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Masterplan Water Cycle Management Report

Menangle Park

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EXECUTIVE SUMMARY

This Water Cycle Management Report has been prepared to support an amendment to Campbelltown Local Environmental Plan 2015 (Campbelltown LEP 2015) in relation to the Menangle Park Urban Release Area (URA), which comprises of 958 hectares of land at Menangle Park. The URA incorporates 498 ha of land owned or under the control of Dahua Group (Aust) Pty Ltd (Dahua) with the remaining area owned or under the control of other landowners.

The site was rezoned from rural to residential on 18 November 2017 and is planned to accommodate approximately 3,400 residential lots, a retail/commercial town centre, employment lands and community and recreational facilities.

The proposed amendment builds upon the site's previous rezoning and associated Structure Plan to create a new sustainable, healthy and high quality residential community comprising:

- 5,250 dwellings (an increase of 1,850 dwellings);
- a new major town centre comprising 30,000 m² of retail / employment gross floor area;
- a new neighbourhood centre (approximately 3,500 m² of employment floor space);
- a revised road and street network to provide better permeability throughout the site;
- sporting fields and parks;
- integrated passive recreation area within a riparian corridor network;
- land for environmental conservation;
- community facilities to support the proposed increase to the population; and
- primary school.

Land to which the planning proposal relates and the Structure Plan

The land to which the proposed LEP amendment and planning proposal relates (the site) includes all land owned or under the control of Dahua and six (6) additional properties on the eastern side of Cummins Road owned or under the control of other landowners (refer to legal description of the site and land application map included at Appendix G). The Structure Plan, as proposed to be amended, continues to relate to all land within the Menangle Park URA.

SMEC has been engaged by Dahua to prepare this Water Cycle Management Report. This purpose of this report is to support the rezoning. This report builds upon documents prepared for the original rezoning - the 'Menangle Park WSUD Strategy Report' by AECOM (2010), 'Menangle Park LES – Local Flooding and Storm Quantity Management (Detention) by GHD (2010) and 'Report for Menangle Park – Review of Drainage Options' by GHD (2011).

The key objectives of this 'Water Cycle Management Report' are to:

- set the strategy for managing water quality and quantity within the Menangle Park Urban Release Area;
- summarise the parameters, results and recommend WSUD devices for the restructured masterplan layout;
- summarise the detention requirements;
- provide cost estimations for S7.11 (previously S94) community drainage infrastructure; and
- outline the updated flood modelling based on the revised masterplan layout.

This report shows that the revised Menangle Park masterplan does not have significant changes to the water strategy that was approved as per the 2017 rezoning.

The WSUD strategy for the revised masterplan layout outlined in the report has been shown to meet the pollution reduction stretch targets at all four outlets to the Nepean River.

The sizes of the basins have been adjusted to account for the proposed changes in density however, the number of detention & WSUD basins and their location remains consistent with the approved strategy.

The impacts to flood levels as a result of filling land to be developed above the 100 year ARI levels remains generally within the precinct boundaries and remains consistent with the approved strategy. Further detailed design will need to be undertaken to ensure that the playing fields south of Menangle Road can be lifted above the 5 Year and 20 Year ARI events, however – with appropriate compensatory storage this will be achievable

Finally – the report also addresses the matters raised by Council in relation to preliminary planning proposal from May 2018 with regard to water cycle management.

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1. BACKGROUND

In 2002 a water cycle management study was prepared for Menangle Park (Ecological Engineering 2002) 'Menangle Park Release Area Water Cycle Management Options Report' prepared for Landcom and Campbelltown City Council (August 2002). This report developed broad water cycle management options for the Menangle Park URA to meet the requirements of the relevant regulations and objectives.

Since 2002 several other studies have been undertaken to progress the development opportunities at Menangle Park.

Previous studies considered in the preparation of this report:

- Summary of Drainage Strategy, Landcom, Nov 2011;
- Menangle Park WSUD Strategy (AECOM, June 2010);
- Review of Drainage Options (GHD, November 2011); and
- Local Flooding and Stormwater Quantity Management (Detention), GHD, May 2010 (GHD, May 2010).

The Menangle Park Release Area was rezoned in late 2017.

A consultation workshop took place with Campbelltown City Council on the 21st of September 2018 in which comments raised in their response to the DRAFT Stormwater Management Report were discussed. This revision of the report addresses the comments raised by Council and discussed at meeting.

2. MASTERPLAN

2.1. Masterplan layout

The current planning proposal is considering a revised masterplan layout is generally consistent within the footprint of the existing structure plan but has relocated density precincts.

The revised Menangle Park layout utilises components of the existing Structure Plan while altering the orientation of the layout to maximise the amount of north-south facing lots to increase the solar access for each dwelling.

Regarding water cycle management, the footprint of the new masterplan is not significantly altered. Proposed basins are generally in the same locations and catchments are generally consistent with the original zoning approval.

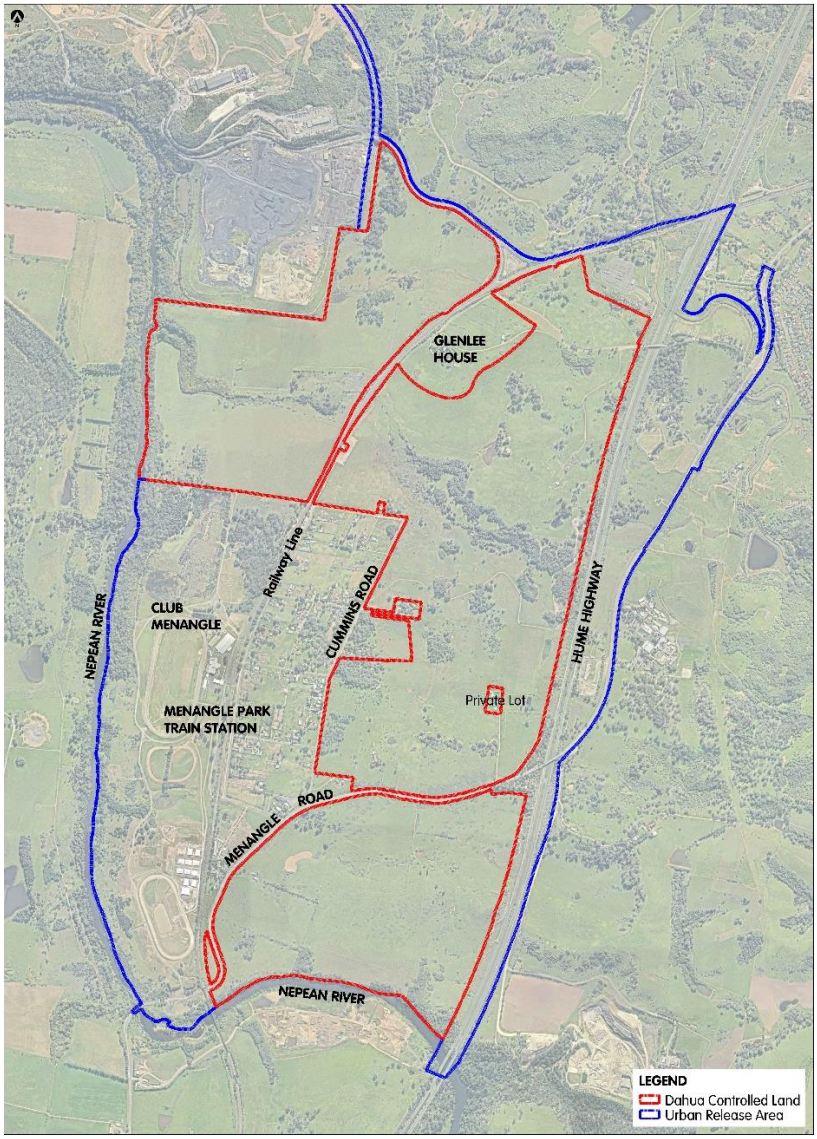

Figure 2-1: Menangle Park Urban Release

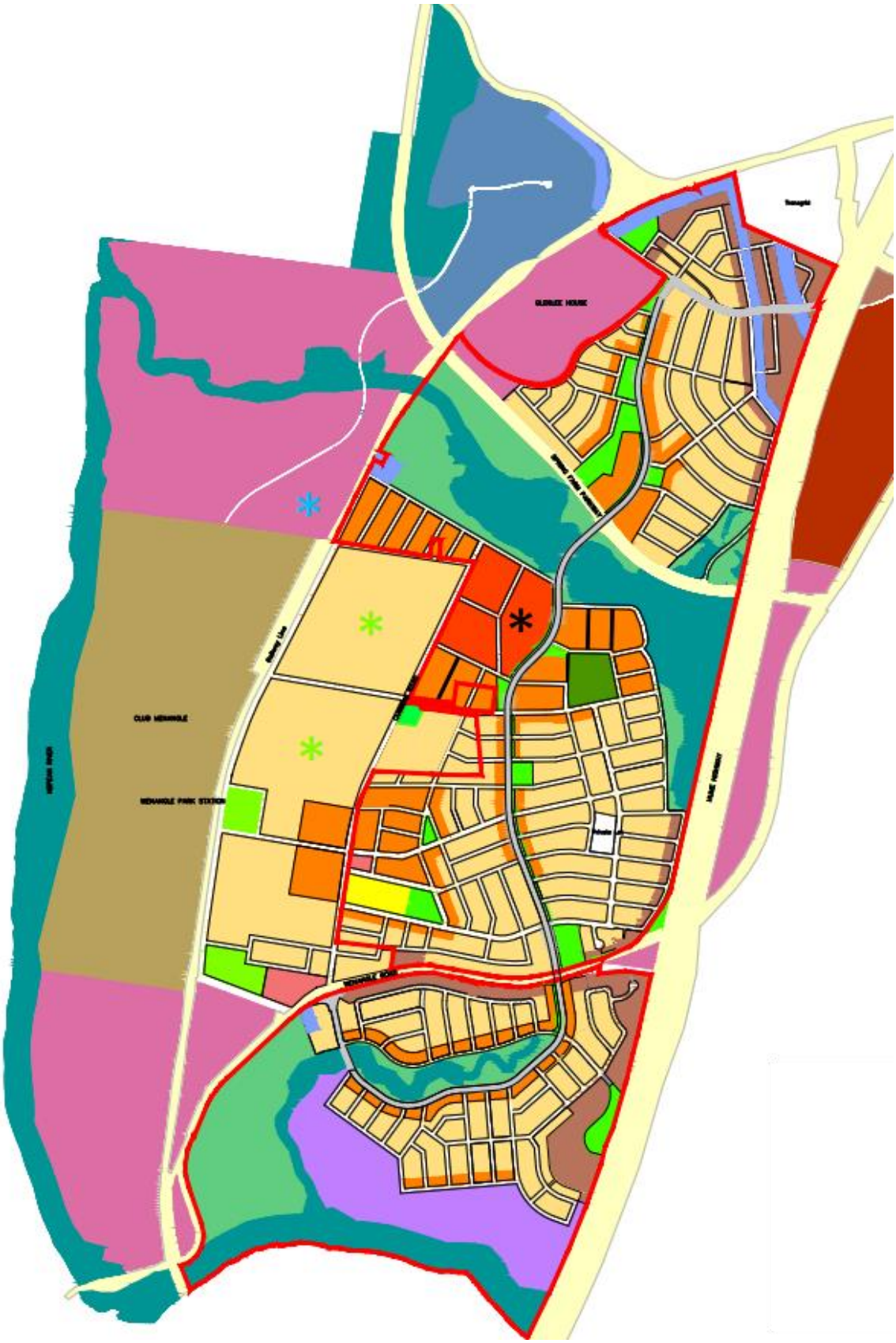

Figure 2-2: Revised Menangle Park Masterplan

2.2. Bulk Earthwork Design

The proposed topography uses the natural contours of the landscape to maintain the vista views throughout and beyond the estate.

Any retaining walls or structures will be incorporated within the topography of the land to provide suitable and manageable building areas.

Existing catchment boundaries are generally maintained. This allows existing catchment flow characteristics to remain. This is consistent with the current approved stormwater management strategy.

3. WATER SENSITIVE URBAN DESIGN OBJECTIVES

The Menangle Park Water Sensitive Urban Design (WSUD) Strategy (AECOM, June 2010) proposed as part of the new masterplan is consistent with the strategy developed by Landcom and Campbelltown Council plan to achieve performance targets consistent with both Landcom's WSUD policy and the state wide water management objectives for new developments established by the NSW government. These objectives approved in the 2017 rezoning are:

- Water quality treatment for stormwater runoff for the 3 month ARI storm targeting:
    - 55% reduction in mean annual load for Total Nitrogen (TN)
    - 70% reduction in mean annual load for Total Phosphorous (TP)
    - 85% reduction in mean annual load for Total Suspended Solids (TSS)
- Management of flows in natural creeklines to achieve a Stream Erosion Index (SEI) of between 1 and 2 by managing the 1 in 1.5 year ARI peak discharge (as per industry practice the 2 year ARI has been adopted instead of the 1.5 year ARI)

This section provides an overview of the site parameters and water quality treatment infrastructure to deliver the objectives specified above. The current strategy has been kept consistent with what was approved during the 2017 rezoning.

3.1. Stormwater Quality Parameters & Objectives

The following is a review of the site parameters and objectives outlined in the Menangle Park 'WSUD Strategy Report' (AECOM, June 2010) to guide the provision of WSUD elements for the revised masterplan layout.

Impervious Area

Reference has been made to Campbelltown Council (June 2009) Table 4.2 'Percentage Impervious for Various Land uses'. The percentage impervious for each post-developed catchment is dependent on the combination of the various lot sizes in the proposed Menangle Park Structure Plan, refer to Table 3-1 below.

Table 3-1: Percentage Impervious for Various Land uses - Campbelltown Council (ref tab 4.2)

Percentage Impervious for Various Landuses

Landuse	Lot Size	Percentage impervious * #
Natural state		0%
Rural		5%
Residential	>2000m^2	30%
Residential	1000 – 2000 m^2	60%
Residential	600 – 1000 m^2	70%**
Residential	400 – 600 m^2	80%
Residential	<400 m^2	90%
Open Space		10% minimum
Industrial		90%
Commercial		100%

* Values other than the nominated values will be considered only if substantiated

\# Council reserves the right to impose higher values if warranted

** Increased to 80% at Councils request

Based on discussions with Campbelltown Council an impervious value of 80% was adopted for lots between 600 – 1000 m^2.

Stream Erosion Index (SEI)

It is noted that the use of the stream erosion index to manage the risk of in stream erosion in urban areas is not currently supported by the Office of Environment and Heritage (OEH). It is understood that assessing the erosion risk in urban streams is being revisited and in development in line with the EPA's risk based framework (Dela-Cruz, Pik, & Wearne, 2017). In addition, the Urban Streamflow Impact Assessment (USIA) has been developed by Sydney Water and is under consideration (Kermode, et al., 2018). As at the time of writing, there has been no official endorsement and therefore the SEI method (assessing the 2 year ARI event) has been adopted as consistent with Council's DA requirements.

Stormwater Treatment Objectives

As previously approved in the 2017 rezoning of the Menangle Park Precinct the water quality discharge targets for the masterplan have been raised due to the proximity and sensitivity of the Nepean River (AECOM, June 2010). The stretch targets adopted are shown in Table 3-2 below.

Table 3-2: Pollutant Removal Targets

Parameter	Typical % reduction	Stretch Target* % reduction
Total Nitrogen (TN)	45%	55%
Total Phosphorous (TP)	65%	70%
Total Suspended Solids (TSS)	85%	85%
Stream Erosion Index (SEI)	3.5 - 5.0	1.0 – 2.0

*Stretch targets to meet water quality targets for the Hawkesbury Nepean River System consistent with investigations by the Healthy Rivers Commission (HRC) as determined by AECOM, 2010.

To achieve these stretch targets, it is necessary to construct WSUD infrastructure such as bio-retention basins and other proprietary devices.

Drainage Catchments

The catchment boundaries for the revised Menangle Park masterplan layout are shown in Figure 3-1.

Figure 3-1: Existing Catchment Boundaries (GHD, 2010)

3.2. WSUD Opportunities

Key Opportunities for WSUD in the revised masterplan layout include:

- a reduction in footprint of the WSUD devices through using bio-retention systems and proprietary devices instead of wetlands;
- integrating WSUD devices into the riparian corridors and complimenting them with innovative landscape solutions;
- amalgamating multiple water quality solutions with larger devices to optimise existing areas of open space adjacent the riparian corridors;
- where sandy deposits occur infiltration of treated runoff may be considered; and
- where flood detention basins occur, water quality treatment areas can be co-located within the detention basin to reduce WSUD infrastructure area requirements.

These opportunities are consistent with the approved Menangle Park WSUD Strategy (AECOM, June 2010).

3.3. Constraints

Key Constraints to WSUD relating to the revised layout include:

- ensuring all WSUD devices are flood free in the 100 year ARI event;
- consideration to the vegetation of significant conservation areas and riparian zones adjacent to creeks as required by the Department of Primary Industries (DPI); and
- the soils on site that are prone to erosion by scour.

4. WATER SENSITIVE URBAN DESIGN STRATEGY

This section discusses the WSUD strategy and modelling methods. The strategy considers the entire precinct and attempts to optimise capital costs, maintenance costs and land requirements for drainage infrastructure. In some instances catchments are over treated for water quality to compensate for untreated catchments. During detailed design this strategy will need to be referenced to ensure that holistic targets are being met.

4.1. WSUD Elements

A range of stormwater treatment elements are available and can be configured as part of the WSUD strategy to meet the pollution control targets. These systems can be integrated with landscape areas throughout the upstream catchment or in centralised locations.

4.2. Bio-Retention Systems co-located within Detention Basins

Bio-retention systems are co-located in detention basins to optimise the footprint required for drainage infrastructure. Inlet flows are separated such that the low flows (<3-month flow) are diverted into the bio-basin and high flows (up to 100 year flow) bypass the bio basin and flow directly to the detention basin. All bio-retention basins have been modelled with 600 mm deep filter media and vegetation for nutrient removal.

Saturated Zone Bio-Retention Systems

Saturated zone bio-retention basins are similar to a regular bio-retention basin however they retain a saturated zone at the base of the basin (below ground level). This provides additional water storage to sustain the macrophyte vegetation and provides improved nutrient removal properties.

Commercially Available Cartridge Filters

There are several different designs available on the market for end of line filters which are reported to perform a similar pollutant load reduction of with a reduced overall footprint. The different types of designs include:

- Hydrosystem (SPEL);
- Jellyfish Filter (HUME); and
- UP-Flo Filter (ROCLA).

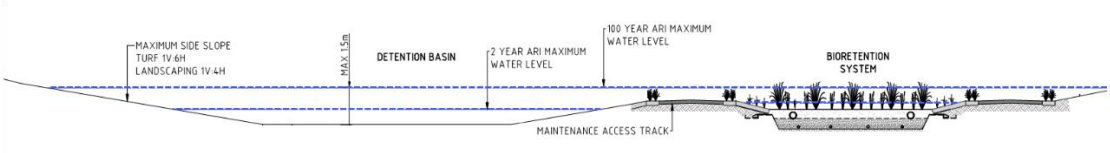

Figure 4-1: Typical Combined Bio-Retention & detention Basin

Gross Pollutant Traps

Gross Pollutant Traps (GPT) are required as part of the treatment train to remove gross pollutants and course sediment prior to stormwater reaching bio-retention systems. A system such as a vortex system which removes coarse sediments has been modelled in this strategy. Alternate systems can be considered during detailed design.

Stand-alone bio-retention basins

Where detention basins are not required bio-retention basins will be constructed on their own. Where possible they will be wholly located above the 100 year flood levels, however basins may be lowered if aesthetic or design constraints require it. The minimum bund levels is recommended to be the 20 year ARI flood level and the design will need to safely manage flows up to the 100 year level. Large flows entering the basin via the pipe network can be diverted around the basin, overland flows from the street network will not be directed into the basin. The basin spillway will be designed to manage flows both leaving the basin in the event of a blocked outlet pipe or pit and flows entering the basin during downstream flooding events.

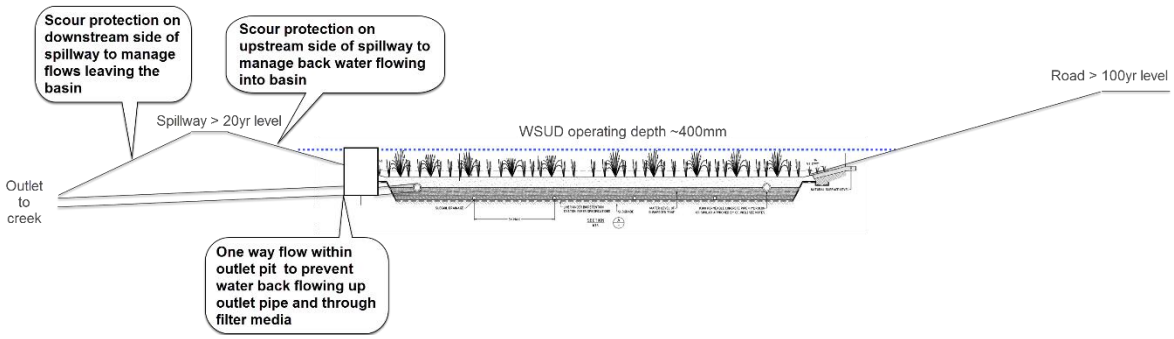

Figure 4-2: Stand-alone bio-retention basin

4.1. WSUD Objectives & Parameters

Water quality modelling was done using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) version 6.2.1 to determine the percentage removal of pollutants from residential source loads using a treatment train of water quality devices.

The program uses performance characteristics for common water quality devices and source pollutant loads for individual pollutants such as Total Suspended Solids (TSS), Total Phosphorus, Total Nitrogen and Gross Pollutants. These parameters are based on compiled research and updated as new data becomes available by the software developer.

Source Node Properties

Catchments have been modelled with two sources nodes each to reflect different types of rainwater runoff from the proposed subdivision:

- Runoff from a residential house roof retained into rainwater tanks; and
- Runoff from the remainder of the catchment discharged into the street drainage system.

The number of dwellings in each catchment has been calculated and multiplied by an average roof area of 200 m^2 to gain the total area for each node. Each of these nodes has been modelled with a percentage impervious of 100%. A second urban source node was also included to model the remainder of each catchment area minus the 100% impervious roof area to total to 80% impervious.

Due to the sandy nature of the soils located at Menangle Park (Theresa Park & Blacktown Soil Landscape) (Douglas Partners, 2017), we have incorporated default rainfall runoff parameters of 250 mm for soil storage capacity and 230 mm for field capacity.

4.2. WSUD Layout

The WSUD strategy to ensure there are no detrimental impacts to water quality is shown in Figure 4-3. All WSUD & detention basins will be raised to ensure they are free from mainstream flooding during the 100-year event and they will safely manage local 100-year flood flows. The development of the precinct in accordance with the proposed masterplan will result in some modifications to the existing drainage catchments. The final catchments boundaries will ultimately be determined during the detailed design of the precinct, however, the strategy below assumes that the catchments are generally consistent with the existing catchments as shown in Figure 4-3. Details of developed catchment areas & land use for the purposed of MUSIC modelling is shown in Appendix A.

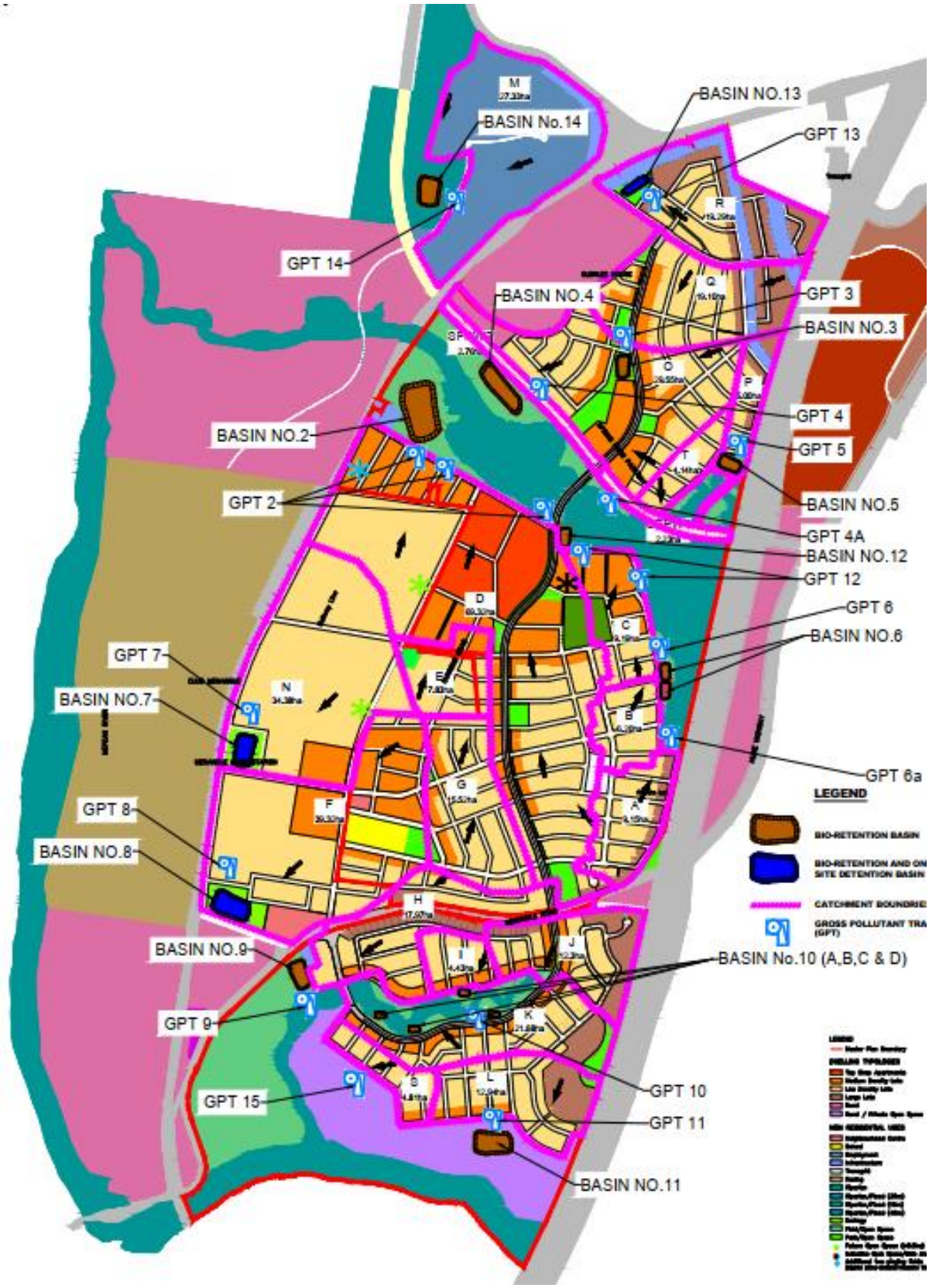

Figure 4-3: Menangle Park WSUD Strategy

Table 4-1: WSUD Basin Requirements

Basin	Catchment area (ha)	WSUD Bio-retention basin area (m^2)
2	92.7	7,000
3	19.1	1,000
4	29.5	3,000
5	5.0	540
6	16.2	2,000
7	30.5	1,500
8	39.7	1,500
9	17.9	2,700
10*	38.4	3100
11	12.9	1,000
12	9.19	1,000
13	19.3	1,150
14	27.3	3,300

** total of four basins (10a – 10d)*

Table 4-2: GPT Requirements

GPT	Catchment treated	Catchment area (ha)	Concept unit*
2	D,E,G	92.7	3 x GPT 41350
3	Q	19.1	1 x GPT 41050
4	O	32.3	1 x GPT 41350
4a	T	5.1	1 x GPT 4600
5	P	5.0	1 x GPT 4600
6	B	6.2	1 x GPT 4600
6a	A	10.0	1 x GPT 4750
7	N	30.5	1 x GPT 41500
8	F	39.7	1 x GPT 41500
9	H, I	17.0	1 x GPT 41050
10	K, J	21.7	4 x GPT 4600
11	L	12.9	1 x GPT 4900
12	C	9.2	2 x GPT 4600
13	R	19.3	1 x GPT 41050
14	M	27.3	1 x GPT 41350
15	S	4.8	4 x GPT 4200

**concept specification only, details provided are based on Ecosol GPTs, final unit to be determined during detailed design*

4.3. Spring Farm Parkway

The Spring Farm Parkway (SFPW) will be designed and constructed by the RMS separate to the precinct development. The management of the stormwater that drains from SFPW has been discussed with the RMS and is considered in the strategy for this precinct.

Three options were considered:

1. SFPW water is treated separately to subdivision water;
2. SFPW water and subdivision water are treated in the same systems; and
3. SFPW water is not directly treated and subdivision water is over-treated to compensate.

Following discussions with RMS the first option has been adopted.

4.4. MUSIC Results

The results from the modelling of the revised Menangle Park Masterplan are provided in Appendix A. The treatment train effectiveness for the four outlets to the Nepean River is summarised in Table 4-3.

Treatment Train Effectiveness

The treatment train effectiveness of the revised masterplan structure plan for the five outlets from the precinct are shown below in Table 4-3.

Table 4-3: Music Results

Parameter	Stretch Target % Reduction	Howes Creek Catchment	Catchment M	Catchment N/F	Menangle South Catchment	Catchment L
Total Nitrogen (TN)	55%	66%	66%	64%	67%	68%
Total Phosphorous (TP)	70%	73%	75%	70%	73%	76%
Total Suspended Solids (TSS)	85%	89%	92%	88%	88%	93%
Stream Erosion Index (SEI)	1.0 – 2.0	The combination of maintaining the 2 year ARI discharge to existing levels combined with the treatment of water through WSUD devices will limit the SEI to between 1 & 2. SEI calculations will need to be shown during detailed design in the Development Application process.				

Further solutions

End of pipe bio-retention systems are generally effective on their own. The bio-retention systems should be supported by a full treatment train approach throughout the catchment, consisting of site, street and neighbourhood scale treatment (Healthy Waterways, June 2006). Additional solutions could be adopted in catchment, to reduce the size of the end of catchment bio-retention system, through adopting permeable pavement paths in active open space, street calming devices with bio-retention systems and tree pits. These solutions would reduce the size of the end of pipe bio-retention system and increase the canopy cover and tree densities throughout the development. It is recommended that during the design alternative solutions are considered that reach the same or better outcome as the end of pipe retention systems.

