

Edmondson Park South Part 3A Project Plan Application (Stage 1) **Water Cycle Management Plan**



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**EDMONDSON PARK SOUTH PART 3A
PROJECT PLAN APPLICATION (STAGE 1)
WATER CYCLE MANAGEMENT PLAN**

- DOCUMENT CONTROL SHEET -

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1. EXECUTIVE SUMMARY

This report has been prepared by J Wyndham Prince Pty Ltd to accompany a Project Application under Part 3A of the Environmental Planning & Assessment Act, 1979 (EP&A Act) and a proposal for State significant site listing under Schedule 3 of State Environmental Planning Policy Major Development 2005 (SEPP Major Development) in relation to the former Ingleburn Army Base and certain adjoining lands within the Edmondson Park Precinct of the South West Growth Centre

The Stage 1 Project Application site comprises an area of approximately 40 hectares and forms part of the larger Edmondson Park Release Area within the South West Growth Centre. It is located within the southernmost portion of the larger development site to the north of the M5 Motorway and to the east of Zouch Road and is approximately 40 km to the south west of Sydney CBD. The site is wholly located within the Campbelltown LGA. The site is referred to herein as Stage 1.

The development of Edmondson Park is subject to the Water Cycle Management plan prepared for the overall Part 3A Concept Plan Application, concurrently prepared by J. Wyndham Prince (Ref. 1). This Project Plan Application report should be read in conjunction with the Concept Plan Report.

Water Cycle Management measures that will be undertaken as part of Stage 1 involve the following components

Water Quality

A treatment train consisting of:

On Lot Treatments

- Appropriate waterwise landscaping practices (resident education, native gardens, mulch, micro-irrigation).
- Implementation of water efficient fittings and appliances in all dwellings (dual flush toilet, AAA shower heads, water efficient taps and plumbing).
- Minimisation of impervious areas.
- Reticulated recycled water.

Street Level Treatments

- Proprietary gross pollutant traps.

Precinct Scale Treatments

- (In the Short to medium term) Sediment Basins located on future development stages.
- (In the longer term) Bio-Retention Raingardens, located within the public reserves and adjacent to the riparian corridors.

Water Quantity

- A regional detention basin within Maxwells Creek which will treat the central portion of Stage 1.
- Within the Bunbury Curran Catchment a detention basin adjacent to the Hume Highway will be required to manage flows from the rural residential portion of the development.

Provision of the proposed detention basins within the development will ensure that peak post development discharges from Edmondson Park into Maxwells Creek are consistent with the peak flows targets previously identified by Webb McKeown & Associates for the Edmondson Park Release Area (Ref. 5). Furthermore, flows from Bunbury Curran Creek will be restricted to pre development levels.

For Stage 1 the proposed Water Cycle Management is functional; delivers the required technical performance; avoids environmental degradation and pressure on downstream ecosystems and infrastructure; and provides for a 'soft' sustainable solution for stormwater management within the release area. Furthermore, it will ensure that the relevant issues listed in the Director General's requirements relating to the management of the Water Cycle for Stage 1 (refer to Table 12.1) are attained. The overall water cycle management concept for the Edmondson Park South Part 3A Application Site is illustrated on Figure 1 which is attached to this report and a copy is provided in Plate E1 hereunder.

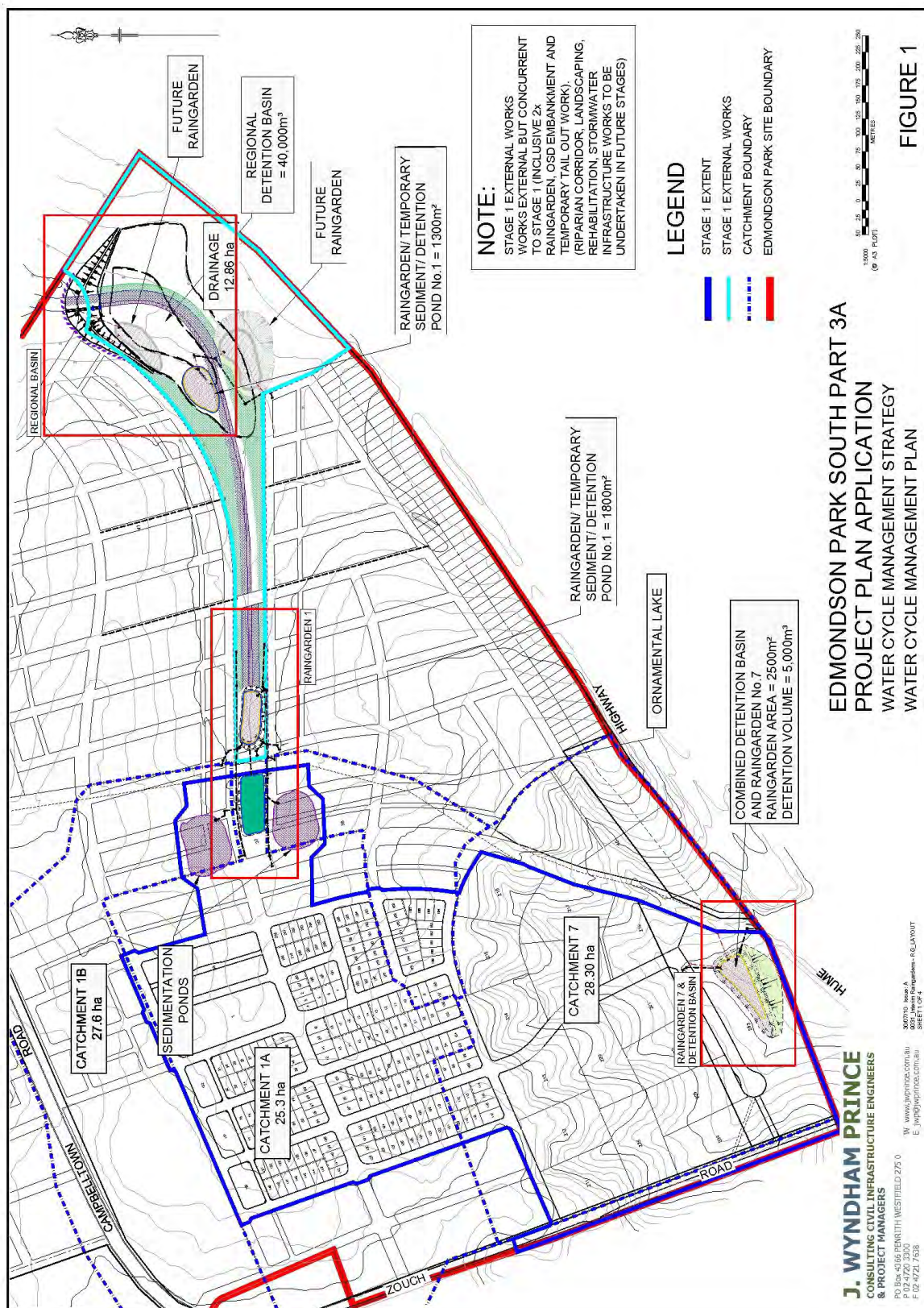


Plate E1 – Edmondson Park South Part 3A – Project Plan Application
Water Cycle Management Plan (Copy of Figure 1)

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PROJECT PLAN APPLICATION (STAGE 1)
WATER CYCLE MANAGEMENT PLAN**

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2. DIRECTOR GENERAL REQUIREMENTS (DGR)

On the 28 July 2010 the Director General of NSW Department of Planning issued a series of requirements (DGR's) relevant to the Edmondson Park South Concept Plan and Project Applications.. A full description of how this report is responding to the individual requirements is summarised in Section 12.

