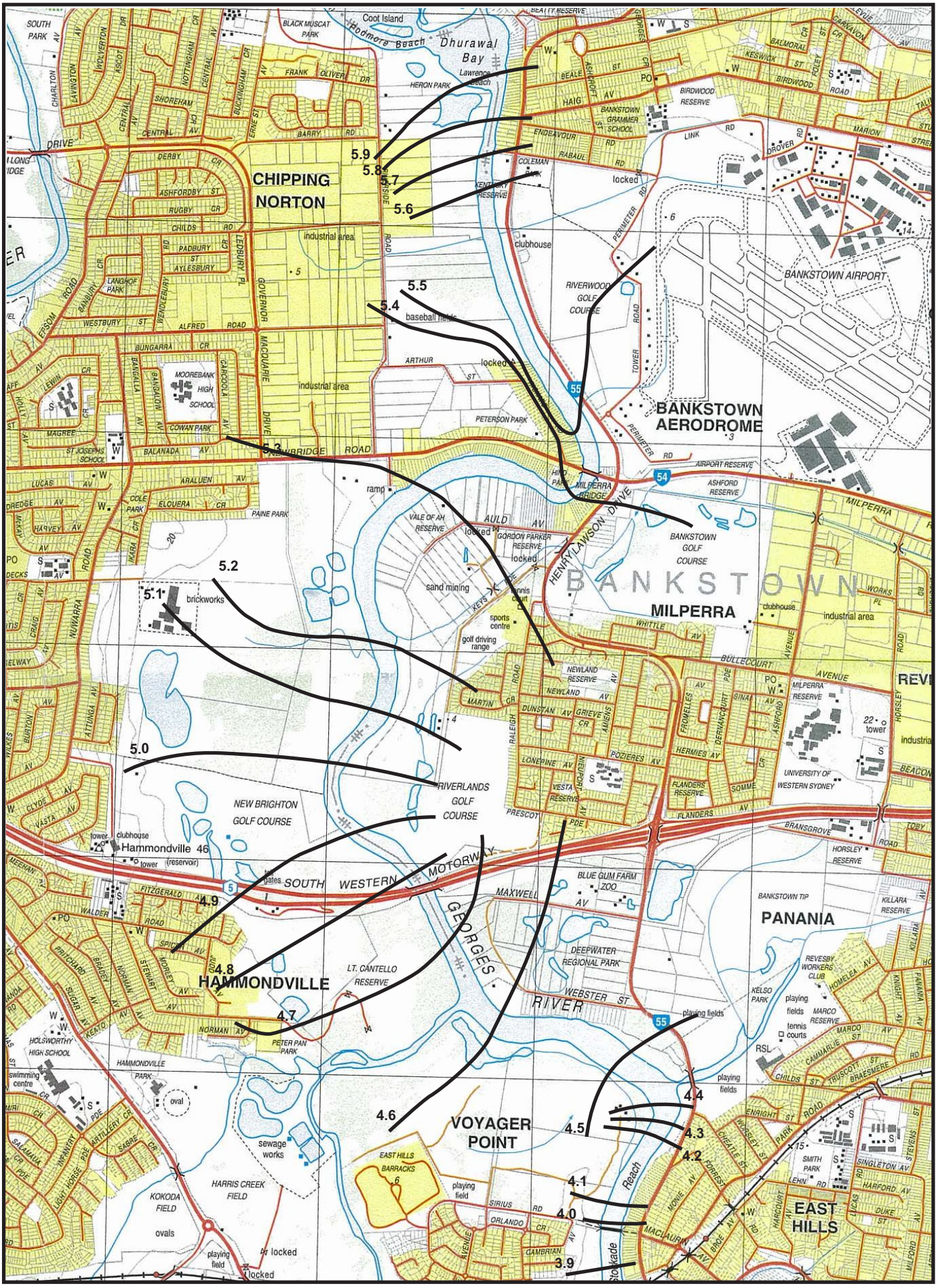
The Plan will be reviewed annually.