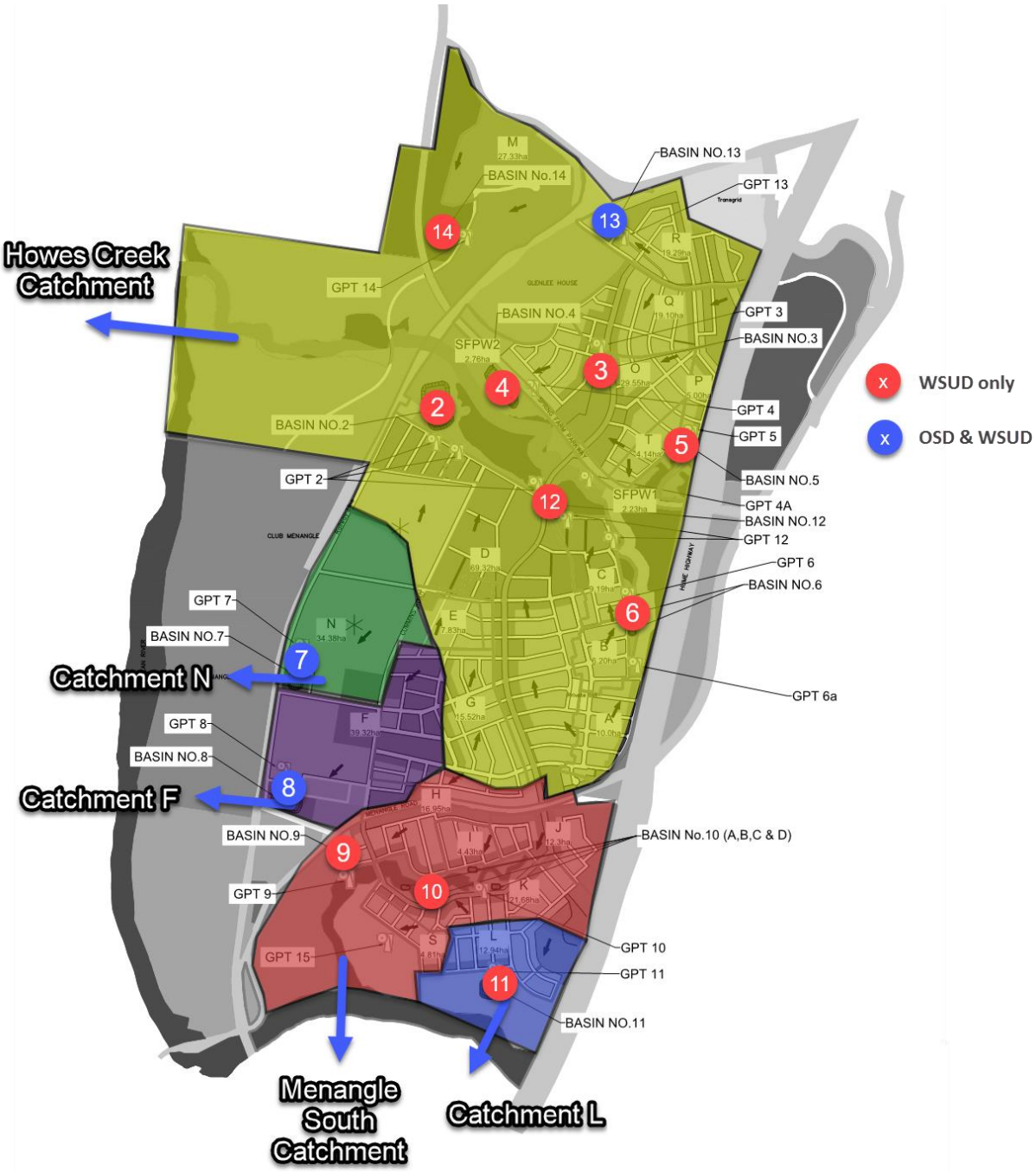

Figure 4-4: Water Quality Measurement Locations

5. DETENTION OBJECTIVES & STRATEGY

The detention strategy for the revised masterplan remains consistent with the strategy as approved in the 2017 rezoning of the Menangle Precinct (GHD, November 2011). The original rezoning process considered two detention strategies during the rezoning process. The original strategy consisted of 11 detention basins at a costed value of $28.4M.

Landcom and Campbelltown Council reviewed the strategy and identified that due to the unique alternative location of the precinct with regards to the proximity to the Nepean River there were opportunities to meet the stormwater storage solutions. The alternative drainage design (GHD, November 2011) suggested removing eight detention basins and redirecting those funds into environmental works such as creek stabilisation. The result was an improved environmental outcome for the precinct and reduced maintenance costs for Council, whilst not resulting in significant increases of peak flows from local catchments reaching the Nepean River.

The current detention strategy builds on the approved detention strategy by maintaining the same number of detention basins and their locations. These have been adjusted in size to accommodate the revised masterplan densities and are shown in Figure 4-3 on page 7. The results remain generally consistent with those approved under the 2017 rezoning strategy (GHD, November 2011).

5.1. Hydrology

The RAFTS models that were prepared for the previous two drainage reports were provided by GHD (November 2011; May 2010) for the purpose of verifying our model and to be used as a base to assess the revised masterplan layout. The modelling approach undertaken is outlined below:

Validation of RAFTS model:

1. Maintain catchment boundaries and ensure total areas are consistent between the revised RAFTS model and the original GHD model to analysis the impact of the revised residential densities;
2. Modify the percentages impervious within the precinct to reflect the revised masterplan layout zoning densities;
3. Assess the results to ensure the changes are consistent with the revised masterplan;
4. Run sensitivity assessment to determine impact of adopting ARR 2016 methodology vs ARR 1987 methodology; and
5. Update detention basin sizing and configuration to ensure results remain consistent with approved concept.

It is assumed in the model that there is a free discharge and that there is no tailwater level impacts on the basins. In addition, the flows from the catchment are relatively fast, resulting in a flashy flow. In addition, a sensitivity analysis was conducted on the ARR 2016 losses, as ARR 2016 recommends a higher initial loss value compared to ARR 1987 although this value is subjective as it is required to take into account antecedent conditions (It is noted that this is managed in ARR 2016 with pre-burst values). As a sensitivity the ARR 2016 recommended losses were adopted (using 1987 temporal patterns and IFD's) showing significantly reduced absolute peak flowrates although the detention assessment remained the same i.e. no increase of peak flows at key locations. This is not best practice to combine methodologies (ARR 1987 and ARR 2016) and was only undertaken as a sensitivity to determine if the loss values have an impact on the findings of the detention assessment.

ARR 2016 was considered by assessing the change in design losses and IFD's in the area. IFD's were compared at the site with values within 5% for the more relevant shorter duration events. Table 5-1

below shows the respective recommended design event losses for each methodology. It is recommended that the future modelling uses ARR2016 and reassess roughness coefficient of the catchments.

Table 5-1: Sensitivity parameters

Methodology	Initial loss (mm)	Continuing loss (mm/hr)
ARR 1987	15	2.5
ARR 2016	45	2.4

The model parameters adopted are shown in Table 5-2.

Table 5-2: RAFTS model parameters

Parameter	Adopted Value
Pervious sub-catchment Manning's n	0.025
Impervious sub-catchment Manning's n	0.015
Global storage factor	1
Initial loss	15mm
Continuing loss	2.5mm/hr

The IFD coefficients adopted are consistent with the approved GHD model and are based on ARR 1987, they are shown below:

Table 5-3: IFD coefficients

IFD Coefficient	mm/hr
2 Year 1hr	32.79
2 Year 12hr	6.36
2 Year 72Hr	1.85
50 Year 1Hr	62.6
50 Year 12hr	12.82
50 Year 72hr	4.03
Geographic Factors	
f2	4.29
f50	15.8

5.1.Nepean River Conditions

Nepean River flood levels are a major influence on the behaviour of some of the lower lying basins in the Menangle Park precinct. To determine the flood risk and associated flood planning levels for the Menangle development a 20 year ARI flood level will be adopted in the Nepean River in conjunction with a localised 100 year ARI storm event over the subject site's catchment.

However, the discharge outlet structure of some of the lower lying basins in the Menangle Park Precinct (Basin 7 and Basin 8 particularly) are at a similar level to the Nepean River 20 year ARI flood level. The high tailwater greatly reduces the capacity of the outlet and it's discharge flow rates.

The localised catchment at Menangle Park is approximately 40 Ha in size and has an expected critical storm duration of 2 hours. In comparison, the Nepean River catchment has an upstream catchment of approximately 1.3 km2 and a critical storm duration of 48 hours (Worley Parsons, 2015). The two catchments have significantly diverse hydrological systems, indicating that the joint probability of a 20 year ARI storm (or higher) occurring in the Nepean River is unlikely to coincide with a localised 100 year ARI storm event (or higher) at Menangle. Therefore, to allow for appropriate design of detention basins, a lower Nepean River flood level will be adopted.

It is noted that the lower Nepean River level is only to be adopted for designing the trunk drainage infrastructure, and that the 20 year ARI flood level in the Nepean River is used for flood risk assessments and flood planning levels for the precinct.

5.2. Basin 7 options considered

The currently approved concept design for Basin 7 requires significant filling within the existing village area to enable the entire catchment to drain to the basin. This option will be difficult to construct unless the entire catchment is developed at the same time. It will also require significant capital expenditure to construct, Figure 5-1 shows the work required for the approved concept design.

- Catchment area draining to Basin 7 – 30.5 ha
- Low flow from Basin 7 discharges south to the existing 3 x 600 culverts
- Flows that exceed the 3 x 600 capacity will flow south via existing swale and eventually go under the rail line via the existing brick lined culvert south of Beersheba Ave
- High flows from Basin 7 will flow north and discharge to the existing 3 x 900 culverts

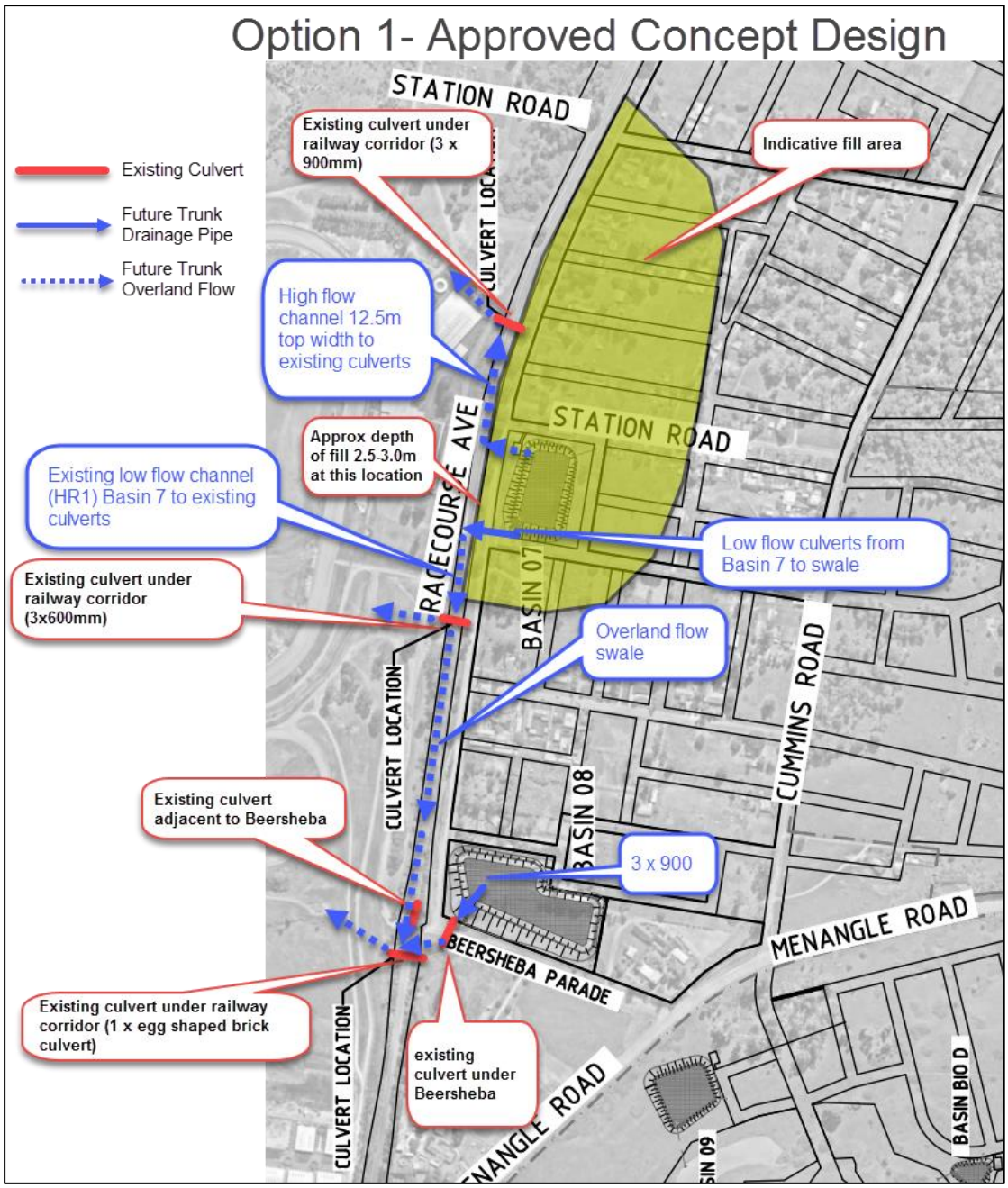

Figure 5-1: Basin 7 Concept Design Option 1

Whilst the proposed masterplan does not significantly change this area following discussions with Council, we have had a look at how the approved concept may be improved to reduce the amount of fill required. The philosophy adopted for Option 2 was to ensure that the flows are not significantly increased at the existing crossing points under the rail line, whilst minimising the fill required for the catchment (Figure 5-2).

- Catchment area draining to Basin 7 – 18.5 ha
- Undetained catchment area draining to existing 3x900 culverts – 12ha
- Low flow and high flow discharge south of Basin 7 to existing 3 x 600 culverts
- Flows that exceed the 3 x 600 capacity will flow south via existing swale and eventually go under the rail line via the existing brick lined culvert south of Beersheba Ave

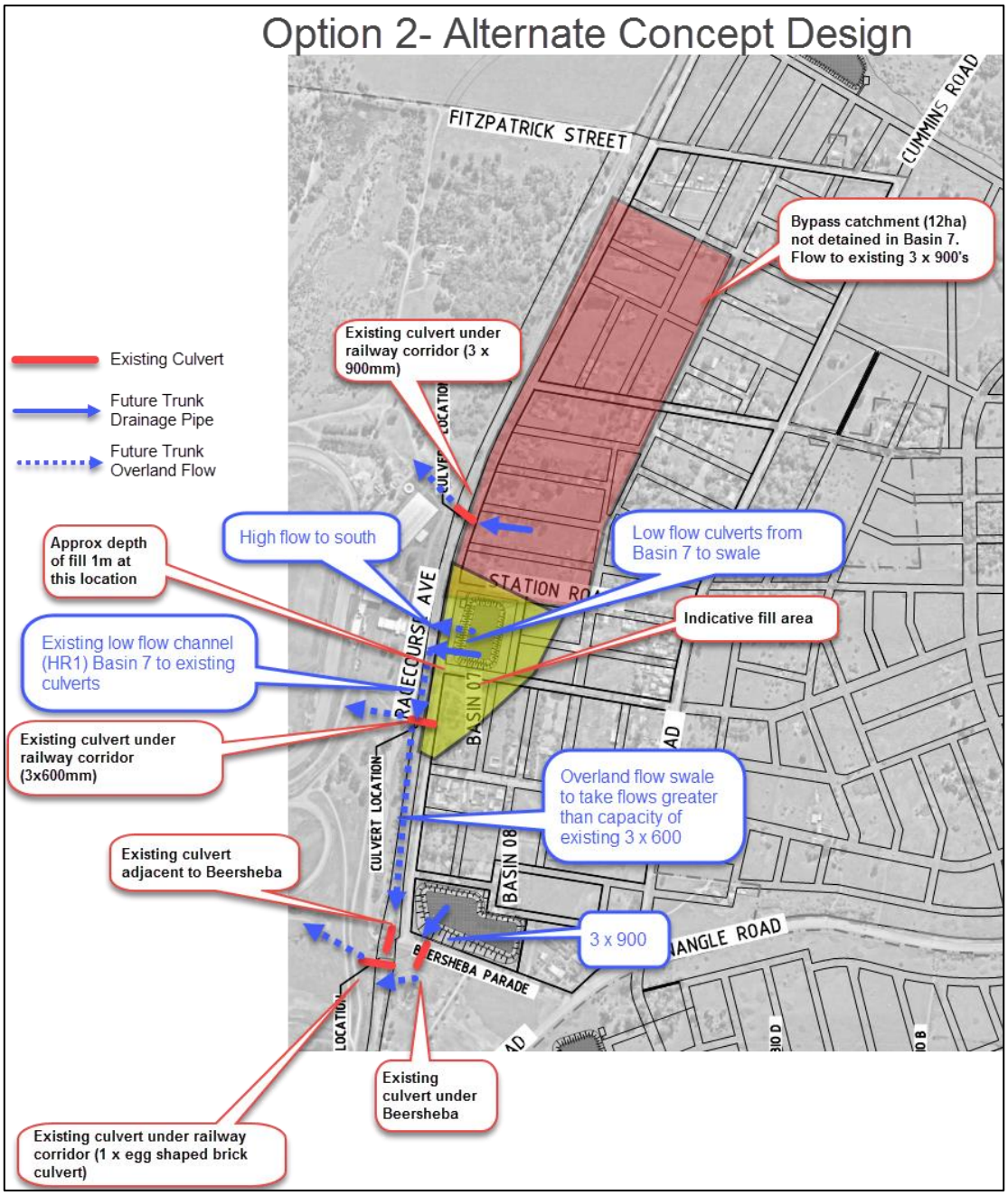

Figure 5-2: Basin 7 Concept Design Option 2

Both Option 1 and Option 2 presented above will detain developed flows to ensure flows at the existing crossings of the rail line are not increased above existing flows. Due to the fragmented ownership of land within this catchment, constructing either of these options may be difficult and will require careful consideration and design during the development application phase. It is noted that the concepts may evolve from those presented in this report.

Refer to Appendix B for the revised RAFT modelling input tables, concept plans of detention basin's 7 (option 1 only), 8 and 13 as well as concept plans for all the WSUD basins.

5.3.Rafts Results

The approved detention strategy allowed for some localised increases in peak flows near the Nepean River to offset basin construction costs with environmental creek restoration works. The results shown in Table 5-6 reflect this same approach.

The remaining detention basins required (Basins 7, 8 & 13) have been modelled in RAFTs with revised storages and weir configurations as outlined in Table 5-4 and Table 5-5.

These basins were designed on the following criteria:

- No worsening of flows for the 2 year and 100 year ARI event at the outlet of the catchment; and
- 400 mm freeboard to the top of the basin bund during the 100 year ARI event.

Table 5-4: Revised Basin Details

Basin Number / Measurement Location	Upstream Catchment Area		Proposed Volume (with min 400 mm freeboard) (m^3)
	Existing	Developed	
7 / Catchment N	25.5	25.5	7,900
8 / Catchment F	39.4	44.7	15,100
13	31.4	31.4	8,900

Table 5-5: Revised Basins No.7, 8 and13 spillway configurations

Basin Number / Measurement Location	Low Flow pipe	Spillway width (m)	Top of bund level (mAHD)	Spillway invert (mAHD)	Basin invert (mAHD)
7 / Catchment N	2x900 RCP	10	79.8	79.0	77.8
8 / Catchment F	2x900 RCP	8	76.5	76.5	74.5
13	2x900 RCP	8	87.5	86.2	85

Table 5-6: Rafts Results

	Peak Flow 2 Year ARI (m^3/s)			Peak Flow 100 Year ARI (m^3/s)		
	Existing	Developed	Change in Peak Flows	Existing	Developed	Change in Peak Flows
Basin 7 / Catchment N*	2.8	2.4	-0.4	8.9	5.9	-3.0
Basin 8 / Catchment F	4.3	2.9	-1.4	14.1	14.4	0.3
Existing brick culvert under rail line	6.1	4.0	-2.1	18.5	16.6	-1.9
Existing 3 x 900 RCPs under rail line	2.8	0.0	-2.8	8.9	5.9	-3.0
Existing 3 x 600 RCPs under rail line	4.3	2.4	-1.9	14.1	2.4	-11.7
Basin 11 / Catchment L	5.1	4.2	-0.9	17.4	10.0	-7.4
Basin 13	3.3	2.6	-0.7	10.5	7.1	-3.4
Howes Creek - Railway Culvert	46.2	44.2	-2.0	142.4	130.3	-12.1
Howes Creek - Outlet to Nepean	48.9	46.3	-2.6	149.1	135.8	-13.3
Menangle South Catchment	12.7	18.2	5.5	37.1	54.3	17.2

* Results shown are for Basin 7 Option 1

Peak flows shown include both the catchments that are being developed and existing catchments that flow through the site to assess the total flow leaving the precinct.

All locations have a decrease in peak flow apart from Menangle South Catchment which has an increase during both the 2 year and 100 year ARI. This increase is a function of increased catchment area from 18 ha to 21 ha and Basins 9 and 10 only being designed to undertake quality functions rather than detention. This is consistent with the approved Stormwater Strategy which also showed an increase in flows entering the Nepean at this location. The increase in flows is negligible in comparison to the instream flows in the Nepean in this location. Annual average daily flows are in the range of 320-850 ML/d at a continuous recording gauge near Camden with gauge number 212216 (pers. comm., WaterNSW), which is substantially greater than the increase in peak discharge. It is therefore clear that there will be no impact will be seen in the river and downstream communities from this increase in flows.

Table 5-7 below shows the results when Option 2 for Basin 7 is considered. There are decreases in peak developed flows at all critical locations apart from a 0.1m3/s increase at the triple 900's under the rail line during the 2 year ARI event. This increase is not considered significant at this concept stage and can be designed out during the development application process.

Table 5-7: Rafts Results - Basin 7 Option 2

	Peak Flow 2 Year ARI (m^3/s)			Peak Flow 100 Year ARI (m^3/s)		
	Existing	Developed	Change in Peak Flows	Existing	Developed	Change in Peak Flows
Basin 7 / Catchment N*	2.8	1.6	-1.2	8.9	2.9	-6.0
Basin 8 / Catchment F	4.3	2.1	-2.2	14.1	9.1	-5.0
Existing brick culvert under rail line	6.1	3.2	-2.9	18.5	11.6	-6.9
Existing 3 x 900 RCPs under rail line	2.8	2.9	0.1	8.9	5.7	-3.2
Existing 3 x 600 RCPs under rail line	4.3	1.6	-2.7	14.1	2.9	-11.2

* Results shown are for Basin 7 Option 2

5.4.Creek Rehabilitation

Creek rehabilitation works in Howes Creek and South Creek were modelled by adopting a longer routing time in the RAFTS model consistent with a well vegetated creek. This resulted in a lower peak discharge under the railway and an increase in South Catchment which is considered acceptable due to its proximity to the Nepean River, the results are shown in Table 5-6 above.

Table 5-8: Summary of Basin Strategy

Basin	Contributing Catchments	Function	Inflow Source	Outflow
2	G, E, D	WSUD	Runoff from contributing catchments will be conveyed to the basin from the east via the pipe drainage network, overland flows in the road network will bypass the basin.	Flow released to Howes Creek
3	Q	WSUD	Runoff from contributing catchments for will be conveyed to the basin from the east via the pipe drainage network, overland flows in the road network will bypass the basin.	Flow released to unnamed creek then to Howes Creek
4	O	WSUD	Runoff from contributing catchments for will be conveyed to the basin from the north via the pipe drainage network, before passing under the proposed Spring Farm Parkway via a culvert/culverts and discharging into the basin. Overland flows will bypass the basin and be discharged into Howes Creek The basin has not been sized to treat water from Spring Farm Parkway (These will be treated as part of the road design/construction).	Flow released to Howes Creek
5	P	WSUD	Runoff from contributing catchments will be conveyed to the basin from the north via the pipe drainage network, overland flows in the road network will bypass the basin. The basin will be located adjacent to the existing creek but will be offline from existing flows from the eastern side of the highway.	Flow released to unnamed creek then to Howes Creek
6	A, B	WSUD	Runoff from contributing catchments will be conveyed to the basin from the south via the pipe drainage network, overland flows in the road network will bypass the basin. The basin will be located adjacent to the existing creek but will be offline from existing flows from the eastern side of the highway.	Flow released to Howes Creek

Basin	Contributing Catchments	Function	Inflow Source	Outflow
7	N	WSUD / OSD	The approved concept has runoff from contributing catchments for flows up to the 100-year ARI Event will be conveyed to the basin from the north and east via the pipe drainage network and overland flows in the road network. Racecourse Avenue will need to be raised by an estimated 2-3 metres in parts to ensure that the 100-year ARI event can be piped from the north with adequate cover whilst also conveying overland flow in the road network. An alternate option has been considered in this strategy which reduces the need for extensive raising of land by allowing part of the catchment to discharge undetained. Whilst both of these concepts work it is envisaged that the design could change during the detailed design process as there will be complications from fragmented land holdings	Low flow from basin = 2 x 900 culverts High flow 10m spillway Approved Option: - Low flows travel south and under the railway via the 3 x 600 culverts and the brick lined culvert - High flows go north via 3 x 900 culverts - Estimate fill required 2-3 metres Alternate Option 2 - Low and high flows travel south and under the railway via the 3 x 600 culverts and the brick lined culvert - Estimate fill required 1 metre - 12ha catchment flows undetained through the 3 x 900 culverts
8	F	WSUD / OSD	Runoff from contributing catchments for flows up to the 100-year ARI Event will be conveyed to the basin from the east and north-east via the pipe drainage network and overland flows in the road network. Racecourse Avenue will need to be regraded where possible to ensure that the 100-year ARI event can be conveyed from the north via overland flow in the road network. Parts of Racecourse Avenue will not be able to drain to Basin 8. The Culverts underneath the railway corridor to the north of the basin (3 x 600) will be closed such that runoff is directed southwards towards the basin rather than passing under the railway. In discussion with Council (**21/04/2010**) it was noted that a portion of Racecourse Avenue and adjacent lots could potentially be offset, should it not be desirable to grade these	Low flow from basin = 2 x 900 culverts High flow 8m spillway Flow released to the Nepean floodplain via a trunk drainage channel to the existing brick lined culvert under the railway. Peak flows during both the 2yr and 100yr ARI at this location have been reduced below existing conditions. It needs to be noted that the velocity modeled through the brick lined culvert with current conditions show a high risk of scour damage with velocities >3m/s

Basin	Contributing Catchments	Function	Inflow Source	Outflow
			areas to Basin 8 using fill. This would be achieved by overcompensating in Basin 8 and allowing the small Racecourse Avenue catchment to bypass the basin. While this has not been simulated, it is expected to have a minor effect on the basin footprint	Consistent with GHD's discussion with Council (21/04/2010) it is understood that the access road to Harness Racing Park need not conform to Councils DCP in terms of drainage serviceability Low flow discharge from the basin go under Beersheba / Racecourse Avenue to the existing open channel prior to draining to the brick lined culvert.
9	H, I	WSUD	The basin will be located adjacent to the existing creek but will be off-line. The basin will collect runoff from the north of the creek and offset runoff flows from the south of the creek rather than directing these flows to the basin. Runoff from contributing catchments will be conveyed to the basin from the east via the pipe drainage network, overland flows in the road network will bypass the basin. Fill will be required to the east of the basin to remove the natural low point in the topography and direct flows to the basin.	Basin outflow released directly to Creek S1. Offset flows to drain to the creek without any water quantity treatment.
10	I, J, K	WSUD	Basin 10 includes 4 individual basins (A, B, C & D) which are located adjacent but off-line to the existing creek. Runoff from contributing catchments will be conveyed to the basin via the pipe drainage network, overland flows in the road network will bypass the basin.	
11	L	WSUD	Runoff from contributing catchments will be conveyed to the basin from the north via the pipe drainage network, overland flows in the road network will bypass the basin. Fill will be required to lift the basin above the 20 year ARI.	Flow released to Creek S2
12	C	WSUD	The basin will be located adjacent but offline to Howes Creek Runoff from contributing catchments will be conveyed to the basin from the south via the pipe drainage network, overland flows in the road network will bypass the basin. Fill will be required to lift the basin above the 20 year ARI.	Flow released to Howes Creek

Basin	Contributing Catchments	Function	Inflow Source	Outflow
13	R	WSUD / OSD	Basin 13 is located north of Glenlee House and will be located upstream of the existing culvert under the rail corridor. The basin is collocated with existing electrical infrastructure and careful design considerations will be required. Runoff from contributing catchments for flows up to the 100-year ARI Event will be conveyed to the basin from the east and north-east via the pipe drainage network and overland flows in the road network.	Flow released to unnamed creek which will join Howes Creek downstream of rail line
14	M	WSUD	Basin 14 is located west of the rail line and will treat water from the industrial zoned land. The basin has not been sized to treat runoff from Spring Farm Parkway Runoff from contributing catchments will be conveyed to the basin from the north via the pipe drainage network, overland flows in the road network will bypass the basin.	Flow released to Howes Creek

6. FLOODING STRATEGY

Catchment Simulation Solution were engaged to review the flood modelling prepared by GHD (November 2011; May 2010)and analyse any flood impacts of the revised masterplan layout. The subsequent report from this review is provided in Appendix A, Catchment Simulation Solutions 'Menangle Park – Revised Planning Proposal Flood Assessment' 2018.

The following parameters were identified in the review of original GHD flood modelling and updated to provide an improved representation of flood behaviour across the area. These parameters include:

- model grid size reduced from 8 m to 4 m;
- terrain representation was updated based upon 2011 LiDAR information;
- the location of some Hume Motorway culverts were updated to ensure the culvert inlet/outlet locations better aligned with the waterways locations defined by the LiDAR information; and
- flow application points were refined (e.g. flows from some sub-catchments were previously applied to the surface of the Hume Motorway rather than the watercourse on either side of the motorway).

The TUFLOW model was then updated to include a representation of the revised masterplan layout. This involved elevating all habitable areas and roadways located between the Hume Motorway and railway line above the peak level of the 100-year ARI flood, please refer to Section 3.2.1 in the attached CSS 'Flood Assessment' in Appendix D.

Additional filling is required in some areas of the masterplan to remove the risk of flooding on developable lots, these include:

- the edge roads along Howes Creek lifted to 0.5 m above the 100-year storm, removing small tributaries north and south of Howes Creek;
- southern bend of Beersheba Parade and future lots adjacent require filling 0.5m above the 100 Year storm event;
- southern portion of the masterplan adjacent the Nepean River to be filled above the major storm event of the Nepean River; and
- rural and Employment lands on the western side of the railway.