Each of the sub-headings below lists the DGR'S Key Assessment Requirements relating to water cycle management on the site.

2.1 Surface Water, Groundwater Quality and Riparian Corridors

- (1) *Assess any potential impacts of proposed development on hydrology and hydrogeology of the site and adjacent areas in terms of impact on water quality having regard to environmental targets for new urban development set out in Managing urban stormwater: environmental targets – Consultation draft (DECC in association with the Sydney Metropolitan CMA, October 2007). In particular, identify how any potential water quality impacts on wetlands both within and adjoining the site, and the ecological values of the Regional Park, will be avoided, mitigated or managed.*
- (3) *Identify drainage and stormwater management infrastructure, including: on site detention of stormwater; water sensitive urban design (WSUD); and drainage infrastructure. Identify the future management and ownership arrangements for stormwater infrastructure, and identify how any requirements of the future owner will be met.*
- (4) *Assess any proposed variation to riparian corridors and associated buffers in accordance with the Riparian Corridor Management Study approach applied to the Growth Centres, and provide justification for any changes. Details of any rehabilitation works for corridors should be provided.*

2.2 Flooding

- (1) *Identify any flood risk associated with the site and demonstrate that the proposed development is suitable in terms of flooding and is consistent with the NSW Floodplain Development Manual: the management of flood liable land (2005).*

2.3 Ecologically Sustainable Development (ESD)

- (1) *The EA should demonstrate that all aspects of the concept plan satisfy the principles of ESD including compliance with BASIX.*
- (2) *The EA should outline commitments to sustainability including water re-use, waste minimisation, the minimisation of energy use and car dependency.*

This report should be read in conjunction with following reports related to the concept application:

- J Wyndham Prince – Edmondson Park South Part 3A Concept Plan Water Cycle Management Plan (Ref. 1)
- Ecological Australia - Concept Plan Report,
- Golders Associates – Geotechnical, Contamination and UXO – Site Suitability Assessment

3. INTRODUCTION – PROCESS FRAMEWORK

This report has been prepared by J. Wyndham Prince Pty Ltd to accompany a Project Application under Part 3A of the Environmental Planning & Assessment Act, 1979 (EP&A Act) for Stage 1 of Edmondson Park South.

Landcom is proposing to deliver a new diverse and sustainable urban community at Edmondson Park South. Once complete, Edmondson Park will accommodate a mix of land uses, a diversity of housing (approximately 3,200 dwellings), a new town centre incorporating 35,000 – 45,000m² retail, business and commercial floor space with employment opportunities for 1,000 people, multi-purpose community and education facilities, a new 150 hectare Regional Park, a number of other local parks and environmental conservation areas.

The new urban community at Edmondson Park South will meet the State Government's objectives to increase housing supply, provide community benefits and create jobs.

The Edmondson Park South project is the subject of a Part 3A Concept Plan and proposal to list Edmondson Park South as a State significant site under SEPP Major Development 2005. The purpose of the Concept Plan is to secure statutory approval for the overall planning framework for the site and to further resolve a number of remaining site-wide infrastructure delivery and land use planning issues. The Stage 1 Project Application (submitted concurrently with the Concept Plan) relates to early works, infrastructure and subdivision for the initial phases of the development and will enable site works to begin in 2010.

This report details the procedures used and presents the results of investigations undertaken in developing a Water Cycle Management Plan that incorporates the principles of Water Sensitive Urban Design (WSUD) to integrate with and support the Edmondson Park Part 3A Project Application (Stage 1) (from here on referred to as the "Stage 1").

The objective of this investigation is to assess the adequacy, in terms of detention and treatment capacity, of the proposed treatment measures to ensure the quantity and quality of stormwater leaving Edmondson Park meets statutory requirements.

The investigation involved the following specific tasks:

- Liaise with Campbelltown City Council, and confirm the statutory requirements and the nominated treatment measures applicable to the Stage 1 Site.
- Undertake a hydrologic analysis to determine the peak 5 and 100 year ARI pre development and post development flows;
- Determine the minimum detention storage requirements to restrict Stage 1 post development flows to pre development levels (within both Maxwells and Bunbury Curran Creek catchments) and to demonstrate compliance with statutory requirements;
- Undertake a water quality analysis and determine the minimum treatment device areas required to achieve Growth Centres Commission's (GCC) Environmental water quality targets;
- Undertake a water quality assessment of the proposed Stage 1 interim treatment devices to demonstrate compliance and consistency with the objectives of JWP's Edmondson Park Concept Plan Water Cycle Management (Ref.1)

- Prepare concept designs for the water quality treatment and detention devices required to achieve the water quality and quantity objectives for the overall developed Stage 1;
- Prepare an Interim Water Cycle Management Plan to support the Part 3A Project Application for development of The Stage 1, detailing the investigations, findings, calculations and design details.

4. PREVIOUS REPORTS / STUDIES

The main stormwater management related study that concern the development of the Stage 1 is titled “Edmondson Park South Part 3A Concept Plan Application - Water Cycle Management Plan” which was prepared by J. Wyndham Prince August 2010 (Ref. 1)

This report has been prepared to accompany a Concept Plan Application under Part 3A of the Environmental Planning & Assessment Act, 1979 (EP&A Act) and a proposal for State significant site listing under Schedule 3 of State Environmental Planning Policy Major Development 2005 (SEPP Major Development) in relation to the former Ingleburn Army Base and certain adjoining lands within the Edmondson Park Precinct of the South West Growth Centre.

This Project Application report shall be read in conjunction with the Concept Plan Application Water Cycle Management Plan Report.

5. EXISTING DEVELOPMENT

5.1 The Site

The Stage 1 Project Application site comprises an area of approximately 40 hectares and forms part of the larger Edmondson Park Release Area within the South West Growth Centre. It is located within the southernmost portion of the larger development site to the north of the M5 Motorway and to the east of Zouch Road and is approximately 40 km to the south west of Sydney CBD. The site is wholly located within the Campbelltown LGA.

Stage 1 consists of undulating grazing land, having generally been cleared and consisting of fenced grass paddocks. Overall Edmondson Park also includes significant portions of bushland, particularly within and adjacent to the watercourses. An existing primary school and rural residential properties are also located within the site. Stage 1 is divided by a ridgeline running generally from west to east along the southern part of the site. The larger northern portion of Stage 1 grades to the north forming the headwaters of Maxwells Creek. The southern portion of the site grades south, across the Hume Highway at Macdonald Road into Bunbury Curran Creek.

