Eastern Creek Raceway
Southern Track Extension

Stormwater Management
Strategy Report

Prepared for:
Australian Racing Driving Club
c/- Evolve Projects

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Prepared by:

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

PO Box 4366
WESTFIELD NSW 2750
DX 8032 PENRITH
P 02 4720 3300
F 02 4721 7638
W www.jwprince.com.au
E jwp@jwprince.com.au

J. WYNDHAM PRINCE

CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

EASTERN CREEK RACEWAY
SOUTHERN TRACK EXTENSION
STORMWATER MANAGEMENT STRATEGY REPORT

- DOCUMENT CONTROL SHEET -

Issue No.	Amendment	Prepared By & Date	Checked By and Date	Approved By and Date
A	Issue for Client Review	CR (26/08/11)	PM (26/08/11)	PM (26/08/11)
B	Issue for DOP Approval	CR (31/08/11)	PM (31/08/11)	PM (31/08/11)
C	Issue for DOP Approval (minor amendment)	CR (01/09/11)	PM (01/09/11)	PM (01/09/11)
D**	Re-issue for DOP Approval (Section 96 amendments)	CR (30/01/12)	PM (31/01/12)	PM (31/01/12)

** For the purposes of clarity, Revision D amendments are shown in red herein.

J. WYNDHAM PRINCE

CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

EASTERN CREEK RACEWAY, SOUTHERN TRACK EXTENSION
STORMWATER MANAGEMENT STRATEGY REPORT

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EXECUTIVE SUMMARY

This report has been prepared to support the DA application for the proposed track extension works at Eastern Creek Raceway. The proposed extension works include the construction of a new pit lane, single building structure (combined control tower / garage), carpark pavement area, track extension and associated earthworks.

Investigation works in this report have been prepared to extend the existing Overall Site Stormwater Strategy to include the new track extension proposed works.

Revision C of this report was previously submitted to the Department of Planning (DOP) in September 2011. DA Approval was consequently granted by DOP in late 2011 with design and construction commencing thereafter.

Major site constraints (optic fibre services) have however recently been discovered that bisect the approved Detention Basin A location, which restricts the required detention volume from being achieved. **Revision D** of this report has subsequently been prepared for re-submission under a Section 96 application. The modified works include the introduction of an additional detention Basin B to accompany the maximised detention storage at Basin A. The combined effect of the attenuating basins have been designed to achieve the overall pre-post requirements.

The primary objective of this investigation is to identify all stormwater issues related to the proposed extension works to ensure that they are incorporated in the detailed design stage. This includes making recommendations on any additional water quality and quantity treatment devices which are to ensure compliance with Blacktown City Council guidelines. Details on land area and outlet arrangements are made as required.

The existing stormwater configuration consists of a combination of concrete pipes, grassed channels, retarding basins and quality treatment devices. There are three (3) existing ponds / basins situated on site within the vicinity of the track extension proposed works. An assessment of the performance of existing basins shows that flows are being attenuated by both Existing Basins 2 and 3. Existing Basin 3 attenuates peak flows by approximately 13% in 100 year ARI and 43% in the 5 year ARI. Similarly Existing Basin 2 attenuates the peak flows between 80-85% for a range of ARI events.

The proposed stormwater strategy includes the construction of two (2) additional detention basins in order to satisfy Blacktown City Council's permissible site discharge rates. These basins have been sized to contain a combined 5273 m^3 of detention storage with staged outlet arrangements. Each of the two (2) Basins include both a low level piped outlet and a high level rock lined weir (where Basin A includes a discharge control pit while Basin B includes a headwall outlet).

The DCS February report (Ref.5) has adopted an *assumed fraction impervious of 15%* across its catchments in order to make recommendations on basin size and arrangement. JWP investigations indicate however that the fraction impervious across the existing catchment draining to Existing Basin 1 is 11.8% (measured digitally). By adopting all new impervious areas from the proposed track extension this would be increased to 14.4%. Results subsequently indicate that the Existing Basin 1 has been sized to attenuate flows from the new track extension works and a new detention basin is not required in this area.

As requested by Blacktown City Council, the pipe network will be sized to convey 20 year ARI flows from the new development areas wherever possible. However it is noted that the existing pipe network across the site is only sized for the 5 year ARI.

The proposed stormwater strategy also includes a number of water quality treatment devices in order to satisfy Blacktown City Council's guidelines. *MUSIC* modelling was

undertaken to demonstrate that the "treatment train" will achieve reductions in the overall post-development pollutant loads from proposed works. Devices included in the strategy include:

- Rainwater tank from roofed areas;
- Gross Pollutant Traps over outlets;
- One (1) x Bio-retention raingarden and permanent wetland;
- The size of the bio-retention raingarden has been sized as 1400 m^2

Due to the conditions and risks associated with racing meets, rapid response procedures are in place to treat any oil or fuel spills which occur across the site. The potential for pollutant runoff is subsequently significantly reduced from that which may occur on a typical street or industrial site. The proposed stormwater strategy will maintain the implementation of these safety procedures.

Provision of two (2) proposed detention basins within the development works will ensure that peak post development discharges are restricted to both pre development levels and Blacktown City Council's permissible site discharge.

Provision of the proposed water quality treatment devices within the development works will ensure that the quality of the post development stormwater discharges will meet the requirements of the NSW Department of Planning and Blacktown City Council.

The proposed Stormwater Management Strategy provides a basis for the detailed design and development of the site to ensure that the objectives for stormwater management and water quality are achieved.

1 INTRODUCTION

The Australian Racing Drivers Club Limited (ARDC) propose to undertake track extension works to the Eastern Creek International Raceway. These proposed works will include track extension works, associated earthworks and two (2) detention basins, a new pit lane, combined garage / control tower and associated pavement area. We understand that the proposed works will be undertaken under a "design and construct" contract.

Several Stormwater Management Studies have previously been undertaken (by others) on the subject site in the early to mid 1990's. The latter studies assessed the performances of existing piped systems and made recommendations for the installation of both water quality and quantity treatment devices as well as pipe upgrades across the site. These studies were based on the existing track configuration and represent the "Overall Site Stormwater Strategy". Refer to Section 2 for further discussion.

Revision C of this report was previously submitted to the Department of Planning (DOP) in September 2011 by JWP to support the current DA application of the proposed track extension works. These investigations were prepared to extend the existing Overall Site Stormwater Strategy to include the new works. Details of the procedures used and results obtained were then summarised for assessment. DA Approval was consequently granted by DOP in late 2011 with design and construction commencing thereafter.

Major site constraints (optic fibre services) have however recently been discovered that bisect the approved Detention Basin A location, which restricts the required detention volume from being achieved. **Revision D** of this report has subsequently been prepared for re-submission under a Section 96 application. The modified works include the introduction of an additional detention Basin B to accompany the maximised detention storage at Basin A. The combined effect of the attenuating basins are then designed to achieve the overall pre-post requirements.

The purpose of this study is to assess all site areas directly affected by the proposed track extension works and identify an appropriate stormwater strategy to ensure compliance with the current Blacktown City Council Guidelines. Recommendations on the treatment of proposed works are made to augment those treatment devices previously mentioned in the Overall Site Stormwater Strategy. For an overall understanding on how water is managed on the Racing Site, this report should be read in conjunction with the October 1996 report (Ref. 1)

This study is limited to stormwater and water quality issues associated with proposed works and does not include an assessment on the existing system.

1.1 Objectives

The primary objective of this investigation is to identify all stormwater issues related to the proposed extension works to ensure they are incorporated in the detailed design stage.

The investigation identifies an appropriate strategy to ensure both the quantity and quality of stormwater runoff exiting the area of proposed works is consistent with both Council's (a) *Blacktown City Council's Engineering guide for development (Ref. 2); and (b) Blacktown City Council's Water Sensitive Urban Design and Integrated Water Cycle Management DCP (Ref. 3)*. Recommendations on land area and outlet arrangements are made as required.

1.2 Methodology

The following methodology has been adopted in this report:

- Assess the existing stormwater network and configuration;
- Review of critical issues, constraints and opportunities (including the recent endorsed Part R of BCC DCP);
- Review of previous reports and drawings;
- Develop an *XP-RAFTS* Model to represent the existing catchment conditions within the vicinity of the proposed extension works. Determine pre-development flows;
- Assess the performance of the existing basin arrangements within *XP-RAFTS;*
- Amend the existing catchment *XP-RAFTS* Model to include the proposed development works. Determine post development flows;
- Confirm size and configuration of the two (2) proposed detention storage basins required to adequately reduce post development flow to pre development levels. Confirm the models performance for 5, 20, and 100 year ARI local storm events;
- Confirm size and configuration of the two (2) proposed detention storage basins required to adequately reduce post development flow to satisfy the requirements of Blacktown City Council's DCP (in particular the permissible site discharge rate);
- Develop a *MUSIC* water quality model for the post development site. Determine the size of the water quality treatment train components to ensure compliance with minimum performance targets;

The proposed track extension works under the current DA submission is split into two distinct areas (refer to Figure 5). For the purposes of this assessment, these development areas shall be known as "P1" and "P2".

The above mentioned methodology has been adopted to determine suitable sized detention basins for those proposed works which are situated within P1. Proposed works at catchment P2 drain to Existing Basin 1 – which was designed by others to attenuate fraction impervious areas of 15%. Assessment has been made in this study to confirm whether the proposed works in area P2 will increase the impervious areas above the 15% allowance made in the modelling that supported the original basin design. This would confirm whether additional detention is required in this catchment. Refer to Section 4.3.2 for full discussion.

JWP have also prepared Stormwater Drainage Concept Plans (9284CC59-61 & 9284/SK1) for the proposed track extension works, this report should be read in conjunction with the drawing set.

2 EXISTING SITE

2.1 The Site

The Eastern Creek International Raceway is situated approximately 40km west of Sydney at Eastern Creek within the municipality of Blacktown.

The racing track was initially constructed in 1990 and the first international event staged at this racetrack was the Motor Cycle Grand Prix in September 1990.

The overall raceway site is bounded by Ferrers Road to the West, Peter Brock Drive to the North, Prospect Reservoir to the East and the Western Sydney International Dragway to the South. The M4 motorway is also situated approximately 150 m to the north, while both the M7 motorway and Eastern Creek floodplain is situated to the west.

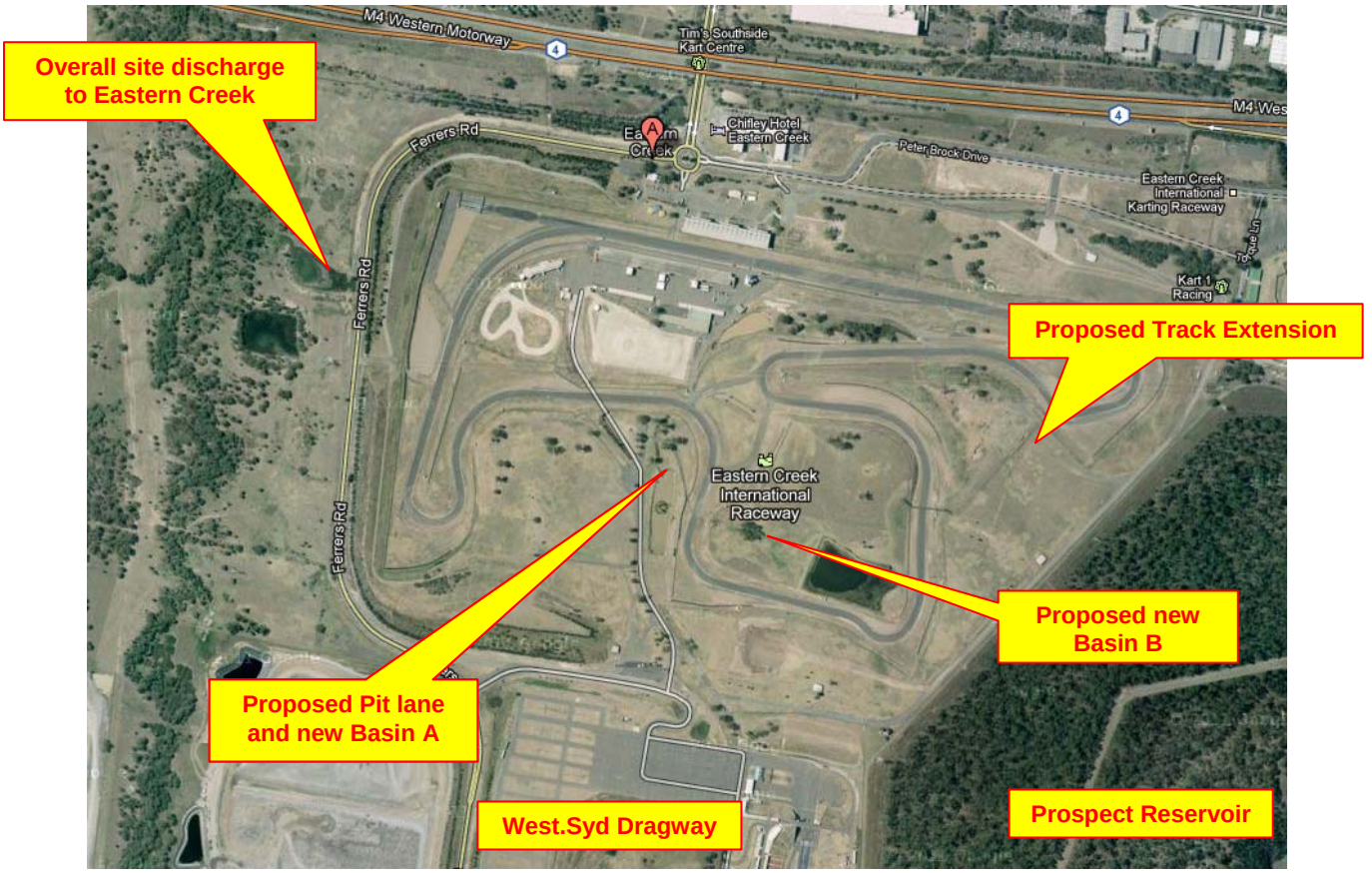


Plate 1: Location of Eastern Creek Raceway

The existing site has an average fraction impervious of 15%. Those areas of development which were initially constructed in the early 1990's include roadways (circulation and track), pit lane, carparks, grandstand, office building and amenities blocks. The remaining areas consist of grassed areas and sand traps.