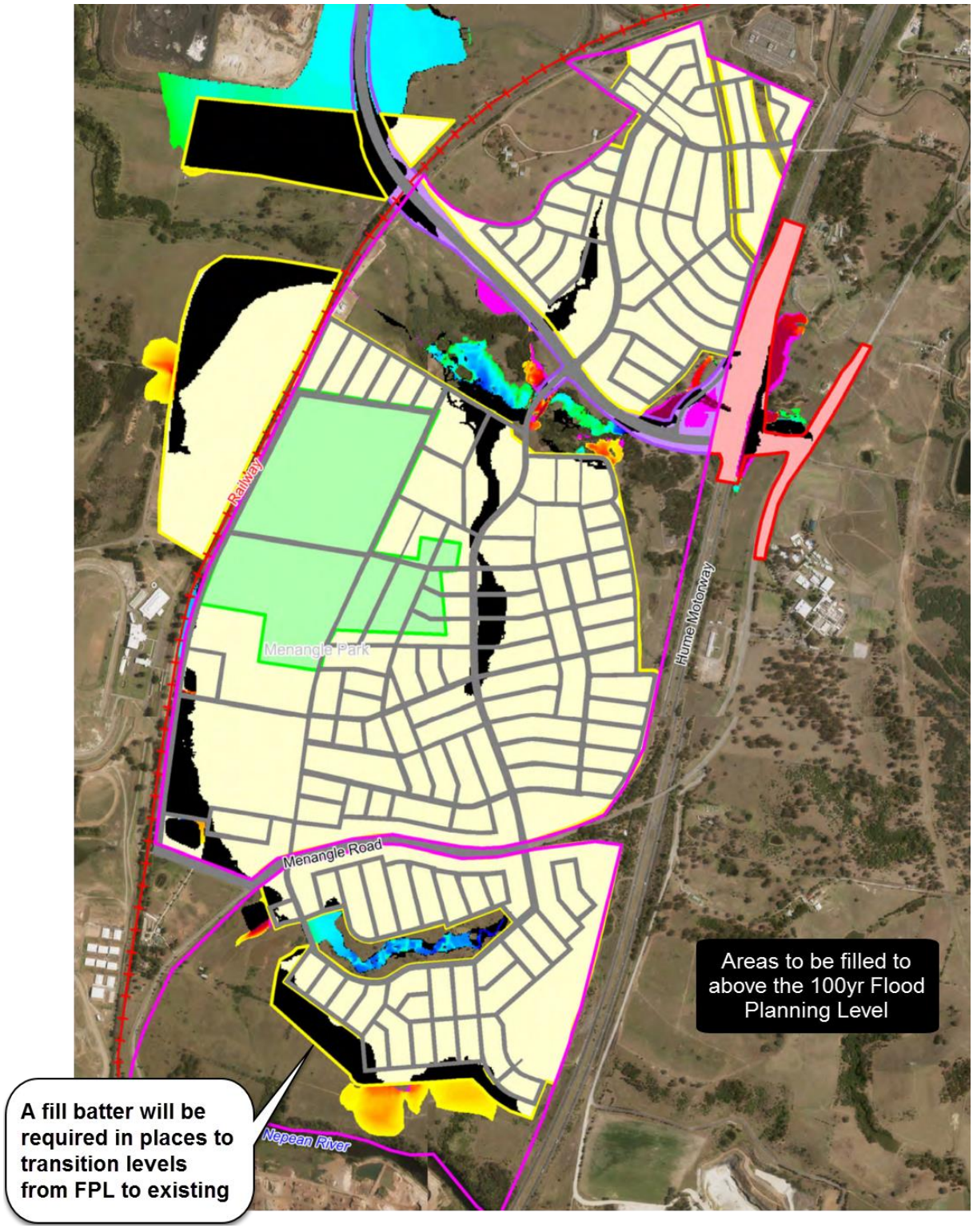

Figure 6-1: Fill Locations

Filling will also be required within the floodplain to protect future sporting fields and amenities. Final levels will be determined during detailed design stage; however indicative levels will be as per Figure 6-2 below. It is understood Campbelltown Council generally requires playing fields to be elevated above the 20% ARI event, with synthetic fields to be elevated above the 5% ARI event (see Figure 6-2).

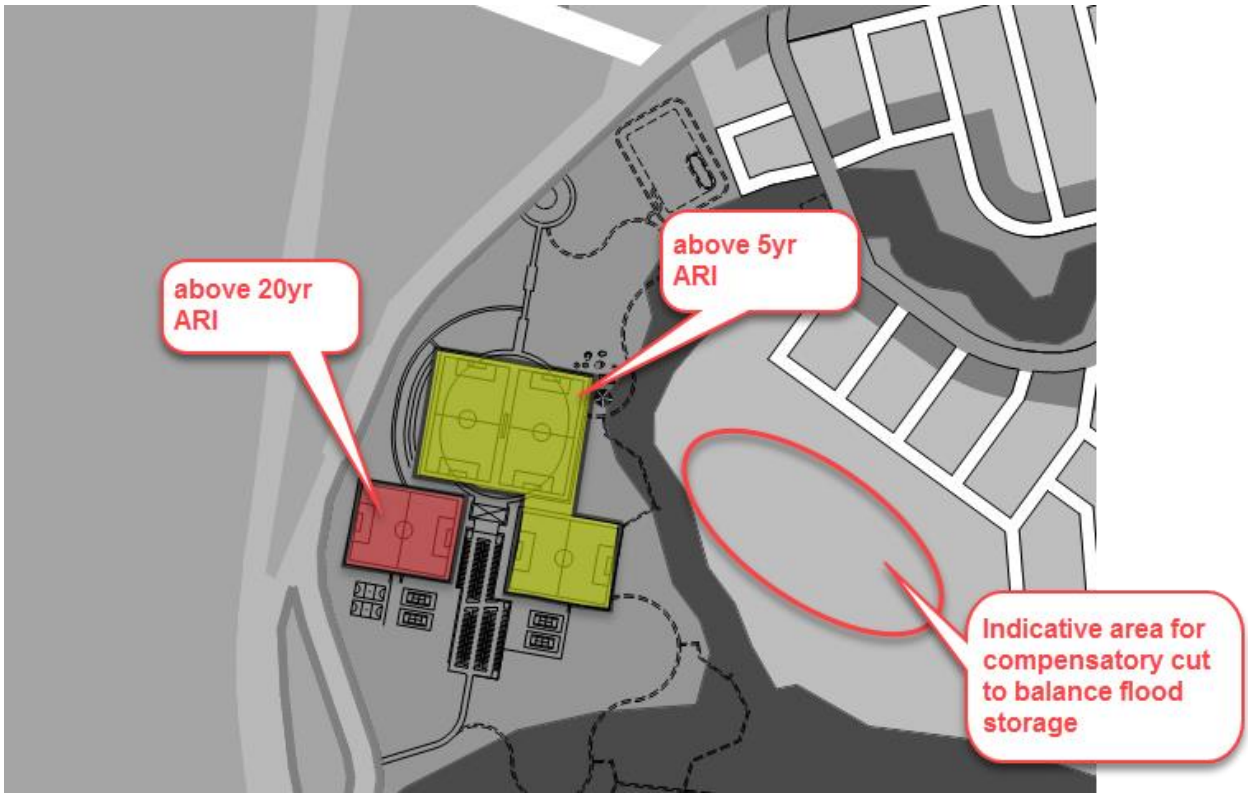

Figure 6-2: Indicative Playing Field Levels Menangle Park

The updated model was used to simulate the 100-year ARI flood for "post-development" conditions.

The outcome of modelling the revised masterplan layout was that the proposed changes will not cause significant increases in peak 100-year flood levels on land located outside of the release area. There are some minor increases located east of the Hume Motorway as a result of the new ramps required for the SFPW interchange. It is anticipated that these increases can be mitigated by providing some compensatory storage upstream of the ramps and some more detailed flood modelling during the detailed design process.

Localised increases in flood levels can be accommodated by additional filling within the precinct to ensure minimum freeboards are met.

The majority of the precinct is located above the PMF (probable maximum flood) however some of the lower lying areas will be inundated and people will be required to evacuate during these rare events. Major roadways generally grade up and away from the major waterways and will serve as evacuation routes.

7. CONCEPT DESIGNS AND ESTIMATE OF COST

To evaluate the previous Section 94 contribution estimates for the WSUD and bio-retention assets, SMEC has undertaken concept designs for the basins identified in Figure 4-4. These concept designs were prepared to confirm:

- Basin footprints and interface with masterplan layout; and
- General order of costs for construction.

Concept designs for the basins can be found in Appendix E.

7.1.Concept Design Constraints

SMEC adopted the following design constraints in developing the concept designs:

- Embankment side slopes of 1V:4H;
- Extended storage depths over bio-retention media of 0.3m;
- Freeboard above 100-year ARI basin level of 0.5m;
- Basin low flow outlets to consist of pit and pipe configuration, and in some instances dual pit and pipe;
- Spillway depths of flow of 0.3m;
- Menangle Park DCP and Campbelltown City Council Engineering Specifications;

7.2. Estimate of Costs

The Estimates of Cost in Appendix F are based on the concept designs in Appendix E and comparable construction rates for similar sized projects at the time of writing of this report and engineering estimates.

Table 7-1 below summarises the estimated construction costs for the treatment trains proposed in this report and has been prepared to confirm that the order of costs for the Stormwater treatment strategy proposed in this report is generally consistent with the strategy proposed in previous reports. The Estimates of Costs in this report are not intended for budget purposes – it is recommended that the designs are further developed with consideration of the final landform prior to finalising budgets for these assets.

Table 7-1: Estimate of Costs for Stormwater Assets

DESCRIPTION	Amount
Basin 02	$3,282,000
Basin 03	$602,000
Basin 04	$1,438,000
Basin 05	$376,000
Basin 06A	$555,000
Basin 06B	$457,000
Basin 07	$1,274,000
Basin 08	$1,289,000
Basin 09	$1,087,000
Basin 10 (BIO A)	$358,000
Basin 10 (BIO B)	$356,000
Basin 10 (BIO C)	$356,000
Basin 10 (BIO D)	$356,000
Basin 11	$606,000
Basin 12	$546,000
Basin 13	$823,000
Basin 14 (Bio Retention Employment Land)	$1,442,000
Overland flow + drainage pipes - S2 to creek	$470,000
TOTAL	$15,673,000

In preparing the above Estimate of Costs SMEC has also reviewed previous cost estimates as prepared by GHD and AECOM as part of their previous reports and compared them against the strategy proposed in this report.

This comparison is provided below as corrected for inflation to 2018 values. The table below confirmed that while an increase of <10% to overall costs is expected for the measures proposed in this report.

	Landcom 2011[1]	Landcom Reduced[1]	SMEC 2018
WSUD	$7.8M[2]	$7.8M[2]	$11.8M
Detention	$17.3M[3]	$6.6M [3]	$3.9M
Creek Stabilisation	-[3]	$6.7M [3]	$6.7M [3]
Total	$25.1M	$21.1M	$22.4M

(1) Increased for CPI by 12.49%
(2) Menangle Park WSUD Strategy – (AECOM, June 2010)
(3) Cost estimated from document "Summary of drainage strategy: Landcom Nov 2011" by addition of Works Cost excluding roads [Table 1] – adopted GHD allowance of $6M (2011) for Creek stabilisation;
(2) Cost estimated from document "Summary of drainage strategy: Landcom Nov 2011", no channel stabilisation required in initial works.

8. CONCLUSION

The report has been prepared to accompany an application for rezoning to Campbelltown City Council to re-structure the layout of the Menangle Park masterplan.

The purpose of this report is to show that the revised Menangle Park masterplan does not have significant changes to the water strategy that was approved for the 2017 rezoning.

The report provided analysis of the revised masterplan layout with respect to the three main areas of the 'Water Cycle Management Plan', which include:

- Detention;
- Flooding; and
- Water Quality.

The WSUD strategy for the revised masterplan layout outlined in the report has been shown to meet the pollution reduction stretch targets at all four outlets to the Nepean River.

The sizes of the basins have been adjusted to account for the proposed changes in density however, the number of detention & WSUD basins and their location remains consistent with the approved strategy.

The impacts to flood levels as a result of filling land above the 100 Year ARI levels remains generally within the precinct boundaries and remains consistent with the approved strategy. Some additional detailed modelling will need to be undertaken during the detailed design of the playing fields south of Menangle Road which are to be lifted above the 5 Year and 20 Year ARI events to ensure that any impacts are local and do not affect the residential lands.

9. REFERENCES

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APPENDIX A – MUSIC MODELLING CATCHMENTS AND RESULTS

N

M
27.33ha

BASIN No.14

BASIN NO.13

GPT 13

Transgrid

R
19.29ha

GPT 14

GLENLEE HOUSE

BASIN NO.4

Q
19.10ha

GPT 3

BASIN NO.3

SFPW2
2.76ha

O
29.55ha

P
5.00ha

GPT 4

BASIN NO.2

SPRING FARM PARKWAY

GPT 5

T
4.14ha

GPT 2

BASIN NO.5

SFPW1
2.23ha

GPT 4A

BASIN NO.12

GPT 12

D
69.32ha

Railway Line

GPT 6

BASIN NO.6

C
9.19ha

GPT 7

CUMMINS ROAD

E
7.83ha

CLUB MENANGLE

N
34.38ha

BASIN NO.7

NEPEAN RIVER

B
6.20ha

HUME HIGHWAY

GPT 6a

MENANGLE PARK STATION

G
15.52ha

Private Lot

A
9.15ha

F
39.32ha

GPT 8

BASIN NO.8

H
17.97ha

MENANGLE ROAD

BASIN NO.9

I
4.43ha

J
12.3ha

BASIN No.10 (A,B,C & D)

GPT 9

K
21.68ha

S
4.81ha

L
12.94ha

GPT 10

GPT 11

GPT 15

BASIN NO.11

LEGEND

BIO-RETENTION BASIN

BIO-RETENTION AND ON SITE DETENTION BASIN

CATCHMENT BOUNDRIES

GROSS POLLUTANT TRAP (GPT)

LEGEND

Master Plan Boundary

DWELLING TYPOLOGIES

- Top Shop Apartments
- Medium Density Lots
- Low Density Lots
- Large Lots
- Rural
- Rural / Private Open Space

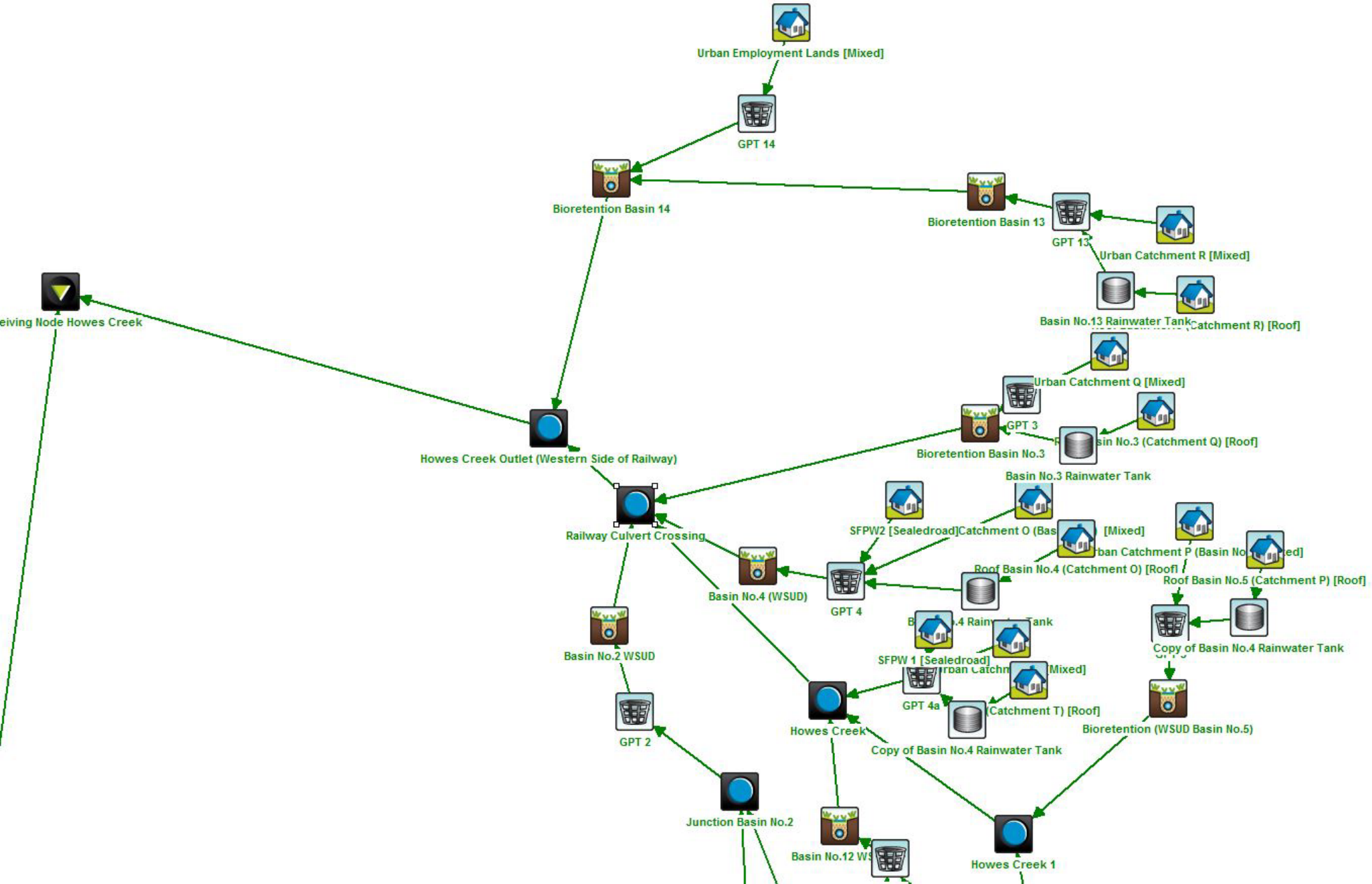
NON RESIDENTIAL USES

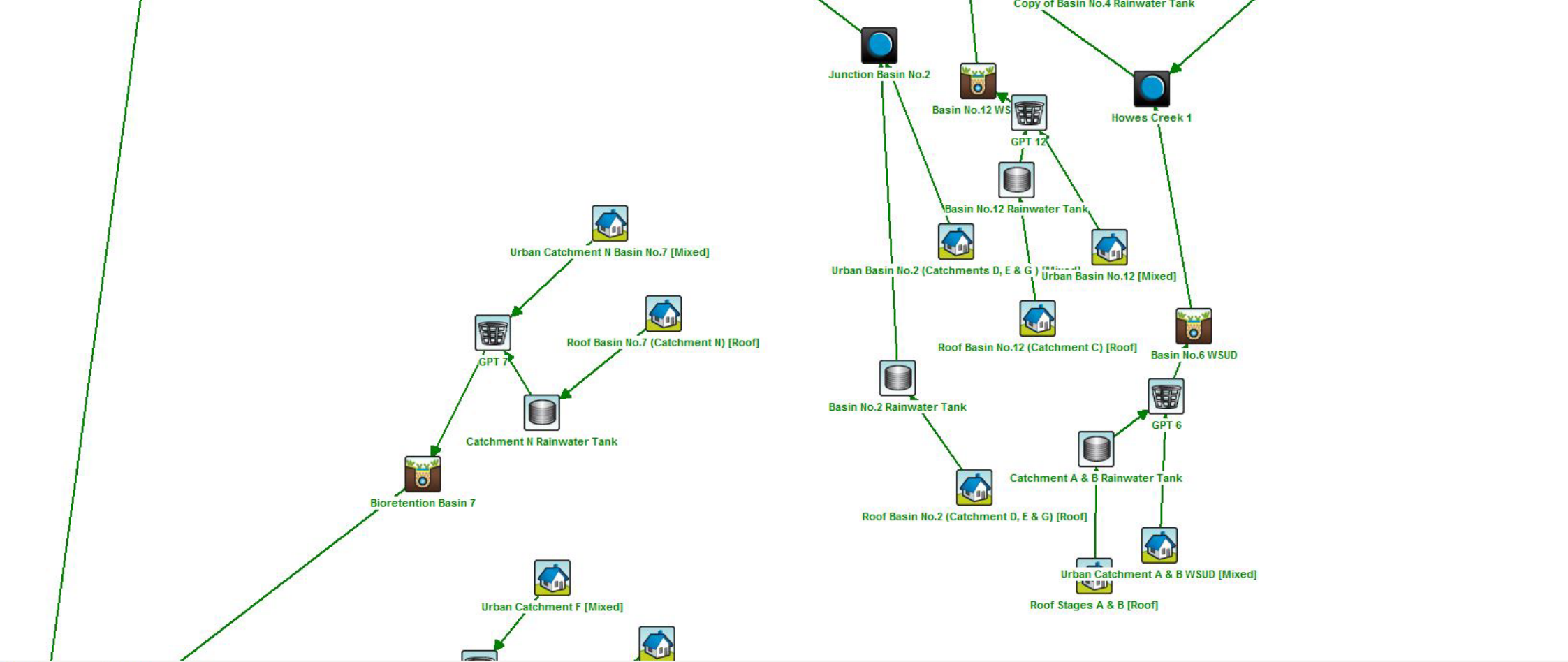
- Neighbourhood Centre
- School
- Employment
- Infrastructure
- Transgrid
- Racing
- Riparian
- Riparian/Flood (30m)
- Riparian/Flood (15m)
- Riparian/Flood (45m)
- Ecology
- Field/Open Space
- Park/Open Space
- Future Open Space (>0.5ha)
- Indicative Open Space/Civic Area
- Additional two playing fields (Approx 2.5ha–Detailed locations TBC)

MUSIC Catchment Areas (ha)

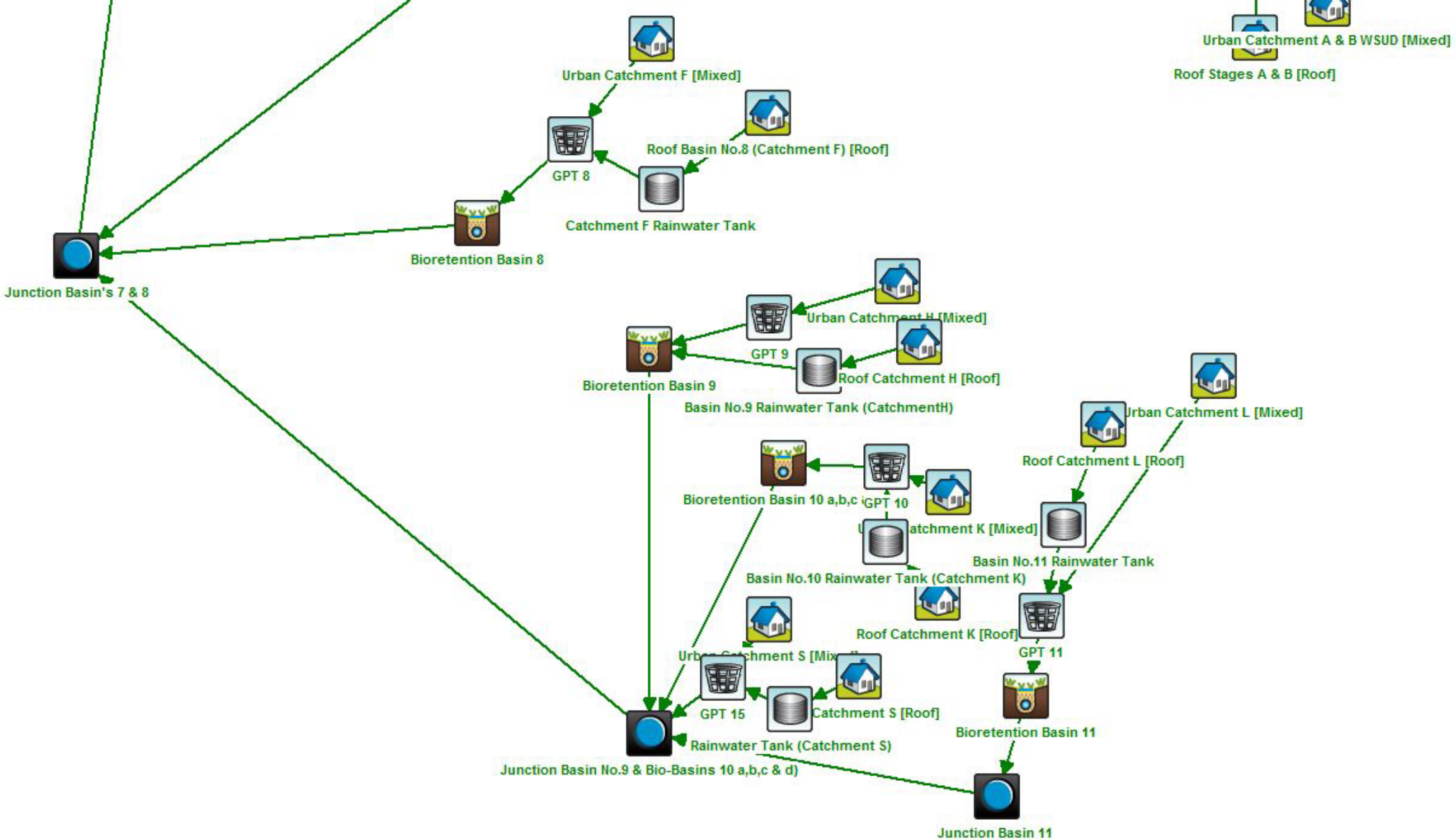
Catchment	Lot Area (Med + Low Density)	R5 Zone Area	Road Area	Open Space (Park)	Employment	Town Centre/High Density	Rural	School/ Neighbourhood Centre	Riparian Corridor	Total Catchment Area (ha)	Total Imprevious Area (ha)	Urban Node Impervious %
A	4.6	1.4	3.1	0.1	0.0	0.0	0.0	0.0	0.0	9.2	7.3	71%
B	4.2	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	5	79%
C	5.6	0.0	2.6	1.0	0.0	0.0	0.0	0.0	0.0	9.2	7	52%
D	40.0	0.2	15.8	3.6	0.0	9.9	0.0	0.0	0.0	69.5	55	57%
E	5.6	0.0	1.8	0.4	0.0	0.0	0.0	0.0	0.0	7.8	6	62%
F	23.4	1.0	0.0	2.8	0.0	0.0	0.0	4.3	0.0	39.3	23	46%
G	10.9	0.0	4.3	0.4	0.0	0.0	0.0	0.0	0.0	15.5	13	69%
H	8.1	3.1	6.6	0.2	0.0	0.0	0.0	0.0	0.0	18.0	14	71%
I	3.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	4.4	4	70%
J	4.8	4.6	2.9	0.0	0.0	0.0	0.0	0.0	0.0	12.3	9	62%
K	11.1	1.4	13.0	1.0	0.0	0.0	0.0	0.0	0.0	26.5	21	74%
L	6.8	3.0	1.8	1.3	0.0	0.0	0.0	0.0	0.0	12.9	9	53%
M	0.0	0	0.9	0.0	26.4	0.0	0.0	0.0	0.0	27.3	27	100%
N	29.0	0	3.9	1.5	0.0	0.0	0.0	0.0	0.0	34.4	27	59%
O	21.1	0.1	12.0	2.6	0.0	0.0	1.7	0.0	0.0	37.4	28	61%
P	1.3	1.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4	73%
Q	9.3	3.4	5.4	0.9	0.0	0.0	0.0	0.0	0.0	19.1	14	64%
R	4.0	5.8	8.7	0.8	0.0	0.0	0.0	0.0	0.0	19.3	15	70%
*Total**	*193.0*	*25.4*	*88.2*	*16.7*	*26.4*	*9.9*	*1.7*	*4.3*	*0.0*	*373.4*	*287.9*	*77%*

*values are shown to 1 decimal place only, any discrepencies in totals is a result of rounding
colour coded in accordance with dwelling types depicted in Masterplan


Urban Employment Lands [Mixed]
GPT 14
Bioretention Basin 14
Bioretention Basin 13
GPT 13
Urban Catchment R [Mixed]
Basin No.13 Rainwater Tank
Urban Catchment Q [Mixed]
GPT 3
Bioretention Basin No.3
Basin No.3 Rainwater Tank
Howes Creek Outlet (Western Side of Railway)
Railway Culvert Crossing
SFPW2 [Sealedroad]
Basin No.4 (WSUD)
GPT 4
Roof Basin No.4 (Catchment O) [Roof]
Roof Basin No.5 (Catchment P) [Roof]
Copy of Basin No.4 Rainwater Tank
Basin No.2 WSUD
SFPW 1 [Sealedroad]
GPT 4a
Howes Creek
Bioretention (WSUD Basin No.5)
GPT 2
Copy of Basin No.4 Rainwater Tank
Junction Basin No.2
Howes Creek 1



2.1767 -355.7779


Urban Catchment A & B WSUD [Mixed]
Roof Stages A & B [Roof]
Urban Catchment F [Mixed]
Roof Basin No.8 (Catchment F) [Roof]
GPT 8
Catchment F Rainwater Tank
Bioretention Basin 8
Junction Basin's 7 & 8
Urban Catchment H [Mixed]
GPT 9
Roof Catchment H [Roof]
Bioretention Basin 9
Basin No.9 Rainwater Tank (CatchmentH)
Urban Catchment L [Mixed]
Roof Catchment L [Roof]
Bioretention Basin 10 a,b,c
GPT 10
Basin No.11 Rainwater Tank
Basin No.10 Rainwater Tank (Catchment K)
Roof Catchment K [Roof]
GPT 11
GPT 15
Catchment S [Roof]
Rainwater Tank (Catchment S)
Bioretention Basin 11
Junction Basin No.9 & Bio-Basins 10 a,b,c & d)
Junction Basin 11

==
DESCRIPTION
This section allows you to specify any information or notes for your project.
==

VersionNu	205	{MUSIC Setup File version number}
Meteorolo	J:\70thous	{MLB Filename}
Constituen	TSS	{Constituent Abbreviation}
Constituen	Total Suspe	{Constituent Name}
MUSIC-link	1	{0 = enabled | 1 = disabled}
MUSIC-link - Music Ve		{The music version this was created with}
MUSIC-link - Metadat		{The version of the metadata used}
MUSIC-link - Council N		{The name of the council}
MUSIC-link - Area Nan		{The name of the audit area}
MUSIC-link - Scenario		{The name of the audit scenario}
Backgroun	J:\70thous	{Background Image}
Backgroun	J:\70thous	{Background Image}