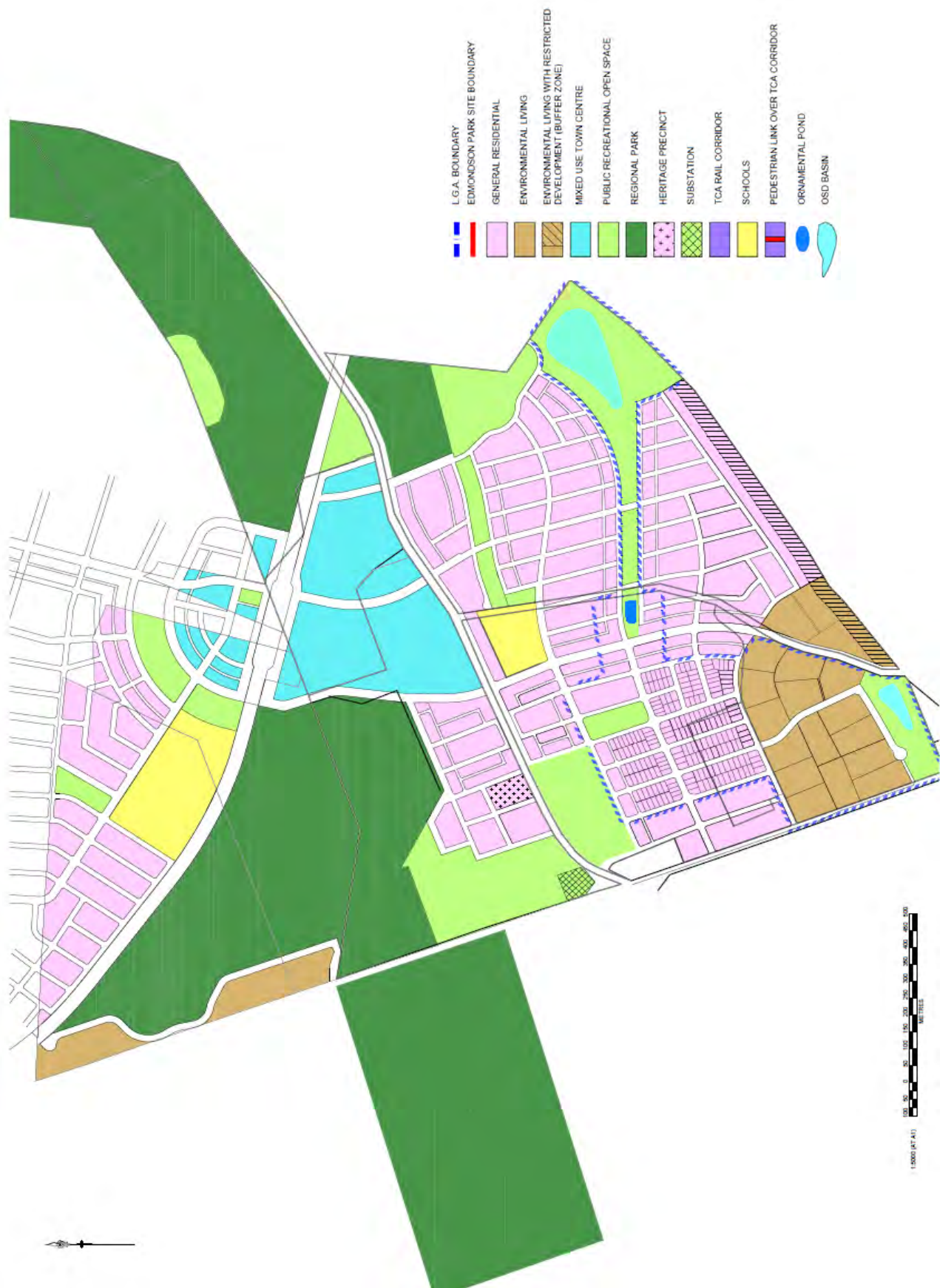


Plate 1: Edmondson Park South – Stage 1 Masterplan

5.2 Existing Drainage Configuration

Stage 1 straddles two catchments, the majority of Edmondson Park South Stage 1 (127 ha) drains to the north and is located within the Maxwells Creek catchment, the remaining 26 hectares to the southern extremities of 'Edmondson Park' drains to the south-east and is located within the Bunbury Curran Creek catchment, both creeks drain into and form part of the Georges River catchment. Stormwater within the Maxwells Creek catchment generally drains in a north-easterly direction towards Campbelltown Road. Maxwells Creek drains north along the Hume Highway then discharges into Cabramatta Creek west of the City Centre of Liverpool, Cabramatta Creek drains into the Georges River at Chipping Norton.

Stormwater within the Bunbury Curran Creek catchment drains south-east across the Hume Highway at Macdonald Road. Bunbury Curran Creek drains east across the south-western railway line then directly into the Georges River at Glenfield.

Discharges from the overall catchment upstream of the Hume highway at Macdonald Road were assessed to determine the impact on the existing drainage infrastructure draining into Bunbury Curran Creek. Campbelltown City Council has advised that the capacity of the existing drainage system downstream of the Hume highway at Macdonald Road is approximately 18.0 m³/s. (see Figure 2 for comparison location) We have assessed the peak pre-development 100 year ARI discharge to this point and have determined that flows are approximately 24 m³/s. The existing flows to Bunbury Curran Creek from 'Edmondson Park' are approximately 6.6 m³/s. Even if flows are fully detained within 'Edmondson Park' (which is not possible) the capacity of the existing system would still be exceeded, therefore, discharges from 'Edmondson Park' shall be controlled such that post-development discharges do not exceed pre-development levels for the Bunbury Curran Catchment.

There are two culvert crossings servicing Stage 1, one is situated under Campbelltown Rd that drains the Maxwells Creek catchment and the other is located under the Hume Highway at the southern fringe that drains to Bunbury Curran Creek catchment.

A small portion of the site, along the Maxwells Creek drainage corridor, is affected by flooding from the 100 year ARI and PMF storm events (Ref. 2). All of the flood affected areas will form part of the proposed riparian corridors and will not be subject to site filling.