Annexure A
20, 50 and 100 Year ARI Flood Levels



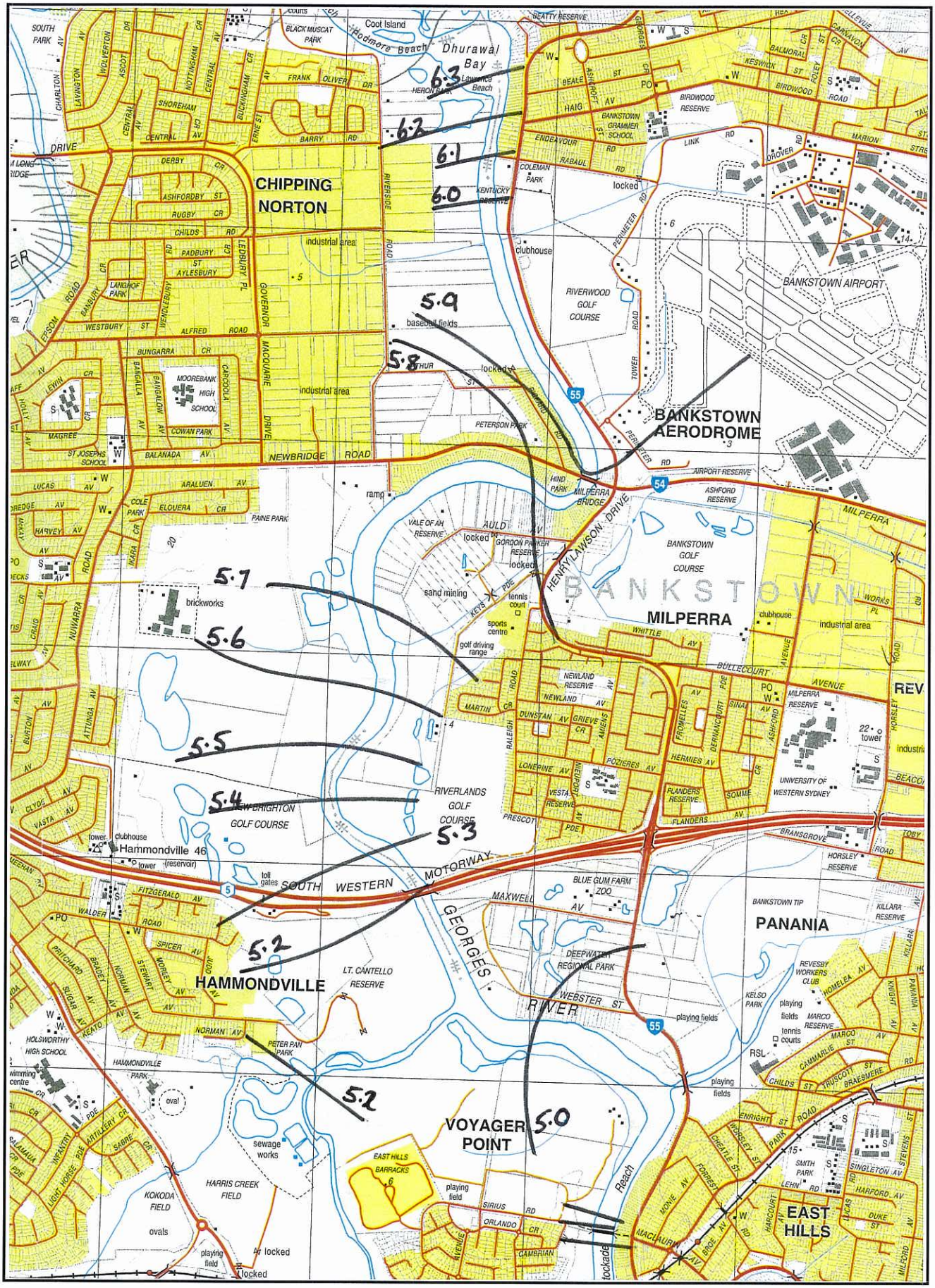
20 Year Flood Levels

(*Source Figures 28a and 28b, Georges River Flood Study, 1991*)



50 Year Flood Levels

(*Source Figures 28a and 28b, Georges River Flood Study, 1991*)



100 Year Flood Levels

(Source Figures 28a and 28b, Georges River Flood Study, 1991)

Appendix 2 Pollution Control Performance of Grass Swales

Moorebank Recyclers Site

Grass Swale Performance

Discharge rate from capture sump (150mm diameter)	(L/s)	70	*Source: Iplex Pipe Design Manual*
Assumed 'n' value for grass swale		0.03	
Base width	(m)	3	
Side slopes	1:X	5	
Longitudinal slope		0.10%	