==

Node Type	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	UrbanSour	{Node Type}
Zoning Sur	Roof	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Roof	Mixed	Mixed	Roof	Roof	Roof	Roof	Roof	Roof	Roof	Roof	Roof	Roof	Mixed	Roof	Mixed	Roof	Sealedroac	Sealedroac	{Zoning Surface Type}
Node Nam	Roof Stage	Urban Catc	Urban Basi	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Emp	Urban Catc	Roof Basin	Urban Basi	Urban Catc	Roof Basin	Roof Basin	Roof Basin	Roof Basin	Roof Catch	Roof Catch	Roof Basin	Roof Basin	Roof Catch	Roof Basin	Urban Catc	Roof (Catcl	Urban Catc	Roof Catch	SFPW 1	SFPW2	{Node Name}
Node ID	1	2	6	7	8	9	10	12	14	15	18	19	37	41	45	53	54	57	59	62	64	65	67	69	71	73	74	77	78	81	82	{Node ID}
Coordinate	472.62245	499.39554	416.07568	504.56510	562.71869	273.66345	249.93233	340.89153	457.35691	359.62201	405.36909	570.45875	570.93199	478.99888	535.75855	423.44047	521.93510	554.61970	449.46338	416.74648	348.61673	295.62582	292.80586	355.45638	599.46978	495.57550	502.44724	293.35184	326.50372	463.65444	451.55862	{Coordinates}{[X:Y]}
General - L	Roof Stage	Urban Catc	Urban Basi	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Catc	Urban Emp	Urban Catc	Roof Basin	Urban Basi	Urban Catc	Roof Basin	Roof Basin	Roof Basin	Roof Basin	Roof Catch	Roof Catch	Roof Basin	Roof Basin	Roof Catch	Roof Basin	Urban Catc	Roof (Catcl	Urban Catc	Roof Catch	SFPW 1	SFPW2	
General - N	WSUD Catc	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	URBAN = T	WSUD Catchment R| |		URBAN = T | |No = 229		WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	WSUD Catc	URBAN = T	WSUD Catc	URBAN = T	WSUD Catc	URBAN = T	URBAN = Total Area - Roof Area||Based on % IMP	
General - Fluxes - Daily																																
General - Fluxes - Sub-Daily																																
General - F	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
Areas - Tot	3.88	11.47	47.01	17.99	16.02	19.01	16.27	12.79	8.55	27.51	27.33	4.02	3.27	4.861	13.05	45.87	11.56	6.04	4.328	4.35	5.18	15.36	15.3	10.9	0.978	2.75	1.398	3.127	1.686	2.223	2.76	{ha}
Areas - Imp	100	75	63	53	70	59	46	71	53	70	99	73	100	52	64	100	100	100	100	100	100	100	100	100	100	74	100	74	100	90	90	{%}
Areas - Per	0	25	37	47	30	41	54	29	47	30	1	27	0	48	36	0	0	0	0	0	0	0	0	0	0	26	0	26	0	10	10	{%}
Rainfall-Ru	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{mm/day}
Rainfall-Ru	120	250	250	250	250	250	250	250	250	250	250	250	120	250	250	120	120	120	120	120	120	120	120	120	120	250	120	250	120	120	120	{mm}
Rainfall-Ru	25	12	12	12	12	12	12	12	12	12	12	12	25	12	12	25	25	25	25	25	25	25	25	25	25	12	25	12	25	25	25	{% of Capacity}
Rainfall-Ru	80	230	230	230	230	230	230	230	230	230	230	230	80	230	230	80	80	80	80	80	80	80	80	80	80	230	80	230	80	80	80	{mm}
Rainfall-Ru	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Rainfall-Ru	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Rainfall-Ru	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	{mm}
Rainfall-Ru	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	{%}
Rainfall-Ru	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	{%}
Rainfall-Ru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{%}
Total Suspe	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	{log mg/L}
Total Suspe	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	{log mg/L}
Total Suspe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Total Suspe	1.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1.3	2.2	2.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	2.2	1.3	2.2	1.3	2.43	2.43	{log mg/L}
Total Suspe	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	{log mg/L}
Total Suspe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Suspe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Total Phos	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.85	-0.85	{log mg/L}
Total Phos	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	{log mg/L}
Total Phos	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Total Phos	-0.89	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.89	-0.45	-0.45	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.45	-0.89	-0.45	-0.89	-0.3	-0.3	{log mg/L}
Total Phos	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	{log mg/L}
Total Phos	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Phos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Total Nitro	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.11	0.11	{log mg/L}
Total Nitro	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	{log mg/L}
Total Nitro	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Total Nitro	0.3	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.3	0.42	0.42	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.42	0.3	0.42	0.3	0.34	0.34	{log mg/L}
Total Nitro	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	{log mg/L}
Total Nitro	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{Index from 0 to 1 for "Mean" | "Stochastically generated"}
Total Nitro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	{R squared}
Import Flo	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Import Flow Properties - Import Flow File																																
Import Flo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Import Flo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Import Flo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Import Flo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Import Flo	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	{Index from 0 to 14 for "ML" | "kL" | "L" | "mL" | "ML/s" | "m3/s" |
Import Flo	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	{ha}

Node Type	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	BioRetenti	{Node Type}
Zoning Surface Type														{Zoning Surface Type}
Node Nam	Basin No.6	Bioretentic	Basin No.2	Basin No.4	Bioretentic	Bioretentic	Bioretentic	Basin No.1	Bioretentic	Bioretentic	Bioretentic	Bioretentic	Bioretentic	{Node Name}
Node ID	23	24	29	30	35	36	39	40	43	46	47	48	49	{Node ID}
Coordinate	513.80668	559.54222	330.77586	391.68330	485.06564	331.62622	388.08029	424.96454	482.80224	298.56952	249.24014	185.66056	197.03172	{Coordinates}{[X:Y]}
General - L	Basin No.6	Bioretentic	Basin No.2	Basin No.4	Bioretentic	Bioretentic	Bioretentic	Basin No.1	Bioretentic	Bioretentic	Bioretentic	Bioretentic	Bioretention Basin 7	
General - Notes														
General - Fluxes														
General - F	360	360	360	360	360	360	360	360	360	360	360	360	360	{in seconds}
Inlet Prope	0	0	0	0	0	0	0	0	0	0	0	0	0	{cubic metres per sec}
Inlet Prope	10	10	10	10	10	10	10	10	10	10	10	10	10	{cubic metres per sec}
Storage Pr	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	{metres}
Storage Pr	2300	700	10000	3600	1500	4600	1500	1500	1500	3800	3200	2200	2200	{square metres}
Filter and N	2000	540	7000	3000	1150	3300	1000	1000	1000	3100	2700	1500	1500	{square metres}
Filter and N	190	190	190	14	50	100	40	40	40	80	80	100	100	{metres}

Filter and N 125 125 125 125 125 125 125 125 125 125 125 125 125 {mm/hr}
Filter and N 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 {metres}
Filter and N 800 800 800 800 800 800 800 800 800 800 800 800 800 {mg/kg}
Filter and N 40 10 40 40 40 40 40 40 40 40 40 40 40 {mg/kg}
Infiltration 0 0 0 0 0 0 0 0 0 0 0 0 0 {mm/hr}
Lining Prop 1 1 1 1 1 1 1 1 1 1 1 1 1
Vegetation 0 0 0 0 0 0 0 0 0 0 0 0 0 {Index from 0 to 2 for "Vegetated with Effective Nutrient Removal Plants" | "Vegetated with Ineffective Nutrient Removal Plants" | "Unvegetated"}
Outlet Prop 2 2 2 2 2 2 2 2 2 2 2 2 2 {metres}
Outlet Prop 0 0 0 0 0 0 0 0 0 0 0 0 0
Outlet Prop 1 1 1 1 1 1 1 1 1 1 1 1 1
Outlet Prop 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.45 {metres}
Advanced I 8000 8000 8000 8000 8000 8000 8000 8000 8000 8000 8000 8000 8000 {m/yr}
Advanced I 20 20 20 20 20 20 20 20 20 20 20 20 20 {mg/L}
Advanced I 6000 6000 6000 6000 6000 6000 6000 6000 6000 6000 6000 6000 6000 {m/yr}
Advanced I 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 {mg/L}
Advanced I 500 500 500 500 500 500 500 500 500 500 500 500 500 {m/yr}
Advanced I 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 {mg/L}
Advanced I 1 1 1 1 1 1 1 1 1 1 1 1 1 {Index from 0 to 4 for "Sand" | "Loamy Sand" | "Sandy Loam" | "Silt Loam" | "Loam"}
Advanced I 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7
Advanced I 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1
Advanced I 3 3 3 3 3 3 3 3 3 3 3 3 3
Advanced I 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35
Advanced I 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35
Advanced I 3 3 3 3 3 3 3 3 3 3 3 3 3
Node Type RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater RainWater {Node Type}
Zoning Surface Type {Zoning Surface Type}
Node Nam Catchment Basin No.2 Basin No.1 Basin No.4 Basin No.3 Basin No.1 Basin No.1 Basin No.9 Catchment Catchment Basin No.1 Copy of Ba Copy of Ba Rainwater {Node Name}
Node ID 22 52 55 56 58 60 61 63 66 68 70 72 75 79 {Node ID}
Coordinate 473.40538 391.70755 538.07878 482.73428 522.80973 440.67978 401.81617 311.84478 245.65593 253.81038 336.25830 592.64716 477.18020 301.23805 {Coordinates}{[X:Y]}
General - L Catchment Basin No.2 Basin No.1 Basin No.4 Basin No.3 Basin No.1 Basin No.1 Basin No.9 Catchment Catchment Basin No.1 Copy of Ba Copy of Ba Rainwater Tank (Catchment S)
General - N Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.(Reuse = 0.63 (3 bedroom house NSW Guidelines)||||Assuming no detention or mains top-up<< only a maximum of 80% of the physical tank volume should be modelled (NSW Guidelines)||||The overflow pipe from individual tanks shall be modelled as a typical 90 or 10
General - Fluxes
General - F 360 360 360 360 360 360 360 360 360 360 360 360 360 360 {in seconds}
Reuse Prop 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Reuse Prop 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Reuse Prop 0 0 0 0 0 0 0 0 0 0 0 0 0 0 {ML/year}
Reuse Prop 0 0 0 0 0 0 0 0 0 0 0 0 0 0 {Index from 0 to 2 for "PET" | "PET - Rain" | "Monthly"}
Reuse Prop 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8 8.33;8.33;8.33;8.33;8.33;8.33;8.33;8.33;8.33;8.33;8.33;8.3
Reuse Prop 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Reuse Prop 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 0.07686 {ML/day}
Reuse Prop 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Reuse Properties - Custom Demand Time Series File
Reuse Prop 5 5 5 5 5 5 5 5 5 5 5 5 5 5 {Index from 0 to 11 for "ML" | "kL" | "L" | "mL" | "ML/s" | "m3/s" | "L/s" | "mL/s" | "ML/day" | "kL/day" | "L/day" | "mL/day"}
Reuse Prop 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222 1.222222
Inlet Prope 0 0 0 0 0 0 0 0 0 0 0 0 0 0 {cubic metres per sec}
Inlet Prope 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 1.21 {cubic metres per sec}
Storage Pro 194 2294 164 578 302 216 217 259 768 765 545 49 70 341
Storage Pro 349.2 4129.2 295.2 1040.4 543.6 388.8 390.6 466.2 1382.4 1377 981 88.2 126 613.8 {square metres}
Storage Pro 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 {metres}
Storage Pro 776 9176 656 2312 1208 864 868 1036 3072 3060 2180 196 280 1364 {kL}
Storage Pro 620.8 7340.8 524.8 1849.6 966.4 691.2 694.4 828.8 2457.6 2448 1744 156.8 224 1091.2
Outlet Prop 1393 4790 1281 2404 1738 1470 1473 1609 2771 2766 2335 700 837 1847 {mm}
Advanced I 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6
Advanced I 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Advanced I 400 400 400 400 400 400 400 400 400 400 400 400 400 400 {m/yr}
Advanced I 12 12 12 12 12 12 12 12 12 12 12 12 12 12 {mg/L}
Advanced I 12 12 12 12 12 12 12 12 12 12 12 12 12 12 {mg/L}
Advanced I 300 300 300 300 300 300 300 300 300 300 300 300 300 300 {m/yr}
Advanced I 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 {mg/L}
Advanced I 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 {mg/L}
Advanced I 40 40 40 40 40 40 40 40 40 40 40 40 40 40 {m/yr}
Advanced I 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 {mg/L}
Advanced I 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 {mg/L}
Advanced I 3500 3500 3500 3500 3500 3500 3500 3500 3500 3500 3500 3500 3500 3500 {m/yr}
Advanced Properties - User Defined Storage-Discharge-Height
Node Type JunctionNo JunctionNo JunctionNo JunctionNo JunctionNo JunctionNo JunctionNo JunctionNo {Node Type}
Zoning Surface Type {Zoning Surface Type}
Node Nam Howes Cre Howes Cre Junction N, Junction Ba Railway Cu Howes Cre Junction Ba Junction Ba {Node Name}
Node ID 4 5 11 13 16 17 34 38 {Node ID}
Coordinate 420.03462 496.44270 37.835488 249.04599 341.33285 305.86631 384.29487 377.25100 {Coordinates}{[X:Y]}
General - L Howes Cre Howes Cre Junction N, Junction Ba Railway Cu Howes Cre Junction Ba Junction Basin 11
General - N Howes Creek
Node Type ReceivingN {Node Type}
Node Nam Receiving N {Node Name}
Node ID 3 {Node ID}
Coordinate 105.86764 {Coordinates}{[X:Y]}
General - L Receiving Node Howes Creek
General - Notes
===

APPENDIX B – RAFTS MODELLING RESULTS

APPENDIX C – RAFTS MODELLING INPUT TABLES

Updated percentage impervious & pervious data from the revised masterplan layouts nominated in red italics.

Developed Case – Sub-catchments for Flood Study						
South Creek						
Sub-catchment	Area (ha)	Impervious Catchment (ha)	Pervious Catchment (ha)	Slope (%)	Impervious Mannings n	Pervious Mannings n
S1	8.06	0.40	7.66	7.4	0.015	0.025
S2	11.33	0.57	10.76	11.4	0.015	0.025
S3	13.12	0.66	12.46	7.6	0.015	0.025
S4	4.68	*3.61*	*1.07*	12.1	0.015	0.025
S5	4.47	*3.30*	*1.17*	7.2	0.015	0.025
S6	5.69	*4.18*	*1.51*	7.5	0.015	0.025
S7	2.17	*1.43*	*0.74*	13.1	0.015	0.025
S8	1.10	*0.94*	*0.16*	12.9	0.015	0.025
S9	1.64	*1.38*	*0.26*	6.8	0.015	0.025
S10	4.73	*3.79*	*0.94*	8.8	0.015	0.025
S11	4.36	*3.18*	*1.16*	10.5	0.015	0.025
S12	3.95	*2.63*	*1.32*	7.6	0.015	0.025
S13	5.63	*3.38*	*2.27*	8.0	0.015	0.025
S14	3.45	*2.25*	*1.20*	4.9	0.015	0.025
S15	4.12	*3.44*	*0.68*	6.5	0.015	0.025
S16	3.25	*1.42*	*1.83*	7.7	0.015	0.025
S17	4.73	*3.33*	*1.40*	5.9	0.015	0.025
S18	8.14	*2.74*	*5.40*	4.9	0.015	0.025
S19	9.08	*1.19*	*7.89*	2.3	0.015	0.025
S20	8.72	*1.52*	*7.20*	1.8	0.015	0.025
S21	4.38	*1.93*	*2.45*	6.0	0.015	0.025
S22	7.39	*2.97*	*4.42*	6.5	0.015	0.025
S23	7.59	*0.73*	*6.86*	3.0	0.015	0.025
Sa1	18.49	1.85	16.64	9.4	0.015	0.025
Sa2	6.17	*2.63*	*3.54*	6.2	0.015	0.025
Sa3	5.58	*3.90*	*1.68*	8.9	0.015	0.025
Sa4	3.55	*1.95*	*1.60*	14.0	0.015	0.025
Sa5	5.44	*3.90*	*1.54*	7.5	0.015	0.025
Sa6	5.59	*2.65*	*2.94*	4.9	0.015	0.025
Sa7	5.86	*0.16*	*5.70*	3.0	0.015	0.025
Sa8	3.13	*1.13*	*2.00*	6.8	0.015	0.025

Village Creeks						
Subcatchment	**Area (ha)**	**Impervious Catchment (ha)**	**Pervious Catchment (ha)**	**Slope (%)**	**Impervious Mannings n**	**Pervious Mannings n**
M1	9.22	0.46	8.76	14.8	0.015	0.025
M2	12.41	0.62	11.79	9.7	0.015	0.025
M3	7.50	*4.09*	*3.41*	2.5	0.015	0.025
M4	11.40	0.00	11.40	13.2	0.015	0.025
M5	18.88	0.94	17.94	4.0	0.015	0.025
M6	18.34	0.00	18.34	11.6	0.015	0.025
M7	12.21	0.00	12.21	23.1	0.015	0.025
M8	4.18	0.00	4.18	12.8	0.015	0.025
M9	15.25	6.10	9.15	4.4	0.015	0.025
M9a	8.00	0.00	8.00	14.0	0.015	0.025
M10	6.95	*3.35*	*3.60*	2.1	0.015	0.025
M11	16.01	0.00	16.01	7.0	0.015	0.025
M12	13.12	0.00	13.12	8.0	0.015	0.025

Subcatchment	**Area (ha)**	**Impervious Catchment (ha)**	**Pervious Catchment (ha)**	**Slope (%)**	**Impervious Mannings n**	**Pervious Mannings n**
M13	17.53	0.88	16.65	11.9	0.015	0.025
M14	15.57	0.00	15.57	2.9	0.015	0.025
M15	7.57	*4.23*	*3.34*	1.7	0.015	0.025
M16	9.81	1.47	8.34	12.7	0.015	0.025
M17	7.72	1.54	6.18	11.8	0.015	0.025
M18	6.23	2.49	3.74	7.5	0.015	0.025
M19	11.59	1.16	10.43	11.8	0.015	0.025
M20	4.30	*2.51*	*1.79*	6.6	0.015	0.025
M21	7.23	*3.39*	*3.84*	3.4	0.015	0.025
M22	3.52	*1.49*	*2.03*	8.6	0.015	0.025
M23	4.31	*1.54*	*2.77*	8.0	0.015	0.025
M24	7.15	*3.26*	*3.89*	4.8	0.015	0.025
M25	7.18	*3.75*	*3.43*	2.5	0.015	0.025
M26	2.82	*2.64*	*0.18*	3.1	0.015	0.025
M27	3.54	*2.88*	*0.66*	5.0	0.015	0.025
M28	4.27	*3.30*	*0.97*	11.0	0.015	0.025
M29	3.65	*3.03*	*0.62*	3.6	0.015	0.025
M30	4.37	*2.50*	*1.87*	6.4	0.015	0.025
M31	5.22	*2.44*	*2.78*	5.6	0.015	0.025
M32	6.83	*2.24*	*4.59*	4.2	0.015	0.025
M33	3.19	*2.81*	*0.38*	10.2	0.015	0.025
M34	5.43	*4.09*	*1.34*	6.9	0.015	0.025
M35	4.13	*3.65*	*0.48*	8.1	0.015	0.025

M36	5.63	*4.45*	*1.18*	6.9	0.015	0.025
M37	4.43	*3.05*	*1.38*	5.2	0.015	0.025
M38	6.50	*3.64*	*2.86*	4.5	0.015	0.025
M39	6.84	*2.33*	*4.51*	2.3	0.015	0.025
M40	6.28	*4.84*	*1.44*	3.6	0.015	0.025
M41	5.86	*3.16*	*2.70*	2.5	0.015	0.025
M41a	6.52	*1.82*	*4.70*	3.0	0.015	0.025
M42	4.63	*2.78*	*1.85*	11.7	0.015	0.025
M43	4.03	*3.32*	*0.71*	5.0	0.015	0.025
M44	4.56	*3.51*	*1.05*	6.4	0.015	0.025
M45	4.88	*3.49*	*1.39*	7.7	0.015	0.025
M46	7.87	*5.46*	*2.41*	5.9	0.015	0.025
M47	5.32	*4.55*	*0.77*	10.2	0.015	0.025
M48	4.97	*3.84*	*1.13*	5.6	0.015	0.025
M49	6.02	*5.15*	*0.87*	4.4	0.015	0.025
M50	3.35	*1.39*	*1.96*	7.0	0.015	0.025
M51	4.44	*2.94*	*1.50*	11.4	0.015	0.025
M52	4.94	*0.44*	*4.50*	3.1	0.015	0.025
M53	5.35	*4.43*	*0.92*	7.2	0.015	0.025
M54	5.71	*4.79*	*0.92*	5.4	0.015	0.025
M55	6.03	*5.15*	*0.88*	4.9	0.015	0.025
M56	7.50	*5.78*	*1.72*	7.9	0.015	0.025
M57	7.92	*6.45*	*1.47*	8.2	0.015	0.025
M58	5.30	*4.49*	*0.81*	5.8	0.015	0.025
M59	7.14	*6.16*	*0.98*	4.8	0.015	0.025
M60	3.96	*3.28*	*0.68*	3.8	0.015	0.025
M61	5.68	*4.57*	*1.11*	3.0	0.015	0.025
M62	6.91	*5.67*	*1.24*	3.0	0.015	0.025

Subcatchment	**Area (ha)**	**Impervious Catchment (ha)**	**Pervious Catchment (ha)**	**Slope (%)**	**Impervious Mannings n**	**Pervious Mannings n**
M63	5.48	*4.32*	*1.16*	5.0	0.015	0.025
M64	4.39	*3.77*	*0.62*	3.0	0.015	0.025
M65	8.29	*4.37*	*3.92*	2.3	0.015	0.025
M66	5.90	*0.46*	*5.44*	1.0	0.015	0.025
M67	6.02	*4.88*	*1.14*	3.8	0.015	0.025
M68	5.72	*0.46*	*5.26*	2.6	0.015	0.025
M69	4.79	*3.94*	*0.85*	2.6	0.015	0.025
M70	5.51	*2.32*	*3.19*	2.5	0.015	0.025
M71	6.17	*0.95*	*5.22*	7.9	0.015	0.025
M72	5.81	*1.85*	*3.96*	8.4	0.015	0.025
M73	17.23	1.72	15.51	1.5	0.015	0.025
M74	13.99	0.00	13.99	2.7	0.015	0.025
M75	13.02	0.65	12.37	2.4	0.015	0.025
M76	10.13	0.00	10.13	1.5	0.015	0.025
M77	12.60	0.00	12.60	1.0	0.015	0.025

Village Creeks						
Subcatchment	**Area (ha)**	**Impervious Catchment (ha)**	**Pervious Catchment (ha)**	**Slope (%)**	**Impervious Mannings n**	**Pervious Mannings n**
N1	13.45	0.00	13.45	4.6	0.015	0.025
N2	17.21	0.00	17.21	7.7	0.015	0.025
N3	7.39	0.00	7.39	10.3	0.015	0.025
N4	9.15	0.00	9.15	4.2	0.015	0.025
N5	11.62	0.00	11.62	8.5	0.015	0.025
N6	8.71	0.00	8.71	21.3	0.015	0.025
N7	6.84	0.00	6.84	13.0	0.015	0.025
N8	15.36	1.54	13.82	23.1	0.015	0.025
N9	15.25	0.76	14.49	9.4	0.015	0.025
N10	14.69	0.00	14.69	19.1	0.015	0.025
N11	12.14	11.05	1.09	4.2	0.015	0.025
N12	16.65	0.83	15.82	11.2	0.015	0.025
N13	11.09	0.55	10.54	8.8	0.015	0.025
N14	12.32	0.62	11.70	14.0	0.015	0.025
N15	9.19	8.00	1.20	5.1	0.015	0.025
N16	5.22	*2.73*	*2.49*	7.4	0.015	0.025
N17	6.03	*4.38*	*1.65*	10.4	0.015	0.025
N18	4.21	*3.39*	*0.82*	9.2	0.015	0.025
N19	6.73	*2.10*	*4.63*	10.3	0.015	0.025
N20	3.71	*0.36*	*3.35*	9.7	0.015	0.025
N21	5.62	*0.56*	*5.06*	9.4	0.015	0.025
N22	17.64	16.85	0.79	5.0	0.015	0.025
N23	13.28	0.00	13.28	10.5	0.015	0.025
N24	11.08	1.11	9.97	14.5	0.015	0.025
N24a	9.43	0.94	8.49	14.5	0.015	0.025
N25	26.93	17.51	9.43	2.7	0.015	0.025
N26	7.19	0.36	6.83	2.0	0.015	0.025
N27	22.05	1.10	20.95	3.7	0.015	0.025
N28	17.04	5.11	11.93	3.5	0.015	0.025
N29	15.79	10.26	5.53	3.5	0.015	0.025
N30	13.96	9.07	4.89	0.1	0.015	0.025

Village Creeks						
Subcatchment	**Area (ha)**	**Impervious Catchment (ha)**	**Pervious Catchment (ha)**	**Slope (%)**	**Impervious Mannings n**	**Pervious Mannings n**
v1	4.84	*3.83*	*1.01*	4.7	0.015	0.025
v2	5.55	*2.68*	*2.87*	5.6	0.015	0.025
v3	7.49	*3.80*	*3.69*	5.3	0.015	0.025
v4	5.10	*1.04*	*4.06*	4.3	0.015	0.025
v5	14.27	1.43	12.84	4.8	0.015	0.025
v6	14.74	1.47	13.27	5.0	0.015	0.025
v7	6.39	*5.10*	*1.29*	7.5	0.015	0.025
v8	5.53	*4.45*	*1.08*	3.5	0.015	0.025
v9	6.88	*5.72*	*1.16*	6.6	0.015	0.025
v10	3.59	*2.86*	*0.73*	2.2	0.015	0.025
v11	4.57	*4.05*	*0.52*	8.3	0.015	0.025
v12	3.91	*3.36*	*0.55*	5.8	0.015	0.025
v13	1.91	*1.72*	*0.19*	4.5	0.015	0.025
v14	7.09	*6.44*	*0.65*	6.0	0.015	0.025
v15	13.92	1.39	12.53	1.0	0.015	0.025
v16	17.12	1.71	15.41	2.7	0.015	0.025
v17	4.86	*3.97*	*0.89*	5.1	0.015	0.025
v18	6.25	*5.06*	*1.19*	7.6	0.015	0.025
v19	5.28	*4.25*	*1.03*	7.7	0.015	0.025
v20	4.11	*3.38*	*0.73*	2.6	0.015	0.025
v21	5.01	*4.19*	*0.82*	3.8	0.015	0.025
v22	17.11	3.42	13.69	2.8	0.015	0.025
v23	21.01	4.20	16.81	1.4	0.015	0.025
v24	12.50	0.63	11.88	3.3	0.015	0.025
v25	20.86	2.09	18.77	1.3	0.015	0.025
O1	9.87	0.99	8.88	2.0	0.015	0.025
O2	4.37	0.44	3.93	3.0	0.015	0.025
O3	9.27	1.85	7.42	2.4	0.015	0.025
O4	18.87	5.66	13.21	2.7	0.015	0.025
O5	6.72	*4.30*	*2.42*	8.0	0.015	0.025

APPENDIX D – FLOOD ASSESSMENT

Menangle Park
Revised Planning Proposal

Flood Assessment

Revision 8
July 2018

Catchment Simulation Solutions

TABLE OF CONTENTS

FIGURES (APPENDIX B)

1 INTRODUCTION

The Menangle Park Urban Release Area is located within the Campbelltown City Council Local Government Area approximately 5.5 km south-west of the Campbelltown CBD. The release area aims to provide approximately 3,400 residential allotments as well as a town centre, employment areas, community facilities as well as public recreation areas.

The Nepean River abuts the western and southern edges of the release area. A number of smaller creeks also drain through the release area. Accordingly, the potential for flooding of the release area from both Nepean River and local catchment runoff is a key consideration for the future development of the area to ensure future occupants are not exposed to an unacceptable flood risk. The development of the release area also may displace a proportion of floodwaters and/or alter runoff volumes and rates from the local catchments which may adversely impact on areas outside of the release area.

A flooding and drainage assessment was prepared by GHD (2010 and 2011) based upon the original planning precinct proposal. This assessment outlined a surface water management system that could be implemented to ensure that development of the area would not adversely impact on existing flooding and drainage behaviour outside of the release area while ensuring the flood risk within the release area could be managed.

Since that time, a revised masterplan has been prepared for a part section of the overall release area. The revised masterplan is included in **Appendix A**.

As the revised masterplan layout has changed relative to the original flooding assessment, SMEC engaged Catchment Simulation Solutions to determine if the revised layout may alter the outcomes of the original flooding investigations. The outcomes of the flooding assessment are presented in the following document.

2 PREVIOUS STUDIES

2.1 Menangle Park LES – Local Flooding and Storm Quantify Management (Detention)

The 'Menangle Park LES – Local Flooding and Storm Quantify Management (Detention)' was prepared by GHD for Campbelltown City Council and Landcom in 2010. The study was completed using an XP-RAFTS hydrologic model to represent rainfall-runoff processes and a 2-dimensional TUFLOW model to simulate the movement of floodwaters across the study area from the Nepean River as well as local catchment runoff.

The XP-RAFTS model was developed to reflect rainfall-runoff behaviour across the local catchments for three different development scenarios:

- Existing conditions
- Developed conditions with no basins
- Developed conditions with basins

The outcomes from the XP-RAFTS modelling showed that that the proposed stormwater quantity management strategy (which incorporated eleven detention basins) would suitably reduce peak post-development discharges to at least existing levels for both the 2-year and 100-year ARI floods. Furthermore, there would be minimal encroachment of the development footprint into the existing 100-year ARI flood extent, indicating that the development of the land is unlikely to displace floodwaters and adversely impact on existing flood behaviour (although this was not explicitly modelled using the TUFLOW model). Accordingly, it was determined that the stormwater strategy would suitably meet the stormwater quantity and flooding requirements outlined in the Campbelltown (Sustainable City) Development Control Plan as well as the NSW Floodplain Development Manual.

2.2 Report for Menangle Park – Review of Drainage Options

The 'Report for Menangle Park – Review of Drainage Options' was subsequently prepared in 2011 by GHD. The review was commissioned to determine the effectiveness and feasibility of a reduced number of flood detention basins after the 2010 study noted that some post-development discharges were predicted to increase as a result of including all of the original basins.

The study confirmed that inclusion of all detention basins could actually increase peak post-development discharges relative to a no or reduced basin scenario. The reductions in peak "no basin" discharges are associated with the increased impervious surfaces allowing water to runoff more rapidly from the local subcatchments before runoff from the upper catchment areas reaches the study area. Inclusion of the detention basins essentially delays the release of flows from the local area, increasing the potential for flows from the lower and upper catchment to coincide.

The report also noted that any small differences in peak flows in areas to the west of the railway line would be “drowned out” by backwater flooding from the Nepean River.