5.3 The Proposed Development

The residential subdivision Project Application (Stage 1) (see Plate 1) is comprised of the following works:

The residential subdivision Project Application comprises:

- the creation of 206 residential lots, 15 Environmental Living lots in 5 stages*;
- the dedication of roads to Campbelltown City Council;
- On-site works comprising:
 - tree removal;
 - earthworks including excavation, cut and fill;
 - design and construction of physical infrastructure, including roads, stormwater drainage and utility reticulation, traffic management works, establishment of open space areas;
 - retaining walls as determined during detailed design;

- design and construction of staged stormwater water quantity and quality infrastructure to achieve objectives required by the Water Cycle Management (WCM) strategy for the greater site;
 - demolition of all existing structures;
 - erosion and sediment control to areas of roadworks and bulk earthworks including provision of temporary sedimentation ponds and diversion drains;
 - Design and construction of an ornamental pond;
 - Landscaping of road reservations;
 - erection of signage and billboards; and;
 - Embellishment of open space.
- Off-site works comprising:
 - construction of the sewer lead in from the Sydney Water carrier main at Ash Road;
 - upgrade of overhead mains and construction of electrical lead-in feeders from the existing zone substation at Prestons;
 - connection to utility services, potable and recycled water, electricity, gas and telecommunications in Campbelltown and MacDonald Roads;
 - Connection to existing stormwater drainage;
 - tree removal;
 - earthworks including excavation, cut and fill;
 - design and construction of physical infrastructure, including roads, stormwater drainage and utility reticulation, traffic management works, including the connection to the existing MacDonald Road;
 - design and construction of staged stormwater water quantity and quality infrastructure to achieve objectives required by the Water Cycle Management (WCM) strategy for the greater site;
 - erection of an acoustic wall;
 - erection of signage and billboards;
 - extension or relocation of existing services including potable and recycled water, gas, telecommunication, power;
 - demolition of all existing structures; and;
 - Proposed new intersection to existing Macdonald Road.

* A number of residue lots will be created in undertaking the Project Application, the number of lots identified in the above description relate to the ultimate number of lots that will be created in the Project Application.

It is intended to seek staged Construction Certificates as necessary to facilitate the efficient delivery of each phase of, the development works.

6. DEVELOPMENT GUIDELINES, OPPORTUNITIES AND CONSTRAINTS

All relevant development guidelines, opportunities and constraints applicable to the Stage 1 application are generally consistent with those outlined in the Part 3A Concept Plan report (Ref. 1).

On the 28 July 2010 the Director General of the Department of Planning issued the requirements for the Part 3A Application. These requirements are listed in Section 2, with details of how the proposed Water Cycle Management Plan deals with these requirements listed throughout the document, and summarised in Section 12.

This Project Plan report should be read in conjunction with the Edmondson Park Part 3A Concept Plan Water Cycle Management Plan

7. WATER CYCLE MANAGEMENT STRATEGY

The Water Cycle Management Strategy proposed for the development has been prepared with consideration of the statutory requirements and guidelines listed in Section 6 of the Concept Plan report. The strategy focuses on mitigating the impacts of the development on the total water cycle and maximising the environmental, social and economic benefits achievable by utilising responsible and sustainable stormwater management practices.

7.1 Proposed Water Cycle Management Elements

To maintain stormwater quality at the required levels, a “treatment train” approach is proposed where various types of pollutants are removed by a number of devices acting in series. The Water Cycle Management plan will consist of elements as outlined below with the detailed modelling of these elements presented Section 10.

Water Quality

A treatment train consisting of:

On Lot Treatments

- Appropriate waterwise landscaping practices (resident education, native gardens, mulch, micro-irrigation).
- Implementation of water efficient fittings and appliances in all dwellings (dual flush toilet, AAA shower heads, water efficient taps and plumbing).
- Minimisation of impervious areas.
- Reticulated recycled water.

Street Level Treatments

- Proprietary gross pollutant traps.

Precinct Scale Treatments

- (In the Short to medium term) Sediment Basins located on future development stages.
- (In the longer term) Bio-Retention Raingardens, located within the public reserves and adjacent to the riparian corridors.
- A regional detention basin within Maxwells Creek which will treat the central portion of Stage 1.
- Within the Bunbury Curran Catchment a detention basin adjacent to the Hume Highway will be required to manage flows from the rural residential portion of the development.

Water Quantity

Attachment A contains a brief description of the Water Cycle Management elements used in the treatment train and the technical parameters used in the Water Quality Modelling (MUSIC) undertaken.

7.1.1 Ornamental Pond

A 3000m² ornamental pond is proposed to be located at the head of the Maxwells Creek riparian corridor. Refer to Figure 4 for the location and general configuration of the pond.

The Pond is to be configured as an open water body providing an aesthetic feature and improved amenity to the local area. This device would be designed to receive and convey limited flood flows which surcharge from the pipe system in the upstream catchment in a 100 ARI event, and will form part of the flow management arrangement across existing MacDonald Road.

7.1.2 Sedimentation Ponds

During Stage 1, sedimentation ponds will be used to manage flows from the development area. Flocculated stormwater will then be used top up the ornamental pond during the construction phase. Construction of Raingarden 1A and the associated flow return system will be deferred until after 80% of the housing development is completed upstream of the devices.

7.1.3 Bio-Retention “Raingarden” Systems

Three “Raingardens” are proposed within the riparian corridor fringes of Stage 1 development to facilitate the removal of suspended solids and nutrients from the urban catchment. The Raingarden sizes and details are illustrated in Figures 4-6.

The Raingardens consist of a loamy sand media bed with a surface which is densely vegetated with native sedges and/or grasses. This device would be designed to receive, convey and treat 3 month ARI flows from the upstream catchment. Treatment is attained by detention of flows, direct filtration and nutrient stripping by bio-films which establish on the surface of the media bed.

The construction of the raingardens would be deferred until 80% of housing is completed in the catchment.

7.1.4 Water Quantity Management

Two Regional detention basins will be incorporated within the development to restrict post development discharges to pre-development levels for the 5 and 100 year ARI storm events. The basins will minimise the impact of the proposed development by reducing storm flows prior to discharge to the bushland and riparian corridors downstream of the site.

These will act as detention systems to limit storm flows up to the 100 year ARI discharging to Maxwells Creek and Bunbury Curran Creek to pre-development levels.

Details of the Water Quantity management elements are provided in Section 8.0 of this report.

For both basins, the final basin works (embankment and outlet structures) will be provided as part of Stage 1. The performance of the devices was also assessed under Stage 1 catchment conditions to demonstrate that the basins will attenuate peak post development flows to pre development levels for the 5 and 100 year ARI conditions (Refer to Section 8).

7.2 Long Term Management

Regular maintenance of the stormwater quality treatment devices is required to control weeds, remove rubbish, and monitor plant establishment and health. Some sediment build-up may occur on the surface of the raingardens and may require removal to maintain the high standard of stormwater treatment.

Proper management and maintenance of the water quality control systems will ensure long-term, functional stormwater treatment. It is strongly recommended that a site-specific Operation and Maintenance (O & M) manual is prepared for the system. The O & M manual will provide information on the Best Management Practices (BMP's) for the long-term operation of the treatment devices. The manual will provide site-specific management procedures for:

- Maintenance of the GPT structures including rubbish and sediment removal.
- Management of raingardens, including plant monitoring, replanting guidelines, monitoring and replacement of the filtration media and general maintenance (i.e. weed control, sediment removal).
- Management of the ornamental pond including removal of rubbish and plant monitoring as required.

8. HYDROLOGIC ANALYSIS

The hydrologic analyses for this study were undertaken using the rainfall - runoff flood routing model XP-RAFTS (Runoff and Flow Training Simulation with XP Graphical Interface) (Ref. 3 & 4).