The terrain is generally undulating with slopes up to 13% while the site drains to Eastern Creek flood plain to the west of Ferrers Road.

2.2 Existing Drainage Configuration

The existing stormwater configuration consists of a combination of concrete pipes, grassed channels, retarding basins and quality treatment devices. The following has been confirmed from site visits and aerial imagery. (Refer to Figure 1):

- There are three (3) existing ponds / basins across the site. Each has a permanent water body and currently provides storage for both retention and detention:
    - **Basin 1** is situated immediately adjacent to the existing carpark / track area. The outlet arrangement has a 3.5 - 6 m wide formalised rock lined concrete weir. The low level outlet consists of an existing grate elevated above the permanent top water level and allows flows to enter the piped system. There is also a floating boom present which we understand is used for quality treatment;
    - **Basin 2** is an original farm dam which has been maintained within Eastern Creek raceway. At some stage, the outlet arrangement has been formalised to include a 525 mm dia pipe along with a high level weir (approximately 3 m wide grassed weir at approximately 1 m above existing top water level);
    - **Basin 3** is an elongated existing dam. The outlet arrangement does not currently include a piped outlet but instead a 1 – 3.5 m wide channel which exits the basin just above the existing top water level. The remaining embankment length along the downstream side is elevated approximately 0.6 m above the existing top water level.
- Grassed channels and pipe networks typically collect stormwater runoff across the site and convey to the retarding basins. There are numerous positions where the pipe network crosses beneath the existing track.
- Trunk drainage pipes convey flows from Basins 1 and 3 beneath the existing racetrack, skidpan and carpark areas. The trunk system discharges via a headwall to the Eastern Creek floodplain to the west;
- The existing Western Sydney International Dragway Centre is situated immediately south of the subject site. Site investigations have confirmed that the stormwater discharge from this site is directed via a piped system into our subject site. Flows are discharged via a headwall near the Gate 7 entry and are conveyed overland through the site. The swale runs parallel to the circulation road and connects to a headwall and piped system before entering Basin 3.

2.3 Review of Existing Studies and Reports

Three (3) Stormwater Drainage Management Reports have previously been prepared for the Eastern Creek Raceway site. A brief description of each strategy is provided below:

<u>Rankine & Hill Consulting Engineers (RHCE) - October 1989</u>

Rankine & Hill Consulting Engineers (1989) *Report on Drainage Strategy* (dated October 1989) (*Ref. 4*)

This report represented the stormwater strategy which was originally adopted when the Raceway was constructed in 1990. The study was undertaken to examine the feasibility of formalising the natural drainage lines through the site as major overland flowpaths within the new Raceway development. Assessment on stormwater management issues was undertaken for both water quality and quantity (within RORB software). The following recommendations were made:

- Minor / Major piped system (20 year and 100 year ARI);
- The effect of the development on the peak flow is very low with the effect on the Eastern Creek flood plain 100 year ARI flood level RL 44.41 m AHD "only a few millimetres";
- On site detention volume of 1500 m^3 to satisfy pre to post limits;
- Existing natural drainage lines to be formalised by culverts and sediment traps;
- General recommendations for oil / grease traps, minor and major gross pollutant traps (GPT), permanent wet pond; and
- Existing ponds to be used as Water Quality or detention ponds.

NSW Dams & Civil Section (DCS) – February 1996

NSW Dams & Civil Section (1996) *Eastern Creek Raceway – Report on Stormwater Drainage Management Study* (Ref. DC960109 dated February 1996) (*Ref. 5*)

This report was undertaken six (6) years after the opening of the track to assess both stormwater and water quality issues which were raised by the NSW Department of Urban Affairs and Planning and to address localised ponding issues. The assessment included modelling within *XP-RAFTS* and *AQUALM-XP* in order to assess any system inadequacies. Recommendations for upgrades to the stormwater system to ensure compliance with Blacktown City Council's Guidelines (Ref. 2 & 3) were then made. These reports recommendations are summarised as follows:

- Gross Pollutants Traps and coarse sediment traps;
- Oil removal via installation of floating booms within the gross pollutant traps and removal of collected oil by an eductor or suction pump;
- Addition of two "retarding basins / sedimentation ponds"; and
- Pipe upgrades to suit 20 year ARI.

The above mentioned recommendations for augmentation works by DCS are shown on Figure 1 in Appendix D. Additional notes have been provided by JWP based on field inspections and observations.

NSW Dams & Civil Section (DCS) – October 1996

NSW Dams & Civil Section (1996) *Eastern Creek Raceway – Report on Stormwater Drainage Management Study Addendum* (Ref. DC96081 dated October 1996) (*Ref. 1*)

This study was issued as an addendum to the February 1996 report. The report makes comment that Blacktown City Council advised on the 30th July 1996 that the minor flow condition is to be based on the 5 year ARI storm event. Assessment was consequently amended to suit. The modified recommendations are summarised as follows:

- Three (3) x CSR Humes Oil & Sediment Separators were specified for removal of free oil and suspended solids;
- Confirmed that the existing piped system is generally adequately sized to convey the 5 year ARI event. Pipe and channel upgrades specified in areas which were not adequate;
- Addition of two "retarding / sedimentation ponds" are still required.

The three (3) studies together represent a comprehensive stormwater management strategy for the overall subject site. It is our understanding that all of these measures were constructed when ARDC purchased and took over the site in the mid to late 1990's.

It is noted that our study does not include an assessment on these existing stormwater systems and is limited to the areas of proposed extension works. Recommendations made in these areas are considered an extension to the existing stormwater management strategy.

In addition to the previous reports, we have also been provided with the following additional historical information at the site:

- The existing pond (Basin 3) which is to be filled in and relocated as part of the proposed works (refer Figures 1 - 3) is located at a similar position to that recommended by DCS (Ref. 1 & 5). This pond however has been modified / extended in more recent years to (a) provide a haven for wildlife; (b) improved aesthetics; and (c) water retention for re-use. We understand that the size is significantly larger than that recommended by DCS (Ref. 1 & 5) which specified the basin to be formed by "an embankment across the watercourse" with a "3 m crest width".
- Due to the conditions and risks associated with racing meets, rapid response procedures are in place to treat any fuel or oil spills which occur across the site. The potential for pollutant runoff is subsequently significantly reduced from that which may occur on a typical street or industrial site. Refer to Section 5.7 for further discussion.

3 PROPOSED DEVELOPMENT

3.1 The Site

The proposed extension works include the construction of a new pit lane, single building structure (combined control tower / garage), carpark pavement area, track extension and associated earthworks. Refer to Figure 3 and drawings 9297CC59-61 & 9297/SK1.

A proposed new pit lane and carpark pavement area will be constructed in the position of the existing Basin 3. Track extensions will also be undertaken for vehicles to enter the pit area. An additional building structure, carpark area and realignment of the loop road are also proposed under future stages in the vicinity of these works. These are not included under this DA however have been considered in this report for the purpose of sizing the basins.

Additional track extensions are also proposed on the eastern side of the site which will replace the existing spectator hill.

3.2 Discussions with Council

A pre-DA meeting was undertaken on the 31st July 2011 at Blacktown City Council (BCC) offices which included attendees from Evolve Projects (EP), J.Wyndham Prince (JWP), Australian Racing Drivers Club (ARDC) and BCC. Several modelling items were discussed and agreed. These items have been incorporated within the modelling and report accordingly. Refer to Appendix D for minutes (Ref. 6).

3.3 Constraints and Opportunities

Several guidelines were considered in developing the Stormwater Management Strategy detailed within this report. Particular attention was given to both *Blacktown City Council's (a) Engineering Guide for Development 2005 – Attachment B On-site detention general requirements and checklist (Ref. 2); and (b) Development Control Plan - Part R Water Sensitive Urban Design and Integrated Water Cycle Management (Ref. 3) together with the overall Blacktown City Council DCP.*

The following opportunities and constraints have been identified for the proposed areas of works. Refer also to Figure 1 and drawings SW02, SW04 and SW05.

- The racing track remains in operation 364 days of the year. There are numerous piped crossings beneath the existing track, carpark areas, skidpan and the like. The positions and sizes of the crossings are fixed in order to maintain the operability of the racetrack. This includes outlet pipes on basins. It is noted that existing pipe systems across the site are constrained to 5 year ARI capacity as agreed with BCC (Ref. 1);
- The proposed new pit lane and carpark area will be constructed in the position of the existing basin 3. In order to undertake this work, we recognise that the existing basin will need to be filled and reconstructed immediately downstream. All piped and flowpaths which are currently directed to the existing basin are to be redirected to the new basin. Refer to Section 4 and drawing SW02;
- A large bank of optic fibre cables has recently been identified as bisecting the proposed Basin A location. These cables impose a major constraint on achieving the detention volumes which are required for satisfy pre-post requirements (refer Section 4.0 for discussion). An opportunity has now been identified to provide an additional detention basin B in the available open space on the inside of the existing track. The proposed Basin B will then provide compensatory detention storage and will work together with Basin A in order to achieve the overall pre-post requirements.

- Basin B is in close proximity to a private sewer main. The design has provided sufficient clearance to allow for any future access and maintenance.
- Track extensions are proposed on the eastern side of the site to replace the existing spectator hill. The proposed track alignment extends on either side of the natural crest and subsequently requires an additional treatment device on the northern side of the hill. A sediment basin has been proposed by JWP in this area as part of the Soil and Water Management Plans for the Bulk Earthworks (refer JWP 9297_DA01-02). There is an opportunity to embellish the sediment basin to form a permanent facility (if required);
- Results in Section 4 have shown that the existing Basin 2 is currently oversized for the receiving catchment. There may be opportunity to modify the piped outlet arrangement (if required) to achieve further detention storage.

4 HYDROLOGIC ANALYSIS

Hydrologic modelling was carried out using the *XP-RAFTS* software package (Version V2009).

The methodology adopted in modelling is summarised in Section 1.2. Details and discussion are included in Sections 4.1 to 4.3 hereunder.

4.1 Sub-Catchments (Pre and Post Development)

Pre-Developed

The existing catchment division was defined from site investigations, detail survey and 2 m aerial contours but also considered alignments of existing roadways and trunk piped systems. Refer to Figure 2.

The catchment area directed to the proposed works is estimated at 40.74 Ha. The existing catchment was then further divided in 8 sub-catchments ranging in size from 1.44 Ha to 11.24 Ha in order to allow for flowpaths, time of concentrations and associated peak flowrates to be modelled accurately. Each sub-catchments adjoins the overall network as shown in Plate 2.

Links were modelled as “channel routing” links in order to represent existing channels and piped systems. Cross sections were determined from detailed survey information and input as “HEC-2” while Mannings ‘n’ values were estimated from site visits.

Where two (2) sub-catchments adjoined at the same location, “time lagging” links (no lag time), were used to combine inflow hydrographs while still allowing for each to be assessed independently.

Post-Developed

The proposed catchment division was defined from the proposed layout plan prepared by Apex Circuit Design (054-VP-M-CT-SW-001 rev A dated 20/05) (Ref. 8). Refer to Figure 3 and Plate 3.

The proposed catchment subdivision was then divided into 10 sub-catchments ranging from 0.39 Ha to 11.24 Ha. Here consideration has been given to:

- Potential future building extensions which may be situated directly next to the proposed pit lane works. These have been considered in the sizing of the basin but are not included as part of this DA;
- The collection and piping of 20 year ARI flows from the Western Sydney International Dragway site (proposed Cat 1.7) to the new basin at Node N1.2;
- Water quality treatment of flows in the pit area (to Node 4.0). Refer Section 5 for discussion.

Links were modelled as “channel routing” links in order to represent overland flowpath swales and proposed pipe systems.

“Diversion” links were included in the model to represent those positions where the new pipe line (sized to convey 20 year ARI) is not directly situated under the overland flowpath (which conveys the 100 year ARI).