The study ultimately determined that retention of Basins 7 and 8 and removal of Basins 2, 4, 4a, 5, 6, 9 and 11 would still meet all required flooding and stormwater quantity requirements. More specifically, it determined that the reduced basin strategy would reduce peak post-development discharged to less than existing levels at the outlet of each local subcatchment into the Nepean River.

Basins 7 and 8, which are to be retained under the reduced basin scenario, are located outside of the area that is the focus of this current study. That is, the reduced basin scenario did not incorporate any detention basins across the revised planning proposal area included in **Appendix A**.

3 REVISED FLOOD MODELLING

3.1 Existing Flood Assessment

In order to understand the potential impact of the proposed masterplan on flood behaviour, it is first necessary to define flood behaviour for "existing" conditions. As discussed, a, XP-RAFTS hydrologic model and a TUFLOW hydraulic computer model was originally developed as part of the 'Menangle Park LES – Local Flooding and Storm Quantify Management (Detention)' (GHD, 2010) to define existing as well as post-development flood behaviour. These models were provided to assist with the current study. However, some refinement of the existing conditions and post-development models were considered necessary to ensure local flood behaviour was being reliably represented. The following chapter summarises the updates that were completed to the models as well as the results of the revised flood results.

3.1.1 Hydrology

No modifications were completed to the 'existing' conditions XP-RAFTS hydrologic model that was developed as part of the 'Menangle Park LES – Local Flooding and Storm Quantify Management (Detention)' (GHD, 2010) for the following reasons:

- The XP-RAFTS model was reviewed and was considered to provide a reasonable representation of rainfall-runoff processes across the local subcatchments;
- There have been negligible changes in catchment conditions since the model was developed. Therefore, the XP-RAFTS model is still considered to provide a reasonable representation of current catchment conditions.

The Australian Rainfall & Runoff 1987 (Engineers Australia) hydrology was also retained in the model.

3.1.2 Hydraulics

The TUFLOW hydraulic model that was originally developed by GHD as part of the 2010 study was obtained and was used to initially assess flood behaviour across the location catchments draining through Menangle Park as well as along the Nepean River for existing topographic and development conditions. However, before the model was used to simulate flood behaviour, it was updated to provide an improved representation of flood behaviour across the area. The updates that were completed to the model included:

- Model grid size reduced from 8 m to 4 m to provide a more detailed description of the existing topography.
- Terrain representation was updated based upon 2011 LiDAR information.
- The location of some Hume Motorway culverts was updated to ensure the culvert inlet/outlet locations better aligned with the waterways locations defined by the LiDAR information.
- Flow application points were refined (e.g., flow from some subcatchments were previously getting applied to the surface of the Hume Motorway rather than the watercourse on either side of the motorway).

The updated model was used to simulate a 100-year ARI local catchment flood occurring in conjunction with a 20-year ARI Nepean River flood for "existing" topographic and development conditions. Peak floodwater depths were extracted from the results of this modelling and are presented in **Figure 1** in **Appendix B**.

Figure 1 shows that inundation to the west of the railway line is dominated by Nepean River. Floodwater depths across the floodplain areas west of the railway exceed 8 metres in some locations but are more typically around 4-5 metres.

In areas to the east of the railway line, floodwaters are typically contained in close proximity to the main creeks/watercourses, although more extensive inundation is predicted upstream of major flow impediments (e.g., Hume Motorway). Peak 1% AEP floodwater depths along these watercourses are typically less than 1 metre.

3.2 Post-Development Flood Assessment

The future development of Menangle Park will involve changes in terrain as well as changes to catchment characteristics which has the potential to increase runoff volumes and peak discharges. These modifications have the potential to impact on existing flood behaviour. Accordingly, the hydrologic and hydraulic models that were used to define existing flood behaviour were updated to include a representation of the proposed development and simulate flood behaviour for post-development conditions. The following sections describe the updates that were completed to the models as well as the results of the post-development simulations.

3.2.1 Hydrology

As discussed, a revised masterplan has been prepared for a part section of the Menangle Park Urban Release Area. A copy of the revised masterplan is provided in **Appendix A**.

In addition to modifications to the overall masterplan layout, modifications to development densities are also proposed. This has the potential to increase the quantity of impervious surface across the area.

In recognition of the potential for these master plan changes to alter on the original hydrologic assessment SMEC updated the XP-RAFTS hydrologic model to reflect the modifications. The overall layout of the model was not altered as part of the updates. However, the pervious/impervious proportions were updated.

The hydrologic model was also updated to reflect removal of detention basins 2, 4, 4a, 5, 6, 9 and 11 as recommended in the Report for Menangle Park – Review of Drainage Options' (GHD, 2011). It should be noted that smaller basins will be provided in leu of these detention basins for water quality purposes, however, these smaller basins were not included in the hydrologic model as they were not considered to provide significant storage during significant rainfall events.

Further details of the updates that were completed to the XP-RAFTS model are contained in the 'Masterplan Water Cycle Management Report: Menangle Park' (SMEC, 2018). This report also summarises peak discharges for both existing and post-development conditions.

The revised hydrologic model was used to re-simulate the 100-year ARI local catchment flood for post-development catchment conditions. This determined that the critical storm duration for post-development catchment conditions typically varied between 1 and 2-hours. The 2-hour storm duration was most commonly critical.

3.2.2 Hydraulics

The TUFLOW model that was developed to represent existing conditions was then updated to include a representation of the revised masterplan layout. This involved:

- elevating all habitable areas located between the Hume Motorway and railway line above the peak level of the 100-year ARI flood.
- The proposed Spring Farm Parkway embankment was included in the TUFLOW model based upon a design terrain model provided by SMEC. This included the interchange/ramps at the Hume Motorway and Menangle Road.
- The proposed detention basins and water quality basins were also included in the terrain representation. The basin geometry was also defined based upon a design terrain model provided by SMEC.
- All other roadways within the Masterplan area were also elevated above the peak 100-year ARI flood level

The extent of the area that was "filled" above the 100-year ARI flood as part of the modelling is reflected by the black "hatched" areas in the post-development floods maps included in **Appendix B**.

The updated model was then used to simulate the 100-year ARI flood for "post-development" conditions. The floodwater depth map from the post-development flood simulation is provided in **Figure 2** in **Appendix B**.

Flood level difference mapping was also prepared to quantify the potential for the proposed development to impact on existing flood levels and extents. The difference mapping was prepared by subtracting peak 'post-development' water levels from 'existing' water levels. The flood level difference map for the 100-year ARI flood is provided in **Figure 3** in **Appendix B**.

The flood level difference mapping shows that the revised filling/masterplan layout will generate some increases and decreases in flood levels and changes in flood extent. More specifically, the filling will prevent inundation across habitable sections of the release area as well as internal roadways. The extent of the area where flood extents are predicted to reduce as a result of the filling is represented by the black areas in the flood level difference map in **Appendix B**. This reduction in flood extents is predicted to displace some floodwater resulting in localised increases in flood levels in the immediate vicinity of the filling. Localised increases in flood level are also anticipated in the vicinity of major bridge/culvert crossing.

The maximum increase in 1% AEP flood levels within the masterplan "footprint" is predicted to be 0.24 metres. However, these changes in flood level are contained within the Menangle Park Urban Release Area and could be accommodated by additional filling in these areas to ensure minimum freeboards can be met.

Increases in flood level are also predicted on the eastern side of the new Hume Highway ramp at the Spring Farm Parkway interchange. The maximum increase in 1% AEP flood level at this location is predicted to be 0.5 metres. Although this increase in flood level is not predicted to adversely impact on any existing buildings/structures, consideration could be given to providing additional storage volume upstream of the ramp as part of the detailed design of the new ramps.

3.3 Preliminary Evacuation Assessment

The future development of the release area will place more people in potentially flood liable areas. This in turn, has the potential to increase the overall flood risk for the area.

As discussed, filling will be completed to ensure all habitable areas of the release area as well as all internal roadways are elevated above the peak level of the 100-year ARI flood. Accordingly, the filling will serve as the first step in ensuring the flood risk can be suitably managed during all events up to and including the 100-year ARI flood.

However, there is potential for larger floods to occur which could result in inundation of habitable areas. In such instances, properly planned and executed evacuation is the most effective strategy in terms of a reliable public safety outcome.

To provide an understanding of the potential impacts of a particularly large flood, an additional "post-development" flood simulation was completed assuming a 100-year ARI local catchment flood occurred in conjunction with a Probable Maximum Flood (PMF) along the Nepean River.

Peak floodwater depths from the PMF simulation are provided in **Figure 4** in **Appendix B**. **Figure 4** shows that much of the central and eastern sections of the Menangle Park area would be located above the peak level of the PMF. Nevertheless, inundation is predicted across some of the western parts of Menangle Park during the PMF. Therefore, evacuation from these lower lying areas would be necessary should a particularly large Nepean River flood (i.e., in excess of the 1% AEP flood) occur.

As discussed, the majority of the masterplan area is predicted to remain above the peak level of the PMF. Evacuation across these more elevated areas will not be required but could still be desirable if flooding is anticipated for an extended timeframe (i.e., future occupants may run out of supplies if they stay in situ for an extended period).

The primary evacuation routes are shown in **Figure 4**. In general, the northern sections of Menangle Park would evacuate via Spring Farm Parkway while the southern sections would evacuate via Menangle Road. Both of these roadways provide access to the Hume Motorway via a new interchange at Spring Farm Parkway (also shown in **Figure 4**), which is located above

the peak level of the PMF. The following observations are made with regard to each evacuation route based on current design information:

- Spring Farm Parkway:
  - West of railway: The lowest point on the road profile is located just west of the railway line and is at an elevation of 76 mAHD, which is located approximately 2 metres below the peak level of the PMF. However, the main entry point for traffic in this area is to the south of this low point and is located at elevation of 83.6 mAHD, which is above the peak level of the PMF. From this point, evacuation would be possible to the east (refer discussion immediately below).
  - East of railway: The lowest point on the road profile is located at an elevation of 81.4 mAHD, which is located above the peak level of the PMF. The roadway constantly grades up towards the Hume Motorway. Accordingly, all properties that adjoin this roadway will have flood free "rising road" evacuation access available.
- Menangle Road: the lowest point along Menangle Road is predicted to be overtopped at the peak of the 100-year ARI flood as well as the PMF near the Racecourse Avenue intersection. However, no urban release areas are proposed on the western side of this low point. From this low point, the road grades up towards the Hume Motorway. This section of roadway is predicted to remain above the peak level of the PMF. Menangle Road drops back down after it crosses the motorway before linking back in with Spring Farm Road. This section of road is also predicted to remain above the peak Nepean River PMF level

It is noted that the evacuation routes are also crossed by several smaller creeks. Therefore, there is still potential for these evacuation routes to be cut during large local catchment events. If access along either evacuation route is cut by floodwaters, it is likely that refuge could be sought on elevated land within the release area (e.g., within the town centre or school grounds).

Overall, it is considered that the major evacuation routes will be suitable for evacuation during all events up to and including the PMF. However, it is recommended that as part of the future civil design for the area, that flood evacuation is duly considered in the design of all minor roadways and, wherever practical, roads be designed so they grade up and out of the floodplain towards each of the main evacuation routes. Provision of these "rising road" evacuation routes will ensure that cars are not forced to drive through deeper waters at any location, which will assist in reducing the flood risk if evacuation is required.

4 SUMMARY

This report has presented the outcomes of a flood assessment that was completed to quantify the potential flood impacts associated with a revised masterplan layout for a part section of the Menangle Park Urban Release Area.

The assessment determined that the revised masterplan layout would typically produce localised increases in flood level relative to existing conditions and those differences are typically contained to the study area. Most of the increases are fully contained to the urban release area. However, some increases in flood levels are also predicted east of the Hume Motorway and are associated with new ramps that are proposed as part of the Spring Farm Parkway interchange. It is likely that these increases could be mitigated by providing some compensatory storage upstream of the ramps.

The filling that is proposed as part of the release area will ensure all habitable areas and internal roadways are elevated above the peak level of the 100-year ARI flood. However, there is potential for larger floods to occur. Although most of the release area is elevated above the peak levels of the Probable Maximum Flood (PMF), evacuation of some of the lower lying areas will be necessary should a particularly large Nepean River flood occur. Each of the major roadways that would serve as evacuation routes during floods are elevated above the peak level of the PMF and generally grade up and away from the major waterways. Accordingly, rising road evacuation should be possible from most sections of the release area. It is recommended that the detailed civil design for the release area take due note of the potential need for flood evacuation routes to be provided and rising road evacuation routes are provided, wherever possible.

5 REFERENCES

- Engineers Australia (1987). Australian Rainfall and Runoff - A Guide to Flood Estimation. Edited by D. Pilgrim.
- GHD (2010). Menangle Park LES – Local Flooding and Storm Quantify Management (Detention). Prepared for Campbelltown City Council and Landcom.
- GHD (2011). Report for Menangle Park – Review of Drainage Options. Prepared for Campbelltown City Council and Landcom.
- SMEC (2018). Masterplan Water Cycle Management Report: Menangle Park.

APPENDIX A
MASTERPLAN LAYOUT

N

GLENLEE HOUSE

Transgrid

SPRING FARM PARKWAY

Railway Line

CLUB MENANGLE

CUMMINS ROAD

HUME HIGHWAY

NEPEAN RIVER

MENANGLE PARK STATION

Private Lot

MENANGLE ROAD

LEGEND

Master Plan Boundary

DWELLING TYPOLOGIES

- Top Shop Apartments
- Medium Density Lots
- Low Density Lots
- Large Lots
- Large Lots 2000sqm
- Rural
- Rural / Private Open Space

NON RESIDENTIAL USES

- Neighbourhood Centre
- School
- Employment
- Infrastructure
- Transgrid
- Racing
- Riparian
- Riparian/Flood (30m)
- Riparian/Flood (15m)
- Riparian/Flood (45m)
- Ecology
- Field/Open Space
- Park/Open Space
- Future Open Space (>0.5ha)

great places_

robertsday.com.au *planning·design·place*

SIZE A0

0 metres 100 200

AERIAL PHOTOGRAPHY
SOURCE: Nearmap
YYMMDD: 17.04.23

CADASTRAL INFORMATION
SOURCE: Craig and Rhodes Survey
YYMMDD: 17/05/31
DWG REF: 1786
PROJECTION: GDA94, MGA56

DRAFT

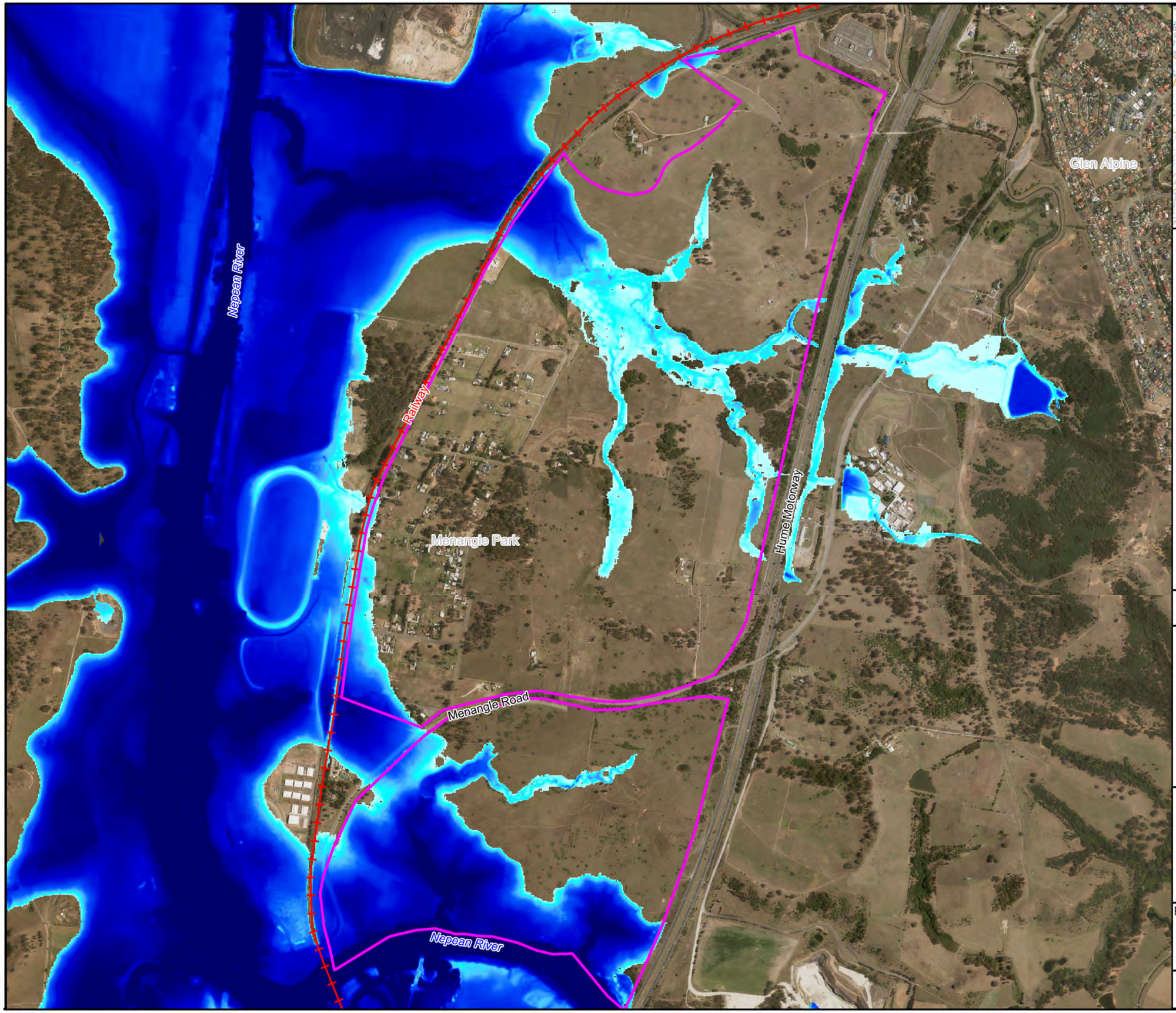
REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
B	DESIGN AMENDMENT	18.04.19	DC	AK
A	DESIGN AMENDMENT	18.04.18	DC	AK

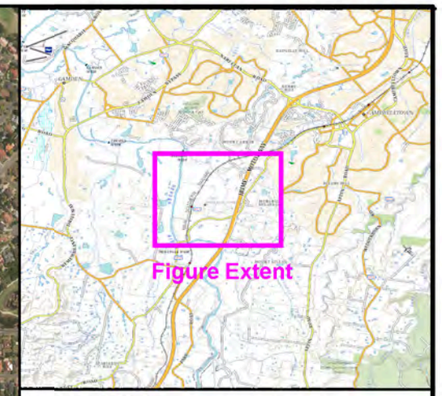
MASTERPLAN
Menangle Park
Campbelltown City Council

REF NO. **DHU-MEN** DRAW NO. **RD04.6** REV. **B**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

APPENDIX B
FIGURES





LEGEND

Study Area

Depths (m)

0.00
0.50
1.00
2.00
4.00
8.00

Notes:

N
W E
S

Scale 1:14,000 (at A3)

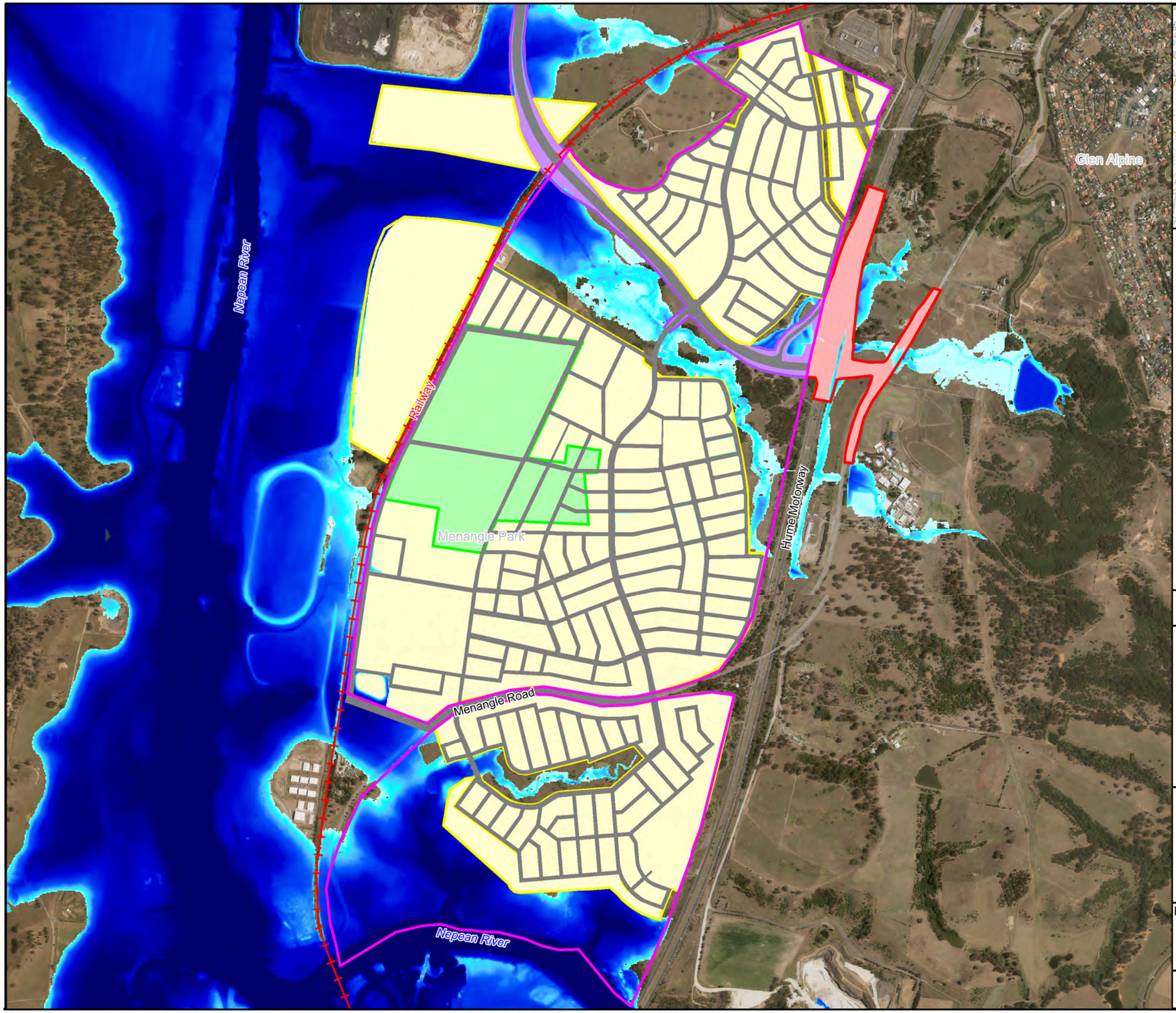
0 0.4 0.8

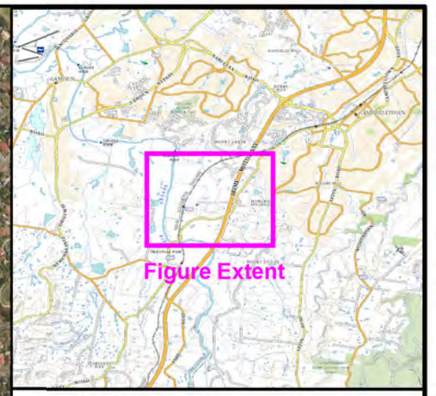
Km

Figure 1:
Peak 100-Year ARI Floodwater Depths for Existing Conditions

Prepared By:
Catchment Simulation Solutions
Suite 2.01, 210 George St
Sydney, NSW 2000

File Name: Fig1 - 100-Yr Depths Existing .wor





LEGEND

- Study Area
- Future development area to be elevated above 100 year ARI flood level
- Topographic modifications associated with proposed roadway
- Hume Motorway modifications
- Area excluded from current investigation

Depths (m)

- 0.00
- 0.50
- 1.00
- 2.00
- 4.00
- 8.00

Notes:

N
W E
S

Scale 1:14,000 (at A3)

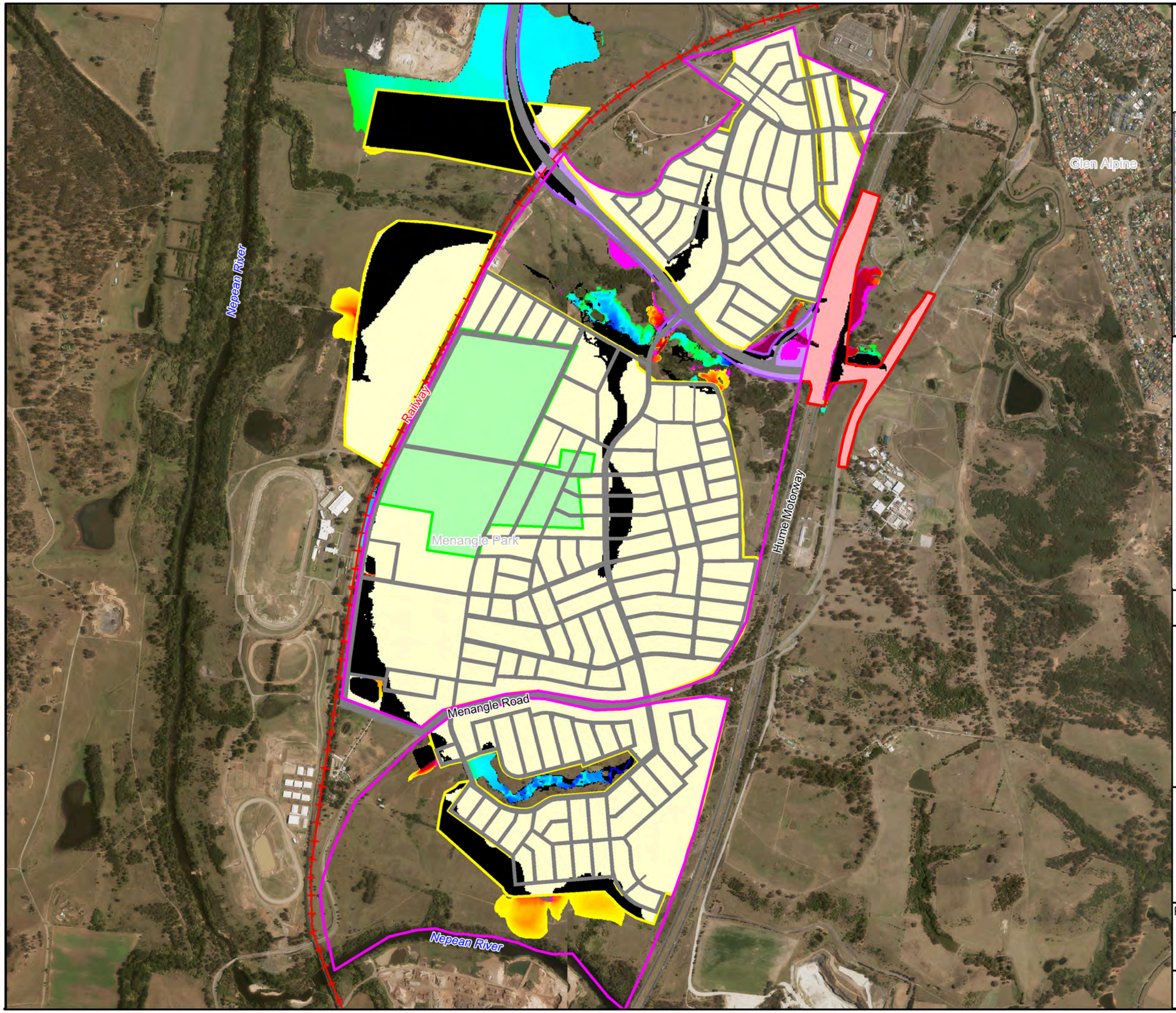
0 0.4 0.8

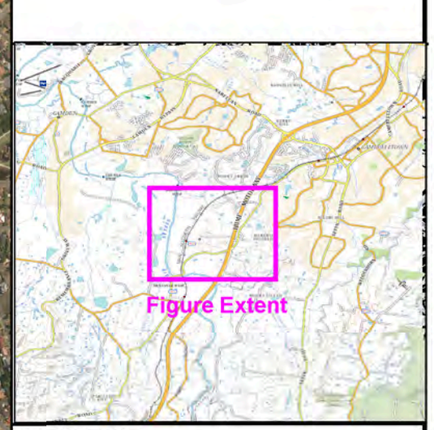
Km

Figure 2:
Peak 100-Year ARI Floodwater Depths for Post-Development Conditions

Prepared By:
Catchment Simulation Solutions
Suite 2.01, 210 George St
Sydney, NSW 2000

File Name: Fig2 - 100-Yr Depths Post .wor





LEGEND

Flood Level Difference (m)

- <= -0.50
- -0.20
- -0.10
- -0.05
- Changes less than 0.05
- 0.05
- 0.10
- 0.20
- >= 0.50
- Was wet, now dry
- Was dry, now wet

Notes:

N
W E
S

Scale 1:14,000 (at A3)