8.1 Sub-Catchments (pre and post development)

Sub-catchment areas contributing to this drainage systems were established through site investigations and photogrammetry contour survey covering the catchment and consideration of the Masterplan for Stage 1. Catchment boundaries for the existing and developed areas contributing to the drainage system are shown on Figures 2 and 3 respectively for the development. Details of the catchments modelled using XP-RAFTS details are provided in Attachments B and C.

8.2 Rainfall Data

Design rainfall intensity-frequency-duration (I.F.D.) data for Edmondson Park South was obtained from Appendix B of Campbelltown City Council's (Sustainable City) DCP (Ref.5). A summary of the rainfall intensities adopted in this study is provided in Table 8.1. The critical storm durations were determined using these values for each sub-catchment.

Table 8.1: INGLEBURN RAINFALL INTENSITIES (mm/hr)

Storm Duration (min.)	Rainfall Intensities (mm/hr)	
	Recurrence Interval (ARI)	
	5	100
5	139	226
10	107	174
15	89	146
20	78	127
25	70	114
30	64	104
45	51	83
60	43.2	71
90	33.9	56
120	28.4	47
180	22.0	36.6
270	17.0	28.5
360	14.1	23.9
540	11.0	18.7
720	9.16	15.7
1080	7.14	12.4
1440	5.98	10.5
2880	3.84	6.87

8.3 Pern

The pern (n) values adopted for the catchments in the XP-RAFTS modelling are consistent with the parameters outlined in Councils DCP (Ref. 5) and are listed in Table 8.2.

Table 8.2: XP-RAFTS PERN VALUES

Parameter	Catchment Condition	Value
Pern (n)	Existing Pervious	0.05
	Urban Pervious	0.025
	Urban Impervious	0.015

8.4 Losses

XP-RAFTS modelling was undertaken using a standard initial and continuing loss rate model. The values adopted for XP-RAFTS modelling are consistent with the parameters outlined in Councils DCP (Ref. 5) and are as follows:

- Pervious catchment*

Initial Loss	15.0 mm
Continuing Loss	2.5 mm

- Impervious Catchment*

Initial Loss	1.5 mm
Continuing Loss	0.0 mm

8.5 Calibration

It is normal practice for flood routing models such as XP-RAFTS to be calibrated with historical rainfall and streamflow data for the catchment being investigated in order to produce the most reliable results. Model parameters are adjusted so that the model adequately reproduces observed hydrographs.

As no streamflow records are available for this location, calibration was undertaken by comparing the results obtained from the Probabilistic Rational Method (PRM) for the existing (undeveloped) catchment, and adjusting the XP-RAFTS model to provide similar results.

The PRM is outlined in Australian Rainfall and Runoff (Ref. 6) and has long been used in rural stormwater drainage design as a reliable estimate of peak flow rates.

Table 8.3: SUMMARY OF PEAK 100 yr ARI FLOW RATES OBTAINED FROM THE VARIOUS ESTIMATION METHODS

Number	Catchment Area	Flows (m ³ /s)	
		PRM	XP-RAFTS
1.00	33.2	6.69	6.08
1.01	21.4	9.96	9.63
1.02	46	16.16	16.02
1.03	13.4	17.83	18.09
2.00	21.6	4.74	4.44
2.01	10	6.43	6.42
1.05	29	27.80	27.36
3.00	26.2	5.53	6.60

The results presented in Table 8.3 shows that the XP-RAFTS model with appropriate modelling parameters is generally a good match for most rural catchments therefore, no calibration was undertaken for the XP-RAFTS.

8.6 Tailwater Effects

The basin outlet operations were checked to confirm whether they were affected by tailwater conditions from regional flooding in the respective watercourses. The storage devices were conservatively designed such that the base of the detention storages were at or above peak 100 year ARI regional flood levels at the respective locations, which is approximately R.L. 51.5 for the Maxwells Creek basin and R.L. 38.0 for the Bunbury Curran Creek basin.

8.7 Post-Development Drainage System

The conveyance of runoff from Stage 1 follows the site's natural terrain. The piped drainage system will collect runoff from the lots and roads and discharge the flows into the treatment systems along the fringes of the drainage corridors. Total peak post development discharges from Stage 1 at Campbelltown Road are less than the pre-development levels.

All stormwater flows from the central corridor of Stage 1 are discharged into Maxwells Creek.

The Bunbury Curran Creek catchment will consist of rural residential lots and this area will discharge into a combined water quality/water quantity control device with a storage volume of 5000 m³.

The post development catchments are shown on Figure 3 and general stormwater management concept layout of the detention basin and bio-retention systems are shown on Figure 1.

8.8 Detention Basins Sizing and Configuration

As part of the development of the post development model, basin size and configurations were determined. Table 8.4 provide the detail of the proposed basin arrangements.

Table 8.4: DETENTION BASINS - GENERAL FEATURES AND CONFIGURATIONS

Parameter	Maxwells Creek Basin		Bunbury Curran Creek
	Webb Mckneown (2007) (Ref. 5)	JWP (2010)	
Base Storage Level	-	53.16	38.50
Storage Volume	37000 m ³	45400 m ³	5000 m ³
Top Water Level	-	53.67	40.20
Detention Depth (max)	-	1.66m	1.20 m
Peak 100 ARI Discharge	10 m ³ /s	7.02 m ³ /s	6.44 m ³ /s

8.9 Discharge Estimates

Detention basin operation under fully developed conditions has been modelled. These results are presented in section 9.0 of the Concept Plan Water Cycle Management Plan.

Discharge estimates were also derived for the existing and developed catchments under Stage 1 conditions for storms with Average Recurrence Intervals (A.R.I.'s) of 5 and 100 years. A range of storm durations from 15 minutes to 12 hours were analysed to determine the critical storm duration for each sub-catchment.

An "Outflows" dummy node (Node 1.05) was incorporated into the XP-RAFTS model to link and sum all the flows from the sub-catchments so a comparison of the pre-development and post-development flows can be made. This node does not represent a physical location.

The 5 and 100 year A.R.I. peak flows from the catchment for each of these conditions is presented in Tables 8.5 and 8.6. The XP-RAFTS modelling outputs are provided in Attachments B and C.

Table 8.5: SUMMARY OF STAGE 1 PEAK DISCHARGES – MAXWELLS CREEK (Node 1.05)

ARI	Pre-development			Post-development			Ratio Post Dev/ Pre Dev
	Peak Inflow (m ³ /s)	Time to Peak (min)	Storm Duration (min)	Peak Inflow (m ³ /s)	Time to Peak (min)	Storm Duration (min)	
5	13.50	108	270	8.81	336	540	65.3%
100	27.36	67	120	15.86	71	120	58.0%

Table 8.6: SUMMARY OF STAGE 1 PEAK DISCHARGES – BUNBURY CURRAN CREEK (Node 7.02d)

ARI	Pre-development			Post-development			Ratio Post Dev/ Pre Dev
	Peak Inflow (m ³ /s)	Time to Peak (min)	Storm Duration (min)	Peak Inflow (m ³ /s)	Time to Peak (min)	Storm Duration (min)	
5	3.08	90	270	2.96	92	270	96.1%
100	6.60	44	120	6.44	46	120	97.6%

8.10 Basin Performance

The performance of the Maxwells Creek and Bunbury Curran Creek on-line regional basins for the 5 and 100 year ARI storm events are detailed in Tables 8.7 and 8.8, respectively.