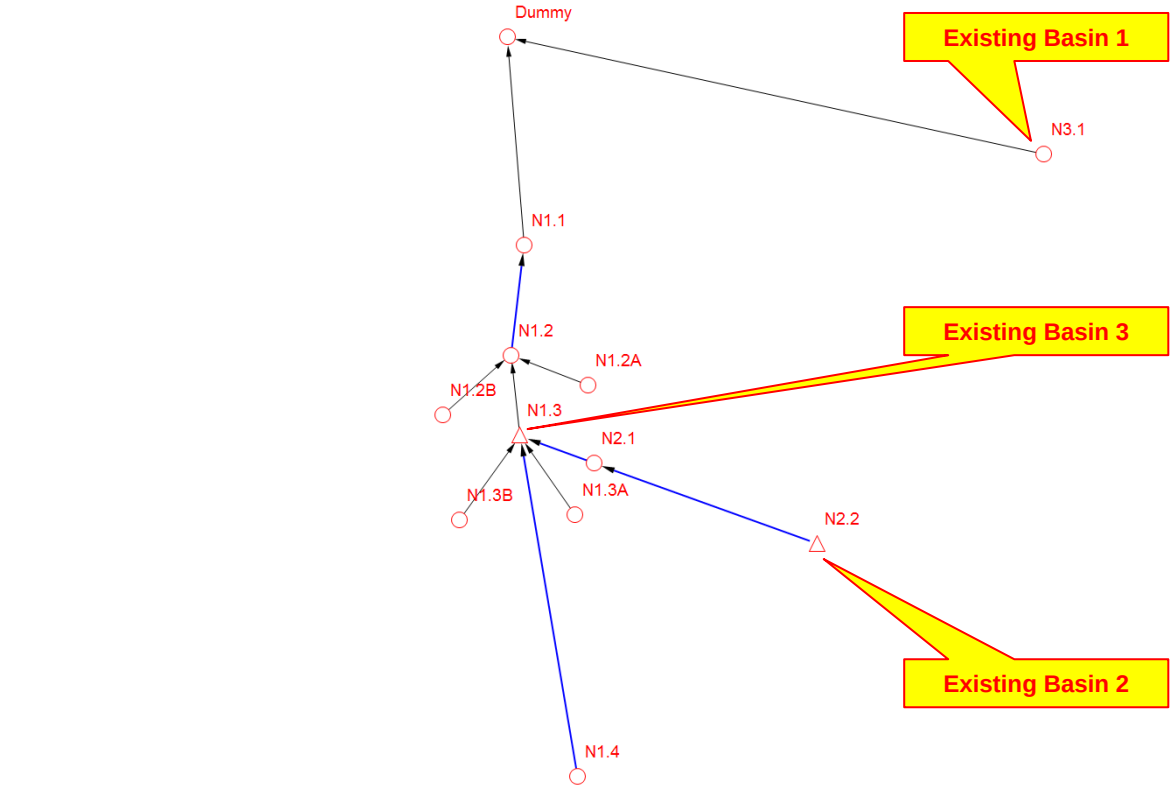


Plate 2: XP-RAFTS Existing layout

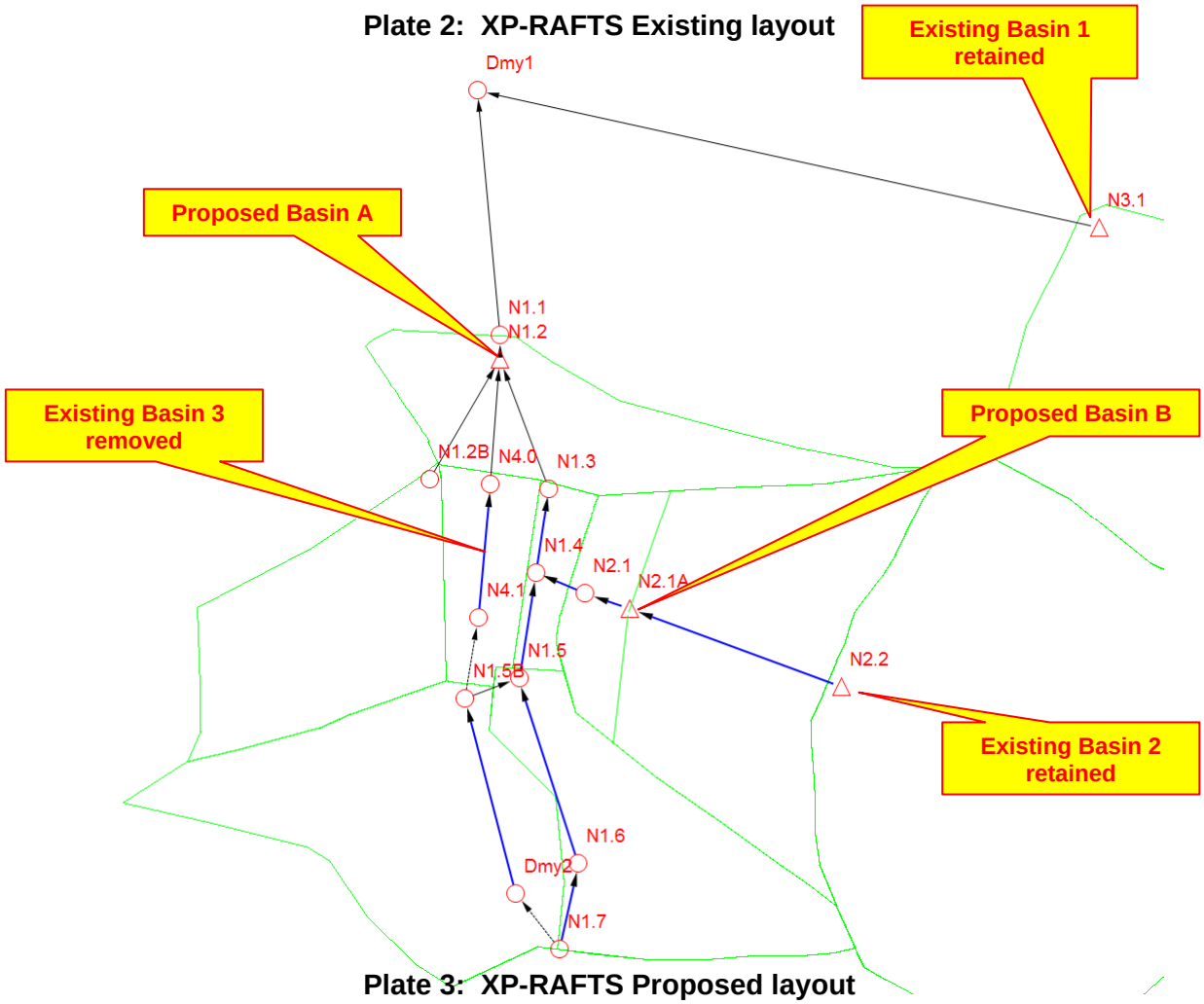


Plate 3: XP-RAFTS Proposed layout

4.2 Rainfall Data

4.2.1 Intensity-Frequency-Duration (I.F.D.)

Design rainfall intensity-frequency-duration (I.F.D.) data for the site were obtained from Blacktown City Council's Engineering Guide for Development 2005 (Ref. 2). A summary of the rainfall intensities adopted in this study is provided in Table 4.1. The critical storm durations were determined using these values for each sub-catchment.

The models used to examine the performance of the catchment utilised temporal patterns for synthetic design storms as detailed in Australian Rainfall and Runoff (Ref. 9).

Table 4.1 - BLACKTOWN RAINFALL INTENSITIES (mm/hr)

	Average Recurrence Interval		
Duration (min)	5 Year (mm/hr)	20 year (mm/hr)	100 year (mm/hr)
15	82	107	139
30	58	75	98
45	46.2	60	78
60	39.2	51	66
90	30.7	39.8	52
120	25.7	33.4	43.4
180	20	26	33.8
240			
270	15.5	20.2	26.2
300			
360	13	16.9	21.9
540	10.1	13.1	17.1
720	8.45	11	14.3

4.2.2 XP-Rafts Parameters

- The type of land use does have an effect on the runoff by providing some "resistance" to the flow. The effect in *XP-RAFTS* is simulated by a storage delay coefficient called "PERN". The following *PERN (n)* values and losses adopted for the catchments in the *XP-RAFTS* modelling are listed in Table 4.2.

Table 4.2 - *XP-RAFTS* Parameters – PERN

Parameter	Catchment Condition	Adopted Value
Pern		
	Existing Pervious	0.05 - 0.08
	Urban Pervious	0.025
	Urban Impervious	0.015

- ARBM loss parameters were adopted as per BCC standards (Ref. 2).

  It is noted that previous studies have adopted the initial and continuing loss parameters. These reports incorporated Loss parameters of 15 mm and 2.5 mm/hr respectively (Ref. 1).

- Areas of Fraction Impervious have been measured digitally from aerial imagery. This was undertaken in order to get an accurate representation of the increase in impervious areas caused by the proposed works. Refer to summary table in Appendix A.

- Slopes of the sub-catchments were generated using the "equal area" method. The slopes for each of the catchments are summarised in Attachment A. Sub-catchment slopes for links and catchments were derived from both aerial contours and detailed survey.
- Hydraulic roughness parameters for the overland flowpaths were estimated based upon site visits and applied in accordance with those recommended in ARR. A Manning's roughness parameter of 0.035 was applied for all grassed areas (including verges) while 0.013 was applied for all road pavements.
- The B-multiplier within *XP-RAFTS* is usually used to calibrate against recorded floods. In the absence of available data, the default of Bx = 1.0 has been applied.

As a check, preliminary *XP-RAFTS* results were compared against those listed in the DCS report (Ref. 1). That is, the 100 year flowrate exiting the overall site (110 Ha) was published at 20.6 m^3/s, while the proposed extension works areas is calculated at only 40.74 Ha. A suitable flowrate was subsequently interpolated by (40.74 / 110) x 20.6. The Flowrate is marked ** in the following table.

Results of the check initially indicated a 30% higher flowrate than those listed by DCS. This however was attributed to the upstream catchment from the Dragway site (Existing Cat 1.4 - 11.64Ha) now being developed. A secondary model was subsequently created with the assumption of greenfield conditions applied on external catchments. Corresponding results indicated model to be within 5-6%.

Table 4.3 Preliminary Comparison of Results

	Flow rate (m^3/s)		
Location	**DCS**	**JWP (1) U/S catchment development**	**JWP(2) U/S catchment greenfield**
Proposed works (40.74Ha)	7.6**	9.9	8.02

Results discussed herein continue on the basis that the upstream catchment is developed. The above comparison is only made for the purposes of calibration against existing results.

4.3 Results

4.3.1 Performance of Existing Basins

As discussed in Section 2.2, there are three (3) existing ponds / basins situated on site within the vicinity of the proposed track extension works. The performance of these basins in attenuating flows has been assessed within *XP-RAFTS*. The following parameters were adopted for the existing basins 2 and 3 (Nodes N1.3 and N2.2 respectively):

Basin 3 (at Node N1.3)

- 1 – 3.5 m wide channel outlet at RL 56.0;
- Permanent top water level at RL 55.89;
- 3m wide high level emergency spillway at RL 56.6;
- Volume to top of embankment = 4340 m^3

Basin 2 (at Node N2.2)

- 525mm dia outlet pipe at 3% at RL 67.3;
- Permanent top water level at RL 67.17;
- 3 m wide high level emergency spillway at RL 68.3;
- Volume to top of embankment = 12690 m^3

In order to assess the performance of the existing detention basin for attenuation of peak storm events, a stage-discharge relationship was generated within excel and input into *XP-RAFTS* based on the above items. Similarly a stage-storage relationship for the detention volume was derived from detailed survey information (i.e from top water level to weir level). Basin Performance Results are summarised in Tables 4.4 and 4.5.

Table 4.4 – Performance of Existing Basin 3 (Node N1.3)

ARI	Max Basin Inflow (m^3/s)	Storm Duration (min)	Max Basin Outflow (m^3/s)	Storm Duration (min)	Storage	Stage	Depth
100	8.63	90	7.53	90	3253	56.74	0.85
20	6.72	90	5.14	90	2907	56.66	0.77
5	4.63	90	2.64	90	2329	56.52	0.63

Table 4.5 – Performance of Existing Basin 2 (Node N2.2)

ARI	Max Basin Inflow (m^3/s)	Storm Duration (min)	Max Basin Outflow (m^3/s)	Storm Duration (min)	Storage	Stage	Depth
100	3.06	90	0.42	720	6468	67.90	0.6
20	2.31	90	0.38	540	4479	67.68	0.39
5	1.35	90	0.29	720	3005	67.53	0.23

The resulting existing flows exiting the area of proposed works is summarised in Table 4.6.

Table 4.6 – Existing Flows from area of Track Extension Works

ARI	Existing basins included?	Max Outflow (m^3/s)	Storm Duration (min)
100	**YES**	**9.99**	**90**
	NO	14.20	90
20	**YES**	**7.01**	**90**
	NO	10.85	90
5	**YES**	**3.83**	**90**
	NO	7.14	90

Assessment on the performance of existing basins show that flows are being attenuated by both Existing Basins 2 and 3. Existing Basin 3 attenuates peak flows by approximately 13 % in 100 year ARI and 43 % in the 5 year ARI. Similarly Existing Basin 2 attenuates the peak flows between 80-85 % for a range of ARI events. Refer to Section 4.3.4 for comparison against current Council permissible site discharge rates.

4.3.2 Proposed

As discussed in Section 1.2, the proposed track extension works under the current DA submission is split into two distinct areas (refer to Figure 5). For the purposes of this assessment, these development areas shall be known as "P1" and "P2".

The proposed development footprint will maintain Existing Basin 1 & Existing Basin 2 (at Node N2.2), while the existing Basin 3 (Node N1.3) will be filled to accommodate the new pit area and associated pavement area.