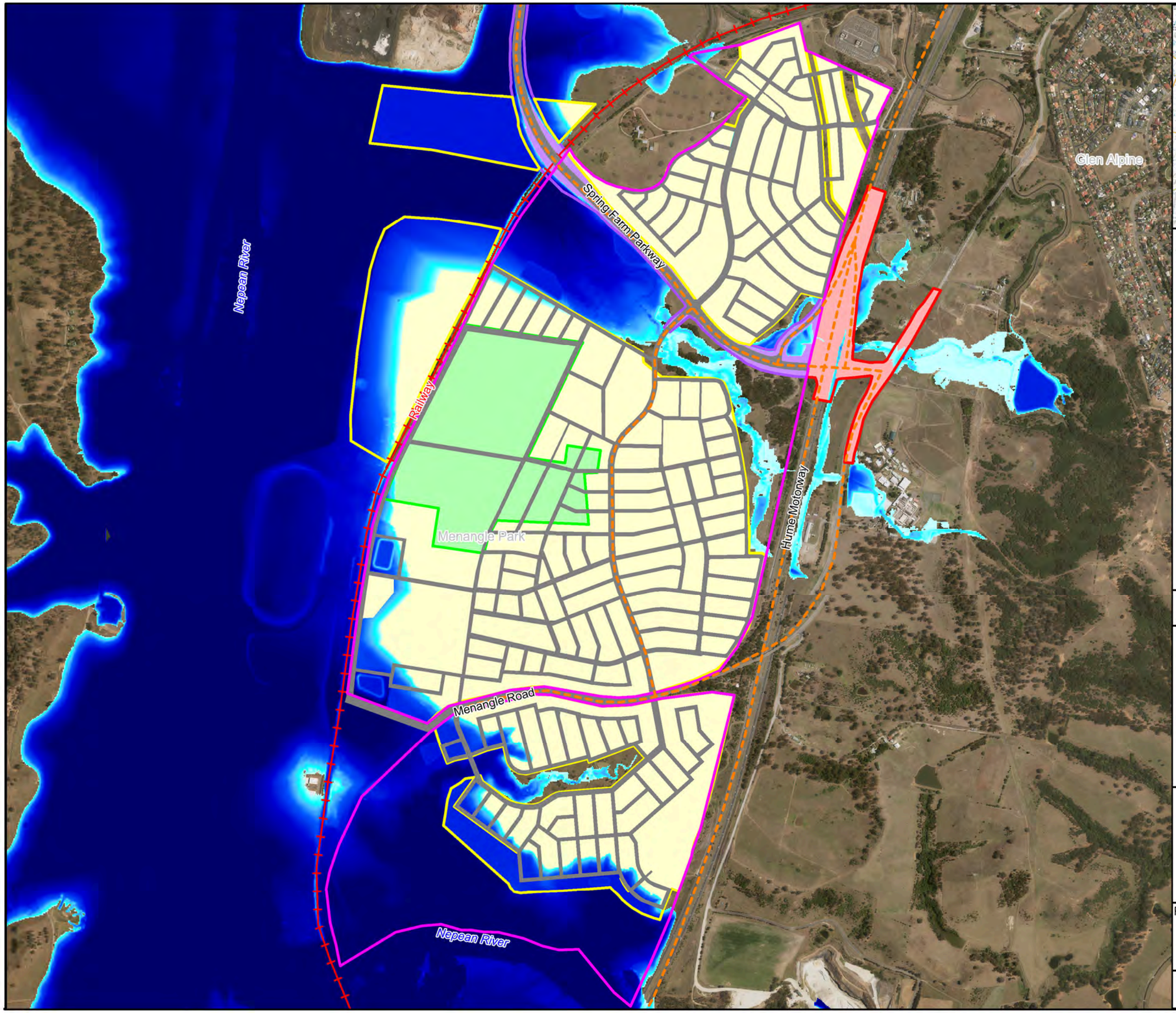
0 0.4 0.8

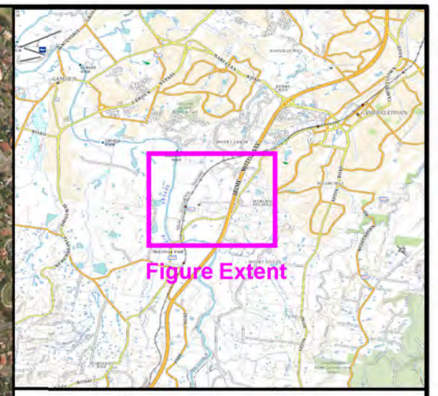
Km

Figure 3:
Predicted Change in Peak 100-Year ARI Flood Levels

Prepared By:
Catchment Simulation Solutions
Suite 2.01, 210 George St
Sydney, NSW 2000

File Name: Fig3 - 100-Yr Level Diff .wor





LEGEND

- Study Area
- Future development area to be elevated above 100 year ARI flood level
- Topographic modifications associated with proposed roadway
- Hume Motorway modifications
- Area excluded from current investigation
- Evacuation Route

Depths (m)

- 0.00
- 0.50
- 1.00
- 2.00
- 4.00
- 8.00

Notes:

N
W E
S

Scale 1:14,000 (at A3)

0 0.4 0.8

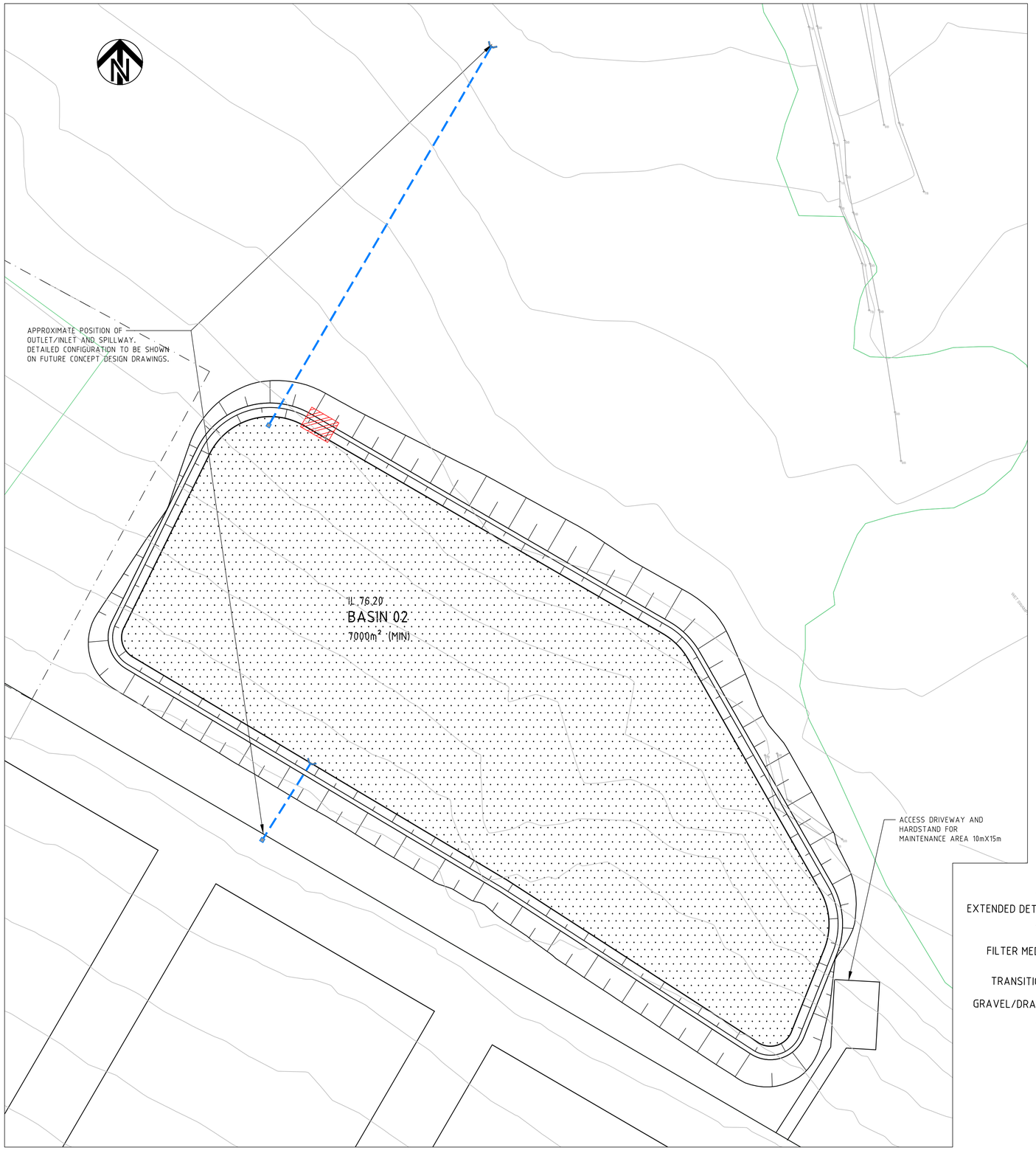
Km

Figure 4:
Peak PMF Water Depths for Post-Development Conditions

Prepared By:
Catchment Simulation Solutions
Suite 2.01, 210 George St
Sydney, NSW 2000

File Name: Fig4 - PMF Depths Post .wor

APPENDIX E – BASIN CONCEPT DESIGNS

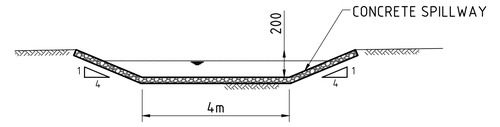


NOTES

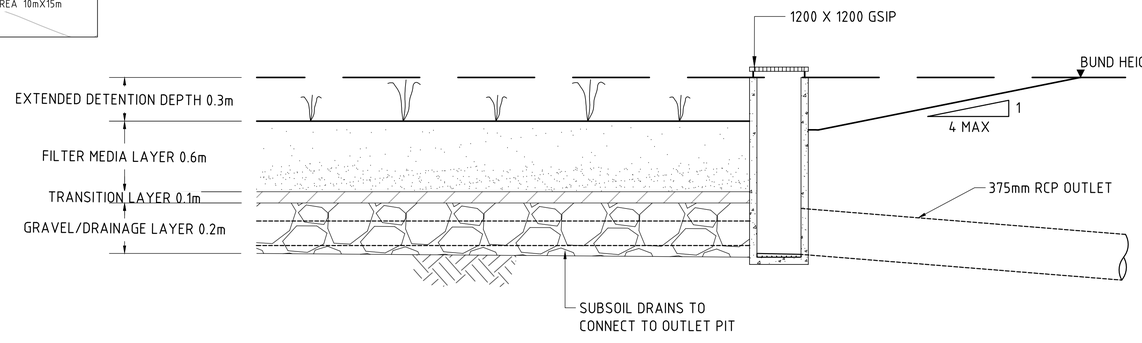
1. THE PURPOSE OF THIS LAYOUT PLAN IS TO PROVIDE AN INDICATION OF THE GENERAL FOOTPRINT OF THE BASIN.
2. PRELIMINARY SKETCHES OF BASIN FOOTPRINT ONLY. OUTLET AND SPILLWAY ARRANGEMENTS SHOWN INDICATIVELY AS THEY WILL BE DESIGNED AS PART OF DEVELOPMENT APPLICATION.

LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE – ASSUMED DIA Φ375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
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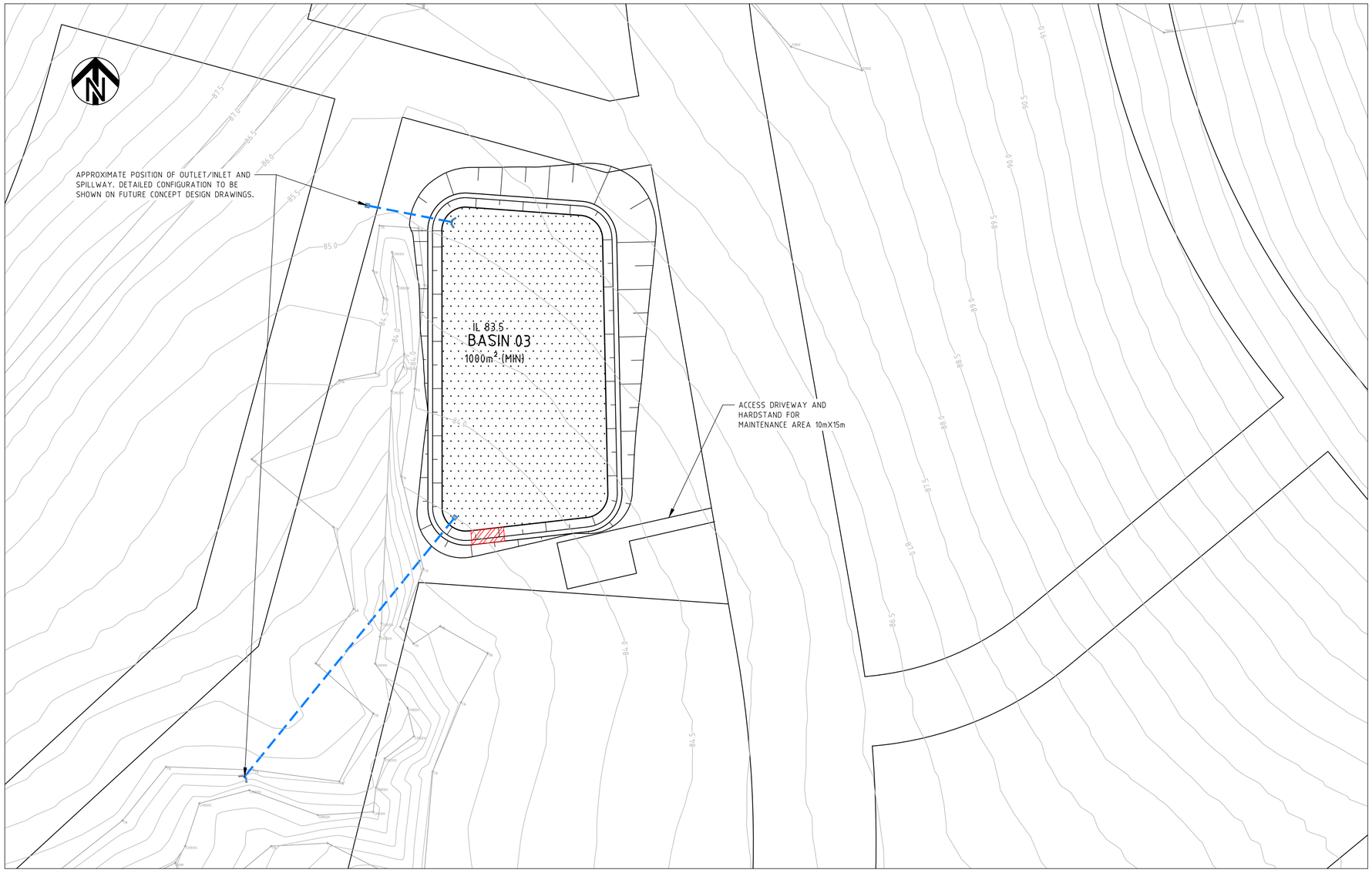
MENANGLE PARK - MASTERPLAN
WSUD -BASIN 02

INFORMATION DOCUMENT

300178115_180711-BASIN 02 LAYOUT_FM_[ID]

SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
LEVEL 1, 178-180 QUEEN STREET
CAMPBELLTOWN, NSW, 2560
PH 02 4640 8222 FAX 02 4628 1056
WWW.SMEC.COM

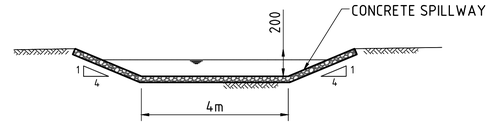


NOTES

1. THE PURPOSE OF THIS LAYOUT PLAN IS TO PROVIDE AN INDICATION OF THE GENERAL FOOTPRINT OF THE BASIN.
2. PRELIMINARY SKETCHES OF BASIN FOOTPRINT ONLY. OUTLET AND SPILLWAY ARRANGEMENTS SHOWN INDICATIVELY AS THEY WILL BE DESIGNED AS PART OF DEVELOPMENT APPLICATION.

LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
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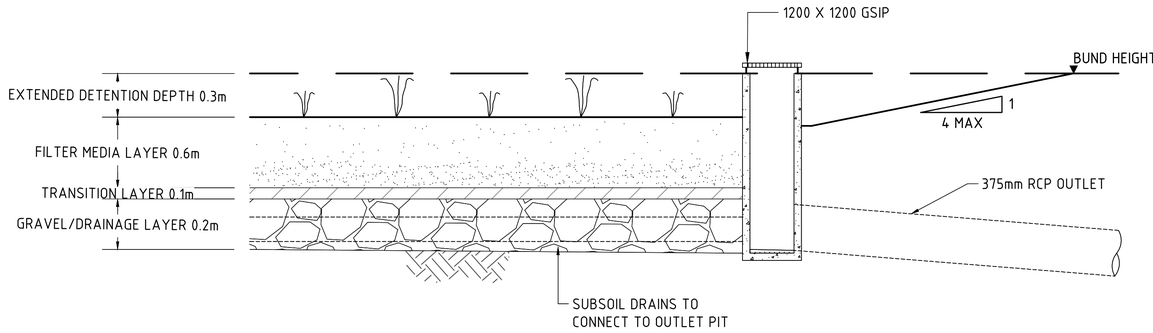

WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

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MENANGLE PARK - MASTERPLAN
WSUD BASIN 3

INFORMATION DOCUMENT

300178115_180711-BASIN 03 LAYOUT_FM_[ID]

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APPROXIMATE POSITION OF OUTLET/INLET AND SPILLWAY. DETAILED CONFIGURATION TO BE SHOWN ON FUTURE CONCEPT DESIGN DRAWINGS.

IL 76.3
BASIN 04
3000m² (MIN)

SPRING FARM PARKWAY

BASIN 04 SIZED TO TREAT RUN OFF FROM SPRING PARKWAY.

APPROXIMATE POSITION OF OUTLET/INLET AND SPILLWAY. DETAILED CONFIGURATION TO BE SHOWN ON FUTURE CONCEPT DESIGN DRAWINGS.

CONNECTION INTO SFP SW SUBJECT TO DETAILED DESIGN

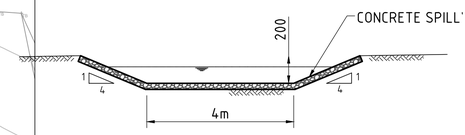
ACCESS DRIVEWAY AND HARDSTAND FOR MAINTENANCE AREA 10mX15m

NOTES

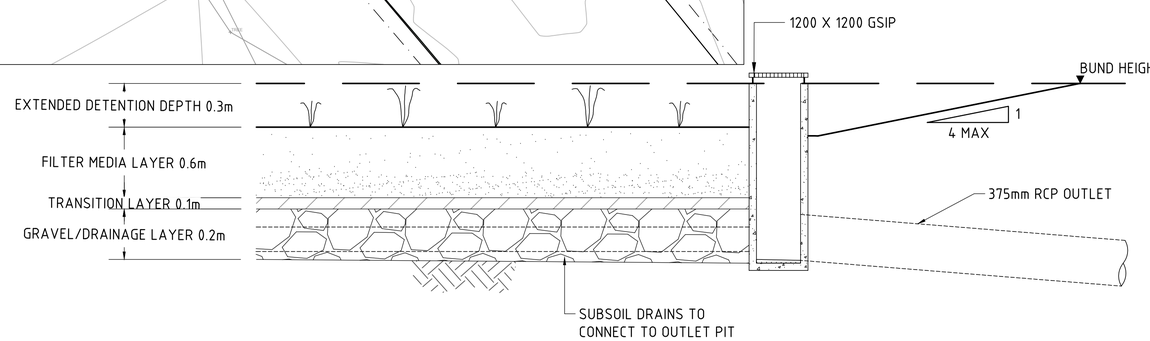
1. THE PURPOSE OF THIS LAYOUT PLAN IS TO PROVIDE AN INDICATION OF THE GENERAL FOOTPRINT OF THE BASIN.
2. PRELIMINARY SKETCHES OF BASIN FOOTPRINT ONLY. OUTLET AND SPILLWAY ARRANGEMENTS SHOWN INDICATIVELY AS THEY WILL BE DESIGNED AS PART OF DEVELOPMENT APPLICATION.

LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

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MENANGLE PARK - MASTERPLAN
WSUD BASIN 04

INFORMATION DOCUMENT
300178115_180711-BASIN 04 LAYOUT_FM_[ID]

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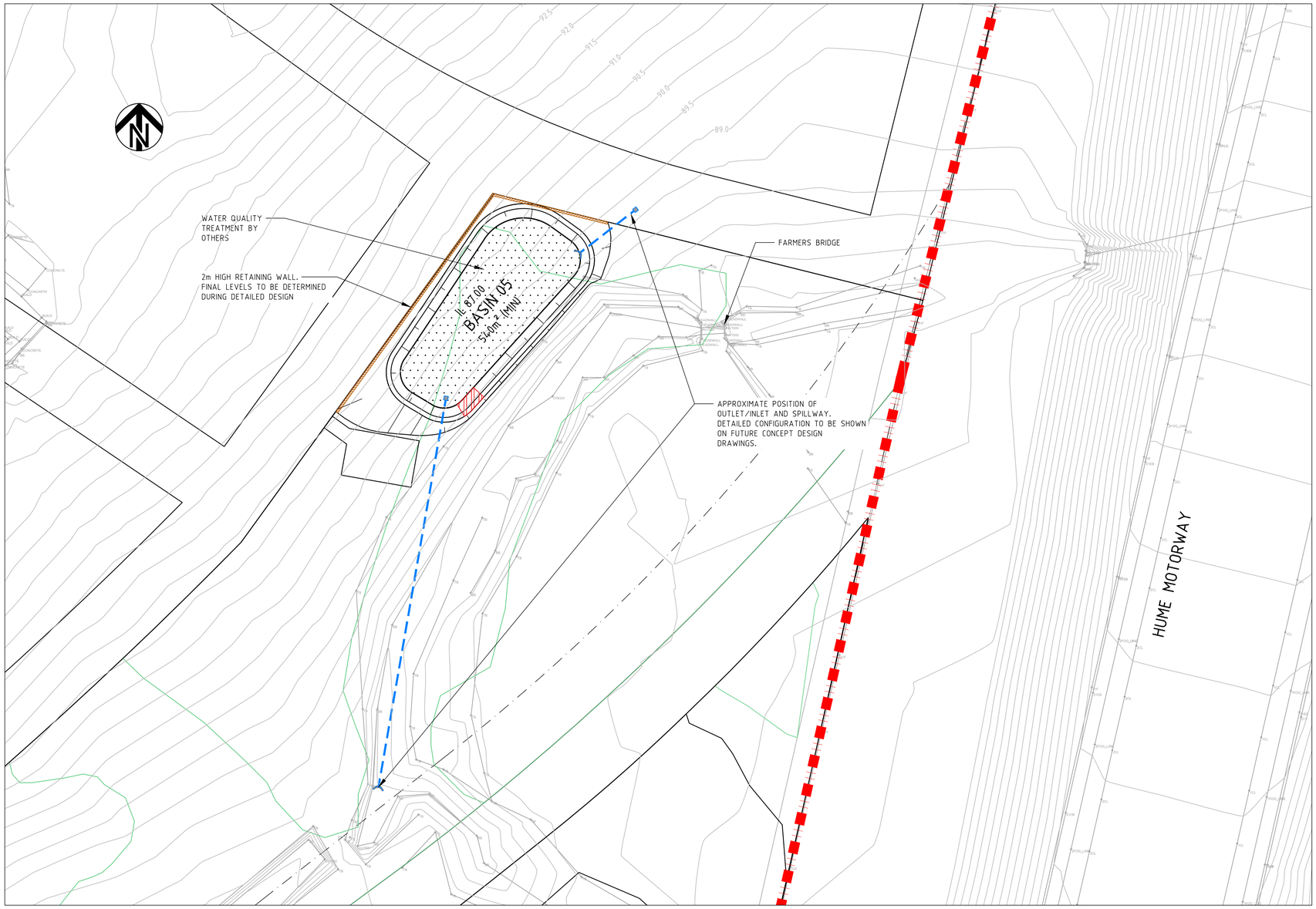

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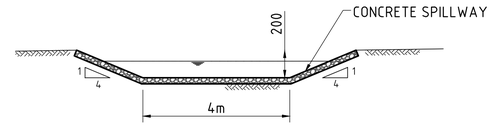
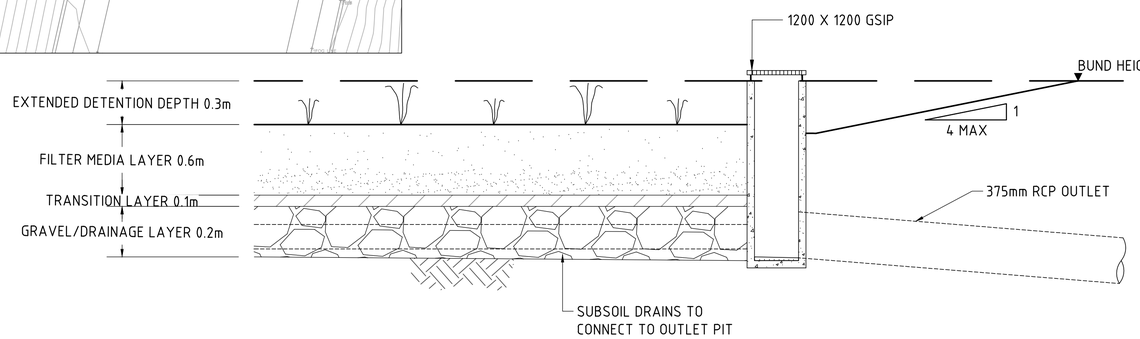
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE – ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

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MENANGLE PARK - MASTERPLAN
WSUD BASIN 5

INFORMATION DOCUMENT

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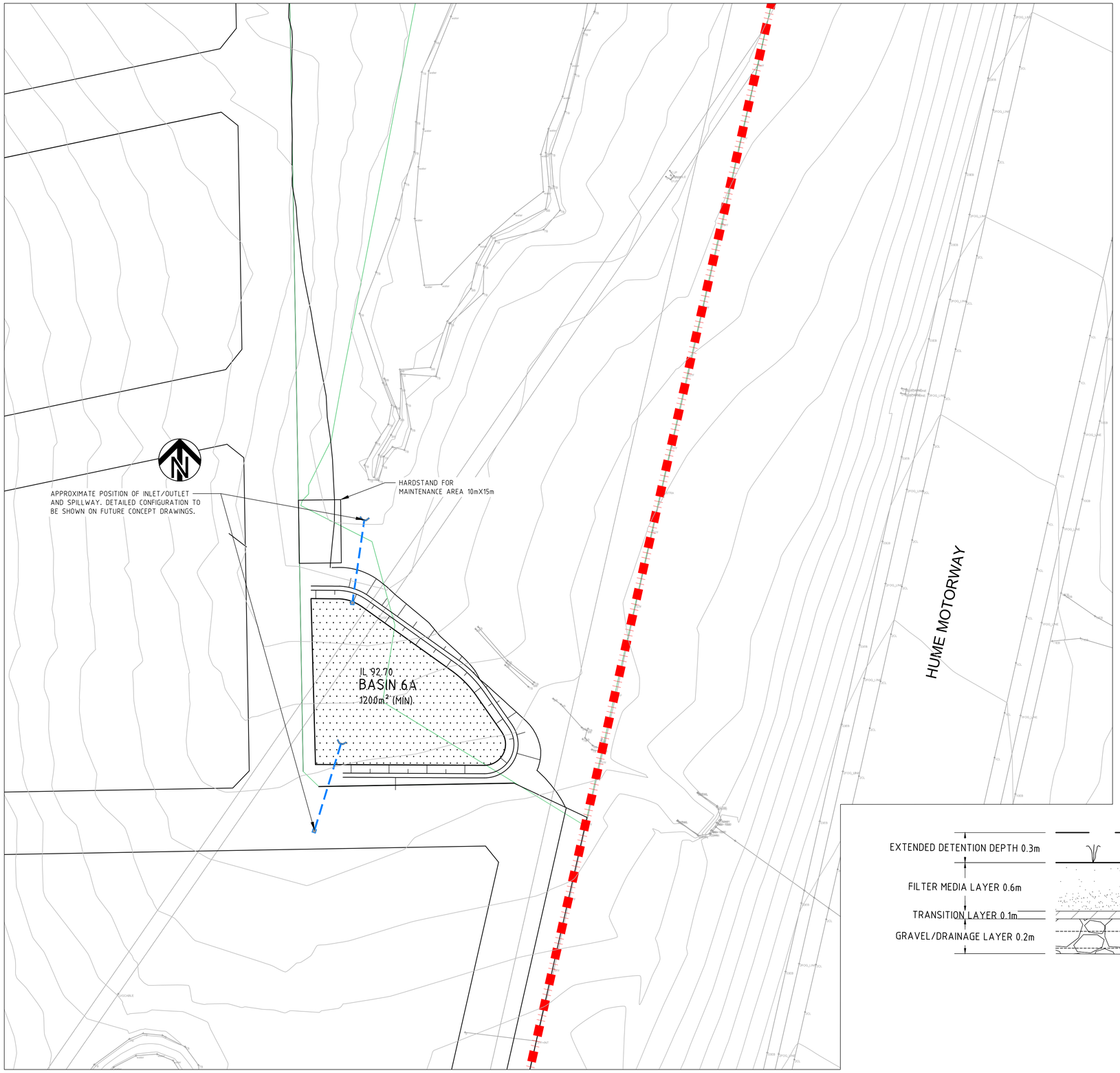

NOTES

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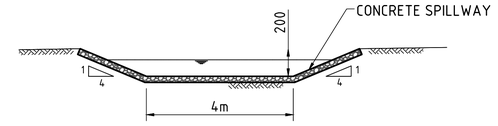
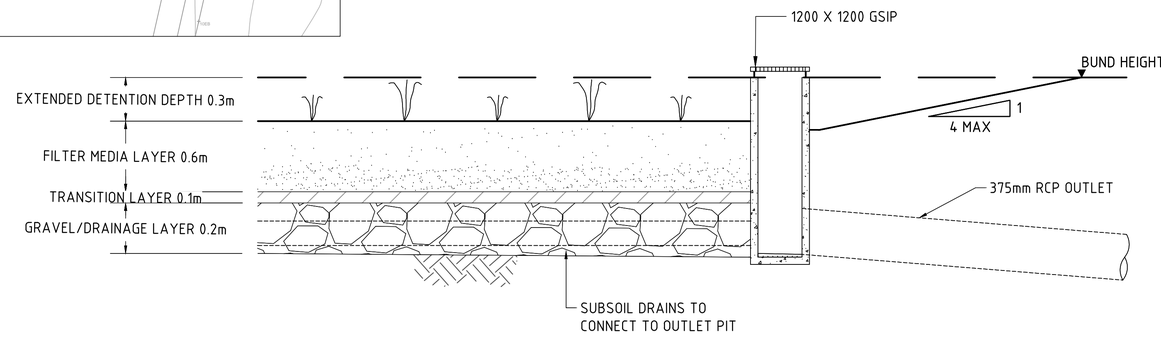
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

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MENANGLE PARK - MASTERPLAN
WSUD BASIN 6A

INFORMATION DOCUMENT

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ACCESS DRIVEWAY AND
HARDSTAND FOR
MAINTENANCE AREA 10mX15m

APPROXIMATE POSITION OF INLET/OUTLET AND
SPILLWAY.
DETAILED CONFIGURATION TO BE SHOWN ON
FUTURE CONCEPT DRAWINGS.