Flow Depth	(m)	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
Cross Section Area	(m2)	0.16	0.20	0.23	0.27	0.32	0.35	0.39	0.43
Wetted Perimeter	(m)	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.6
Hydraulic Radius	(m)	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
Flow Velocity	(m/s)	0.14	0.16	0.18	0.20	0.22	0.23	0.24	0.26
Discharge	(L/s)	23	32	42	54	70	80	95	112

Catchment >		**1A**	**1C**	**1D**
Swale length (nominal)	(m)	130	200	200
Swale arean (m2)	(m2)	390	600	600
Catchment (ha)	(ha)	0.775	1.65	1.1
Area Ratio		0.050	0.036	0.055
TSS Removal		**75%**	**70%**	**75%**

*Source: "Treatment Techniques" Figure 5.3**

Bioretention Swale Performance

Catchment		**1B**	**Carpark**	**Total**
Area	(m2)	2,900	1,200	4,100
Bio-swale Area	(m2)			220
Area Ratio				0.05
TSS removal				**75%**

*Source: "Treatment Techniques" Figure 6.4**
**Managing Urban Stormwater: Treatment Techniques*
(DECC, 2008)

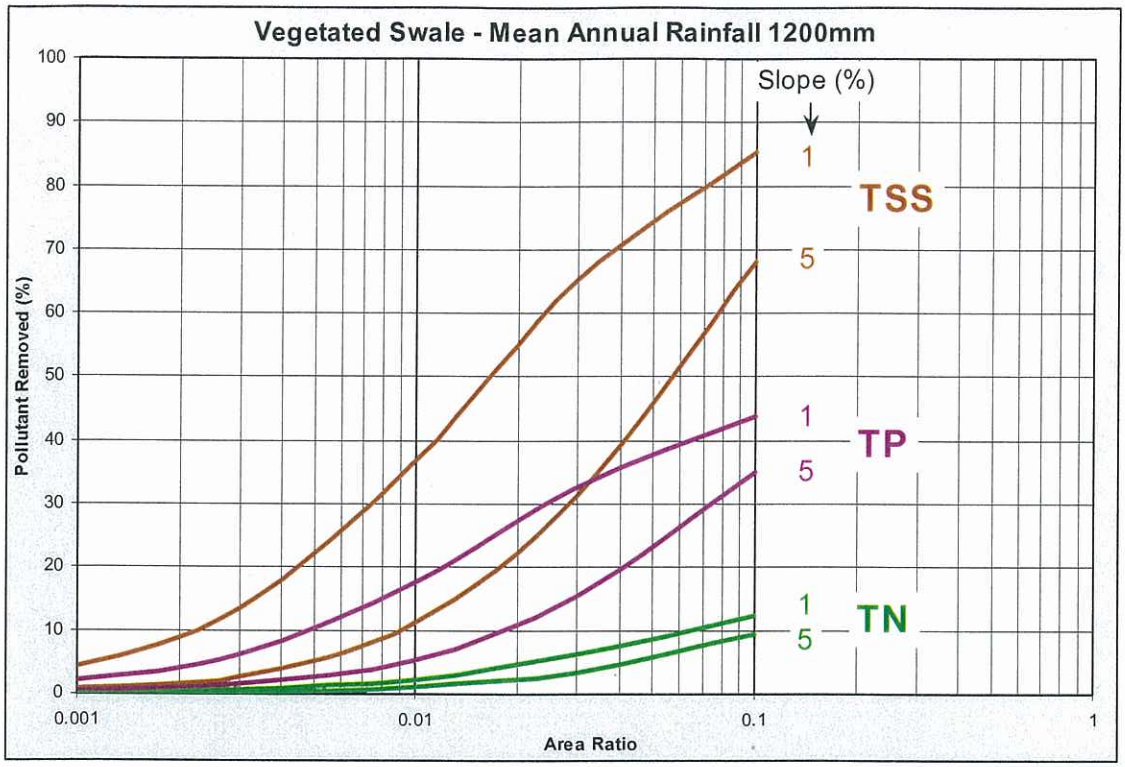


Figure 5.3 Indicative swale pollutant removal performance for area with 1200 mm average annual rainfall

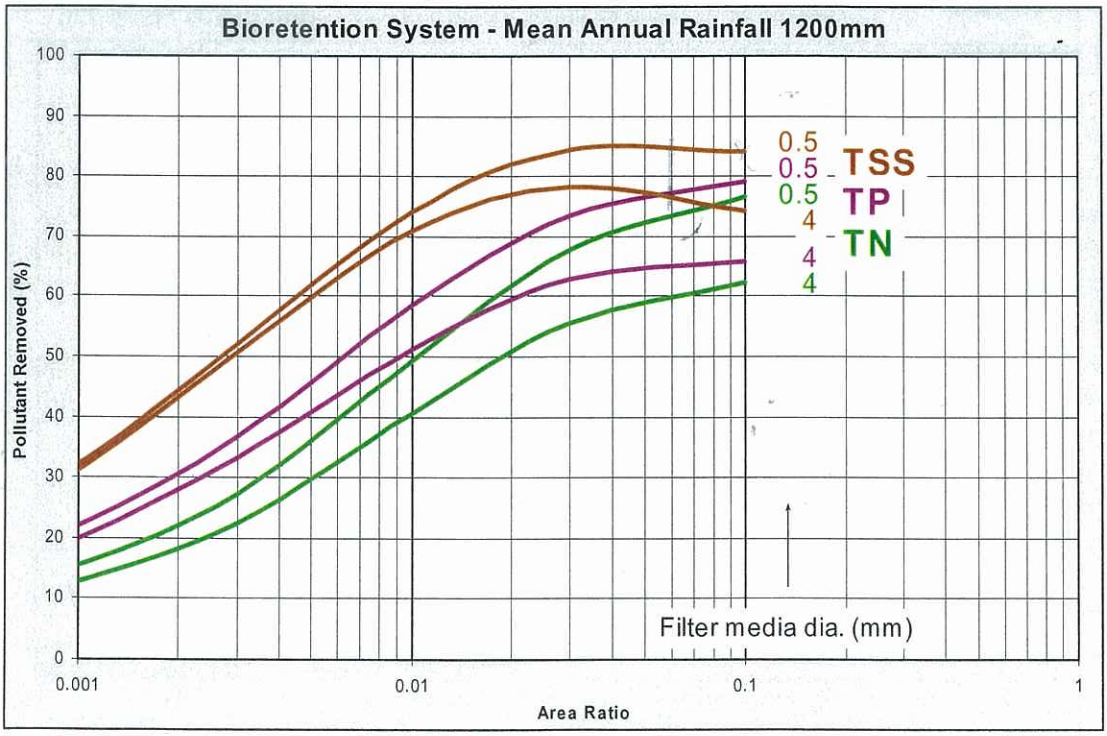


Figure 6.4 Indicative bioretention swale pollutant removal performance for area with 1200 mm average annual rainfall

Appendix 3 Effect of Heavy Compaction on Surface Levels in Area 2

Jeffery and Katauskas Pty Ltd

CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
ABN 17 003 550 801

AS/NZS ISO 9001 Certified
Davis Langdon Certification Services

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Email: engineers@jkgroup.net.au

9 December 2010
Ref: M22833SA7let2

Concrete Recyclers (Group) Pty Ltd
PO Box 238
RYDALMERE NSW 1701

ATTENTION: Mr Brent Lawson

By email: brent@concreterecyclers.com.au

Dear Sir

ADDITIONAL GEOTECHNICAL ADVICE
PROPOSED EARTHWORKS FOR PART 3A CONCRETE RECYCLING DEVELOPMENT
LOT 6, DP 1065574 NEWBRIDGE ROAD, MOOREBANK, NSW

The details of your email dated 23 November 2010 have been noted. We understand that additional flood storage capacity is required in Area 2, as shown on Asher McNeill & Partners Pty Ltd Drawing No. 9226flood01$^{REV\ B}$. Area 2 is located across the capping layer of a former landfill, and its surface area is approximately 30,000m^2.

We expect that heavy compaction using a Broons BH-1300 "square" impact roller or equivalent will cause significant subsidence of the landfill cap. Based on our knowledge of the landfill depth and constituent materials, such heavy compaction should lower the landfill cap surface level in Area 2 to a maximum depth of about 500mm. The required 150mm depth should be easily achieved.

Should you require any further information regarding the above please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of
JEFFERY AND KATAUSKAS PTY LTD

Andrew Jackaman
Senior Associate

Paul Stubbs
Principal