The proposed stormwater strategy has been developed to ensure that flows exiting the site are not increased from the existing scenario. The management of flows generated from the proposed works includes the construction of two (2) new detention basins which are situated at proposed node N1.2 and N2.1A – also known as Proposed Basins "A" and "B" respectively. Refer to Plate 3, Figure 3 and drawings 9284CC59-61 & 9284/SK1. The following discussion is provided:

Area P1

Due to the removal of existing basin 3 and a large increase in impervious areas, **Detention Basin A** has been proposed to attenuate flows. Basin A shall be situated immediately adjacent to the new pit lane / pavement area and shall be constructed as a "wet" basin which includes raingarden, wetland and detention facilities. Flows will be attenuated prior to discharge to the existing trunk pipe system.

As discussed in Section 3.3, due to existing optic fibre services bisecting the approved Proposed Basin A location, additional storage at **Detention Basin B** is also proposed in order to achieve statutory requirements. That is, the combined effect of the detention storages will attenuate the overall post development flows to not exceed the pre developed flows.

The configuration of Basin A allows for detention to be maximised while liaising with relevant authorities (Telstra) for adequate clearances. Basin B is sized to compensate for the shortfall of detention storage. An opening in the safety barrier, grassed swales and diversion mounds are all provided as part of the detailed design to ensure that the receiving catchment to the basin is maximised (refer to 9297/SK1).

The configuration of Basin 2 is also dictated by existing services in the area. As part of the concept design, sufficient clearances have been provided to the existing private sewer main to allow for future maintenance and access.

Area P2

The Existing Basin 1 has been constructed from recommendations made in the DCS reports (Ref. 5 & 1). We understand that these recommendations were made in order to provide treatment of both water quality and quantity for a catchment area of 29.65Ha across the raceway site. A portion of the proposed track extension works under the current DA is situated within this catchment area (approx. 5.75Ha).

The DCS February report (Ref.5) has adopted an *assumed fraction impervious of 15%* across its catchments in order to make recommendations on basin size and arrangement. JWP investigations indicate however that the fraction impervious across the existing catchment draining to Existing Basin 1 is 11.8% (measured digitally). By adopting all new impervious areas from the proposed track extension this would be increased to 14.4%.

Existing Basin 1 was originally sized for a degree of development in the catchment that has not been exceeded even with consideration to the new track extension works. A new

detention basin is therefore not required in this area. Refer to the following table (also see Figure 5):

Table 4.7 – Existing Fraction Impervious to Existing Basin 1

Area (Ha)	Area P2a	Area P2b	Total to Existing Basin 1
Total	23.9	5.75	29.65
Impervious	2.73	0.78	3.65
	11.4%	13.6%	**11.8%**

Table 4.8 – Proposed Fraction Impervious to Existing Basin 1

Area (Ha)	Area P2a	Area P2b	Total to Existing Basin 1
Total	23.9	5.75	29.65
Impervious	2.73	1.53	4.26
	11.4%	26.6%	**14.4%**

Staged outlet arrangements are to be provided at new Basin A to include (a) discharge control pit with low level piped outlet; (b) high level staged spillway to suit the 20 and 100 year ARI events and to compensate for any blockages. While Proposed Basin B will include (a) headwall and piped culvert outlet; (b) high level staged spillway to suit the 20 and 100 year ARI event. The following components are included:

Discharge Control Pit (DCP) and outlet pipe

DCP's are to be constructed at Proposed Basin A immediately adjacent to the raingarden treatment area. The grate level will be formed at a suitable level to enable 0.3 m extended depth for the bio-retention system. Under the 3 month flow conditions, the structure acts as a weir, however in major storms it becomes a submerged outlet.

The DCP has been designed to suit both pre-post on the 5 and 20 year ARI events and BCC's permissible site discharge. The 100 year ARI event will also discharge via the piped system along with the high level spillway. A letter box style pit shall be provided to minimise chance of blockages via debris.

Headwall and outlet Pipe

A headwall outlet has been designed from the invert of Proposed Basin B using the "Culvert Outlet" method within *RAFTS* (300 mm dia at 2 %). The outlet pipe shall discharge flows at the nearby twin 675 dia pipe headwall structure.

High level Spillway

Upon both Basins A and B, high level weirs / spillways have been designed to sit above the 20 year ARI Top Water Level and provide a staged discharge relationship for the 100 year event. Overflow calculations have been undertaken in the event of flows greater than the 100 year ARI event or if the outlet pipe is 100% blocked. Refer to Appendix A for detailed calculations.

Scour protection over the spillways has been provided via a reno mattress or gabion baskets.

Stage-Discharge Relationship

The stage-discharge relationship was calculated for the proposed outlet arrangement of Basin A. This included assessment of a series of discharges through the system and recording the headwater required to force a certain flowrate through the system. A similar

relationship at Basin B was also modelled with *RAFTS* using the standard input parameters (i.e 5 m wide, C = 1.74)

Refer to Appendix A for detailed calculations. Iterations were performed on the proposed outlet arrangements in order to satisfy pre-post requirements for the 5, 20 and 100 year ARI events against the permissible site discharges specified by the BCC. These comparisons were made at Node N1.2 to assess the combined effect of the proposed Detention Basins. A summary of basin results are shown in Section 4.3.4 along with discussion.

4.3.3 Proposed Basin Results

Discharge estimates were derived for the pre and post developed catchments for the 5, 20 and 100 year ARI events. A range of standard storm durations from 15 minutes to 12 hours were analysed to determine the critical storm duration for each sub-catchment.

We understand that the subject site is situated within "Area 4 - All Other Hawkesbury River Sub-Catchment" under BCC's recently revised "Blacktown OSD Catchment Area" Figure (Ref. 7). The BCC Engineering Guide for Development (Ref. 2) lists the Site Storage Ratio (SSR) and the Permissible Site Discharge (PSD) for Area 4, summarised in Table 4.9 below.

Table 4.9 – Council's SSR and PSD

All Other Hawkesbury River Sub-Catchment	Site Draining Area		
	100%	90%	80%
Max PSD l/s/ha	147	101	56
SSR m^3/ha	264	301	473

In order to undertake assessment against both the 5, 20 and 100 year ARI, the following PSD's were extrapolated based on known relationships between various ARIs (Ref. 11).

Table 4.10 – 5, 20 and 100 year PSD

		Permissible Site Discharge (m^3/s)
ARI	Fraction	Basin N1.2 (Area P1)
100	1.0	5.15
20	0.77	3.97
5	0.56	2.89

XP-RAFTS modelling was undertaken to determine a suitable sized detention storage basin and outlet arrangement. Comparisons were made against both pre-post development and Council's PSD requirements.

4.3.4 Comparison of Flows

The following table shows a comparison of post development flowrates against both BCC's PSD and results from the existing *XP-RAFTS* modelling.

Table 4.11 – Peak Flow Comparison at Node 1.2

(Attenuation from Basins A and B)

ARI	Existing *RAFTS* at N1.1 (m^3/s)	PSD (m^3/s)	Basin Inflow (m^3/s)	Basin Outflow (m^3/s)
100	8.41	**5.15**	9.02	**5.15**
20	5.82	**3.97**	6.95	**3.74**
5	3.09	**2.89**	5.05	**2.83**

Table 4.12 – Summary of Basin A Results (N1.2)

Basin Results						
ARI	Basin Inflow (m^3/s)	Basin Outflow (m^3/s)	Piped (m^3/s)	Weir (m^3/s)	Storage (m^3)	Top Water RL (m)
100	9.02	**5.15**	3.47	1.68	3849	55.20
20	6.95	**3.74**	3.21	0.53	2930	54.93
5	5.05	**2.83**	2.83	0	1835	54.57

Table 4.13 Summary of Basin B Results (N2.1A)

Basin Results						
ARI	Basin Inflow (m^3/s)	Basin Outflow (m^3/s)	Piped (m^3/s)	Weir (m^3/s)	Storage (m^3)	Top Water RL (m)
100	1.40	**0.65**	0.19	0.46	1423	60.50
20	1.06	**0.42**	0.18	0.24	1299	60.43
5	0.68	**0.18**	0.18	0	1032	60.26

Results from the *XP-RAFTS* modelling has indicated that peak flowrates are generated within the 90 minute duration for each of the 5, 20 and 100 year ARI events. Comparisons of peak results within Table 4.11 indicate that by adopting the layout and outlet arrangements of Detention Basins A and B, then post-development flows will be sufficiently attenuated to satisfy both pre-post requirements and Council's PSD requirements. The details of the detention basins are summarised in Tables 4.12 and 4.13.

Modelling has adopted an arrangement which will restrict flows from the area of proposed extension works to BCC's PSD rather than pre-post. Importantly, we do believe this to be very conservative since we understand that the standard value for PSD (which has been specified by BCC) would have likely been based on the assumption of the catchments being fully developed and not necessarily catchments which have small amounts of impervious areas like the subject site.

4.3.5 Basin Performance and Arrangement

The proposed basin configurations have adopted the following items. Refer also to drawings 9284CC59-61 and 9284/SK1for details:

Proposed Basin A (Node N1.2)

- Top of filter media in raingarden at RL 53.60;
- Permanent water body / wetland at RL 53.70;
- Top of Extended Detention at RL 53.90;
- Discharge control pit with grate level at RL 53.90. Connect to existing 1050 mm dia outlet pipe;
- 2.80 m wide high level emergency spillway at RL 54.70;
- Required detention volume = 3849 m^3;
- Depth of detention storage over the water quality device has been restricted to 1.3 m. Fence is provided at surrounds for pedestrian safety;
- 0.5 m freeboard to top of embankment;

- 1 in 3 side slopes adopted to maximise detention storage. Fence to be provided at basin surrounds for safety in accordance with BCC standards.

Proposed Basin B (Node N2.1A)

- No raingarden or wetland;
- Minimum 1% grade at basin invert;
- Headwall outlet from basin at RL 59.0. 300 mm dia pipe outlet discharging to the nearby twin 675 mm dia headwall.
- 3 m wide high level emergency spillway at RL 60.30;
- Required detention volume = 1423 m^3;
- Maximum Depth of detention storage at outlet is 1.5 m with a typical depth across the basin at 1.2m. It is noted that this basin is situated at the centre of the track and has complete restricted access from all pedestrians;
- 0.5 m freeboard to top of embankment;
- 1 in 5 side slopes adopted for walk in, walk out.

5 WATER QUALITY ANALYSIS

The water quality analysis for this study was undertaken using the model MUSIC (Model for Urban Stormwater Improvement Conceptualisation) version 5.0 (Ref. 12). This water quality modelling software was developed by the Cooperative Research Centre (CRC) for Catchment Hydrology, which is based at Monash University and was first released in July 2002. Version 5.0 was released in 2011.

The model provides a number of features relevant for the development:

- It is able to model the potential nutrient reduction benefits of both gross pollutant traps, raingarden / bio-retention systems and it incorporates mechanisms to model stormwater re-use as a treatment technique;
- It provides mechanisms to evaluate the attainment of water quality objectives;

5.1 Catchments

5.1.1 Treatment Layout

MUSIC modelling was undertaken to demonstrate that the "treatment train" will achieve reductions in the overall post-development pollutant loads and concentrations being discharged from the proposed extension works and that these discharges comply with the designated target objectives.

The extent of catchments used in this model is shown in Figure 4, while Plate 4 shows the general arrangement and construction of the MUSIC model undertaken in order to determine compliance with the required water quality targets.

The division of MUSIC catchments was simplified to represent four (4) distinct areas which range in size from 5.75 Ha to 16.52 Ha. Catchment "Cat 3" represents those areas upstream from the subject site.

Impervious areas were measured from both aerial imagery, detailed survey information and the proposed track layout (Ref. 8). Areas were then assigned within MUSIC into categories of "Roofs", "Roads", "Other Impervious", and "Grassed" components.

As discussed in Section 2.3, we confirm that rapid response procedures are currently in place to treat any oil / fuel / grease spills which occur across the site. Subsequently, the potential for pollutant runoff is significantly reduced from that which may occur on a typical street or industrial site. Refer to Section 5.7 for further discussion. As agreed with BCC (Ref. 6) all existing and proposed tracks have been modelled as "Other Impervious". The pit area and associated pavement has been modelled as "Roads" due to the higher risk of occurrence.

Catchment 4

Existing Basin 1 has been constructed from recommendations made in the DCS reports (Ref. 5 & 1). We understand that these recommendations were made in order to provide treatment of both water quality and quantity for a catchment area of 29.65Ha across the raceway site. A portion of the proposed track extension works under the current DA is situated within this catchment area (approx. 5.75Ha).

As discussed in Section 4.3.2, JWP investigations indicate the Existing Basin 1 was originally sized for a degree of development in the catchment that has not been exceeded even with consideration to the new track extension works. A new raingarden for Catchment 4 is therefore not required in this area.

Catchment 1-3

Runoff from the pit area and connecting pavement is connected directly to the formal drainage network before being treated in a vortex-type GPT prior to discharging to the downstream combined raingarden / wetland / detention basin A.

Prior to connection the formal drainage network, roof drainage from the new building will be connected to a 10 kL rainwater tanks for re-use on site.

Flows from external catchments (i.e "Cat 3") will be conveyed directly to the new basin A without being connected to a GPT.

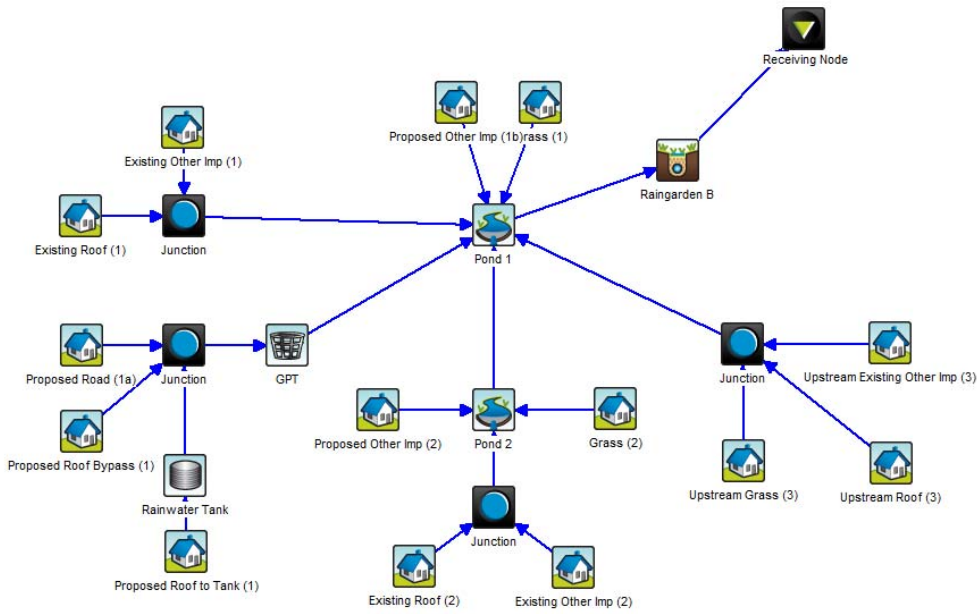


Plate 4: MUSIC Model – Post Development
(9297MUpostdev_music5)

5.2 Rainfall Data

The MUSIC model is able to utilise rainfall data based on 6 minute, hourly, 6 hourly and daily time steps. A 6 minute time step was chosen for this analysis, which is in accordance with the recommendations within the MUSIC User's Manual (Ref. 14).

Rainfall records for the area were obtained from Blacktown City Council. The station used and the years of record selected were determined by BCC and are tabulated below. We understand this data set includes rainfall data for missing periods and compares well with other local rainfall stations.

Station No	Location	Years of Record	Type of Data
67035	Liverpool (Whitlam Centre)	1967 - 1976	6 minute

5.3 Soil / Groundwater Parameters and Pollutant Loading Rates

In the absence of site specific data, the soil / groundwater parameters and pollutant loading rates adopted for the urban catchments of the Eastern Creek site are based on the recommended parameters provided by the Department of Environment and Climate Change for areas within Western Sydney (Ref. 13) and Cooperative Research Centre for Catchment Hydrology (Ref. 14), respectively. The adopted parameters are also consistent with the values specified in Council's WSUD ICWM DCP (Ref. 3) and are presented in Appendix B.

5.4 Treatment Device Performance

Each element of the treatment train, as represented in the MUSIC model, is described below.

5.4.1 Rainwater Tanks

A single 10kL rainwater tanks has been incorporated alongside the new building in accordance with BCC DCP (Ref. 3). Refer to Appendix B for discussion and typical parameters adopted in modelling. Modelling of the rainwater tank has adopted the following:

Minimum Connected Roof Area

It has been assumed that 50% of the roofed areas will be directly connected to rainwater tanks. The remaining 50% of the roof area is assumed to by-pass the rainwater tanks and discharge directly to the raingarden

Rainwater Tank Size

Nominal rainwater tank sizes were assumed to include:

- 10,000 L tank;
- 8,000 L of each rainwater tank is available for reuse (80% capacity – assumed 20% top-ups from potable water reticulation);
- 2 m high with 100 mm dia. overflow outlet.

Average Reuse

The average "daily demand" reuse adopted in the investigation was been assumed based on experience on previous projects. A usage of 337.5 litres per day has been derived by applying the following assumptions:

- 20 people every two hours;
- 10 people per hour (all flush);
- 75/25% split assumed for full / half flush;
- 9 hours of operation;
- 337.5 litres per day usage.

5.4.2 Litter and Sediment Control Structures

The drainage system which collects runoff from the pit area and connecting pavement has been modelled with a GPT to remove litter and coarse sediment prior to discharge into the combined wetland / raingarden / detention basin. This GPT shall be installed on the pipe discharge outlet to the raingarden.

Indicative location of the proposed GPT unit is shown on Plate 4 and drawing SW02. Refer to Attachment B for the modelling parameters used in MUSIC.

5.4.3 Bio-Retention Raingarden Systems

One (1) bio-retention system (raingarden) have been positioned on Catchment 1-3 to ensure that stormwater runoff is captured and treated prior to discharging to the trunk stormwater system for the overall subject site. The raingarden will be positioned within Proposed Detention Basin A.

Modelling results have indicated that the total surface area of Bio-retention required is 1400 m^2. This area represents approximately 0.5 % of the Proposed Extension Works catchment area. Refer to drawings SW02 for further details on both the location and size of the proposed bio-retention system. The general features and configuration of the raingarden used within MUSIC is detailed in Attachment B.

5.5 Pollutant Load Estimates

Total annual pollutant load estimates were derived from the results of a MUSIC model based on a stochastic assessment of the developed site incorporating the proposed water quality treatment system. The estimated annual pollutant loads and reductions for Total Suspended Solids (TSS), Total Phosphorus (TP), Total Nitrogen (TN) and Gross Pollutants (GP) for the proposed development works is presented in Table 5.1

Results are listed in Table 5.1 for the sizing of the raingarden A. Refer also to Figure 4.

Table 5.2 - SUMMARY OF ESTIMATED MEAN ANNUAL POLLUTANT LOADS AND REDUCTIONS AT RAINGARDEN (RAFTS BASIN N1.2)

	Mean Annual Loads (kg/yr)			
	GP	**TSS**	**TP**	**TN**
Total Development Source Loads (ML/yr)	3240	22400	42.7	314
Target Removal (%) from BCC	**90%**	**85%**	**65%**	**45%**
Minimum Reduction Required	2916	19040	27.8	141.3
Total Residual Load from site	23.4	3250	14.1	152
Total Reduction Achieved (kg/yr)	3216.6	19150	28.3	162
Total Reduction Achieved (%)	**99.3%**	**85.5%**	**66.3%**	**51.7%**

5.6 Discussion of MUSIC Modelling Results

The MUSIC modelling demonstrates that the combination of rainwater tank, gross pollutant trap and raingarden bio-retention system will, when configured according to the "treatment train" proposed for the Eastern Creek Raceway extension works, reduce the priority pollutant loads to the required minimum pollution control targets required by Blacktown City Council.

5.7 Treatment of other pollutants

MUSIC modelling undertaken in Section 5.1-5.6 has demonstrated compliance for TP, TN, GP and TSS. Pollutants generated at a racing circuit however also include Hydrocarbons, Oils and Fuels.

We understand from ARDC that due to the conditions and risks associated with racing meets, rapid response procedures are in place to treat any fuel or oil spills when they occur across the site. The potential for pollutant runoff is subsequently significantly reduced from

that which may occur on a typical street or industrial site. The proposed stormwater strategy will maintain the implementation of these safety procedures for all areas.

Suitable treatment devices has subsequently been made based on the following:

- All track and grassed areas will be conveyed to detention basins (existing and proposed). The treatment of pollutants from the track area will be performed by the rapid response procedures.
- These rapid response procedures will also be used to clean oil or fuel spills in pit lane and garage area.

6 SUMMARY & CONCLUSION

This report was originally prepared to support the DA application of the proposed track extension works. While Revision D is prepared in support of the Section 96 submission. These investigation works have been prepared to extend the existing Overall Site Stormwater Strategy to include the new proposed works.

All stormwater issues related to the proposed extension works have been assessed to ensure that they are incorporated in the detailed design stage. Recommendations for additional water quality and quantity treatment devices are made to ensure compliance with Blacktown City Council guidelines.

Assessment of the performance of existing basins shows that flows are being attenuated by both Existing Basins 2 and 3. Existing Basin 3 attenuates peak flows by approximately 13% in 100 year ARI and 43% in the 5 year ARI. Similarly Existing Basin 2 attenuates the peak flows between 80-85% for a range of ARI events.

The proposed stormwater strategy includes the construction of two (2) additional detention basins in order to satisfy Blacktown City Council's permissible site discharge rates. These basins have been sized to contain a combined 5272 m^3 of detention storage with staged outlet arrangements. Each of the two (2) Basins include both a low level piped outlet and a high level rock lined weir (where Basin A includes a discharge control pit while Basin B includes a headwall outlet).

The DCS February report (Ref.5) has adopted an *assumed fraction impervious of 15%* across its catchments in order to make recommendations on basin size and arrangement. JWP investigations indicate however that the fraction impervious across the existing catchment draining to Existing Basin 1 is 11.8% (measured digitally). By adopting all new impervious areas from the proposed track extension this would be increased to 14.4%. Results subsequently indicate that the Existing Basin 1 has been sized to attenuate flows from the new track extension works and a new detention basin is not required in this area.

As requested by Blacktown City Council, pipe network will be sized to convey 20 year ARI flows from the areas of new works wherever possible. However it is noted that the existing pipe network across the site is only sized for the 5 year ARI.

The proposed stormwater strategy also includes a number of water quality treatment devices in order to satisfy Blacktown City Council's guidelines. MUSIC modelling was undertaken to demonstrate that the "treatment train" will achieve reductions in the overall post-development pollutant loads from areas of proposed works. Devices included in the strategy include:

- Rainwater tank from roofed areas;
- Gross Pollutant Traps over outlets to basins;
- One (1) x Bio-retention raingarden and permanent wetland;
- The sizes of the bio-retention raingarden have been sized as 1400 m^2

Due to the conditions and risks associated with racing meets, rapid response procedures are in place to treat any oil or fuel spills which occur across the site. The potential for pollutant runoff is subsequently significantly reduced from that which may occur on a typical street or industrial site. The proposed stormwater strategy will maintain the implementation of these safety procedures.

Provision of two (2) proposed detention basins within the development works will ensure that peak post development discharges are restricted to both pre development levels and Blacktown City Council's permissible site discharge.

Provision of the proposed water quality treatment devices within the development works will ensure that the quality of the post development stormwater discharges will meet the requirements of the NSW Department of Planning and Blacktown City Council.

The proposed Stormwater Management Strategy provides a basis for the detailed design and development of the site to ensure that the objectives for stormwater management and water quality are achieved.

7 REFERENCES

1. NSW Dams & Civil Section (1996) *Eastern Creek Raceway – Report on Stormwater Drainage Management Study Addendum* (Ref. DC96081 dated October 1996)
2. Blacktown City Council (2005). Engineering Guide for Development
3. Blacktown City Council's (2006) *Development Control Plan - Part R Water Sensitive Urban Design and Integrated Water Cycle Management* (Amendment 12 dated 3rd May 2011)
4. Rankine & Hill Consulting Engineers (1989) *Report on Drainage Strategy* (dated October 1989)
5. NSW Dams & Civil Section (1996*) Eastern Creek Raceway – Report on Stormwater Drainage Management Study* (Ref. DC960109 dated February 1996)
6. Email correspondence from Blacktown City Council (Mr Tony Merrilees) to JWP. Dated 16th July 2011;
7. Email correspondence received from Blacktown City Council (Mr Tony Merrilees) to JWP. Dated 1st July 2011;
8. Apex Circuit Design – Design Drawing 054-VP-M-CT-SW-001 rev A dated 20/05
9. Institution of Engineers, Australia (2001). Australian Rainfall and Runoff
10. BUREAU OF METEOROLOGY (1994) – Bulletin 53 – The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method, with amendments as issued in 1996.
11. Not used
12. CRC For Catchment Hydrology (2005). MUSIC Model for Urban Stormwater Improvement Conceptualisation – User Guide Version 3
13. Metropolitan Catchment Management Authority (2010). Draft NSW MUSIC Modelling Guidelines
14. CRC for Catchment Hydrology (2004) Stormwater Flow and Quality, and the Effectiveness of Non-Proprietary Stormwater Treatment Measures – A Review and Gap Analysis. Technical Report 04/8.
15. Wong T.H.F., Duncan, H.P., Fletcher, T.D & Jenkins, G.A. (2001). A Unified Approach to Modelling Stormwater Treatment, - Proceedings of the 2nd South Pacific Stormwater Conference, Auckland, New Zealand, 27-29 June 2001, pp 319-327

Appendix A

XP-RAFTS – Data and Results

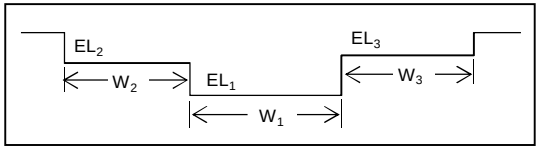
PROPOSED RAFTS AREA BREAKUP

	Cat 1.2A	Cat 1.2B	Cat 4.0	Cat 1.4	Cat 1.5A	Cat 1.5B	Cat 1.7	Cat 2.1	Cat 2.2	Cat 3.1	Total
Total Area	**1.82**	**2**	**0.76**	**0.39**	**2.17**	**3**	**11.24**	**3.97**	**9.63**	**5.75**	**40.73**
Existing Roads	0.289	0.462	0	0.157	0.03	0.358	2.34	0.25	0.86	0.32	
Existing carpark	0	0	0	0	0.204	0.548	2.79	0.01	0.02	0.43	
Existing Building	0	0	0	0	0	0.01	0.45	0	0	0.03	
Proposed Roads / Carpark	0.026	0	0.735	0.067	0.71	0.04	0	0.107	0.298	0.75	
Proposed Roofs	0	0	0.025	0	0	0.26	0	0	0	0	
Remaning Grassed	1.505	1.538	0	0.166	1.226	1.784	5.66	3.603	8.452	4.22	
Total % Impervious	**17%**	**23%**	**100%**	**57%**	**44%**	**41%**	**50%**	**9%**	**12%**	**27%**	

	Cat 1.2A	Cat 1.2B	Cat 4.0	Cat 1.4	Cat 1.5A	Cat 1.5B	Cat 1.7	Cat 2.1	Cat 2.2	Cat 3.1
Catchment Slope	**6.3**	**7.3**	**3**	**2.5**	**7.53**	**13.1**	**3.5**	**8.1**	**6**	**4.8**

PROPOSED BASIN N1.2

FOLLOW THE PROCEDURES BELOW, ENTERING VALUES IN THE YELLOW BOXES.



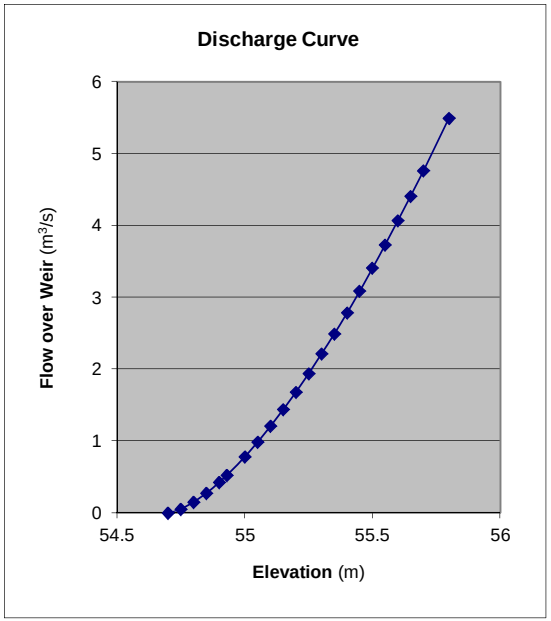
1. Enter Parameters for 1 to 10 weirs.

Weir No.	1	2	3	4	5	6	7	8	9	10
Crest Elevation (m AHD)	54.7									
Weir Width (m)	2.8									
Weir Coefficient	1.7									

The lowest weir should be placed first.

2. Fill in the Required Depths in the yellow column in the table below.

Depth (m)	Elevation (m AHD)	Discharge (m^3/s)
0	54.7	0
0.05	54.75	0.053218
0.1	54.8	0.150524
0.15	54.85	0.276531
0.2	54.9	0.425747
0.25	54.93	0.525048
0.3	55	0.782148
0.35	55.05	0.985619
0.4	55.1	1.204195
0.45	55.15	1.436897
0.5	55.2	1.682914
0.55	55.25	1.941561
0.6	55.3	2.212248
0.65	55.35	2.494463
0.7	55.4	2.787751
0.75	55.45	3.091711
0.8	55.5	3.405979
0.85	55.55	3.730228
0.9	55.6	4.064159
0.95	55.65	4.4075
1	55.7	4.76
1.1	55.8	5.491563



PROPOSED BASIN 1.2

5 YEAR ARI - STAGE DISCHARGE RELATIONSHIP							
Invert level of pipe	52.44	based on survey					
Centre outlet pipe	52.965		C	1.7	Weir at pit	1.704	
Pipe	1.05	dia	L	10	Width	4.8	m

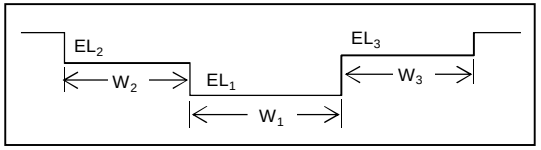
**outlet pipe sized to 5yr. Combination with high level overflow weir. See separate spreadsheet
**inlet pit to Council minimum standards 1.2x1.2m
**outlet pipe as per existing 1050dia. No orifice

Stage RL	Cd	Act Area	Eff Area	H	(2gH)^0.5	Orifice	Entry via Weir at pit	High level Weir	Combined Weir + Pipe
53.9	0.6	0.471	0.8654	0.935	4.28	0.00	**0.00**	0.00	0.00
54	0.6	0.471	0.8654	1.035	4.50	2.34	**0.26**	0.00	0.26
54.1	0.6	0.471	0.8654	1.135	4.72	2.45	**0.73**	0.00	0.73
54.2	0.6	0.471	0.8654	1.235	4.92	2.55	**1.34**	0.00	1.34
54.6	0.6	0.471	0.8654	1.635	5.66	**2.94**	4.79	0.00	2.94
54.8	0.6	0.471	0.8654	1.835	6.00	**3.11**	6.98	0.00	3.11
55	0.6	0.471	0.8654	2.035	6.32	**3.28**	9.44	0.00	3.28
55.2	0.6	0.471	0.8654	2.235	6.62	**3.44**	12.12	0.00	3.44
55.4	0.6	0.471	0.8654	2.435	6.91	**3.59**	15.03	0.00	3.59
55.7	0.6	0.471	0.8654	2.735	7.32	**3.80**	19.75	0.00	3.80

Input to RAFTS	
Stage RL	Combined Orifice + Weir
53.9	0.00
54	0.26
54.1	0.73
54.2	1.34
54.6	2.94
54.8	3.11
55	3.28
55.2	3.44
55.4	3.59
55.7	3.80

PROPOSED BASIN N2.1A

FOLLOW THE PROCEDURES BELOW, ENTERING VALUES IN THE YELLOW BOXES.



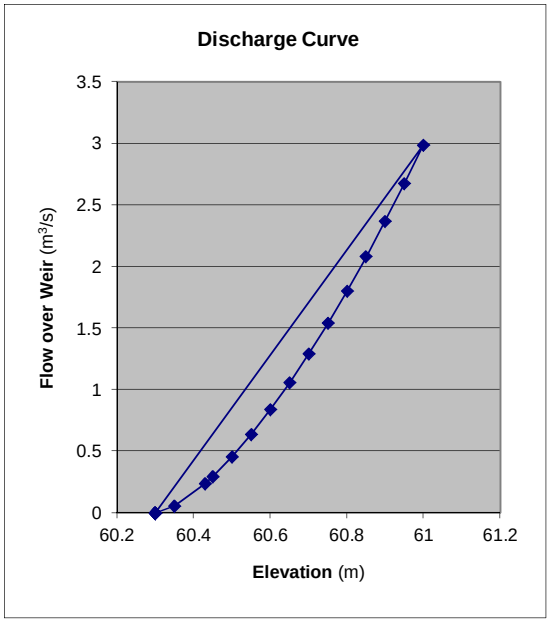
1. Enter Parameters for 1 to 10 weirs.

Weir No.	1	2	3	4	5	6	7	8	9	10
Crest Elevation (m AHD)	60.3									
Weir Width (m)	3									
Weir Coefficient	1.7									

The lowest weir should be placed first.

2. Fill in the Required Depths in the yellow column in the table below.

Depth (m)	Elevation (m AHD)	Discharge (m^3/s)
0	60.3	0
0.05	60.35	0.05702
0.1	60.43	0.239048
0.15	60.45	0.296283
0.2	60.5	0.456158
0.25	60.55	0.6375
0.3	60.6	0.838016
0.35	60.65	1.05602
0.4	60.7	1.290209
0.45	60.75	1.539533
0.5	60.8	1.803122
0.55	60.85	2.080244
0.6	60.9	2.370266
0.65	60.95	2.672638
0.7	61	2.986876
	60.3	0
	60.3	0
	60.3	0
	60.3	0
	60.3	0
	60.3	0
	60.3	0



Appendix B

MUSIC - Parameters

MUSIC MODEL - CATCHMENT INPUTS

	Labels & Areas (Ha)				Totals
Impervious Areas Retained	**1**	**2**	**3**	**4**	
Roads	2.53	0.86	1.36	0.32	5.07
Roofs	0.03	0.02	0.43	0.03	0.50
Carparks	0.83	0	2.72	0.43	3.98
Existing Pond		0.80			0.80
Total Existing Impervious Surfaces	3.39	1.68	4.51	0.78	10.35

Additional Impervious Areas	**1**	**2**	**3**	**4**	
Roads	0.45	0.30	0	0.75	1.50
Roofs	0.28	0	0	0	0.28
Carparks	0.62	0	0	0	0.62
Total Proposed Impervious Surfaces	1.36	0.30	0	0.75	2.41

Total Impervious Surfaces	4.74	1.98	4.51	1.53	12.76
Percentage Impervious (%)	28.7	12.2	51.1	26.6	
Catchment Area	16.52	9.64	8.84	5.75	40.74

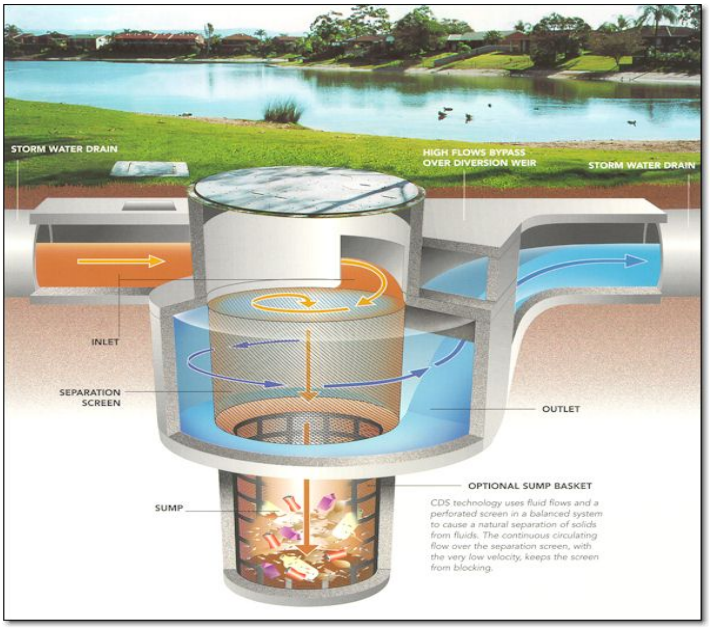
Simplified Music Node Data	**1**	**2**	**3**	**4**	
Total Roofed Area	0.31	0.02	0.43	0.03	0.78
Existing Other Impervious	3.36	1.66	4.08	0.75	9.85
Proposed Other Impervious	1.07	0.30	0	0.75	2.12
Grass	11.78	7.66	4.32	4.22	27.98

Rainwater Tank
20 people every two hours,
10 people per hour (all flush)
Assume a mixture between full flushes & half flushes of a 75/25% split
Assume 9 hours of operation

337.5 litres per day usage

GROSS POLLUTANT TRAPS (GPT'S)

GPT devices are typically provided at the outlet to stormwater pipes. These systems operate as a primary treatment to remove litter, vegetative matter, free oils and grease and course sediments prior to discharge to a downstream (Secondary and Tertiary) treatment devices.



Music Modelling Parameters

Within MUSIC transfer functions are used to calculate the stormwater effluent concentration of the stormwater flowing into the device, using a simple graphical relationship between the inflow and outflow concentration. MUSIC allows the user to describe the performance of the generic node by using a graphically based transfer function editor, for each of the pollutant types – Gross Pollutants (GP), Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

Since the effectiveness of pollutant load removal varies between different GPT devices, the MUSIC modelling assumed the indicative pollutant removal as documented in Council's WSUD DCP for vortex-type GPT's.

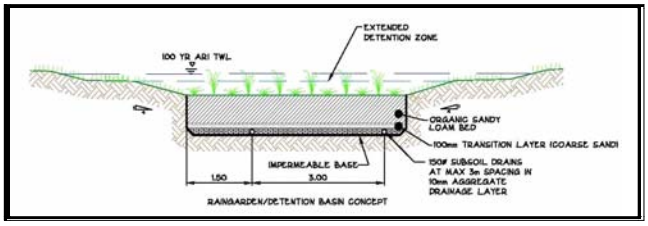
We understand that BCC has a preference for proprietary wet sump GPTs which use vortex technology to separate the pollutants out of the water column. The criterion, used to assess the performance of the GPTs in the MUSIC model, was based on the credit given to vortex-type GPTs (Ref. 3, p.81) i.e. Total Suspended Solids (TSS) - 70% for concentrations > 75 mg/L, and Total Phosphorus (TP) - 30% for concentrations > 0.5 mg/L. No credit was given to the GPTs capacity to remove oils, other nutrients or metals. However, if required it is possible to incorporate oil skimming or oil absorbent materials within a wet sump GPT for the purpose of removing non-emulsified, free floating oils.

The high flow bypass for each of the gross pollutant traps were set to the 3-month ARI flowrates from the contributing catchment as generated within *XP-RAFTS* in Section 4. This included 0.085m^3/s for pavement areas directed to Raingarden B and 0.227m^3/s for areas directed to Raingarden A.

BIO-RETENTION RAINGARDEN

The media beds of the bio-retention systems are typically 600 mm deep with an average particle size of 0.5 mm and a hydraulic conductivity of 100 mm/hr with a minimum depth of extended storage above the media of 300 mm. A discharge control structure will be configured to promote extended detention times for the treatment flows.

Treatment is attained by detaining flows to promote sedimentation, direct filtration of particulate matter and nutrient stripping by bio-films which establish on the surface of the media bed and within the gravel layer. The organic sandy loam bed and plant system minimises evaporation losses and the raingarden will be constructed with an impermeable barrier to prevent seepage losses and to avoid groundwater salinity impacts.



Music Modelling Parameters

The general features of the Bio-Retention Raingardens proposed for the site are indicated in Table D6 below:

Table D6

BIO-RETENTION SYSTEM
GENERAL FEATURES AND CONFIGURATION

Raingarden	
Storage Properties	
Extended Detention Depth (m)	0.3
Surface Area (m^2)	1400
Seepage Loss (mm/hr)	0
Infiltration Properties	
Filter Area (m^2)	1400
Filter depth (m)	0.6
Filter Media Particle Diameter (mm)	0.5
Saturated Hydraulic Conductivity (mm/hr)	100
Outlet Properties	
Overflow Weir Width	2.4

The expected sediment and nutrient removal performance of the bio-retention systems was determined using the default equations and parameters provided in the MUSIC model (Ref. 12). The water quality reduction mechanisms in MUSIC are based on an exponential decay equation referred to as the k – C* curve (refer to Wong et al. – Ref. 15).

The performance parameters used in the MUSIC model are summarised in Table D6 and D7. The viability of the raingarden and the longevity of its pollutant removal efficiency is dependent on the capacity of the pre-treatment GPTs to intercept and remove light litter, detritus and coarse sediment.

Table D7

MUSIC – PERFORMANCE PARAMETERS

	Bio-Retention		Rainwater Tanks	
Pollutant	**k (m/yr)**	**C* (mg/L)**	**k (m/yr)**	**C* (mg/L)**
TSS	8000	20.000	400	12.000
TP	6000	0.130	300	0.130
TN	500	1.400	40	1.400

Once the catchments upstream of the raingarden are stabilised, the maintenance of the raingarden would generally involve plant replacement, weed control, repair of localised erosion and minor structural damage, the removal of localised sediment build-up, and checking for any reduction in infiltration capacity and hydraulic conductivity of the media. This would be undertaken on a quarterly basis on average with media and vegetation replacement budgeted for on a decadal cycle.

MUSIC MODELLING LANDUSE PARAMETERS

Details of the soil / groundwater parameters adopted for the MUSIC modelling undertaken for this development are presented in Table D1 below. The adopted Annual Pollutant event mean concentrations are also presented in Table D2 below:

Table D1

ADOPTED SOIL / GROUNDWATER PARAMETERS FOR THE SITE (Source: DECC Technical Note – Ref. 14)

	Units	Urban	Non-Urban
Impervious Area Parameters			
Rainfall threshold (Road 1, Roof 0.5)	mm/day	1.4	1.4
Pervious Area Parameters			
Soil storage capacity	mm	170	210
Initial storage	% of capacity	30	30
Field capacity	mm	70	80
Infiltration capacity coefficient - a		210	175
Infiltration capacity coefficient - b		4.7	3.1
Groundwater Properties			
Initial depth	mm	10	10
Daily recharge rate	%	50	35
Daily baseflow rate	%	4	20
Daily deep seepage rate	%	0	0

The pollutant loading rates adopted for the urban catchments are based on the recommended parameters provided by the Cooperative Research Centre for Catchment Hydrology (Ref.14). These values are consistent with the values recommended for use by BCC (Ref. 3) and have been presented in Table D2.

Table D2

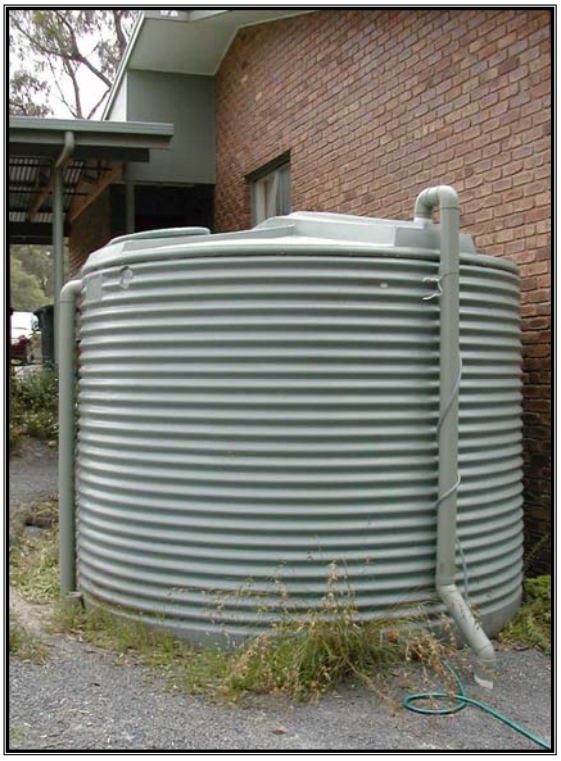
ADOPTED ANNUAL POLLUTANT EVENT MEAN CONCENTRATIONS (Source: CRCCH – Ref. 14)

	Roofs		Roads / Carparks		Remaining Urban	
Pollutant	**Base Flow (mg/L)**	**Storm Flow (mg/L)**	**Base Flow (mg/L)**	**Storm Flow (mg/L)**	**Base Flow (mg/L)**	**Storm Flow (mg/L)**
TSS	-	20.0	-	269	15.8	141
TP	-	0.129	-	0.501	0.141	0.251
TN	-	2.00	-	2.19	1.29	2.00

RAINWATER TANKS

Rainwater tanks are sealed tanks designed to contain rainwater collected from roofs. Rainwater tanks provide the following main functions:

- Allow the reuse of collected rainwater as a substitute for mains water supply, for use for toilet flushing, laundry, or garden watering (facilitate attainment of BASIX compliance).
- Provide some on-site detention, thus reducing peak flows and reducing downstream velocities; (when designed with additional storage capacity above the overflow);
- Provide captured stormwater for internal hot water supply (in some instances).



The water collected can be reused as a substitute for mains water supply either indoors (toilet flushing and laundry) or outdoors (garden watering). Rainwater tanks can be either above ground or underground. Above ground tanks can be placed on stands to prevent the need of installing a pump to distribute the water. Such systems are referred to as gravity systems. Pressure systems require a pump and can be either above or below ground tanks.

Tanks can be constructed of various materials such as Colorbond, galvanised iron, polymer or concrete.

Music Modelling Performance Criteria

The expected sediment and nutrient removal performance of the proposed devices was determined using the default equations and parameters provided in the MUSIC model. The water quality reduction mechanisms in MUSIC are based on an exponential decay equation referred to as the k -C* curve. The adopted MUSIC modelling parameters for Rainwater tanks are presented in the following table.

TABLE D3 – Rainwater Tank Parameters

	Rainwater Tanks	
Pollutant	**k (m/yr)**	**C* (mg/L)**
TSS	400	12.000
TP	300	0.130
TN	40	1.400

Appendix C

Not Used

Appendix D

Correspondence from Council

Chris Randall

From: Chris Randall
Sent: Tuesday, 2 August 2011 10:58 AM
To: Aneesh.singh@blacktown.nsw.gov.au; Anthony.Merrilees@blacktown.nsw.gov.au
Cc: brian rowston; Peter Mehl; 'Geoff Arnold'
Subject: 9297_Eastern Creek Raceway_Meeting 31/07/2011

Follow Up Flag: Follow up
Flag Status: Completed

Aneesh,

Thankyou kindly for meeting with us last Friday on short notice to discuss the stormwater issues on the Eastern Creek Raceway.

It is our understanding that the following items were discussed and agreed:

- The proposed works under this DA includes:
  - Track extension, 1 proposed building, new pit lane and accompanying asphalt area.
  - New building and pit lane will be constructed over the existing basin – which will be relocated immediately downstream.
- Future buildings shown on the plan will form under a future DA pending grant approvals from the government.
  - These will not be shown on the plans (to avoid confusion) but will be considered within modelling.
  - If modelling shows that basin arrangement cannot work with these included. Then we may reconsider approach.
- RAFTS modelling shall be undertaken to satisfy pre-post requirements for the proposed on the local catchment.
  - Assessment is only required for those areas affected by proposed work.
  - 20 year pipe system
- MUSIC modelling will be required for the proposed works.
  - Assessment is only required for those areas affected by proposed work
  - Racing track can be modelled as “other impervious” node under Council’s guidelines.
  - Existing tracks and impervious areas can be assessed against older guidelines.
  - Any new works to be assessed against current removal rate guidelines.
  - Demonstrate compliance accordingly for TSS, TN, TP.
  - Consideration to be given to existing arrangement
  - Rainwater tank required for new building (toilet reuse)
- ARDC confirmed that they have stringent practices and procedures in place to immediately treat any oil / grease spillages on site.
  Details on these procedures and any relevant insurances will be included in the report to Council.
- At this stage, it is likely that 2 new treatment ponds / detention basins will be constructed in order to achieve statutory requirements.
  These will allow for runoff to be treated on either side of the crest.
- ARDC confirmed that it is their preference to have these undertaken as wet basins. This will allow preservation of wildlife and possible retention re-use.
- Council indicated that due to building over the existing basin, works may need to be referred to DWE. JWP to confirm if flowpath is a blue line on 1:25,000 topographic maps and discuss further with Council (Pauline Daw). *It is noted that we have since checked topographic maps and confirm that a blue line is not shown and have left a message with Pauline.*
- During the filling of the dam, a flowpath will be created to convey flows downstream.
  At this stage, we anticipate the proposed works will include a combination of pipes and / or swales to direct upstream runoff to the new basin.

JWP propose and understand that the following information is required for DA.

- Electronic copies of models
- Stormwater Drainage Concept Plan
- Brief summary report of Stormwater Strategy.

We trust that this meets Council’s satisfaction and provides assistance in approval processes.
Please feel free to contact me at any time if there are any issues.

Regards

Chris Randall – Water Resources Engineer

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

P 02 4720 3342 **F** 4721 7638 **W** www.jwprince.com.au
580 High Street, Penrith NSW
PO Box 4366 PENRITH WESTFIELD 2750

Appendix E

Figures

TRUNK PIPE SYSTEM UNDER TRACK, SKID PAN AND PIT AREA. CONSTRAINT - PIPE SYSTEMS ARE SIZED TO SUIT 5 YEAR ARI (TYP)

EXISTING POND / BASIN 1.

TRUNK PIPE SYSTEM. DISCHARGES TO EASTERN CREEK

SKIDPAN

3 X CSR HUMES OIL SEPARATORS (RECOMMENDED BY DCS)

EXISTING POND / BASIN 3

PIPE DISCHARGE TO SITE FROM DRAGWAY. CONNECTS TO SWALE

DRAGWAY SITE

EXISTING POND / BASIN 2. OPPORTUNITY TO MODIFY OUTLET TO ACHIEVE FURTHER DETENTION (IF REQUIRED)

THIS PLAN HAS BEEN DEVELOPED FROM FROM AN EXTRACT OF DCS 1996 REPORT AND INCLUDES JWP MARKUPS IN RED.

COMMENTS ARE PROVIDED ON BOTH CONSTRAINTS AND OPPORTUNITIES AND THE EXISTING INFRASTRUCTURE.

GENERAL CONSTRAINT - EXISTING PIPE SYSTEM FOR OVERALL SITE HAS BEEN DESIGNED FOR 5 YEAR ARI.

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300 W www.jwprince.com.au
F 02 4721 7638 E jwp@jwprince.com.au

Aerial Photograph Date: 2011 (supplied courtesy of NearMap Pty Ltd)

Notes:

N W E S

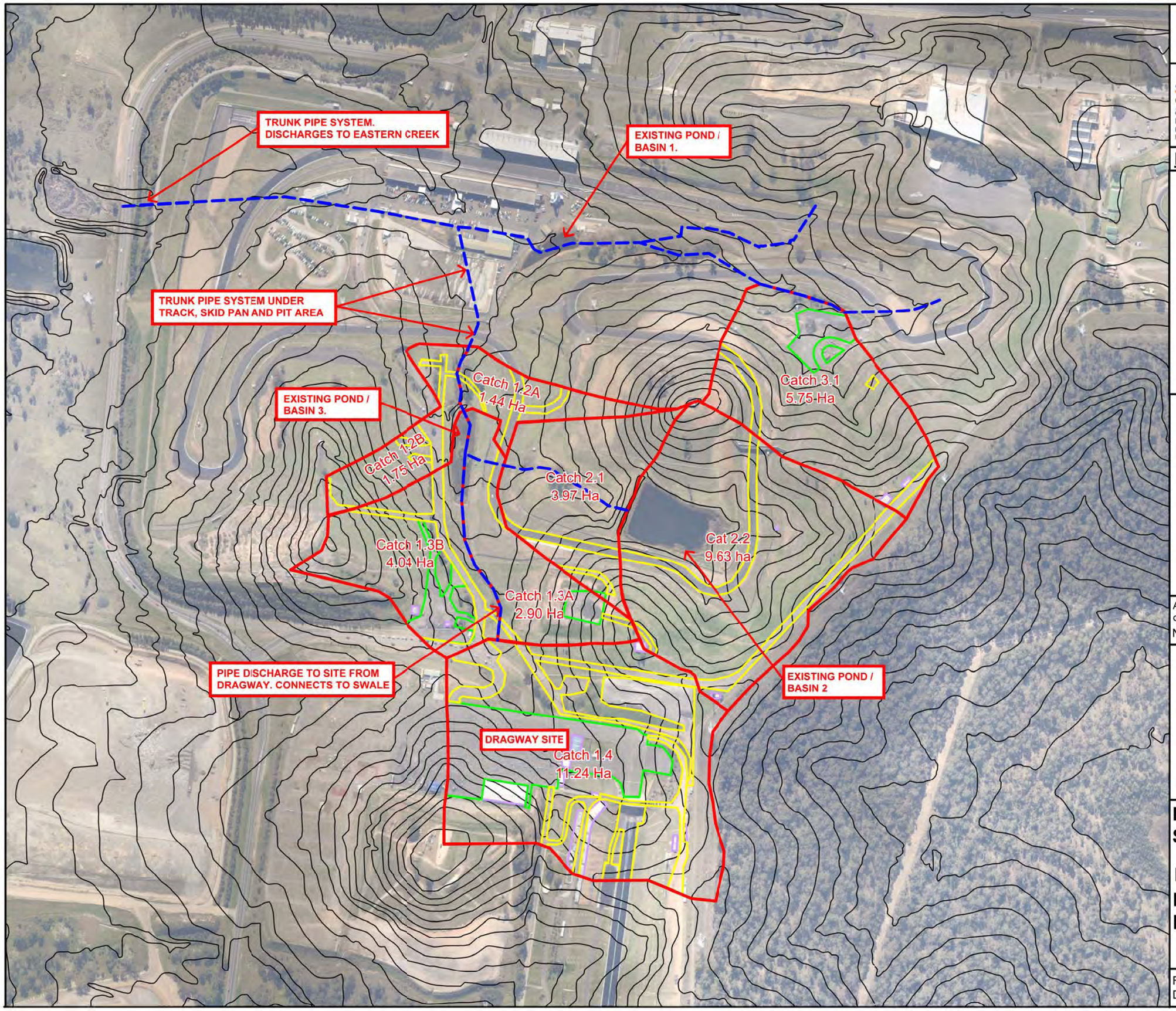
Not to Scale

Eastern Creek Raceway Stage 2

Figure 1

Existing Drainage Configuration

File Name: 9297_FIGURE01
Date : 24/08/2011 Issue A



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300 W www.jwprince.com.au
F 02 4721 7638 E wp@jwprince.com.au

LEGEND

- EXISTING FLOWPATH CENTRELINE
- XP-RAFTS SUB-CATCHMENT
- 2.0M INTERVAL EXISTING CONTOUR
- EXISTING ROADS
- EXISTING CARPARK
- EXISTING ROOFS

Aerial Photograph Date: 2011 (supplied courtesy of NearMap Pty Ltd)

Notes:

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S

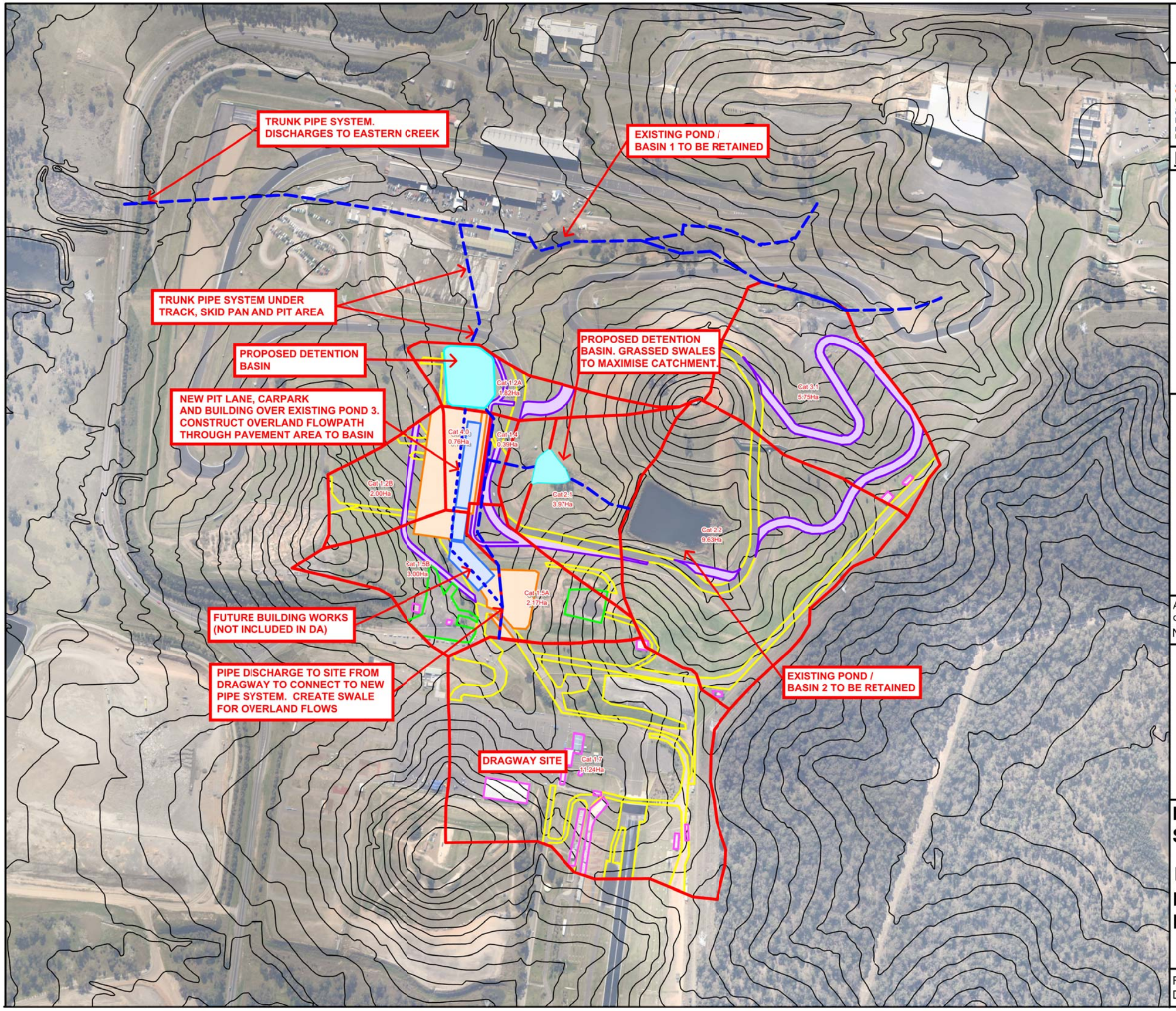
Scale 1: 5,000

100 0 100 m

Eastern Creek Raceway Stage 2

Figure 2
RAFTS Catchment Plan Existing

File Name: 9297_FIGURE02
Date : 24/08/2011 Issue A



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300
F 02 4721 7638
W www.jwprince.com.au
E jwp@jwprince.com.au

LEGEND

- EXISTING FLOWPATH CENTRELINE
- XP-RAFTS SUB-CATCHMENT
- 2.0M INTERVAL EXISTING CONTOUR
- EXISTING ROADS
- EXISTING CARPARK
- EXISTING ROOFS
- PROPOSED ROADS
- PROPOSED CARPARK
- PROPOSED BUILDINGS
- PROPOSED DETENTION BASIN

Aerial Photograph Date: 2011 (supplied courtesy of NearMap Pty Ltd)

Notes:

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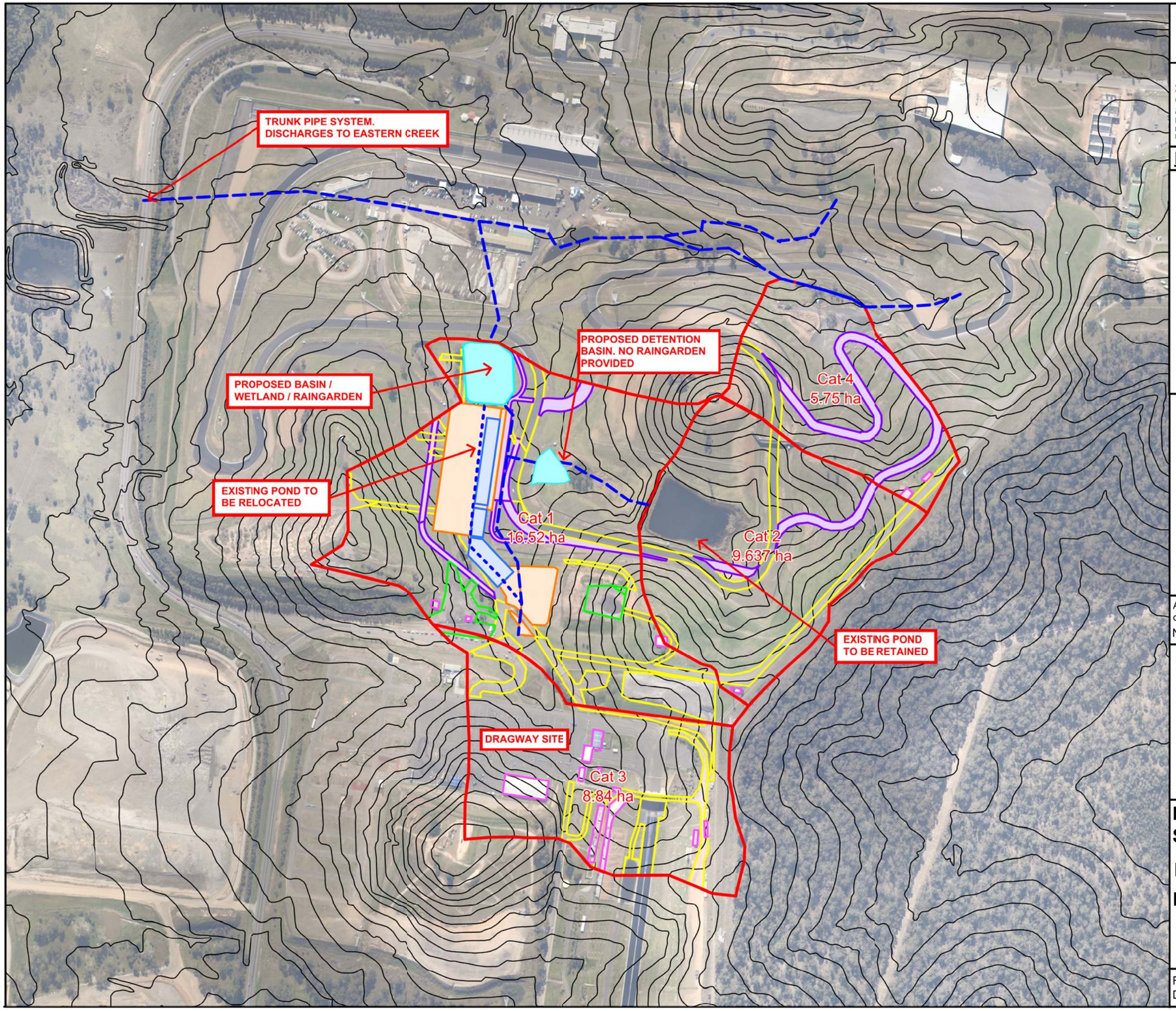
Scale 1: 5,000

100 0 100 m

Eastern Creek Raceway Stage 2

Figure 3
RAFTS Catchment Plan Proposed

File Name: 9297_FIGURE03
Date : 01/02/2012 Issue C



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300
F 02 4721 7638
W www.jwprince.com.au
E jwp@jwprince.com.au

LEGEND

- PROPOSED FLOWPATH CENTRELINE
- MUSIC SUB-CATCHMENT
- 2.0M INTERVAL EXISTING CONTOUR
- EXISTING ROADS
- EXISTING CARPARK
- EXISTING ROOFS
- PROPOSED ROAD
- PROPOSED CARPARK
- PROPOSED BUILDING
- PROPOSED BASIN / WETLAND / RAINGARDEN

Aerial Photograph Date: 2011 (supplied courtesy of NearMap Pty Ltd)

Notes:

N
W E
S

Scale 1: 5,000

100 0 100 m

Eastern Creek Raceway Stage 2

Figure 4

MUSIC Catchment Plan

File Name: 9297_FIGURE04
Date : 01/02/2012 Issue B

B	ISSUE FOR S96 APPROVAL	CR	CR	PM	PM	21/02/12
A	ISSUE FOR APPROVAL	CR	CR	PM	PM	31/08/11
	AMENDMENT	DES	DRN	CKD	APR	DATE

J. WYNDHAM PRINCE CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

PO Box 4366 PENRITH WESTFIELD NSW 2750

P 02 4720 3300 F 02 4721 7638 W www.jwprince.com.au E jwp@jwprince.com.au

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DATUM:

ORIGIN:

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TENDER ISSUE
NOT FOR CONSTRUCTION

EASTERN CREEK RACEWAY, SYDNEY SOUTHERN EXTENSION

PROPOSED WORKS LAYOUT

PLAN No: 9297/URE5 B

FILE No: 9297FIGURE5

SHEET SIZE: A1 ORIGINAL

Plotted: 1 February , 2012 4:56:48 PM File Name: z:\9297\WDrawings\SW - Figures\9297Figure5.dwg