IL 89.00
BASIN 6B
800m² (MIN)

WATER QUALITY
TREATMENT BY OTHERS

HUME MOTORWAY

DENSE VEGETATION

90.5
91.0
91.5
92.0
92.5
93.0
93.5

NOTES

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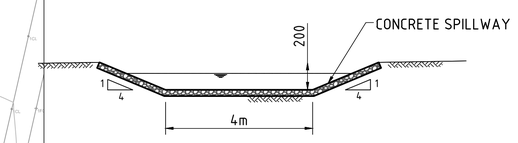
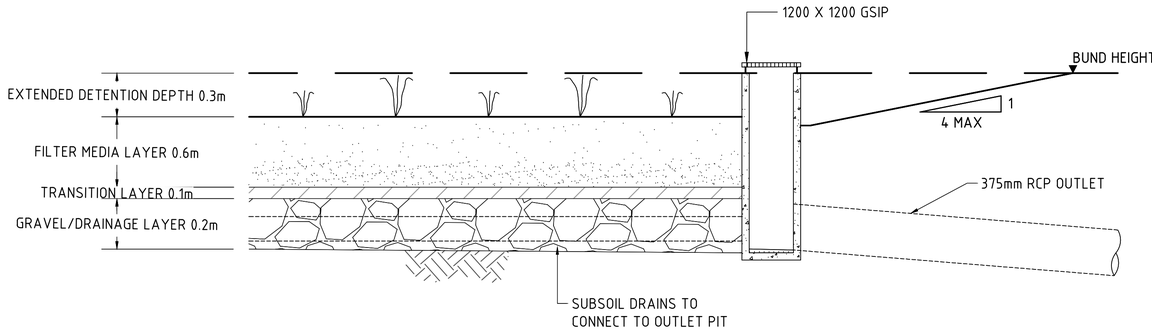
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE – ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
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MENANGLE PARK - MASTERPLAN
WSUD BASIN 6B

INFORMATION DOCUMENT

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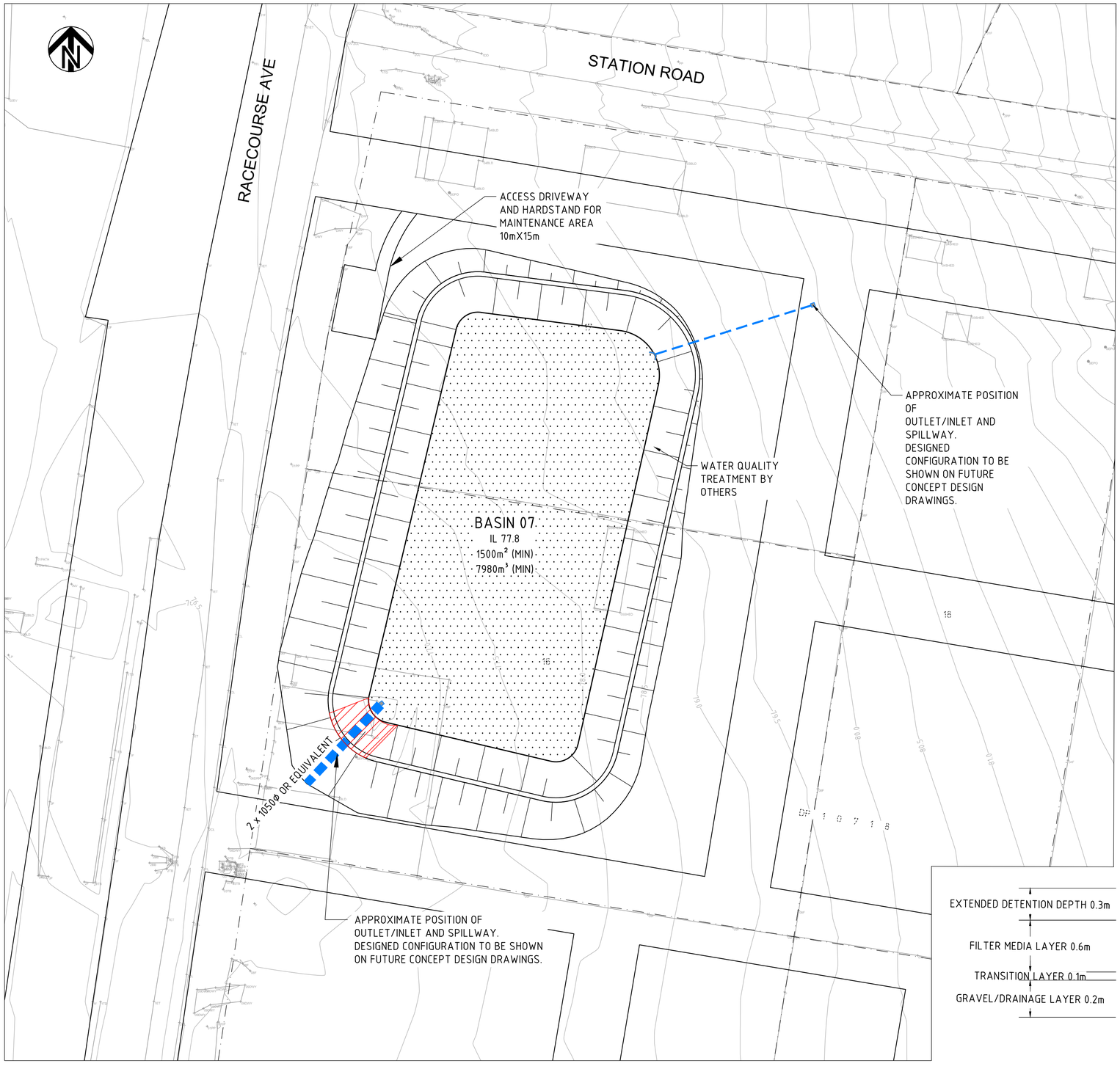

NOTES

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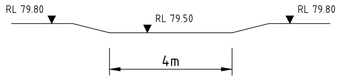
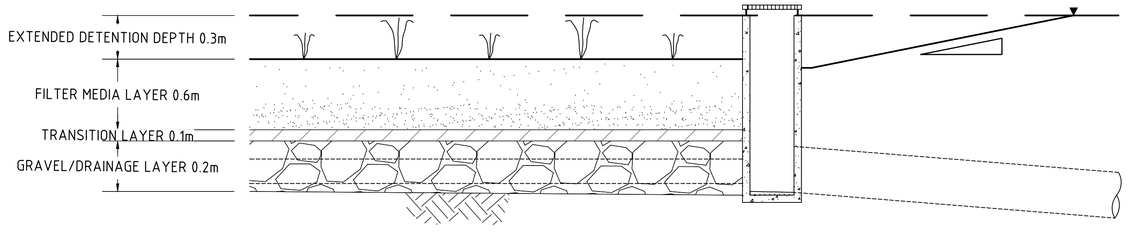
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



BASIN OUTLET ARRANGEMENT

SCALE 1:100



NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

SCALE 1:100 1 0 1 2 3 4 5

DRAWING FILE LOCATION / NAME

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MENANGLE PARK - MASTERPLAN

DETENTION/WSUD - BASIN 7

INFORMATION DOCUMENT

300178115_180711-BASIN 07 LAYOUT_FM_[ID]

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RACECOURSE AVE

HARDSTAND FOR
MAINTENANCE AREA 10mX15m

WATER QUALITY
TREATMENT BY OTHERS

APPROXIMATE POSITION OF
INLET/OUTLET AND SPILLWAY.
DETAILED CONFIGURATION TO BE SHOWN
ON FUTURE CONCEPT DESIGN DRAWINGS.

BASIN 08
IL 74.50
1500m² (MIN)
15165m³ (MIN)

2x900Ø OR EQUIVALENT

CONNECT TO EXISTING CULVERT UNDER
RACECOURSE AVENUE. APPROXIMATE
POSITION OF INLET/OUTLET AND SPILLWAY.
DETAILED CONFIGURATION TO BE SHOWN ON
FUTURE CONCEPT DESIGN DRAWINGS.

BEERSHEBA PARADE

DP 658926

DP 776612

DP 776612

NOTES

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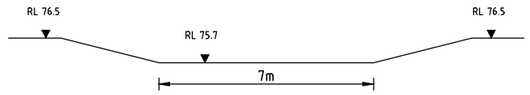
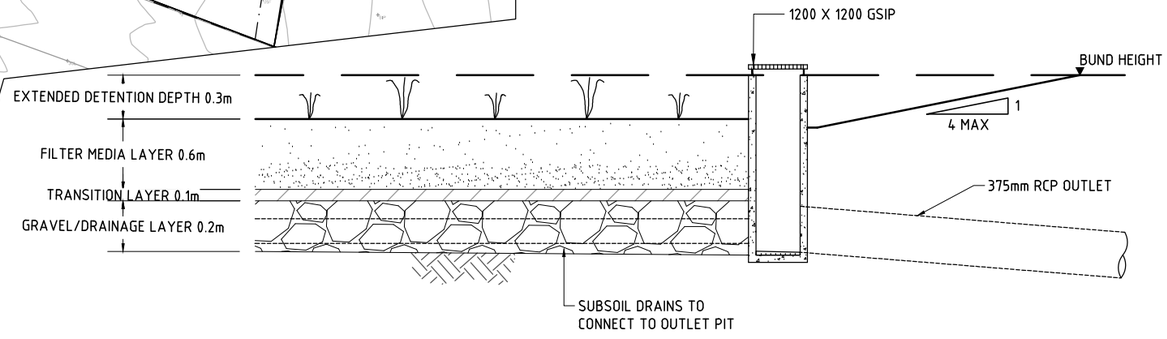
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



BASIN OUTLET ARRANGEMENT
SCALE 1:100



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20 SCALE 1:100 1 0 1 2 3 4 5

DRAWING FILE LOCATION / NAME
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MENANGLE PARK - MASTERPLAN
DENTENTION/WSUD - BASIN 8

INFORMATION DOCUMENT

300178115_181031-BASIN 08 LAYOUT_MJ_[ID]

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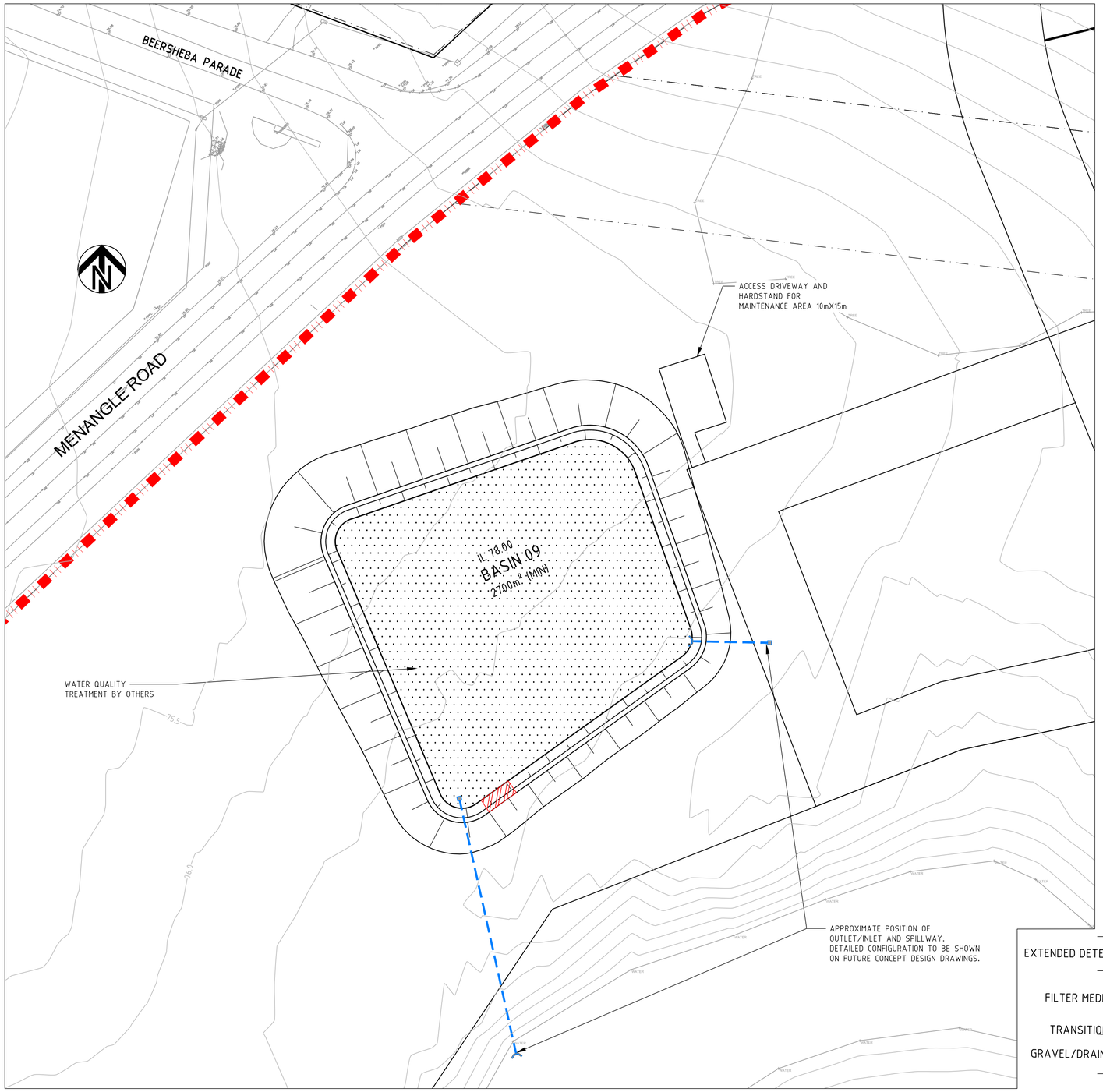

NOTES

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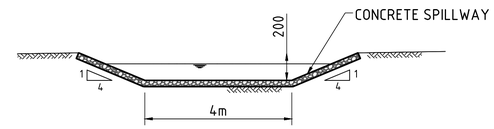
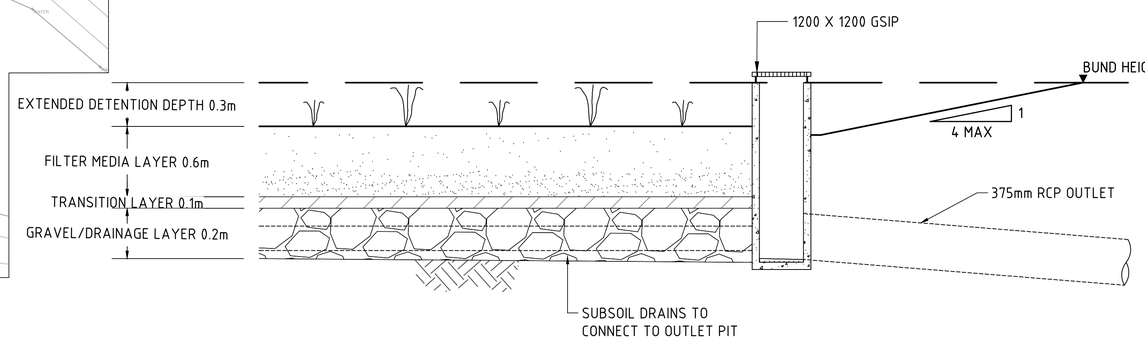
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
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MENANGLE PARK - MASTERPLAN
WSUD - BASIN 9

INFORMATION DOCUMENT

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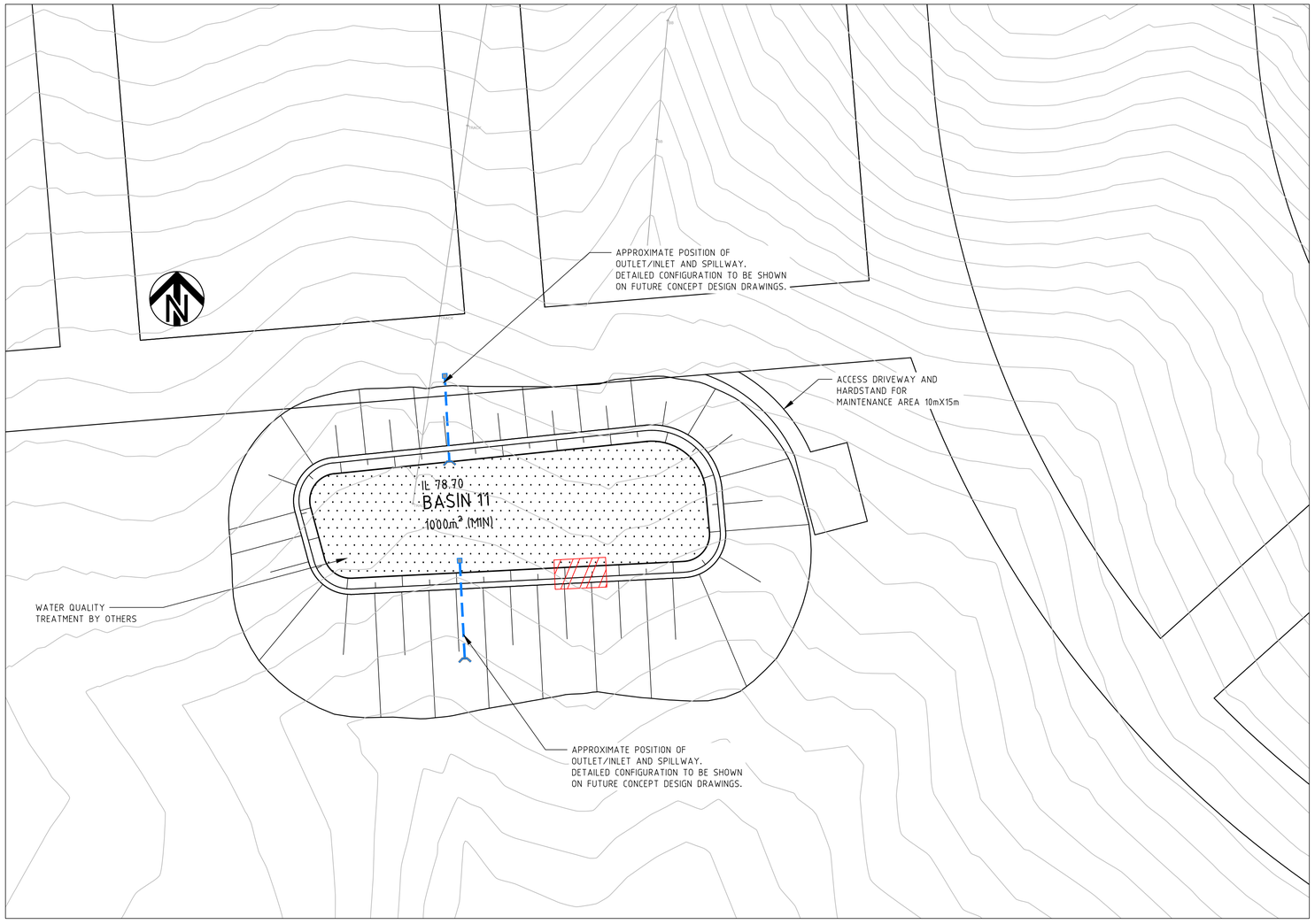

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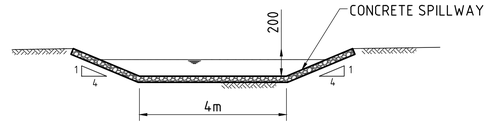
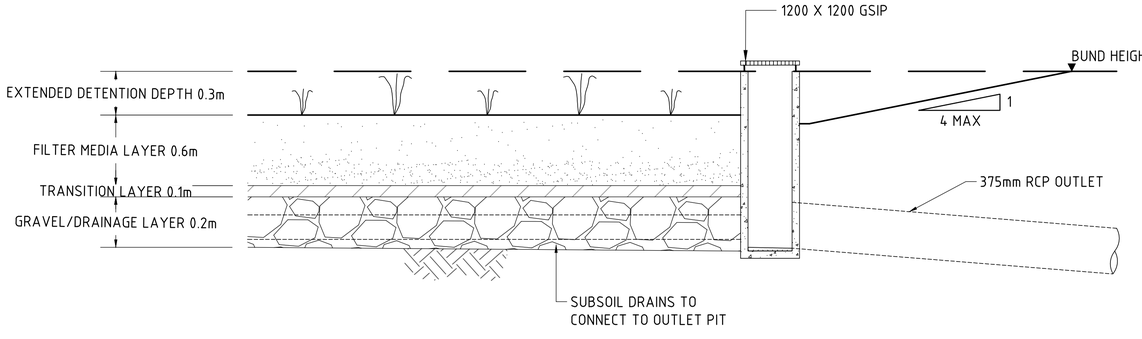
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS

N.T.S



WATER QUALITY POND

TYPICAL SECTION

SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME

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MENANGLE PARK - MASTERPLAN

WSUD - BASIN 11

INFORMATION DOCUMENT

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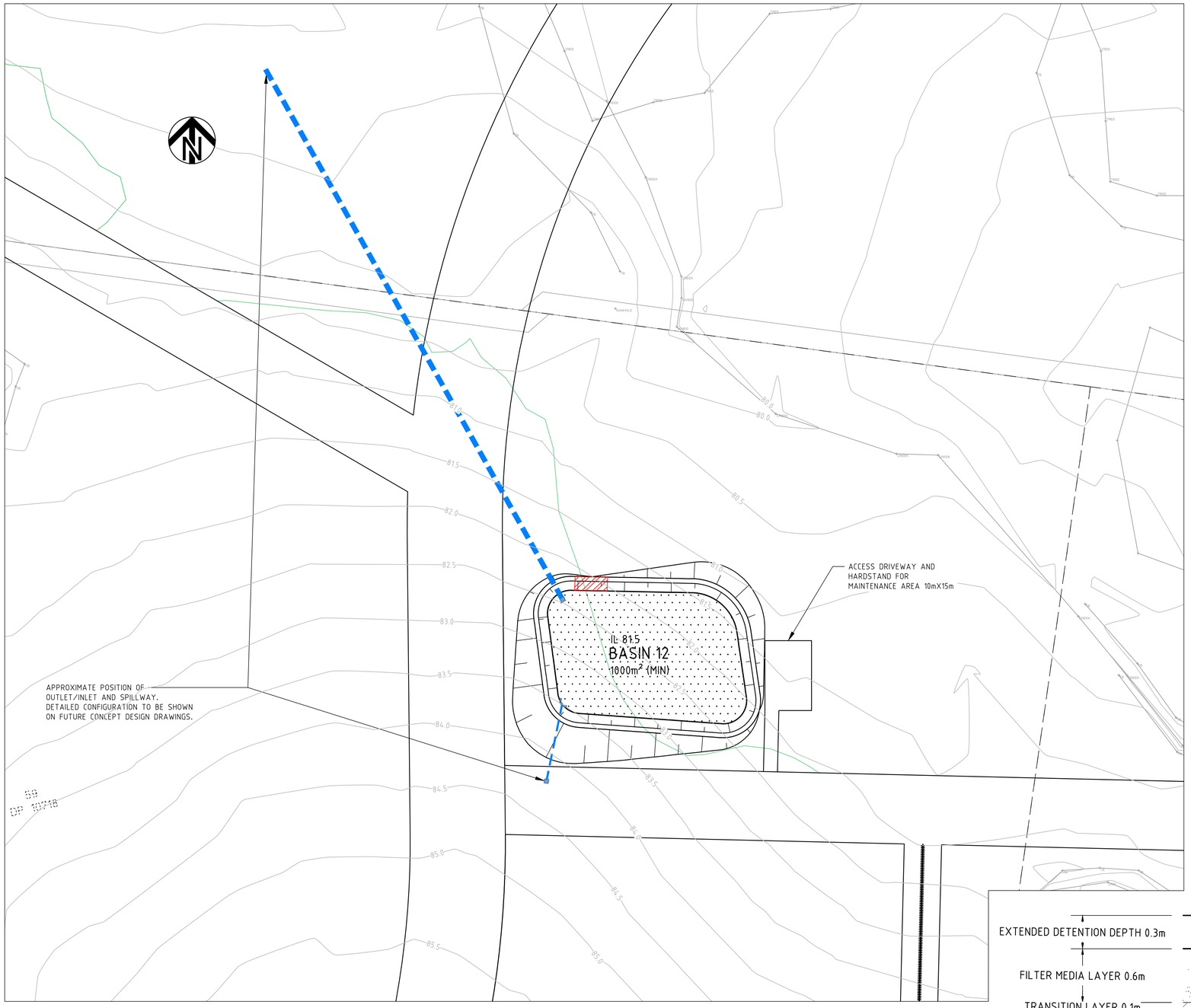

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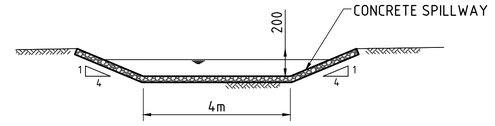
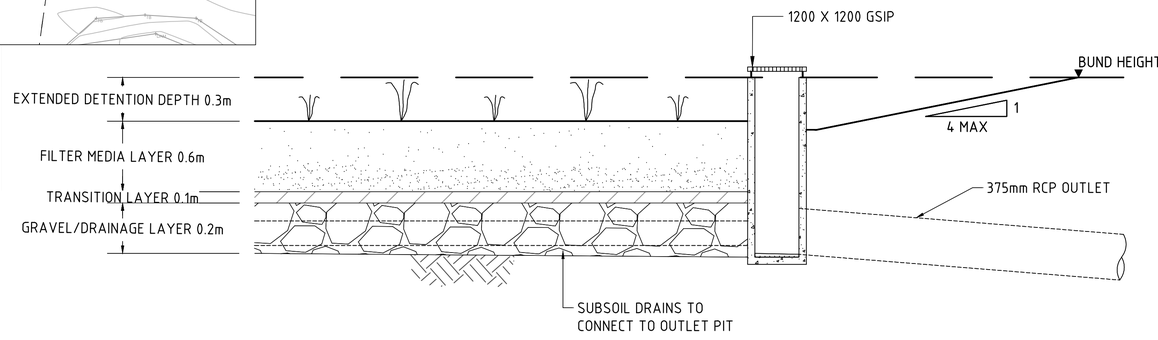
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE – ASSUMED DIA Φ375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
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MENANGLE PARK - MASTERPLAN
WSUD - BASIN 12

INFORMATION DOCUMENT

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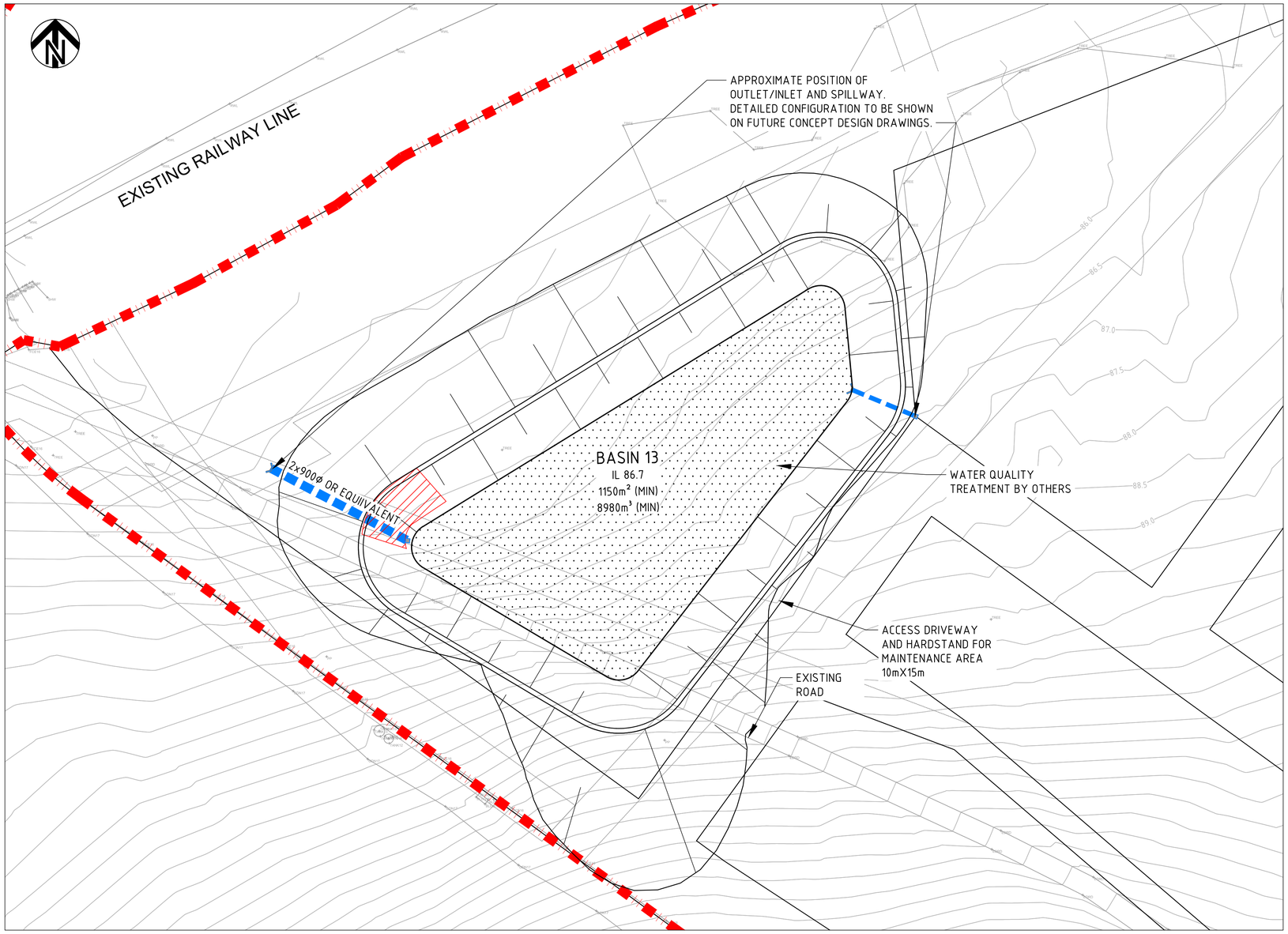

NOTES

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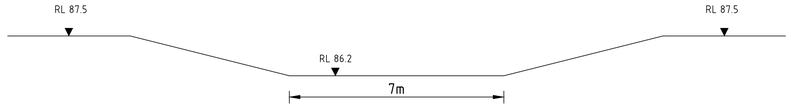
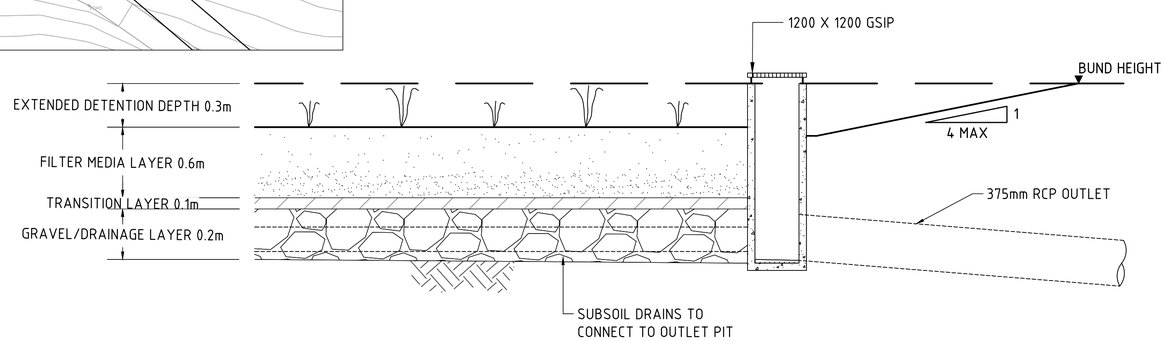
LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



BASIN OUTLET ARRANGEMENT

SCALE 1:100



WATER QUALITY POND

TYPICAL SECTION

SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

SCALE 1:100 1 0 1 2 3 4 5

DRAWING FILE LOCATION / NAME

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MENANGLE PARK - MASTERPLAN

DETENTION/WSUD - BASIN 13

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APPROXIMATE POSITION OF OUTLET/INLET AND SPILLWAY. DETAILED CONFIGURATION TO BE SHOWN ON FUTURE CONCEPT DESIGN DRAWINGS.