Table 8.7: STAGE 1 DETENTION BASIN PERFORMANCE – MAXWELLS CREEK BASIN

ARI	Max Inflow (m ³ /s)	Storm Duration (min)	Time To Peak (min)	Max Outflow (m ³ /s)	Storm Duration (min)	Time To Peak (min)	Storage (m ³)	Stage (m)	Depth (m)
5	8.05	90	37	4.21	540	358	9169	52.49	0.99
100	16.18	90	37	7.02	540	364	25842	53.16	1.66

Table 8.8: STAGE 1 DETENTION BASIN PERFORMANCE – BUNBURY CURRAN CREEK BASIN

ARI	Max Inflow (m ³ /s)	Storm Duration (min)	Time To Peak (min)	Max Outflow (m ³ /s)	Storm Duration (min)	Time To Peak (min)	Storage (m ³)	Stage (m)	Depth (m)
5	5.32	90	30	2.96	270	92	2250	39.27	0.77
100	11.01	90	30	6.44	120	46	4446	39.63	1.13

8.11 Discussion of Modelling Results

8.11.1 Maxwells Creek Catchment

The XP-RAFTS modelling undertaken shows that the interim on-line regional detention storage provided for the Stage 1 development within the Maxwells Creek catchment draining to Campbelltown Road is adequate to restrict post development peak discharges to pre development levels within Maxwells Creek for storm events between the 5 and 100 year ARI for the development as follows:

- Reduction of the total 5 year ARI post development peak site discharges into Maxwells Creek at Campbelltown Road to 8.81 m³/s, which is less than the pre development peak discharge from the catchment of 13.50 m³/s.
- Reduction of the total 100 year ARI post development peak site discharges into Maxwells Creek at Campbelltown Road to 15.86 m³/s, which is less than the pre development peak discharge from the catchment of 27.36 m³/s.

8.11.2 *Bunbury Curran Creek Catchment*

The XP-RAFTS modelling undertaken shows that the detention storage provided for the whole of the Bunbury Curran Creek catchment draining to the Hume Highway is adequate to restrict post development peak discharges to pre-development levels within Bunbury Curran Creek for storm events between the 5 and 100 year ARI for the development as follows:

- Reduction of the total 5 year ARI post development peak site discharges upstream of the Hume Highway into Bunbury Curran Creek to 2.96 m³/s, which is less than the pre development peak discharge from Edmondson Park of 3.08 m³/s.
- Reduction of the total 100 year ARI post development peak site discharges upstream of the Hume Highway into Bunbury Curran Creek to 6.44 m³/s, which is less than the pre development peak discharge from Edmondson Park of 6.60 m³/s.

9. FLOOD MANAGEMENT

Webb McKeown and Associates were engaged by Landcom in 2007 to develop a detailed SOBEK hydraulic model of the Maxwells Creek floodplain. This was summarised in Part 5 of their 2007 study (Ref. 5). The study concluded that the Maxwell's Creek drainage corridor downstream of MacDonald Road is affected by flooding from the 100 year ARI and PMF storm events. The majority of these identified flood affected areas will form part of the riparian corridors to be provided in The 'Edmondson Park' site and as a consequence will not require site filling which may have had an impact upon these identified flood levels.

All development lots are proposed to be outside the 100 year ARI flood and will have a minimum freeboard of 500mm to comply with the FDM (Ref 7) and Campbelltown and Liverpool City Council requirements.

Throughout the development, 100 year ARI flooding will be managed by a combination of a appropriately designed pipe drainage system and containment of surcharge flows (greater than pipe capacity) within the road reserves. Flows in road reserves will be limited to a V x D product of 0.4 to comply with Campbelltown and Liverpool City Council requirements.

10. WATER QUALITY ANALYSIS

The water quality analysis for this study was undertaken using the modelling program MUSIC. The parameters and rainfall data adopted for the modelling are consistent with those reported in the Part 3A Concept Plan Application (Ref. 1).

10.1 Catchments

MUSIC models were established for the Stage 1 to represent the proposed stormwater management components. The total catchment area assessed is approximately 67 hectares with the general arrangement of these elements are shown in Plate 2. Catchment extents are indicated on Figure 2 with details of the water elements provided in Attachment D.

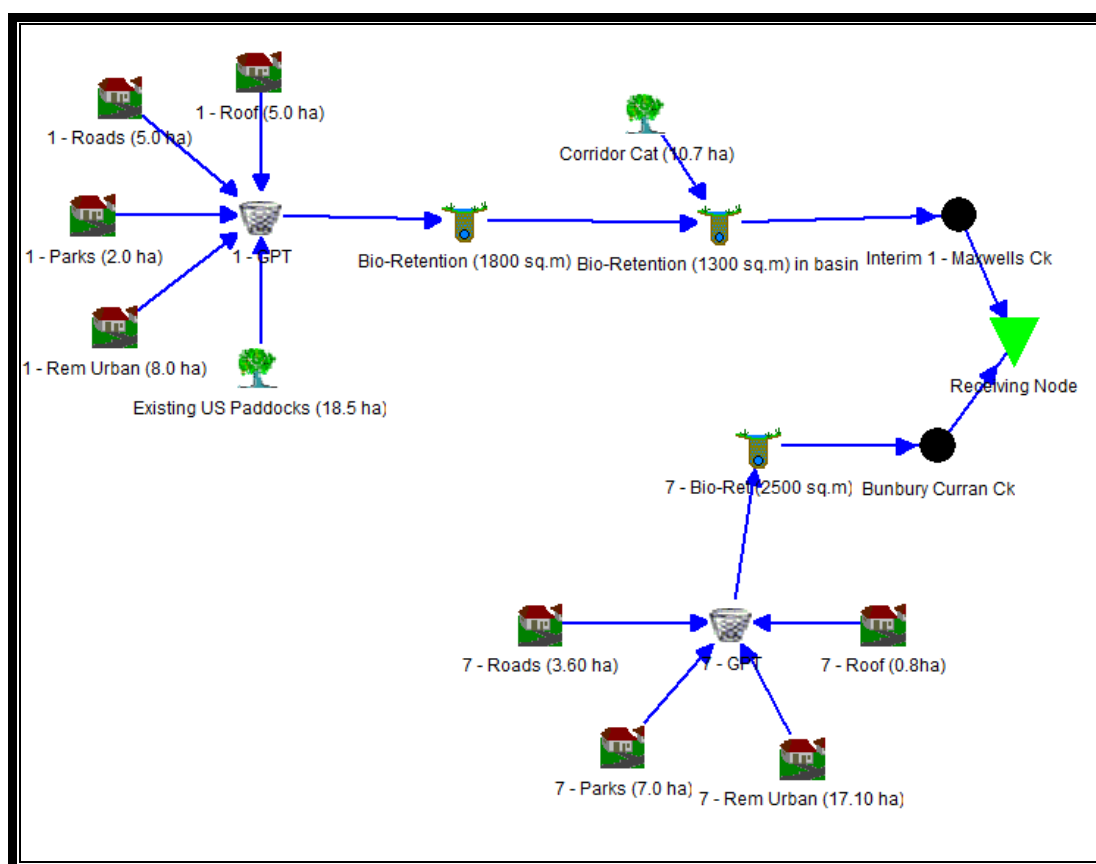


Plate 2: MUSIC Model Layout – Stage 1 Site Conditions (9031MU_04.sqz)

The treated catchments were divided into three sub-catchments representing the proposed Stage 1 catchment (i.e. Roof, Roads and Remaining Urban). The catchment details are provided in Table 10.1.

Table 10.1: CATCHMENT DETAILS – STAGE 1 CONDITIONS

Catchment	Source	Area (ha)	Fraction Impervious
1	Roads	5.00	1.0
	Roofs	5.00	1.0
	Remaining Urban	8.00	0.6
	Parks	2.00	0.05
	Existing Upstream Paddocks	18.50	0.05
7	Roads	3.60	1.0
	Roofs	0.80	1.0
	Remaining Urban	17.10	0.2
	Parks	7.00	0.05

10.2 Pollutant Load Estimates and Discussion of Modelling

Total annual pollutant load estimates were derived using MUSIC for the Stage 1 development incorporating the proposed water quality treatment system.

The estimated annual pollutant loads and reductions are presented in Table 10.2.

Table 10.2: SUMMARY OF POLLUTANT CONCENTRATION REDUCTIONS – STAGE 1 DEVELOPMENT – MAXWELLS CREEK CATCHMENT

Pollutant	Sources (kg/yr)	Discharges (kg/yr)	Reductions (%)
TSS	22700.0	2320.0	90%
TP	35.7	12.2	66%
TN	286.0	143.0	50%
GP	3960	3	100%

Table 10.3: SUMMARY OF POLLUTANT CONCENTRATION REDUCTIONS – STAGE 1 BUNBURY CURRAN CREEK CATCHMENT

Pollutant	Sources (kg/yr)	Discharges (kg/yr)	Reductions (%)
TSS	17300	1050	94%
TP	24	7	72%
TN	191	105	45%
GP	2200	0	100%

Table 10.4: COMPARISON OF POLLUTANT REDUCTIONS AND CONCENTRATIONS TO TARGET LEVELS –STAGE 1 DEVELOPMENT

Pollutant	MUSIC Mean Pollutant Loading Rate - Urban Storm Conditions (mg/l)	MUSIC Mean Discharge Concentration (mg/l)	MUSIC Reduction of Pollutant Loads from Site (9031MU_04.sqz) (%)	Minimum Target Reductions (DECC & Council) (%)	Minimum Target Reductions (Georges River) (%)
TSS	195	1.16	92%	85%	80%
TP	0.21	0.032	69%	65%	60%
TN	1.67	0.64	48%	45%	35%

The performance of the proposed water quality management strategy for Edmondson Park obtained from the MUSIC model, as summarised in Table 10.4, shows that:

- In order to achieve the objective of an 85% reduction in TSS from the proposed development, the maximum allowable TSS discharge from the Stage 1 development

into Maxwells Creek is 3405 kg/yr, the MUSIC modelling predicts that TSS is reduced to 2320 kg/yr. the maximum allowable TSS discharge from the development into Bunbury Curran Creek is 2595 kg/yr, the MUSIC modelling predicts that TSS is reduced to 1050 kg/yr. The water quality management strategy therefore achieves the target reductions for TSS.

- In order to achieve the objective of a 65% reduction in TP from the proposed development, the maximum allowable TP discharge from the Stage 1 development into Maxwells Creek is 12.5 kg/yr, the MUSIC modelling predicts that TP is reduced to 12.2 kg/yr. the maximum allowable TP discharge from the development into Bunbury Curran Creek is 8.4 kg/yr, the MUSIC modelling predicts that TP is reduced to 7.0 kg/yr. The water quality management strategy therefore achieves the target reductions for TP.
- In order to achieve the objective of a 45% reduction in TP from the proposed development, the maximum allowable TN discharge from the Stage 1 development into Maxwells Creek is 157 kg/yr, the MUSIC modelling predicts that TN is reduced to 143 kg/yr. the maximum allowable TN discharge from the development into Bunbury Curran Creek is 105 kg/yr, the MUSIC modelling predicts that TN is reduced to 105 kg/yr. The water quality management strategy therefore achieves the target reductions for TN.

The combination of proposed stormwater quality treatment devices will meet GCC Development Code and the George's River Stormwater Management Plan water quality objectives for the Stage 1 development for both the Maxwells Creek and Bunbury Curran Creek catchments.

11. INDICATIVE CONSTRUCTION AND MAINTENANCE COSTS

11.1 Indicative Construction Costs

Indicative construction costs were determined for the major stormwater elements proposed for the Stage 1 development and are summarised in Table 11.1.

Table 11.1: INDICATIVE CONSTRUCTION COSTS – INTERIM STAGE 1 DEVELOPMENT

	Item	Quantity	Unit	Unit Cost (\$/Unit)	Device Cost (\$)	Total Cost (\$)
Catchment 1	GPT 1a (Max 25ha)	1	ea	110000	110000	
	GPT 1b (Max 25ha)	1	ea	110000	110000	
	Pump return to Pond	1	ea	52000	52000	
	Sedimentation Basin Pumps*	2	ea	3000	6000	
	Bio-Retention Raingarden*	1800	m ³	250	450000	
	Bio-Retention Raingarden*	1300	m ³	250	325000	1,053,000
Catchment 7	GPT 7a (Max 20ha)	1	ea	85000	85000	
	GPT 7b (Max 8ha)	1	ea	44000	44000	
	Detention Basin	5000	m ³	70	350000	
	Bio-Retention Raingarden	2500	m ²	250	625000	754,000
	Total					1,807,000

Note: The Detention Basin servicing Catchment 1 will eventually service the entire Edmondson Park Part 3A south of Campbelltown Road draining to Maxwells Creek.

The proposed interim sediment ponds are assumed to be part of the standard subdivision construction stage Soil and Water Management costs.

*These work will be deferred until approximately 80% completion of the housing in Stage 1

11.2 Indicative Maintenance Costs

Indicative maintenance costs were determined for the major stormwater elements proposed for the Stage 1 development and are summarised in Table 11.2. Costs were broken down to identify the cost variations for both the establishment period (up to 3 years for construction) and the long term maintenance cost (after the 3 year establishment period).

Indicative maintenance requirements for the stormwater management devices are outlined in Section 7.

Table 11.2: INDICATIVE ANNUAL MAINTENANCE COSTS – INTERIM STAGE 1 DEVELOPMENT

	Item	Quantity	Unit	Unit Cost (\$/unit)	Establishment Period (0-3 yrs)		Long-Term Period (>3 yrs)	
					Frequency (times/year)	Total Cost (\$/yr)	Frequency (times/year)	Total Cost (\$/yr)
Catchment 1	GPT 1a (Max 25ha)	1	ea	\$ 4,000	4	16,000	2	8,000
	GPT 1b (Max 25ha)	1	ea	\$ 4,000	4	16,000	2	8,000
	Pump return to Pond	1	ea	\$ 500	2	1,000	1	500
	Sedimentation Basin Pumps	2	ea	\$ 500	2	2,000	2	2,000
	Bio-Retention Raingarden	1800	m ²	\$ 2	2	7,200	1	3,600
	Bio-Retention Raingarden	1300	m ²	\$ 2	2	5,200	1	2,600
	Detention Basin	40000	m ³	\$ 0.50	2	40,000	1	20,000
Catchment 7	GPT	1	ea	\$ 3,500	4	14,000	2	7,000
	Bio-Retention Raingarden	2500	m ²	\$ 2	2	10,000	1	5,000
	Detention Basin	5000	m ³	\$ 0.50	2	5,000	1	2,500
	TOTAL					116,400		59,200

11.3 Ownership Arrangements

All water quality and quantity devices will be located within public reserves or road ways. It would be envisaged that transfer of ownership of these devices would form part of an agreement between Landcom and Campbelltown City Council at some time in the future when development of Edmondson Park in completed.

12. DGR RESPONSES

Following is a list of the DGR's as outlined in Section 2 with responses addressed in this report and by nominated drawings.

Table 12.1 RESPONSES TO THE DIRECTOR GENERALS REQUIREMENTS

REQUIREMENT	RESPONSE
➤ Surface Water, Groundwater Quality and Riparian Corridors (1) Assess any potential impacts of proposed development on hydrology and hydrogeology of the site and adjacent areas in terms of impact on water quality having regard to environmental targets for new urban development set out in Managing urban stormwater: environmental targets – Consultation draft (DECC in association with the Sydney Metropolitan CMA, October 2007). In particular, identify how any potential water quality impacts on wetlands both within and adjoining the site, and the ecological values of the Regional Park, will be avoided, mitigated or managed. (3) Identify drainage and stormwater management infrastructure, including: on site detention of stormwater; water sensitive urban design (WSUD); and drainage infrastructure. Identify the future management and ownership arrangements for stormwater infrastructure, and identify how any requirements of the future owner will be met. (4) Assess any proposed variation to riparian corridors and associated buffers in accordance with the Riparian Corridor Management Study approach applied to the Growth Centres, and provide justification for any changes. Details of any rehabilitation works for corridors should be provided.	Hydrology assessments were undertaken on the site with regards to water quantity and water quality. Details of the assessments, results and discussions have been outlined in Sections 9, 11, 12 of the Concept Plan Water Cycle Management Plan. The Water Cycle Management Plan complies with the targets within the listed DGR reference with the results presented in Section 10.2. Suitable management measures to avoid exacerbation of site/soil salinity and to limit additional surface and groundwater interaction are presented in Section 7.8 of the concept plan report. Nominated drainage and stormwater management infrastructure are outlined in Section 7 of this report with descriptions of the individual elements provided within Attachment A. Future management and ownership arrangements are outlined in Section 11.3. For details on the Riparian corridors management refer to section 8.0 of the Concept Plans Water Cycle Management plan.
➤ Flooding (1) Identify any flood risk associated with the site and demonstrate that the proposed development is suitable in terms of flooding and is consistent with the NSW Floodplain Development Manual: the management of flood liable land (2005).	Section 10 JWP's Concept plan Water Cycle Management Plan report discusses the flooding within 'Edmondson Park' with details of the flood investigation undertaken by Webb McKeown & Associates on 2007 (Ref. 4 & 5). The concept plan investigations comply with the FDM guidelines
➤ Ecologically Sustainable Development - The EA should demonstrate that all aspects of the concept plan satisfy the principles of ESD including compliance with BASIX. - The EA should outline commitments to sustainability including water re-use, waste minimisation, the minimisation of energy use and car dependency.	Demonstration of Ecologically Sustainable Development including BASIX compliance is discussed in section 6.7.2 and outlined in Sections 7.1 and 7.2 of the Concept Plans Water Cycle Management plan. The report outlines commitments to sustainability including reductions in potable water demand, use of reticulated recycled water and introduction of integrated natural resources that limit the impacts on downstream ecosystems, as outlined in Section 7.1 and 7.2 Concept Plans Water Cycle Management plan.

13. SUMMARY & CONCLUSION

The Water Cycle Management Strategy for the Stage 1 development at Edmondson Park South has been prepared to support the Part 3A Project Application process for the Stage 1 development of the site. The strategy is to be read in conjunction with the Water Cycle Management Plan prepared concurrently by J. Wyndham Prince to support the Part 3A Concept Plan Application for the development of Edmondson Park South (Ref. 1), and has been prepared to conform to the statutory requirements and industry best practice for stormwater management in this catchment.

The Water Cycle Management Strategy consists of a treatment train consisting of at lot treatment, street level treatment and subdivision / development treatment measures.

The structural elements proposed for the Stage 1 development consists of:

- Proprietary GPT units at each stormwater discharge point (4 required).
- A proposed raingarden servicing the northern (Maxwells Creek) catchment with a surface area of 3100 m²
- Proposed ornamental pond with static water surface area of 3,000 m².
- (In the short & medium Term) Sedimentation Ponds will constructed to manage flows from the Stage 1 development areas.
- (In the longer term) Two proposed raingardens to service the Maxwells Creek catchment (1,800 and 1,300 m²) and a proposed raingarden servicing the southern (Bunbury Curran Creek) catchment with a surface area of 2,500 m².
- A proposed regional detention storage basin on Maxwells Creek with a storage volume of approximately 45,000 m³.
- A proposed regional detention storage basin at the Hume Highway in the Bunbury Curran Creek catchment with a storage volume of 5,000 m³.

Provision of the proposed detention basins within the development will ensure that peak post development discharges from Edmondson Park into Maxwells Creek are consistent with the peak flows targets previously identified by Webb McKeown & Associates for the Edmondson Park Release Area (Ref. 5). Furthermore flows from Bunbury Curran Creek will be restricted to pre development levels.

The Water Cycle Management strategy proposed for Edmondson Park South Stage 1 is functional; delivers the required technical performance; avoids environmental degradation and pressure on downstream ecosystems and infrastructure; and provides for a 'soft' sustainable solution for stormwater management within the release area. Furthermore, it will ensure that the relevant issues listed in the Director General's requirements relating to the management of water on the site are attained.

The proposed Water Cycle Management Strategy provides the basis for the detailed design and development of Stage 1 to ensure that the objectives for Water Cycle Management on the site are achieved.

14. REFERENCES

1. J. WYNDHAM PRINCE (2010) – Edmondson Park Part 3A Concept Plan Approval - Water Cycle Management Plan
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6. Institution Of Engineers, Australia (1987). Australian Rainfall and Runoff. -Institution of Engineers Australia
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