ACCESS DRIVEWAY AND HARDSTAND FOR MAINTENANCE AREA 10mX15m

BASIN BIO D
IL 81.5

BASIN BIO B
IL 84.5

BASIN BIO C
IL 82.5

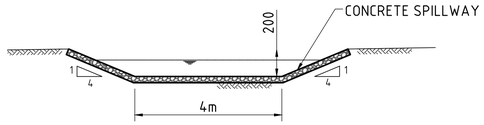
BASIN BIO A
IL 87.0

NOTES

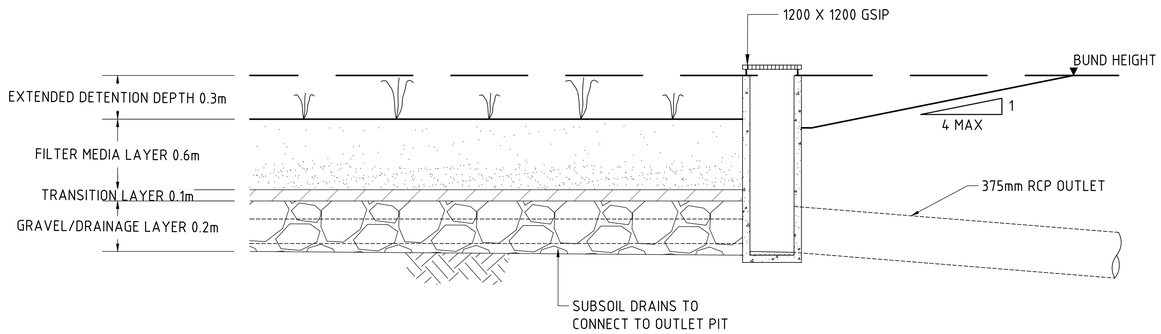
1. THE PURPOSE OF THIS LAYOUT PLAN IS TO PROVIDE AN INDICATION OF THE GENERAL FOOTPRINT OF THE BASIN.
2. PRELIMINARY SKETCHES OF BASIN FOOTPRINT ONLY. OUTLET AND SPILLWAY ARRANGEMENTS SHOWN INDICATIVELY AS THEY WILL BE DESIGNED AS PART OF THE NEXT CONCEPT DESIGN PHASE.
3. TOTAL 2000m^2 (MIN) REQUIRED

LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
J:\70thousands\78115\11. CAD\Info_Docs\300178115_180711-BASIN BIO_RETENTION_BASINS LAYOUT_FM_[ID].dwg

MENANGLE PARK - MASTERPLAN
WSUD -BASIN BIO - RETENTION BASINS

INFORMATION DOCUMENT

300178115_180711-BASIN BIO_RETENTION_BASINS LAYOUT_FM_[ID]

SMEC AUSTRALIA PTY LTD
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APPROXIMATE POSITION OF OUTLET AND SPILLWAY. CONFIGURATION TO BE SHOWN ON FUTURE CONCEPT DESIGN DRAWINGS.

IL 77.0
BASIN EMP
3300m² (MIN)

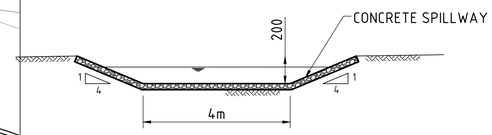
ACCESS DRIVEWAY HARDSTAND FOR MAINTENANCE AREA 10mX15m

NOTES

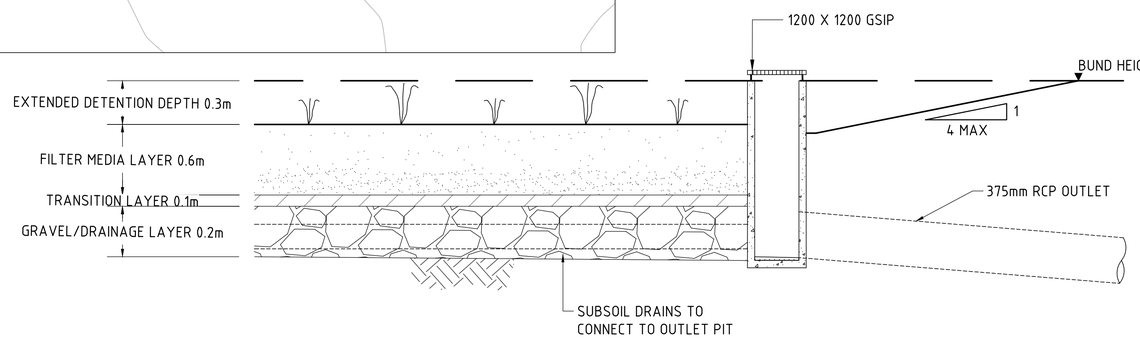
1. THE PURPOSE OF THIS LAYOUT PLAN IS TO PROVIDE AN INDICATION OF THE GENERAL FOOTPRINT OF THE BASIN.
2. PRELIMINARY SKETCHES OF BASIN FOOTPRINT ONLY. OUTLET AND SPILLWAY ARRANGEMENTS SHOWN INDICATIVELY AS THEY WILL BE DESIGNED AS PART OF DEVELOPMENT APPLICATION.

LEGEND

- SITE BOUNDARY
- FUTURE ROAD
- DRAINAGE PIPE - ASSUMED DIA Ø375
- RIPARIAN EDGE
- CADASTRAL BOUNDARY
- EXISTING ROAD BOUNDARY
- APPROXIMATE SPILLWAY LOCATION



SPILLWAY DETAILS
N.T.S



WATER QUALITY POND
TYPICAL SECTION
SCALE N.T.S.

NOT FOR CONSTRUCTION

SCALE 1:500 5 0 10 20

DRAWING FILE LOCATION / NAME
J:\70thousands\78115\11. CAD\Info__Docs\300178115__180711-BASIN EMP LAYOUT__FM__[ID] .dwg

MENANGLE PARK - MASTERPLAN
WSUD - BASIN EMPLOYMENT LAND

INFORMATION DOCUMENT

300178115_180711-BASIN EMP LAYOUT_FM_[ID]

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APPENDIX F – REGIONAL DRAINAGE COST ESTIMATES

Summary of Estimate of Costs Civil Works - Basins Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	14/11/2018

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Campbelltown NSW 2560
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DESCRIPTION		Amount	
Basin 02		$	3,282,000
Basin 03		$	602,000
Basin 04		$	1,438,000
Basin 05		$	376,000
Basin 06A		$	555,000
Basin 06B		$	457,000
Basin 07		$	1,274,000
Basin 08		$	1,289,000
Basin 09		$	1,087,000
Basin 10 (BIO A)		$	358,000
Basin 10 (BIO B)		$	356,000
Basin 10 (BIO C)		$	356,000
Basin 10 (BIO D)		$	356,000
Basin 11		$	606,000
Basin 12		$	546,000
Basin 13		$	823,000
Basin 14 (Bio Retention Employment Land)		$	1,442,000
Overland flow + drainage pipes - S2 to creek		$	470,000
	TOTAL	**$**	**15,673,000**

Assumptions for all cost estimates:

1 No allowance for rock, clay or waterlogged soils in bulk earthworks
2 Site insurances not included
3 Any fill material assumed to be site sourced
4 Outlet headwall assumed to accommodate 375mm pipe
5 No allowance for internal road drainage
6 No allowance for export of excess material off site
7 Basin floor assumed to be flat
8 Scour protection assumed infront of headwalls at 25m2 each
9 Survey, site set up, enviro and geotech reports assumed for whole site
10 GPT costed at unit price only
11 Landscaping and planting other than basin floor excluded
12 An allowance of 20% for contingencies has been made
13 No allowance has been made for management or maintenance of the basins

Estimate of Costs Civil Works - Basin 02 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
2	**Basin 02**				
2.1	**Bulk Earthworks**				
2.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	7000	$8,400.00
2.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.50	7000	$10,500.00
2.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	12600	$63,000.00
2.1.4	Trim & Consolidate Basins	m^2	2.00	7000	$14,000.00
2.2	**Furniture**				
2.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
2.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
2.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
2.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
2.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
2.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
2.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
2.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
2.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
2.2.10	GPT 2 - 3x GPT 41350	Item	270,000.00	3	$810,000.00
2.3	**Filter Media**				
2.3.1	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2 Water truck hire - excluding cost of water	Item	1,317,092.00	1	$1,317,092.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$469,000.00
	Contingency				
	Contingency	%	20%		$469,000.00
3	**Total (Rounded to nearest $1,000)**				**$3,282,000.00**

Estimate of Costs Civil Works - Basin 03 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

SMEC AUSTRALIA
ABN 47 065 475 149
Level 1, 178-180 Queen Street
Campbelltown NSW 2560
Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
3	**BASIN 03**				
3.1	**Bulk Earthworks**				
3.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1000	$1,200.00
3.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1000	$1,000.00
3.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	1500	$7,500.00
3.1.4	Trim & Consolidate Basins	m^2	2.00	1000	$2,000.00
3.2	**Furniture**				
3.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
3.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
3.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
3.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
3.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
3.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
3.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
3.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
3.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
3.2.10	GPT 3 - GPT 41050	Item	110,000.00	1	$110,000.00
3.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2	Item	188,156.00	1	$188,156.00
3.3.1	Water truck hire - excluding cost of water				
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$86,000.00
	Contingency				
	Contingency	%	20%		$86,000.00
3	**Total (Rounded to nearest $1,000)**				**$602,000.00**

Estimate of Costs Civil Works - Basin 04 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
4	**BASIN 04**				
4.1	**Bulk Earthworks**				
4.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	3000	$3,600.00
4.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	3000	$3,000.00
4.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	6600	$33,000.00
4.1.4	Trim & Consolidate Basins	m^2	2.00	3000	$6,000.00
4.2	**Furniture**				
4.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
4.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
4.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
4.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
4.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
4.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
4.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
4.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
4.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
4.2.10	GPT 4 - GPT 41350	Item	270,000.00	1	$270,000.00
4.2.11	GPT 4a - GPT 4600	Item	35,000.00	1	$35,000.00
4.3	**Filter Media**				
4.3.1	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2 Water truck hire - excluding cost of water	Item	564,468.00	1	$564,468.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$207,000.00
	Contingency				
	Contingency	%	20%		$207,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,438,000.00**

Estimate of Costs Civil Works - Basin 05 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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Level 1, 178-180 Queen Street
Campbelltown NSW 2560
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Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
5	**BASIN 05**				
5.1	**Bulk Earthworks**				
5.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	540	$648.00
5.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	540	$540.00
5.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	1620	$8,100.00
5.1.4	Trim & Consolidate Basins	m^2	2.00	540	$1,080.00
5.2	**Furniture**				
5.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
5.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
5.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
5.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
5.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
5.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
5.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
5.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
5.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
5.2.10	GPT 5 - GPT 4600	Item	35,000.00	1	$35,000.00
5.3	**Filter Media**				
5.3.1	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2 Water truck hire - excluding cost of water	Item	101,604.24	1	$101,604.24
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$54,000.00
	Contingency				
	Contingency	%	20%		$54,000.00
3	**Total (Rounded to nearest $1,000)**				**$376,000.00**

Estimate of Costs Civil Works - Basin 06A Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of fees
Revision	A
Issue Date	26/10/2018

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ABN 47 065 475 149
Level 1, 178-180 Queen Street
Campbelltown NSW 2560
Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
6	**BASIN 06A**				
6.1	**Bulk Earthworks**				
6.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1200	$1,440.00
6.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1200	$1,200.00
6.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	2160	$10,800.00
6.1.4	Trim & Consolidate Basins	m^2	2.00	1200	$2,400.00
6.2	**Furniture**				
6.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
6.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
6.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
6.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
6.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
6.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
6.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
6.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
6.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
6.2.10	GPT 6 - GPT 4600	Item	35,000.00	1	$35,000.00
6.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
6.3.1	Water truck hire - excluding cost of water	Item	225,787.20	1	$225,787.20
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$79,000.00
	Contingency				
	Contingency	%	20%		$79,000.00
3	**Total (Rounded to nearest $1,000)**				**$555,000.00**

Estimate of Costs Civil Works - Basin 07 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	14/11/2018

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Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
8	**BASIN 08**				
8.1	**Bulk Earthworks**				
8.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1500	$1,800.00
8.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1500	$1,500.00
8.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	6200	$31,000.00
8.1.4	Trim & Consolidate Basins	Item	2.00	1500	$3,000.00
8.2	**Furniture**				
8.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	1	$1,200.00
8.2.2	Supply and install 2x1050mm Headwall. Includes Webforge grating	each	8,000.00	1	$8,000.00
8.2.3	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
8.2.4	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
8.2.5	1200x1200 GSIP	each	5,000.00	1	$5,000.00
8.2.6	2400x2400 GSIP	each	10,000.00	1	$10,000.00
8.2.7	375mm dia RCP RRJ Class 3	m	110.00	50	$5,500.00
8.2.8	2x1050mm dia RCP RRJ Class 3 (outflow)	m	1,060.00	25	$26,500.00
8.2.9	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
8.2.10	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
8.2.11	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
8.2.12	Spillway - Concrete	Item	10,000.00	1	$10,000.00
8.2.13	GPT 7 - GPT 41500	Item	320,000.00	1	$320,000.00
8.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
8.3.1	Water truck hire - excluding cost of water	Item	282,234.00	1	$282,234.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	30%		$239,000.00
	Contingency				
	Contingency	%	30%		$239,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,274,000.00**

Estimate of Costs Civil Works - Basin 08 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	14/11/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
8	**BASIN 08**				
8.1	**Bulk Earthworks**				
8.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1500	$1,800.00
8.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1500	$1,500.00
8.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	6900	$34,500.00
8.1.4	Trim & Consolidate Basins	Item	2.00	1500	$3,000.00
8.2	**Furniture**				
8.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	1	$1,200.00
8.2.2	Supply and install 4x900mm Headwall. Includes Webforge grating	each	10,000.00	1	$10,000.00
8.2.3	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
8.2.4	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
8.2.5	1200x1200 GSIP	each	5,000.00	1	$5,000.00
8.2.6	2400x2400 GSIP	each	10,000.00	1	$10,000.00
8.2.7	375mm dia RCP RRJ Class 3	m	110.00	35	$3,850.00
8.2.8	2x900mm dia RCP RRJ Class 3	m	800.00	40	$32,000.00
8.2.9	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
8.2.10	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
8.2.11	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
8.2.12	Spillway - Concrete	Item	10,000.00	1	$10,000.00
8.2.13	GPT 8 - GPT 41500	Item	320,000.00	1	$320,000.00
8.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
8.3.1	Water truck hire - excluding cost of water	Item	282,234.00	1	$282,234.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	30%		$242,000.00
	Contingency				
	Contingency	%	30%		$242,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,289,000.00**

Estimate of Costs Civil Works - Basin 08 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
8	**BASIN 08**				
8.1	**Bulk Earthworks**				
8.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1500	$1,800.00
8.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1500	$1,500.00
8.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	6900	$34,500.00
8.1.4	Trim & Consolidate Basins	Item	2.00	1500	$3,000.00
8.2	**Furniture**				
8.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
8.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
8.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
8.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
8.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
8.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
8.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
8.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
8.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
8.2.10	GPT 8 - GPT 41500	Item	320,000.00	1	$320,000.00
8.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
8.3.1	Water truck hire - excluding cost of water	Item	282,234.00	1	$282,234.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	30%		$229,000.00
	Contingency				
	Contingency	%	30%		$229,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,222,000.00**

Estimate of Costs Civil Works - Basin 09 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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ABN 47 065 475 149
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Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
9	**BASIN 09**				
9.1	**Bulk Earthworks**				
9.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	2700	$3,240.00
9.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	2700	$2,700.00
9.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	5400	$27,000.00
9.1.4	Trim & Consolidate Basins	m^2	2.00	2700	$5,400.00
9.2	**Furniture**				
9.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
9.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
9.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
9.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
9.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
9.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
9.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
9.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
9.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
9.2.10	GPT 9 - GPT 41050	Item	110,000.00	1	$110,000.00
9.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
9.3.1	Water truck hire - excluding cost of water	Item	508,021.20	1	$508,021.20
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$155,000.00
	Contingency				
	Contingency	%	20%		$155,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,087,000.00**

Estimate of Costs Civil Works - Basin 10 (BIO A) Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
14	**BASIN BIO A**				
14.1	**Bulk Earthworks**				
14.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	500	$600.00
14.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	500	$500.00
14.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	750	$3,750.00
14.1.4	Trim & Consolidate Basins	m^2	2.00	500	$1,000.00
14.2	**Furniture**				
14.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
14.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
14.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
14.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
14.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
14.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
14.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
14.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
14.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
14.2.10	GPT 10 (1 of 4) - GPT 4600	Item	35,000.00	1	$35,000.00
14.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
14.3.1	Water truck hire - excluding cost of water	Item	94,078.00	1	$94,078.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$51,000.00
	Contingency				
	Contingency	%	20%		$51,000.00
3	**Total (Rounded to nearest $1,000)**				**$358,000.00**

Estimate of Costs Civil Works - Basin 10 (BIO B) Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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ABN 47 065 475 149
Level 1, 178-180 Queen Street
Campbelltown NSW 2560
Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
15	**BASIN BIOB**				
15.1	**Bulk Earthworks**				
15.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	500	$600.00
15.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	500	$500.00
15.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	500	$2,500.00
15.1.4	Trim & Consolidate Basins	m^2	2.00	500	$1,000.00
15.2	**Furniture**				
15.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
15.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
15.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
15.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
15.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
15.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
15.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
15.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
15.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
15.2.10	GPT 10 (1 of 4) - GPT 4600	Item	35,000.00	1	$35,000.00
15.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
15.3.1	Water truck hire - excluding cost of water	Item	94,078.00	1	$94,078.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$51,000.00
	Contingency				
	Contingency	%	20%		$51,000.00
3	**Total (Rounded to nearest $1,000)**				**$356,000.00**

Estimate of Costs Civil Works - Basin 10 (BIO C) Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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ABN 47 065 475 149
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Campbelltown NSW 2560
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Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
16	**BASIN BIOC**				
16.1	**Bulk Earthworks**				
16.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	500	$600.00
16.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	500	$500.00
16.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	500	$2,500.00
16.1.4	Trim & Consolidate Basins	m^2	2.00	500	$1,000.00
16.2	**Furniture**				
16.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
16.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
16.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
16.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
16.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
16.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
16.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
16.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
16.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
16.2.10	GPT 10 (1 of 4) - GPT 4600	Item	35,000.00	1	$35,000.00
16.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
16.3.1	Water truck hire - excluding cost of water	Item	94,078.00	1	$94,078.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$51,000.00
	Contingency				
	Contingency	%	20%		$51,000.00
3	**Total (Rounded to nearest $1,000)**				**$356,000.00**

Estimate of Costs Civil Works - Basin 10 (BIO D) Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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Level 1, 178-180 Queen Street
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Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
17	**BASIN BIOD**				
17.1	**Bulk Earthworks**				
17.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	500	$600.00
17.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	500	$500.00
17.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	500	$2,500.00
17.1.4	Trim & Consolidate Basins	m^2	2.00	500	$1,000.00
17.2	**Furniture**				
17.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
17.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
17.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
17.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
17.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
17.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
17.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
17.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
17.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
17.2.10	GPT 10 (1 of 4) - GPT 4600	Item	35,000.00	1	$35,000.00
17.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
17.3.1	Water truck hire - excluding cost of water	Item	94,078.00	1	$94,078.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$51,000.00
	Contingency				
	Contingency	%	20%		$51,000.00
3	**Total (Rounded to nearest $1,000)**				**$356,000.00**

Estimate of Costs Civil Works - Basin 11 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
10	**BASIN 11**				
10.1	**Bulk Earthworks**				
10.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1000	$1,200.00
10.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1000	$1,000.00
10.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	2700	$13,500.00
10.1.4	Trim & Consolidate Basins	m^2	2.00	1000	$2,000.00
10.2	**Furniture**				
10.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
10.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
10.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
10.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
10.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
10.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
10.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
10.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
10.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
10.2.10	GPT 11 - GPT 4900	Item	80,000.00	1	$80,000.00
10.2.11	GPT 15 - 4x GPT 4200	Item	9,000.00	4	$36,000.00
10.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
10.3.1	Water truck hire - excluding cost of water	Item	188,156.00	1	$188,156.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$88,000.00
	Contingency				
	Contingency	%	20%		$88,000.00
3	**Total (Rounded to nearest $1,000)**				**$606,000.00**

Estimate of Costs Civil Works - Basin 12 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
12	**BASIN 12**				
12.1	**Bulk Earthworks**				
12.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1000	$1,200.00
12.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1000	$1,000.00
12.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	1500	$7,500.00
12.1.4	Trim & Consolidate Basins	m^2	2.00	1000	$2,000.00
12.2	**Furniture**				
12.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
12.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
12.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
12.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
12.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
12.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
12.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
12.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
12.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
12.2.10	GPT 12 - 2x GPT 4600	Item	35,000.00	2	$70,000.00
12.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
12.3.1	Water truck hire - excluding cost of water	Item	188,156.00	1	$188,156.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$78,000.00
	Contingency				
	Contingency	%	20%		$78,000.00
3	**Total (Rounded to nearest $1,000)**				**$546,000.00**

Estimate of Costs Civil Works - Basin 13 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	14/11/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
13	**BASIN 13**				
13.1	**Bulk Earthworks**				
13.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	1150	$1,380.00
13.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	1150	$1,150.00
13.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	6200	$31,000.00
13.1.4	Trim & Consolidate Basins	m^2	2.00	1150	$2,300.00
13.2	**Furniture**				
13.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	1	$1,200.00
13.2.2	Supply and install 2x900mm Headwall. Includes Webforge grating	each	6,000.00	1	$6,000.00
13.2.3	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
13.2.4	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
13.2.5	1200x1200 GSIP	each	5,000.00	1	$5,000.00
13.2.6	2400x2400 GSIP	each	10,000.00	1	$10,000.00
13.2.7	375mm dia RCP RRJ Class 3	m	110.00	43	$4,730.00
13.2.8	2x900mm dia RCP RRJ Class 3	m	800.00	32	$25,600.00
13.2.9	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
13.2.10	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
13.2.11	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
13.2.12	Spillway - Concrete	Item	10,000.00	1	$10,000.00
13.2.13	GPT 13 - GPT 41050	Item	110,000.00	1	$110,000.00
13.3	**Filter Media**				
	Supply and install basin floor inclusive of the below:				
	Slotted underdrain pipes				
	(a) 100mm dia., supply and install				
	(b) 150mm dia., supply and install				
	Clean out points for slotted pipes				
	(a) 100mm dia.				
	(b) 150mm dia.				
	Geofabric to base and walls.				
	200mm gravel drainage + 400mm saturated zone				
	(a) Supply and delivery				
	(b) install				
	Hardwood woodchips				
	(a) Supply and install				
	(b) Install to transition sand layer as directed				
	100mm Sand Transition layer				
	(a) Supply and delivery				
	(b) Install				
	Filter material 600mm deep				
	(a) Supply and delivery				
	(b) Install				
	Rock energy dissipation				
	(a) Roack placed at inlet				
	Inflow distribution (150mm half pipe)				
	Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
13.3.1	Water truck hire - excluding cost of water	Item	216,379.40	1	$216,379.40
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	30%		$154,000.00
	Contingency				
	Contingency	%	30%		$154,000.00
3	**Total (Rounded to nearest $1,000)**				**$823,000.00**

Estimate of Costs Civil Works - Basin 14 Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	26/10/2018

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SMEC AUSTRALIA
ABN 47 065 475 149
Level 1, 178-180 Queen Street
Campbelltown NSW 2560
Phone : 02 4640 8222
Email : ben.cork@smec.com

	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging). Survey of stripped levels prior to commencement of filling.	Item	12,000.00	1	$12,000.00
1.2.2	Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
17	**BASIN BIOD**				
17.1	**Bulk Earthworks**				
17.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	3300	$3,960.00
17.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	3300	$3,300.00
17.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	990	$4,950.00
17.1.4	Trim & Consolidate Basins	m^2	2.00	3300	$6,600.00
17.2	**Furniture**				
17.2.1	Supply and install 375mm Headwall. Includes Webforge grating	each	1,200.00	2	$2,400.00
17.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	72.00	50	$3,600.00
17.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
17.2.4	1200x1200 GSIP	each	5,000.00	2	$10,000.00
17.2.5	375mm dia RCP RRJ Class 3	m	110.00	75	$8,250.00
17.2.6	Hardstand and Driveway - Concrete	m^2	70.00	190	$13,300.00
17.2.7	Base - assumed 150mm DGB20	m^2	19.00	190	$3,610.00
17.2.8	Sub-base - assumed 330mm	m^2	25.00	190	$4,750.00
17.2.9	Spillway - Concrete	Item	10,000.00	1	$10,000.00
17.2.10	GPT 14 - GPT 41350	Item	270,000.00	1	$270,000.00
17.3	**Filter Media**				
	Supply and install basin floor inclusive of the below: Slotted underdrain pipes (a) 100mm dia., supply and install (b) 150mm dia., supply and install Clean out points for slotted pipes (a) 100mm dia. (b) 150mm dia. Geofabric to base and walls. 200mm gravel drainage + 400mm saturated zone (a) Supply and delivery (b) install Hardwood woodchips (a) Supply and install (b) Install to transition sand layer as directed 100mm Sand Transition layer (a) Supply and delivery (b) Install Filter material 600mm deep (a) Supply and delivery (b) Install Rock energy dissipation (a) Roack placed at inlet Inflow distribution (150mm half pipe) Planting area including 150mm subsoil cultivation, 200mm topsoil, 75mm mulch planting (mix tube stock - pot size) 12/m2				
17.3.1	Water truck hire - excluding cost of water	Item	620,914.80	1	$620,914.80
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$206,000.00
	Contingency				
	Contingency	%	20%		$206,000.00
3	**Total (Rounded to nearest $1,000)**				**$1,442,000.00**

Estimate of Costs Civil Works - S2 Chanel/Pipe Menangle Park

Job Name	Menangle Park Basin Cost Estimates
Client	Dahua Group Australia
Job No	78115
File No.	78115 - Basin - Estimate of Civil Construction Costs
Revision	A
Issue Date	14/11/2018

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	Description	Unit	Price	QTY	Amount
1.1	**General**				
1.1.1	Site establishment and setting out of works - including site security fences, dust/shade cloth and all WH&S requirements. Inclusive of all safety barrier fencing required during the works. Inclusive of all site security measures for the duration of the works.	Item	12,000.00	1	$12,000.00
1.1.2	Prepare Site Management Plan and Environmental Management Plan.	Item	5,000.00	1	$5,000.00
1.1.3	ATF fencing to perimeter of site (Maximum 6 month hire)	m	15.00	1500	$22,500.00
1.1.4	Geotechnical testing & reporting (strip inspections, level 1 fill testing for cut to fill on site only, supervision & pavement testing)	Item	12,000.00	1	$12,000.00
1.2	**Survey**				
1.2.1	Survey & setout of all associated construction works inclusive of all services (excludes boundary pegging).	Item	12,000.00	1	$12,000.00
1.2.2	Survey of stripped levels prior to commencement of filling. Survey of final fill levels and provision of fill plans (pdf & dwg format)	Item	700.00	1	$700.00
17	**BASIN BIOD**				
17.1	**Bulk Earthworks**				
17.1.1	Strip topsoil from construction areas all stages (average 150mm thick) and stockpile onsite to be respread on lots & footpaths.	m^2	1.20	900	$1,080.00
17.1.2	Replace topsoil 200mm thick to berms, batters, swales and site regrading areas.	m^2	1.00	900	$900.00
17.1.3	Excavate in OTR material all roads, footpaths, lots, batters, basins, swales and regrade areas and cart to fill areas. Spread, from and compact to Council requirements.	m^3	5.00	900	$4,500.00
17.1.4	Trim & Consolidate Batters	m^2	2.00	900	$1,800.00
17.2	**Furniture**				
17.2.1	Supply and install 1800 mm Headwall. Includes Webforge grating	each	8,000.00	2	$16,000.00
17.2.2	Supply and place 360mm thick scour protection/ rip rap with A44 bidum.	m^2	150.00	50	$7,500.00
17.2.3	Interpretive Signage - Provisional allowance due to insufficient detail (Provisional)	Item	500.00	1	$500.00
17.2.5	1800mm dia RCP RRJ Class 3	m	1,000.00	240	$240,000.00
	Construction Supervision and Project Management				
	Construction Supervision and Project Management	%	20%		$67,000.00
	Contingency				
	Contingency	%	20%		$67,000.00
3	**Total (Rounded to nearest $1,000)**				**$470,000.00**

APPENDIX G – LAND APPLICATION MAP

N

GLENLEE HOUSE

Transgrid

SPRING FARM PARKWAY

Railway Line

CUMMINS ROAD

CLUB MENANGLE

NEPEAN RIVER

MENANGLE PARK STATION

Private Lot

MENANGLE ROAD

HUME HIGHWAY

LEGEND

- Master Plan Boundary

DWELLING TYPOLOGIES

- Top Shop Apartments
- Medium Density Lots
- Low Density Lots
- Large Lots
- Rural
- Rural / Private Open Space

NON RESIDENTIAL USES

- Neighbourhood Centre
- School
- Employment
- Infrastructure
- Transgrid
- Racing
- Riparian
- Riparian/Flood (30m)
- Riparian/Flood (15m)
- Riparian/Flood (45m)
- Ecology
- Field/Open Space
- Park/Open Space
- Future Open Space (>0.5ha)
- Indicative Open Space/Civic Area
- Additional two playing fields (Approx 2.5ha–Detailed locations TBC)

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DRAFT

1: 4000 SIZE A3

CADASTRAL INFORMATION
SOURCE: Craig and Rhodes Survey
YYMMDD: 18/10/31
DWG REF: 1786
PROJECTION: GDA94, MGA56

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
E	DESIGN AMENDMENT	18.04.27	DC	AK
D	DESIGN AMENDMENT	18.04.16	DC	AK
C	DESIGN AMENDMENT	18.04.13	DC	AK
B	DESIGN WORKSHOP	18.04.11	DC	AK
A	DESIGN AMEMDMENT	18.04.10	DC	AK

DRAFT

MASTERPLAN
Menangle Park
Campbelltown City Council

REF NO. DRAW NO. REV.
DRU–MEN RD04.0 E

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY