Cardno
Shaping the Future

Potts Hill Residential Precinct

Project Application
Engineering and Infrastructure Report

Job Number 600246

Prepared for Landcom

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Executive Summary

Sydney Water Corporation, in partnership with Landcom, is proposing to develop land surplus to its operational requirements at Potts Hill.

The western precinct, to which this application refers, is proposed to be developed as a residential subdivision comprising in excess of 200 Torrens titled lots, two (2) medium density sites and open space areas. The project is to be assessed as a Part 3A Major Development Application.

This report has been prepared by Cardno in support of a Part 3A Major Development Application submission for the above noted residential subdivision.

The report focuses on the interaction between the proposed development and local infrastructure, stormwater drainage including on site detention and water quality, essential services including water, sewer, electrical, telecommunications and gas supply. Negotiations with Sydney Water Corporation are continuing regarding the possibility of providing reticulated recycled water services to the development.

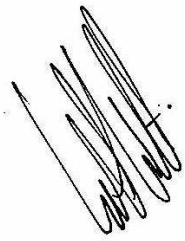
A significant engineering issue relates to earthwork cut and fill operations including reworking existing fill material contained on the majority of the site. The proposed methodology and sequence for earthwork operations is discussed in a separate geotechnical report prepared by Geotechnique.

Three intersections with the adjoining existing road network are proposed. These are discussed in the traffic report prepared by Halcrow MWT.

As part of the design process, a number of meetings and discussions have been held with Bankstown City Council. Where applicable, Council's concerns and comments have been addressed in the engineering/subdivision design and noted in this report where relevant.

It is proposed that all roads and drainage facilities will be dedicated to Bankstown City Council as part of the subdivision registration process.

No significant engineering issues are anticipated in integrating the proposed development to the existing neighbourhood.



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1 Introduction

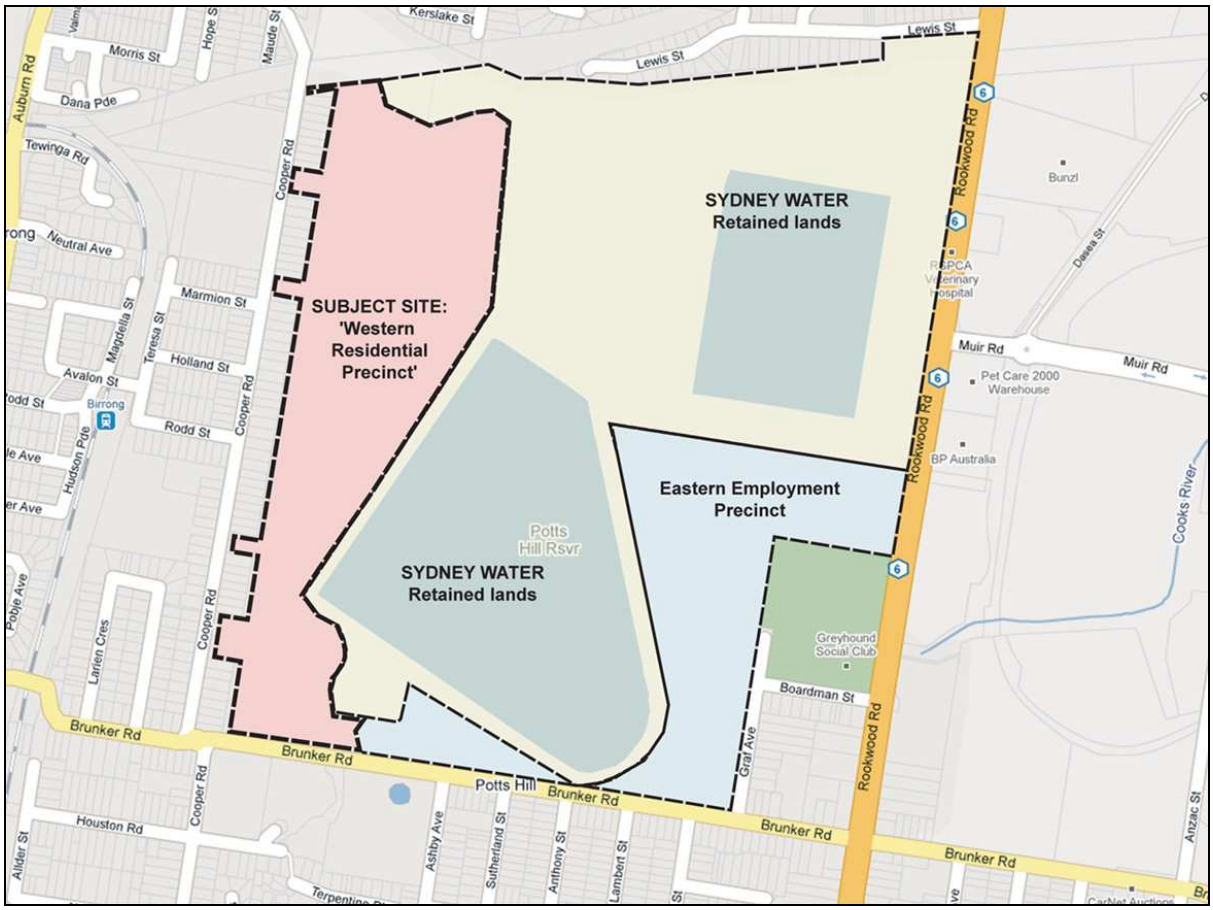
Sydney Water Corporation in partnership with Landcom is proposing to develop surplus land within its 'Critical Inventory Centre' located at Potts Hill for residential use. The proposed development includes the creation of more than 200 Torrens title residential lots, two (2) medium density development sites generally to the northern and southern extents of the development area together with establishment of public open space areas.

Cardno has been commissioned by Landcom to undertake concept civil engineering and infrastructure design and investigations for the residential precinct. This report addresses works required for the construction of the road network, drainage facilities and infrastructure for the proposed residential subdivision.

The project is to be assessed under a Part 3A Major Development Application. This report and accompanying drawings (as listed in Appendix A) form part of the Project Application and should be read in conjunction with the Environmental Assessment prepared by Architectus together with the various specialist reports.

A locality plan is presented in Figure 1.

Figure 1: Locality plan



As part of the design process, a number of meetings and discussions were held with Bankstown City Council. Where applicable, Council's comments and requirements have been addressed in the civil and infrastructure design. Details of Council consultation and discussions are included in the Environmental Assessment prepared by Architectus.

2 Previous Studies

A number of previous studies have been undertaken to assess existing site conditions and the feasibility of the proposed residential subdivision. The most relevant of these previous studies relating to the engineering and infrastructure design are listed below:

- *Potts Hill Reservoir, Contour and Detail Survey*, Lean and Haywood, Drawing 76862.01.D01, July 2007
- *Potts Hill Western Precinct, Infrastructure Investigation*, J Wyndham Prince, Document 8654, July 2009
- *Potts Hill Geotechnical Investigation Report*, Coffey Geotechnics, Project 50363, Ref GEOLCOV23274AA-AG, 30 January 2008
- *Potts Hill Sydney Water Corporation Surplus Land, Services, Civil Engineering and Water Management Report*, Worley Parsons, Project 6242.05, 26 May 2008

Where appropriate, these documents have been referenced for background information.

3 Existing Site

The Western Residential Precinct is located on land currently owned by Sydney Water Corporation. It is bound to the north by the City Rail Bankstown line, to the east by Sydney Water Corporation's retained operational land, to the south by Brunker Road and to the west by existing residential properties fronting Cooper Road. The development site has an area of 23.08Ha.

The majority of the site is underlain by fill material from the construction of the adjoining Reservoir No 2 (completed in 1924). For further discussion on the underlying material and proposed earthworks strategy refer to Section 4.

Fill depth varies to a maximum of approximately 10m. The fill batter is generally readily defined on site with existing batter slopes typically 3H:1V with local areas increasing to 2.5H:1V. The batter is generally well vegetated.

To meet Sydney Water Corporation's security requirements, buffer zones are required between the proposed residential subdivision and Sydney Water Corporation retained operational land. A 30m buffer will be provided to the existing water supply canal (adjacent to the northern medium density site) and a 50m buffer to Reservoir No 2 along the eastern boundary.

4 Earthworks

As part of previous geotechnical investigations, engineering bore logs have been completed to assess the type of material that underlies the surface. These bores generally indicate four soil horizons as presented in Table 1.

Table 1: Summary of existing soil horizons

Horizon ID	Description
1A	Generally fill that includes some isolated areas containing deleterious material such as building rubble, concrete, pipes etc
1B	Generally silty clay from the construction of Reservoir No 2 that is free from deleterious material
2	Represents residual soil conditions prior to the placement of fill from the Reservoir No 2 construction
Rock	Existing rock profile that underlies the site

As part of earthworks operations it is proposed to strip and excavate a portion of the 1A horizon and screen or appropriately treat the material prior to either reuse on site, storage on Sydney Water Corporation retained operational land, or disposal from site.

Details of the earthworks requirements are presented in the geotechnical report by Geotechnique titled '*Potts Hill Residential Estate, Concept Design – Phase One – Interim Report'*. It presents discussion and requirements for the proposed earthworks operations.

To minimise the risk to structures, including Reservoir No 2 and existing dwellings, earthworks boundary offsets as presented in Table 2 will be observed during construction. Note that the restrictions are indicative only and will need to be confirmed prior to commencement of construction.

Table 2: Summary of earthworks boundary offsets for earthworks operations

Location	Restriction
Eastern boundary (Adjacent to Reservoir No 2)	No earthworks machinery within 50m of the reservoir edge to limit particle velocities to less than 5mm/second
Western boundary (Adjacent to existing Cooper Road lots)	Earthworks within 30m of boundary line to be undertaken with machinery that restricts particle velocities to less than 5mm/second

5 Roads

Public roads are to be constructed as part of the proposed works to the engineering requirements of Bankstown City Council. Roads will be dedicated to Council as part of the subdivision registration process hence becoming public assets maintained by Council.

5.1 Site Layout

The urban residential layout has been master-planned by Architectus and forms the basis for the engineering design. The site is categorised by a grid pattern of north-south and east-west oriented roads. The road pattern is informed by the geometry of the site and a desirable urban outcome to provide clear view corridors. Given the predominant straight geometry of much of the road network, appropriate speed controls are proposed to be incorporated into the design.

5.2 Road Geometry and Grades

Roads have been designed for a 50km/hr design speed.

Ninety (90) degree bends in the road control lines have been designed with a minimum horizontal radius of 12.5m. Where the control line angle is less than 90 degrees, the horizontal radius has been increased to facilitate turning movements for the design vehicle.

Roads have generally been designed with a minimum grade of 1.0% however due to various site constraints some roads have been graded to an absolute minimum of 0.5%. Maximum roads grades have generally been set to less than 12%.

Vertical curves have been provided at changes in vertical grade. At intersections, a minimum vertical curve length of 10m has generally been adopted.

5.3 Turning Paths

Design vehicle turning paths have been assessed on the internal road intersections for a 9.9m long rigid garbage truck. Dimensions of the vehicle have been adopted from MacDonald Johnson (garbage truck manufacturer) and entered into the AutoCAD based AutoTurn program.

Where higher lot densities dictate the introduction of laneways, garbage pick-up is assumed to the rear.

AutoTurn has confirmed, conceptually, the suitability of the proposed road layout with respect to turning paths.

5.4 Road Cross Sections

Typical road cross sections have been adopted by Architectus, generally in accordance with Landcom's Street Design Guidelines. Typical cross sections are provided on the concept engineering drawings.

5.5 Road Pavement

It is proposed to construct the road network as a flexible pavement consisting of a prepared subgrade, granular subbase course, granular base course and asphalt wearing course.

All roads will be designed for a twenty (20) year design period with equivalent standard axles (ESAs) as follows:

- Roads 1 and 3 - 3 x 10^5 ESAs;
- Local roads generally - 6 x 10^4 ESAs;
- Shareways - 2 x 10^4 ESAs.

The design subgrade CBR will be adopted as CBR 3% based on the preliminary geotechnical investigation. It is proposed to verify subgrade CBR by testing following completion of the proposed earthworks.

5.6 External Intersections

The site will connect to the existing road network at three (3) locations:

a) Intersection No 1 - Road No. 1 and Cooper Road

b) Intersection No 2 - Road No. 13 and Cooper Road

c) Intersection No 3 - Road No. 3 and Brunker Road

Intersection No 1

It is proposed to construct a single lane circulating roundabout at the intersection of Cooper Road and proposed Road No.1.

As part of these works the existing Birrong Girls High School car park entry may be realigned to become a fourth leg of the roundabout. Alternatively, the car park entry could be relocated a safe distance to the north of the proposed roundabout. Discussions with the High School and adjoining neighbours are ongoing and will be resolved prior to construction.

Intersection No. 2

It is proposed to connect Road No 13 to Cooper Road as an unsignalised 'T' intersection.

Intersection No. 3

It is proposed to connect Road No 3 to Brunker Road with a modified 'seagull' type intersection allowing left turns into and from Road No. 3 and right turns from Brunker Road. Right turns from Road No. 3 into Brunker Road will not be permitted and the geometry of the intersection will prohibit this movement.

For additional details on the proposed external intersections refer to traffic report prepared by Halcrow MWT.

5.7 Internal Intersections and Speed Controls

Internal road intersections will be treated as standard 'T' or four-way intersections as appropriate. At selected intersections and at intermediate locations along proposed roads, kerb blisters or similar controls will be provided to reduce speeds to ensure a safe environment for both pedestrians and vehicular traffic.

Full details of the intersection treatments and speed controls will be provided at the detailed design stage in consultation with Halcrow MWT. For additional discussion on intersection treatments and speed controls refer to the traffic report proposed by Halcrow MWT.

6 Site Grading

Lot and road grades at the perimeter of the site have generally been designed to match adjacent site levels except at two locations where retaining walls are proposed along the site boundary:

- Along the eastern boundary (parallel to Reservoir No 2): The retaining wall varies in height between 1.0m and 2.5m. The wall is required to support the Sydney Water Corporation operational land adjoining Reservoir No 2 where the proposed roads and lots are lower than existing levels;

- Along the northern boundary (Road No 4): A retaining wall is required to support the existing open space beyond to provide appropriate vertical road geometry. The maximum wall height is approximately 0.6m.

The two medium density sites (in the north and south of the site) are not proposed to be regraded other than the provision of a batter along the road verge to existing surface levels. A similar treatment will be provided adjoining the Canal Park and Brunker Road open spaces.

Due to the site gradients it is proposed to implement various lot treatments to reduce the impact of grade on the useability of the residential lots. The proposed treatments will generally, depending on the severity of the gradient, include a combination the measures outlined below:

- 0.5m high embankment at the front of proposed lots at a maximum 4H:1V slope;

- Maximum rear yard grade of 10%;

- Maximum 2m high batter between adjoining lots in rear yards at a maximum 3H:1V slope;

- Stepped or split level house construction

One or more of the above treatments are generally proposed for each lot. Where possible, lot grades have been configured to allow roof drainage to discharge to the street. While this does not eliminate the need for interallotment drainage in the rear of the lots, the front of the dwelling has an improved visual appearance from the street.

An indicative lot treatment plan is included on the concept engineering drawings. Design contours as shown on the engineering plans assume a straight grade through the lots between boundaries. Full details of the proposed finished bulk earthworks levels, including lot levels, will be provided at the detailed design stage.

7 Stormwater Drainage

It is proposing to provide stormwater detention and water quality bioretention basins to reduce peak flows to predevelopment levels and improve the quality of the stormwater discharge from the development site. The proposed bioretention/detention basins will meet the requirements of Council's Engineering Policy and Landcom's Water Sensitive Urban Design guidelines.

7.1 Policy Requirements

Bankstown City Council's Development Engineering Standards (June 2009) requires the road drainage network to be designed for the critical 10 year ARI (average recurrence interval) (10% AEP – annual exceedence probability) storm event. Overland flow paths are to be designed for the 100 year ARI (1% AEP) storm event.

Council also requires that peak flows leaving the site be no greater than those from the existing site (ie pre-developed flows to match post-developed flows) for the critical 5 year ARI through to the 100 year ARI storm events. Further, Landcom's Water Sensitive Urban Design policy requires that the post-developed peak flows from the site not exceed those from the existing site for the 1.5yr ARI storm event.

7.2 Existing Drainage Network

Cooper Road has an existing stormwater pit and pipe network to which the development site will discharge stormwater. Further, there are two existing pipes that pass under the railway to the north of the site that may be utilised for site discharge.

Details of existing pipe sizes have been adopted from information provided by Bankstown City Council. Where necessary, this information has been supplemented with field inspections. Surface and invert levels of existing pits and pipes have been adopted from the detail survey undertaken by Lean and Haywood.

A discussion on connections into the existing stormwater network is presented in Sections 7.7 to 7.9.

7.3 Proposed Stormwater Network

An indicative stormwater layout has been presented on the concept engineering plans (drawing numbers 053 and 054). As part of the detailed design, a comprehensive 'Drains' model will be prepared to analyse the proposed pit and pipe network. Pits will be positioned in accordance with normal engineering practice and to limit the gutter flow width to 2.5m during the design storm event.

7.4 Proposed Intersection Drainage

As part of the intersection works, it will be necessary to construct new stormwater drainage pits and pipes within Cooper and Brunker Road. The extent of the additional drainage works will be confirmed during the detailed design stage.

7.5 Catchments

The existing site comprises four (4) catchments. Based upon the detail survey and aerial photography, peak flows from each of the existing catchments were estimated using methods described in Australian Rainfall and Runoff. A summary of the results is presented in Table 3.

Table 3: Summary of existing catchment properties and flows

Catchment	Area	Impervious	Q5	Q100
Ex 1	4.29 ha	25 %	0.60 m³/s	1.18 m³/s
Ex 2	12.55 ha	15 %	1.23 m³/s	3.2 m³/s
Ex 3	5.07 ha	0 %	0.44 m³/s	1.24 m³/s
Ex 4	6.84 ha	0 %	0.76 m³/s	1.97 m³/s

As a function of the proposed regrading, the developed site will comprise three (3) catchments. Catchments 1 and 2 are generally similar in area to the existing catchments noted above. Existing Catchments 3 and 4 will be combined as Catchment 3, discharging to Cooper Road. It should be noted that the existing outlets from existing Catchments 3 and 4 join in Larien Crescent approximately 75m downstream of the site.

A summary of proposed catchment properties and flows (without on site detention) is presented in Table 4. Note that the catchment areas and flows include upstream catchments. All upstream catchments are assumed to be undeveloped (ie imperviousness = 0%).

Table 4: Summary of proposed catchment properties and flows (without on site detention)

Catchment	Area	Impervious	Q5	Q100
1	4.7 ha	75 %	1.32 m³/s	4.48 m³/s
2	11.7 ha	75 %	3.20 m³/s	5.39 m³/s
3	11.8 ha	75 %	2.28 m³/s	4.48 m³/s

The medium density sites are included in the above calculations assuming they will not have their own water quality or detention facilities.

7.6 Detention/Water Quality Basins

To satisfy Council's on-site detention requirements and Landcom's water quality guidelines, it is proposed to provide combined detention and water quality basins at the downstream end of each proposed catchment. Details on the water quality assessment are included in Section 7.11.

The basins will serve to detain flows to meet Council's policy requirements while including filter material and vegetation in the base (bioretention) to address water quality requirements. Basins will be dedicated to Council for ownership, operation and maintenance as part of the subdivision registration process.

A 'Drains' model was developed to simulate the basins and determine required detention volumes. Rainfall data was adopted from Council's Development Engineering Standards (June 2009) and the proposed development areas assumed to be 75% impervious. Open spaces are assumed to be 0% impervious. Catchments upstream of the development have been assumed to bypass the detention and water quality basins. Full details of the Drains model are provided in Appendix B.

For the purpose of this analysis, it was assumed that basin connection points into the existing stormwater network have a constant hydraulic grade line (HGL) 150mm below grate level.

A summary of basin sizes and a comparison of existing and developed peak flows is presented in Table 5.

Table 5: Comparison of existing and developed flows and basin volumes

Catchment	Q5 (Existing)	Q5 (Proposed)	Q100 (Existing)	Q100 (Proposed)	Basin Volume
1	0.60 m³/s	0.59 m³/s	1.18 m³/s	1.08 m³/s	1,250 m³
2	1.23 m³/s	1.18 m³/s	3.20 m³/s	2.64 m³/s	3,700 m³
3	1.19 m³/s	1.19 m³/s	3.09 m³/s	2.89 m³/s	2,000 m³

Each of the basins is briefly described in the following sections. It should be noted that the preferred basin arrangements as presented below are the result of various iterations, investigations and discussions on alternative arrangements with the project design team.

As part of the consultation process undertaken with Bankstown City Council, consideration was asked to be given to the requirements of the NSW Dam Safety Committee (DSC) in relation to the proposed basins. The DSC undertakes assessment of existing and proposed water retaining bodies and considers the consequence of failure. Where appropriate, the water retaining bodies may be classified as 'prescribed'. The warrant for a basin to be considered as 'prescribed' is a function of the severity of loss and damage should failure occur.

An assessment for each basin against the Consequence Categories as presented in the Dam Safety Committee document 'DSC13 – Consequence Categories for Dams' was made. A summary of the Consequence Categories for each basin is presented in Table 6.

Table 6: Summary of Dam Safety Committee Consequence Categories for each basin

Basin	Population at Risk (PAR)	Severity of Loss and Damage	Consequence Category
Basin 1	<1	Minor	Very Low
Basin 2	<1	Negligible	Very Low
Basin 3	<1	Negligible	Very Low

As the Consequence Category for each basin is considered to be very low, referral to the NSW Dam Safety Committee is not considered to be necessary.

The proposed basins will be constructed with emergency spillways discharging to either the railway corridor (Basin 1) or Cooper Road (Basins 2 and 3). In all instances the emergency overflows will be directed away from existing properties. The basins will be dry for the majority of the time, only holding water for relatively short durations during and after storm events.

7.7 Basin 1

Basin 1 is proposed to be constructed in the north-western corner of the site. The basin will generally be excavated into the existing ground and supported by retaining walls. A fence will be provided to the top of the retaining walls.

The basin will incorporate filter media and vegetation over the base area for water quality treatment.

Discharge from the basin will be directed to the existing 600mm stormwater pipes that discharge under the railway immediately to the north. An emergency spillway incorporating appropriate scour protection will be included on the northern side and discharge to the railway (as per existing conditions).

A 3m wide concrete ramp graded at 8H:1V will be provided to allow access for maintenance and emergency egress. Local batters will be landscaped as appropriate.

For details of basin landscape embellishment works, refer to documentation by the Landscape Architect (Place Design).

7.8 Basin 2

Basin 2 is located toward the centre of the site. Due to the required detention volume and considerate to the topographical constraints of the site, the basin has been split into four 'cells'. The two lower cells, bounded to the west by existing lots fronting Cooper Road and to the east by proposed Road 2, will perform a combined detention and water quality function. The two upper cells, bounded to the west by proposed Road 2 and to the east by the rear boundary of lots fronting proposed Road 3, will function as detention basins only.

A flow splitting pit will be provided to direct water quality flows to the lower cells for treatment.

The lower cells will include retaining walls on two sides. These retaining walls will include a fence or railing as required. The side fronting Road 2 will be a turfed or landscaped batter with slopes varying from 7H:1V to 3H:1V. A 3m wide concrete ramp will be provided at the 7H:1V slope to allow access for maintenance and emergency egress. The lower cells will include filter media and vegetation over the base area for water quality treatment.

Pedestrian access over the lower cells will be provided in the form of either a bridge or elevated path. If a path is ultimately selected, the two lower cells will be linked via a series of box culverts (or similar).

The cells discharge to the existing 900mm stormwater pipe in Cooper Road. An emergency spillway and scour protection will be included on the western side of the lower cells discharging to Cooper Road (as per existing conditions).

The upper cells will include a full height retaining wall and safety fence on the eastern side. Turfed and landscaped batters will be provided on two sides of the cells with batter slopes varying from 7H:1V to 3H:1V. A 3m wide concrete ramp will be provided at the 7H:1V slope to allow access for maintenance and emergency egress. The upper cells will include a turfed base (water quality treatment provided in lower cells only).

Pedestrian path access over the upper cells will be provided. The cells are proposed to be linked via a series of box culverts (or similar). Maximum ponded depth within the upper cells is proposed to be approximately 1.2m. An emergency spillway and scour protection will be included on the western side of the upper cells discharging to Road 2.

For details of basin landscape embellishment works, refer to documentation by the Landscape Architect (Place Design).

7.9 Basin 3

Basin 3 is located within the proposed Brunker Road Park fronting Cooper Road. The basin will have landscaped earth mounds on three sides with a maximum grade of 3H:1V. A 1.0m high retaining wall will be included on the inside slope of the basin to minimise the basin footprint. A fence on this wall is not proposed.

The footprint of the basin is proposed to be an irregular shape so that existing vegetation can be retained on the northern side of the basin where possible. Access to the Brunker Road Park from Cooper Road will be provided adjacent to the southern side of the basin.

It is proposed to incorporate a viewing platform to the eastern side of the basin constructed over a full height retaining wall. The retaining wall has been included to reduce the basin footprint and ensure that ecological communities that exist to the east of the basin can be retained where possible. This platform will include a safety rail/fence.

A 3m wide concrete ramp will be provided in the north-east corner of the basin to allow access for maintenance and emergency egress.

The basin will discharge to the existing 750mm stormwater pipe in Cooper Road. The discharge arrangement will require the removal of a short section of 300mm pipe that currently drains the park to the Cooper Road stormwater network. Discharge from the basin to the existing Cooper Road network may require a box culvert to minimise potential service conflicts with existing services.

For details of basin landscape embellishment works, refer to documentation by the Landscape Architect (Place Design).

7.10 Basin Fencing

Basins will generally be dry with a maximum 300mm depth of water detained for a maximum of three (3) days for water quality treatment. During extreme storm events, such as the 100 year ARI event, water will be detained for typically no more than 2 to 3 hours to a maximum depth of 1.5m in Basins 1 and 3 and 1.2m in Basin 2. With the exception of retaining walls greater than 1.0m in height, it is generally not proposed to fence the basins.

7.11 Water Quality

Bankstown City Council does not currently have a water quality or water sensitive urban design (WSUD) policy. It is therefore proposed to adopt Landcom's Water Sensitive Urban Design guidelines for this development. This was confirmed by Council as acceptable on 20/10/09 (refer email from Council's Martin Beveridge included in Appendix C).

Landcom's WSUD policy requires the following reduction in mean annual pollutant loads:

- Total suspended solids (TSS): 85% reduction
- Total phosphorous (TP): 65% reduction
- Total nitrogen (TN): 45% reduction

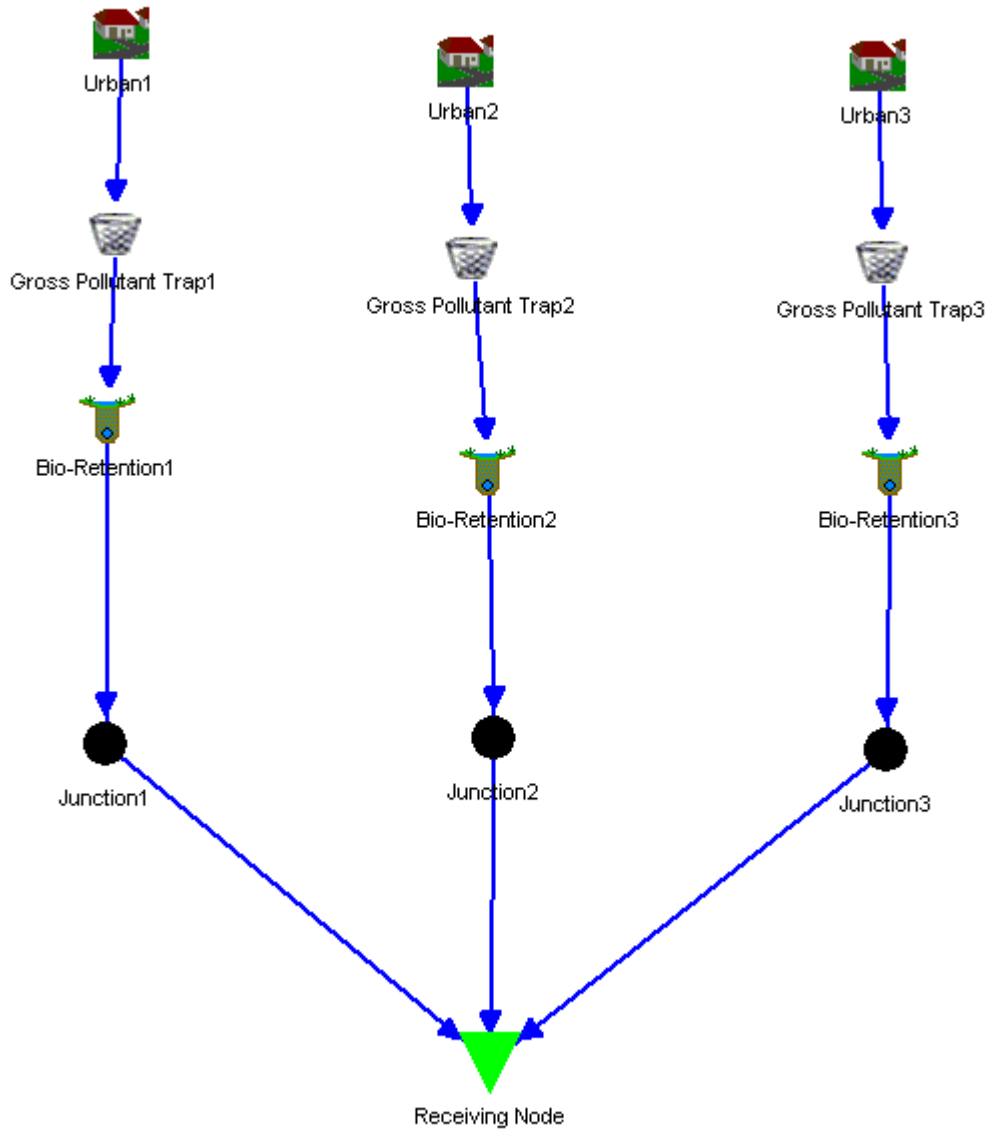
It is noted that the Landcom guidelines include higher reduction targets than generally required by the Department of Environment, Climate Change and Water (DECCW).

The proposed treatment train will incorporate:

- Gross pollutant traps
- Bioretention basins

A preliminary MUSIC model was prepared to simulate the proposed development and water quality treatment train. A screen capture of the MUSIC model is presented in Figure 2.

Figure 2: Screen Capture of MUSIC model



The preliminary MUSIC model utilised 6 minute rainfall data for the 20 year period from 1963 to 1982 from rainfall station 66062 – Sydney (Observatory Hill). This 20 year period was selected as it included a close match to the wet, dry and mean year annual rainfalls over the full data set.

For the purpose of modelling, it was assumed that the gross pollutant traps would be Rocla 'CDS' units (or equivalent). It is noted that Council has advised that their preference is for CDS units (refer email from Council's Vimal Vimalaratnam 09/11/2009 included in Appendix D).

Bioretention basins were assessed assuming:

- Bypass of flows greater than the 6 month storm event
- Maximum extended detention depth of 0.3m
- Filter depth of 0.6m
- Filter particle diameter of 0.5mm

The required area of bioretention was modelled as:

- Basin 1: 600m²
- Basin 2: 1,750m²
- Basin 3: 750m²

Results of the proposed treatment train modelling are presented in Tables 7 to 9 for each of the three basins.

Table 7: Summary of water quality MUSIC modelling for Basin 1

Pollutant	Source (Without Treatment)	Residual Load (With Treatment Train)	Reduction
Flow (ML/yr)	39.9	39.9	0%
Total Suspended Solids (TSS) (kg/yr)	8,020	370	95.4%
Total Phosphorus (TP) (kg/yr)	16.4	3.77	77.0%
Total Nitrogen (TN) (kg/yr)	115	56.4	50.8%
Gross Pollutants (kg/yr)	1,050	0	100.0%

Table 8: Summary of water quality MUSIC modelling for Basin 2

Pollutant	Source (Without Treatment)	Residual Load (With Treatment Train)	Reduction
Flow (ML/yr)	89.5	89.6	0%
Total Suspended Solids (TSS) (kg/yr)	17,900	603	96.6%
Total Phosphorus (TP) (kg/yr)	36.7	7.29	80.1%
Total Nitrogen (TN) (kg/yr)	256	118	54.1%
Gross Pollutants (kg/yr)	2,360	0	100.0%

Table 9: Summary of water quality MUSIC modelling for Basin 3

Pollutant	Source (Without Treatment)	Residual Load (With Treatment Train)	Reduction
Flow (ML/yr)	42.6	42.6	0%
Total Suspended Solids (TSS) (kg/yr)	8,610	337	96.1%
Total Phosphorus (TP) (kg/yr)	17.6	3.72	78.9%
Total Nitrogen (TN) (kg/yr)	122	57.5	52.9%
Gross Pollutants (kg/yr)	1,130	0	100%

Output from the MUSIC model is presented in Appendix E.

It is proposed to vegetate the bioretention areas with species as suggested in the document 'Water Sensitive Urban Design – Technical Guidelines for Western Sydney', May 2004, published by Stormwater Trust and Upper Parramatta River Catchment Trust.

7.12 Temporary Erosion and Sedimentation Control Measures

Temporary erosion and sedimentation control measures will be implemented on the site during the construction works. Where possible, the works will be staged to limit the disturbed area potentially exposed to erosion at any one time.

The temporary erosion and sedimentation control measures will be installed and maintained in accordance with Landcom's Managing Urban Stormwater – Soils and Construction, March 2004 (referred to as the 'Blue Book').

It is proposed that the water quality and detention basins will be utilised as temporary sediment control basins during construction. A summary of the calculated basin sizes in accordance with 'Blue Book' procedures is presented in Table 10. All required temporary basin volumes are less than the permanent basin volume. It has been assumed that the upstream catchments will bypass the temporary sediment basins.

Table 10: Summary of temporary sediment basin volumes

Catchment	Temporary Basin Volume
1	825m³
2	1,850m³
3	880m³

8 Potable Water

Potable water will be reticulated throughout the subdivision. An existing 500mm CICL main exists in Brunker Road with a 150mm PVC main in Cooper Road. A connection will be made to both of these existing mains to service the site, subject to Sydney Water Corporation approval. Existing water mains that service the existing Sydney Water Corporation buildings in the western precinct will be decommissioned as part of the proposed works.

A Feasibility Application was made to Sydney Water Corporation by J Wyndham Prince in their report of July 2009. It was stated that potable water would be available to the site from the existing mains in Brunker and Cooper Roads. A copy of the Feasibility Letter received by J Wyndham Prince is included in Appendix G. A revised Feasibility Application has been submitted by Cardno, however, at the time of report preparation, a response was not available.

Details of the proposed potable water network will be provided at the detailed design stage. The proposed network will be designed to meet Sydney Water Corporation's requirements.

The northern portion of the site is underlain by a 3,000mm CICL trunk water main that services Reservoir No 2. This trunk main is approximately 30m below existing surface levels. Sydney Water Corporation have confirmed that they have no special requirements for protecting the main during the proposed earthworks operations, nor do they require an easement over the main (refer email from Sydney Water's Steve Maxwell dated 09/11/2009 included in Appendix F).

9 Recycled Water

Recycled water reticulation is proposed to be provided throughout the subdivision.

Landcom are currently in negotiations with Sydney Water Corporation as to the supply of recycled water to the site.

The proposed network will be designed to meet Sydney Water Corporation's requirements. It is noted that the layout provided with the Feasibility Application made by J Wyndham Prince is generally consistent with the current design.

10 Sewer

A series of existing 150mm and 225mm diameter sewer mains exist in Cooper Road. It is proposed to discharge sewer from the subdivision to the existing sewer network at three locations, subject to Sydney Water Corporation approval. Existing sewer mains that currently service the Sydney Water Corporation buildings will be decommissioned as part of the proposed works.

A Feasibility Application was made to Sydney Water Corporation by J Wyndham Prince in their report of July 2009. It was stated that sewer would be available to the site from the existing mains in Cooper Road. A copy of the Feasibility Letter received by J Wyndham Prince is included in Appendix G. A revised Feasibility Application has been submitted by Cardno, however, at the time of report preparation, a response was not available. It is noted that the layout provided with the feasibility application made by J Wyndham Prince is generally consistent with the current design.

Details of the proposed sewer reticulation network will be provided at the detailed design stage. The proposed network will be designed to meet Sydney Water Corporation's requirements.

11 Electricity

The site is proposed to be serviced by underground power connected to the existing electricity network.

As part of the proposed works, the existing electrical service within the site will be decommissioned. This decommissioning includes the private Sydney Water Corporation owned substation located immediately south of the existing vehicle entry off Cooper Road.

The site currently has 132kV electrical cables running though the northern portion of the site. The cables run parallel with the northern site boundary (adjacent to the railway) and parallel to the rear boundary of the existing residential lots fronting Cooper Road. The cables then pass to the western side of Cooper Road before crossing Cooper Road and running down the western verge. The cables and associated structures are not located within an easement. A meeting between Landcom, Cardno and Energy Australia representatives was held on 21 October 2009. Landcom are currently in negotiations with Energy Australia as to the possible relocation of the existing 132kV electrical cables.

As part of Energy Australia's strategy to meet the increasing electrical demand in Potts Hill and its surrounding suburbs, a zone substation at Potts Hill has been proposed. Planning for the substation is partially complete, however, a site and time frame for the commissioning of the new zone substation has not been confirmed.

An Application for Connection was made to Energy Australia on 2 October 2009. Energy Australia have subsequently confirmed that supply will be made available to the development (refer Appendix H).

Verbal discussions between Energy Australia and Cardno representatives have confirmed that the development is not dependent upon commissioning of new infrastructure (ie the Potts Hill Zone Substation) and that the existing network is capable of supplying the development. Written advice securing electrical supply will be forthcoming at such time as the site has development consent.

Details of the proposed electrical supply and street lighting to the residential subdivision will be provided at the detailed design stage.

12 Gas

Reticulated gas is proposed to be provided to the site. Preliminary discussions by Cardno with the service authority, Jemena, indicate that the existing network should be able to provide supply to the subdivision. Jemena advise that an application for the provision of gas to the subdivision should be made following the Project Application approval.

13 Telecommunications

Preliminary discussions with Telstra have indicated that telecommunications will be made available to the development, however, legislative changes resulting from the National Broadband Network may impact upon the selection of the service provider.

An 'Application for Intent to Develop' has been made with Telstra. At the time of preparation of this report a response had not been received.

Details of the proposed telecommunication services to the proposed residential subdivision will be provided at the detailed design stage.

Appendix A

Drawing List

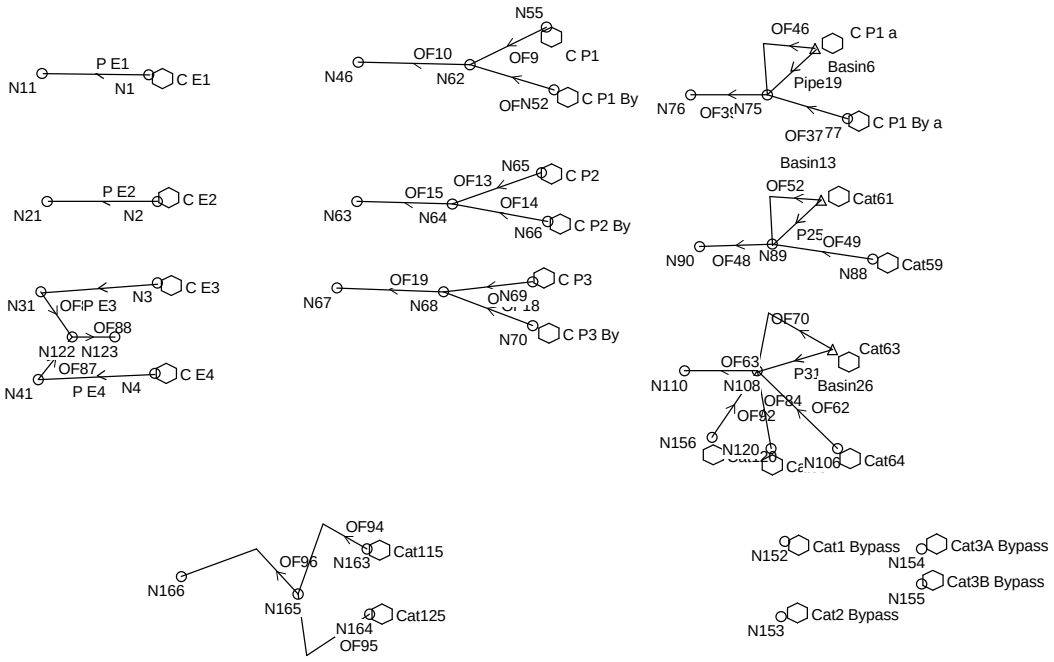
POTTS HILL RESIDENTIAL PRECINCT

CONCEPT CIVIL DESIGN - PROJECT APPLICATION - DRAWING LIST

DRAWING NUMBER	DESCRIPTION
600246-001	COVER SHEET & DRAWING SCHEDULE
600246-002	GENERAL NOTES
600246-010	SITE PLAN
600246-011	GENERAL ARRANGEMENT PLAN - 1 OF 2
600246-012	GENERAL ARRANGEMENT PLAN - 2 OF 2
600246-015	TYPICAL ROAD SECTIONS - SHEET 1 OF 3
600246-016	TYPICAL ROAD SECTIONS - SHEET 2 OF 3
600246-017	TYPICAL ROAD SECTIONS - SHEET 3 OF 3
600246-020	INDICATIVE CUT & FILL PLAN - EXISTING SURFACE TO DESIGN SURFACE
600246-024	INDICATIVE STAGING PLAN
600246-025	INDICATIVE LOT TREATMENT PLAN
600246-026	INDICATIVE LOT TREATMENT DETAILS - SHEET 1 OF 3
600246-027	INDICATIVE LOT TREATMENT DETAILS - SHEET 2 OF 3
600246-028	INDICATIVE LOT TREATMENT DETAILS - SHEET 3 OF 3
600246-030	ROAD LONGITUDINAL SECTIONS - MC01 CH 0 TO 600
600246-031	ROAD LONGITUDINAL SECTIONS - MC01 CH 600 TO 758.782 & MC02 CH 0 TO 300
600246-032	ROAD LONGITUDINAL SECTIONS - MC02 CH 300 TO 600
600246-033	ROAD LONGITUDINAL SECTIONS - MC02 CH 600 TO 1082.261
600246-034	ROAD LONGITUDINAL SECTIONS - MC03 CH 0 TO 600
600246-035	ROAD LONGITUDINAL SECTIONS - MC03 CH 600 TO 1053.771
600246-036	ROAD LONGITUDINAL SECTIONS - MC04, MC05, MC06, MC07 & MC08
600246-037	INDICATIVE TRAFFIC CONTROL LOCATIONS
600246-040	CATCHMENT PLAN
600246-041	WATER QUALITY & DETENTION BASIN No. 1 - PLAN & DETAILS
600246-042	WATER QUALITY & DETENTION BASIN No. 2 - ARRANGEMENT PLAN
600246-043	WATER QUALITY & DETENTION BASIN No. 2 - DETAILS
600246-044	WATER QUALITY & DETENTION BASIN No. 3 - PLAN
600246-045	WATER QUALITY & DETENTION BASIN No. 3 - DETAILS
600246-050	CONCEPT SEWER LAYOUT - SHEET 1 OF 2
600246-051	CONCEPT SEWER LAYOUT - SHEET 2 OF 2
600246-052	CONCEPT POTABLE & RECYCLED WATER LAYOUT
600246-053	CONCEPT STORMWATER LAYOUTSHEET 1 OF 2
600246-054	CONCEPT STORMWATER LAYOUTSHEET 2 OF 2
600246-055	EROSION & SEDIMENTATION CONTROL - PLAN
600246-056	EROSION & SEDIMENTATION CONTROL - DETAILS

Appendix B

Drains Model Data



POTTS HILL RESIDENTIAL
CONCEPT DETENTION BASIN SIZING
CARDNO (NSW)

DRAINS INPUT

PIT / NODE DETAILS Version 9

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss
N1	Node					100		0		283	-129		23	
N11	Node					100		0		181	-128		38	
N2	Node					39.45		0		291	-250		24	
N21	Node					39.1		0		186	-250		39	
N3	Node					40.77		0		291	-329		25	
N31	Node					40.41		0		180	-337		40	
N4	Node					40.82		0		289	-415		26	
N41	Node					40.78		0		178	-421		41	
N46	Node					100		0		483	-117		84	
N52	Node							0		671	-144		90	
N55	Node					101		0		663	-84		95	
N62	Node							0		590	-120		94175	
N63	Node							0		481.667	-250.833		94180	
N64	Node							0		573.333	-253.333		94181	
N65	Node							0		659.167	-222.5		94182	
N66	Node							0		665	-270		94183	
N67	Node							0		462.5	-333.333		94184	
N68	Node							0		565	-336.667		94185	
N69	Node							0		650	-327.5		94186	
N70	Node							0		650	-369.167		94187	
N76	Node							0		801.667	-149.167		94241	
N77	Node							0		951.667	-171.667		94242	
N75	Node					1		0		874.167	-148.333		94240	
N88	Node							0		975	-306		94275	
N90	Node							0		810	-294		94277	
N89	Node					1		0		879	-292		94276	
N106	Node							0		941.667	-487.5		99185	
N110	Node							0		795.833	-413.194		99197	
N108	Node					1		0		864.583	-413.194		99192	
N120	Node							0		877.778	-486.806		99230	
N122	Node							0		209.722	-379.861		99236	
N123	Node							0		250	-379.861		99237	
N152	Node							0		891.667	-575.833		99302	
N153	Node							0		887.5	-647.5		99303	
N154	Node							0		1022.5	-583.333		99304	
N155	Node							0		1022.5	-616.667		99310	
N156	Node							0		821.667	-475.833		99328	
N163	Node							0		491.2	-582.4		99340	
N164	Node							0		493.6	-644.8		99343	
N165	Node							0		425.2	-625.6		99345	
N166	Node							0		313.6	-608.8		99348	

DETENTION BASIN DETAILS

Name	Elev	Volume	Init Vol. (cu	Outlet Typ	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Lengtl	id
Basin6	0	0	0	Orifice		560	0			920.293	-104.321	No			94245
	1.5	1200													
Basin13	0	0	0	Orifice		700	0			926	-249	No			94284
	1.5	3100													
Basin26	0	0	0	Orifice		380	0			936.806	-391.667	No			99199
	1.5	1900													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor
C E1	N1	4.29	25	75	0	0	0	0	290	350	0	2.8	3.9	0	0.012	0.15	0	0			
C E2	N2	12.55	0	85	15	0	0	0	0	400	230	0	4.2	4.4	0	0.15	0.012	0			
C E3	N3	5.07	0	100	0	0	0	0	0	370	0	0	3.6	0	0	0.15	0	0			
C E4	N4	6.84	0	100	0	0	0	0	0	330	0	0	6.8	0	0	0.15	0	0			
C P1 By	N52	0.2	0	100	0	0	20	0										0			
C P1	N55	4.5	75	25	0	0	0	0	290	320	0	2.8	4.3	0	0.012	0.15	0	0			
C P2	N65	10.1	75	25	0	0	0	0	230	350	0	4.4	4.8	0	0.012	0.15	0	0			
C P2 By	N66	1.6	0	100	0	0	20	0										0			
C P3	N69	5.14	75	25	0	0	0	0	320	320	0	4.2	4.2	0	0.012	0.15	0	0			
C P3 By	N70	6.67	0	100	0	0	20	0										0			
C P1 By a	N77	0.2	0	100	0	0	20	0										0			
C P1 a	Basin6	4.5	75	25	0	0	0	0	290	320	0	2.8	4.3	0	0.012	0.15	0	0			
Cat59	N88	1.6	0	100	0	0	20	0										0			
Cat61	Basin13	10.1	75	25	0	0	0	0	230	350	0	4.4	4.8	0	0.012	0.15	0	0			
Cat64	N106	1.3	0	100	0	0	30	0										0			
Cat63	Basin26	4.81	75	25	0	0	0	0	320	320	0	4.2	4.2	0	0.012	0.15	0	0			
Cat69	N120	5.35	0	100	0	5	30	0										0			
Cat1 Bypas	N152	0.22	0	100	0	0	0	0	-1	140	-1	-1	1	-1	-1	0.15	-1	0			
Cat2 Bypas	N153	1.65	0	100	0	0	0	0	-1	220	-1	-1	1	-1	-1	0.15	-1	0			
Cat3A Bypa	N154	1.27	0	100	0	0	0	0	-1	250	-1	-1	1	-1	-1	0.15	-1	0			
Cat3B Bypa	N155	2.72	0	100	0	0	0	0	-1	250	-1	-1	8	-1	-1	0.15	-1	0			
Cat120	N156	0.78	75	25	0	0	0	0	300	300	0	2.7	2.7	0	0.012	0.15	0	0			
Cat115	N163	2	75	25	0	0	0	0	270	270	0	4	4	0	0.015	0.15	0	0			
Cat125	N164	0.7	0	100	0	0	0	0	-1	120	-1	-1	12	-1	-1	0.15	-1	0			

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
P E1	N1	N11	50	99	98.5	1	Concrete, u	600	600	0.3	New	2	N1		0				
P E2	N2	N21	50	38.58	38.07	1.02	Concrete, u	600	600	0.3	New	1	N2		0				
P E3	N3	N31	32.6	39.83	39.33	1.53	Concrete, u	600	600	0.3	New	1	N3		0				
P E4	N4	N41	13	39.29	38.89	3.08	Concrete, u	750	750	0.3	New	1	N4		0				
Pipe19	Basin6	N75	25	-0.3	-0.55	1	Concrete, u	600	600	0.3	NewFixed	1	Basin6		0				
P25	Basin13	N89	25	-0.3	-0.55	1	Concrete, u	750	750	0.3	NewFixed	1	Basin13		0				
P31	Basin26	N108	25	-0.3	-0.55	1	Concrete, u	750	750	0.3	NewFixed	1	Basin26		0				

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
OF86	N31	N122		0.1				Dummy us	0.2	0.05	0.6	1	0	99238
OF87	N41	N122		0.1				Dummy us	0.2	0.05	0.6	1	0	99239
OF2	N52	N62		2.6				Dummy us	0.2	0.05	0.6	1	0	91
OF9	N55	N62		0.1				Dummy us	0.2	0.05	0.6	1	0	94176
OF10	N62	N46		0.1				Dummy us	0.2	0.05	0.6	1	0	94177
OF15	N64	N63		0.1				Dummy us	0.2	0.05	0.6	1	0	94194
OF13	N65	N64		0.1				Dummy us	0.2	0.05	0.6	1	0	94192
OF14	N66	N64		2.9				Dummy us	0.2	0.05	0.6	1	0	94193
OF19	N68	N67		0.1				Dummy us	0.2	0.05	0.6	1	0	94198
OF17	N69	N68		0.1				Dummy us	0.2	0.05	0.6	1	0	94196
OF18	N70	N68		0.1				Dummy us	0.2	0.05	0.6	1	0	94197
OF37	N77	N75		2.6				Dummy us	0.2	0.05	0.6	1	0	94239
OF46	Basin6	N75		0.1	1.5	10	1.74	Dummy us	0.2	0.05	0.6	1	0	94265
OF39	N75	N76		0.1				Dummy us	0.2	0.05	0.6	1	0	94249
OF49	N88	N89		2.9				Dummy us	0.2	0.05	0.6	1	0	94274
OF52	Basin13	N89		0.1	1.5	10	1.74	Grassed sw	0.5	0.4	1	1	0	94281
OF48	N89	N90		0.1				Dummy us	0.2	0.05	0.6	1	0	94278
OF62	N106	N108		0.1				Dummy us	0.2	0.05	0.6	1	0	99186
OF70	Basin26	N108		0.1	1.5	10	1.74	Grassed sw	0.5	0.4	0.6	1	0	99204
OF63	N108	N110		0.1				Dummy us	0.2	0.05	0.6	1	0	99187
OF84	N120	N108		0.1				Dummy us	0.2	0.05	0.6	1	0	99231
OF88	N122	N123		0.1				Dummy us	0.2	0.05	0.6	1	0	99240
OF92	N156	N108		0.1				Dummy us	0.2	0.05	0.6	1	0	99329
OF94	N163	N165		0.1				Dummy us	0.2	0.05	0.6	1	0	99346
OF95	N164	N165		0.1				Dummy us	0.2	0.05	0.6	1	0	99347
OF96	N165	N166		0.1				Dummy us	0.2	0.05	0.6	1	0	99349

DRAINS RESULTS - Q5

DRAINS results prepared 13 November, 2009 from Version 2009.06

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N1	99.27		0.599				
N11	98.77		0				
N2	40.31		1.232				
N21	38.95		0				
N3	40.26		0.44				
N31	40.26		0				
N4	40.67		0.757				
N41	40.63		0				
N75	-0.25		0.033				
N89	-0.19		0.268				
N108	-0.36		0.9				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C E1	0.599	0.388	0.234	7.66	35.35	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
C E2	1.232	0	1.232	0	45.19	7.02	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
C E3	0.44	0	0.44	0	49.84	0	AR&R 5 year, 1.5 hours storm, average 36.2 mm/h, Zone 1
C E4	0.757	0	0.757	0	34.84	0	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
C P1 By	0.033	0	0.033	0	20	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
C P1	1.3	1.22	0.089	7.66	32.54	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
C P2	3.125	3.051	0.074	4.45	25.38	0	AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1
C P2 By	0.268	0	0.268	0	20	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
C P3	1.503	1.412	0.101	7.2	32.77	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
C P3 By	1.116	0	1.116	0	20	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
C P1 By a	0.033	0	0.033	0	20	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
C P1 a	1.3	1.22	0.089	7.66	32.54	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
Cat59	0.268	0	0.268	0	20	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
Cat61	3.125	3.051	0.074	4.45	25.38	0	AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1
Cat64	0.163	0	0.163	0	30	0	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
Cat63	1.406	1.321	0.094	7.2	32.77	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
Cat69	0.669	0	0.669	5	30	0	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
Cat1 Bypas	0.023	0	0.023	0	37.02	0	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
Cat2 Bypas	0.136	0	0.136	0	57.53	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
Cat3A Bypa	0.098	0	0.098	0	62.12	0	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
Cat3B Bypa	0.356	0	0.356	0	28.09	0	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
Cat120	0.223	0.21	0.014	7.91	35.99	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
Cat115	0.583	0.544	0.043	7.54	30.03	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
Cat125	0.131	0	0.131	0	13.28	0	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1

Outflow Volumes for Total Catchment (34.4 impervious + 59.8 pervious = 94.2 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious cu.m (Runoff %)
AR&R 5 yea	11377.67	4363.45 (3	3604.30 (8	759.15 (10.5%)
AR&R 5 yea	17576.53	8992.73 (5	5745.20 (8	3247.53 (29.1%)
AR&R 5 yea	22127.6	12728.31 (!	7317.00 (9	5411.31 (38.5%)
AR&R 5 yea	25737.06	15619.13 (I	8563.60 (9	7055.54 (43.2%)
AR&R 5 yea	29032.66	18288.24 (I	9701.80 (9	8586.44 (46.6%)
AR&R 5 yea	31543.6	19988.98 (I	10568.98 (!	9420.00 (47.1%)
AR&R 5 yea	38134.8	24894.18 (I	12845.40 (!	12048.79 (49.8%)
AR&R 5 yea	43596.08	29127.73 (I	14731.58 (!	14396.14 (52.0%)
AR&R 5 yea	51128.89	34300.91 (I	17333.21 (!	16967.70 (52.3%)
AR&R 5 yea	57060.96	38198.95 (I	19381.89 (!	18817.06 (52.0%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P E1	0.599	2.5	99.265	98.765	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
P E2	1.232	4.4	40.312	38.95	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
P E3	0.44	2	40.26	40.26	AR&R 5 year, 1.5 hours storm, average 36.2 mm/h, Zone 1
P E4	0.757	1.7	40.672	40.63	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
Pipe19	0.564	3.9	0.003	-0.247	AR&R 5 year, 1.5 hours storm, average 36.2 mm/h, Zone 1
P25	0.928	4.4	0.061	-0.189	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
P31	0.294	3.4	-0.113	-0.363	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF86	0.44	0.44	0.256	0.062	0.05	16.48	0.76	AR&R 5 year, 1.5 hours storm, average 36.2 mm/h, Zone 1
OF87	0.757	0.757	0.256	0.078	0.07	19.54	0.89	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF2	0.033	0.033	0.256	0.024	0.01	7.93	0.35	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF9	1.3	1.3	0.256	0.097	0.1	23.49	1.02	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF10	1.316	1.316	0.256	0.097	0.1	23.49	1.03	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF15	3.205	3.205	0.256	0.141	0.18	32.11	1.29	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF13	3.125	3.125	0.256	0.139	0.18	31.75	1.29	AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1
OF14	0.268	0.268	0.256	0.051	0.03	14.15	0.67	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF19	2.278	2.278	0.256	0.123	0.14	28.52	1.18	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF17	1.503	1.503	0.256	0.103	0.11	24.57	1.07	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF18	1.116	1.116	0.256	0.091	0.09	22.23	0.98	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF37	0.033	0.033	0.256	0.024	0.01	7.93	0.35	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF46	0	0	0.256	0	0	0	0	
OF39	0.594	0.594	0.256	0.07	0.06	18.1	0.83	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF49	0.268	0.268	0.256	0.051	0.03	14.15	0.67	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF52	0	0	1.072	0	0	0	0	
OF48	1.183	1.183	0.256	0.093	0.09	22.59	1.01	AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1
OF62	0.163	0.163	0.256	0.042	0.02	12.35	0.58	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF70	0	0	0.893	0	0	0	0	
OF63	1.186	1.186	0.256	0.094	0.09	22.77	0.99	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF84	0.669	0.669	0.256	0.074	0.06	18.82	0.85	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF88	1.188	1.188	0.256	0.094	0.09	22.77	0.99	AR&R 5 year, 1 hour storm, average 46.3 mm/h, Zone 1
OF92	0.223	0.223	0.256	0.047	0.03	13.43	0.63	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF94	0.583	0.583	0.256	0.07	0.06	17.92	0.83	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF95	0.131	0.131	0.256	0.038	0.02	11.63	0.55	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1
OF96	0.705	0.705	0.256	0.076	0.07	19.18	0.86	AR&R 5 year, 25 minutes storm, average 74 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin6	0.72	577.4	0.564	0.564	0
Basin13	0.86	1771.7	0.928	0.928	0
Basin26	0.92	1171	0.294	0.294	0

CONTINUITY CHECK for AR&R 5 year, 2 hours storm, average 30.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
N1	1589.99	1589.99	0	0
N11	1589.99	1589.99	0	0
N2	4218.56	4218.56	0	0
N21	4218.56	4218.56	0	0
N3	1495.8	1495.8	0	0
N31	1495.8	1495.8	0	0
N4	2031.05	2031.05	0	0
N41	2031.05	2031.05	0	0
N46	2404.65	2404.65	0	0
N52	60.05	60.05	0	0
N55	2344.6	2344.6	0	0
N62	2404.65	2404.65	0	0
N63	5742.34	5742.34	0	0
N64	5742.33	5742.34	0	0
N65	5261.96	5261.96	0	0
N66	480.38	480.38	0	0
N67	4680.56	4680.56	0	0
N68	4680.57	4680.56	0	0
N69	2678	2678	0	0
N70	2002.57	2002.57	0	0
N76	2406.77	2406.77	0	0
N77	60.05	60.05	0	0
Basin6	2344.6	2346.72	0	-0.1
N75	2406.77	2406.77	0	0
N88	480.38	480.38	0	0
N90	5744.71	5744.71	0	0
Basin13	5261.96	5264.34	0	0
N89	5744.71	5744.71	0	0
N106	388.76	388.76	0	0
N110	4724.72	4724.72	0	0
Basin26	2506.07	2331.8	175.36	0
N108	4726.7	4725.71	0	0
N120	1599.89	1599.89	0	0
N122	3526.85	3526.85	0	0
N123	3526.85	3526.85	0	0
N152	65.23	65.23	0	0
N153	485.68	485.68	0	0
N154	372.73	372.73	0	0
N155	811.85	811.85	0	0
N156	406.25	406.25	0	0
N163	1042.32	1042.32	0	0
N164	210.26	210.26	0	0
N165	1252.59	1252.59	0	0
N166	1252.59	1252.59	0	0

Run Log for 091109 OSD Calcs for PA Plans 600246.drn run at 08:03:33 on 13/11/2009
The maximum flow exceeded the safe value in the following overflow routes: OF96, OF94, OF88, OF87, OF86, OF84, OF63, OF48, OF49, OF39, OF19, OF18, OF17,

DRAINS RESULTS - Q100

DRAINS results prepared 13 November, 2009 from Version 2009.06

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N1	99.4		1.176				
N11	98.9		0				
N2	48.36		3.198				
N21	39.25		0				
N3	41.45		1.236				
N31	40.56		0				
N4	41.21		1.968				
N41	40.93		0				
N75	-0.17		0.271				
N89	-0.12		1.361				
N108	-0.33		2.504				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C E1	1.176	0.624	0.694	6.19	28.58	0	AR&R 100 year, 25 minutes storm, average 126 mm/h, Zone 1
C E2	3.198	0	3.198	0	36.31	5.64	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
C E3	1.236	0	1.236	0	36.29	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
C E4	1.968	0	1.968	0	28	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
C P1 By	0.068	0	0.068	0	20	0	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
C P1	2.365	2.249	0.116	4.77	20.26	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
C P2	5.347	5.092	0.255	3.63	20.68	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
C P2 By	0.547	0	0.547	0	20	0	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
C P3	2.723	2.591	0.131	4.48	20.4	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
C P3 By	2.28	0	2.28	0	20	0	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
C P1 By a	0.068	0	0.068	0	20	0	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
C P1 a	2.365	2.249	0.116	4.77	20.26	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
Cat59	0.547	0	0.547	0	20	0	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
Cat61	5.347	5.092	0.255	3.63	20.68	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
Cat64	0.359	0	0.359	0	30	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat63	2.548	2.425	0.123	4.48	20.4	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
Cat69	1.479	0	1.479	5	30	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat1 Bypas	0.061	0	0.061	0	29.75	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat2 Bypas	0.381	0	0.381	0	39.02	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat3A Bypa	0.277	0	0.277	0	42.13	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat3B Bypa	0.87	0	0.87	0	22.57	0	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Cat120	0.398	0.38	0.018	4.92	22.41	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
Cat115	1.064	1.008	0.056	4.7	18.69	0	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
Cat125	0.324	0	0.324	0	10.29	0	AR&R 100 year, 20 minutes storm, average 140 mm/h, Zone 1

Outflow Volumes for Total Catchment (34.4 impervious + 59.8 pervious = 94.2 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 100	18988.93	11624.18 (	6233.00 (8	5391.18 (44.7%)
AR&R 100	29660.4	21125.40 (	9918.60 (9	11206.80 (59.5%)
AR&R 100	37664	28252.65 (	12682.81 (	15569.85 (65.1%)
AR&R 100	43941.34	33775.62 (	14850.80 (	18924.81 (67.9%)
AR&R 100	49434	38368.20 (	16747.80 (	21620.39 (68.9%)
AR&R 100	54142	42339.51 (	18373.80 (	23965.71 (69.7%)
AR&R 100	66382.8	52823.09 (	22601.37 (	30221.72 (71.7%)
AR&R 100	75327.99	60391.00 (	25690.76 (	34700.24 (72.6%)
AR&R 100	88981.2	71710.90 (	30406.17 (	41304.73 (73.1%)
AR&R 100	97926.41	78600.11 (	33495.67 (	45104.44 (72.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P E1	1.176	2.9	99.405	98.905	AR&R 100 year, 25 minutes storm, average 126 mm/h, Zone 1
P E2	3.198	11.3	48.363	39.25	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
P E3	1.236	4.4	41.455	40.56	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
P E4	1.968	4.5	41.212	40.93	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
Pipe19	0.807	4.3	0.079	-0.171	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
P25	1.275	4.8	0.132	-0.118	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
P31	0.387	3.5	-0.078	-0.328	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF86	1.236	1.236	7.665	0.095	0.1	22.95	1.02	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF87	1.968	1.968	7.665	0.115	0.13	27.08	1.14	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF2	0.068	0.068	7.665	0.03	0.01	10.02	0.45	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF9	2.365	2.365	7.665	0.124	0.15	28.88	1.19	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF10	2.371	2.371	7.665	0.124	0.15	28.88	1.19	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF15	5.386	5.386	7.665	0.174	0.26	38.75	1.47	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF13	5.347	5.347	7.665	0.173	0.26	38.57	1.48	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF14	0.547	0.547	7.665	0.068	0.06	17.56	0.82	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF19	4.476	4.476	7.665	0.161	0.23	36.24	1.41	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF17	2.723	2.723	7.665	0.132	0.16	30.31	1.24	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF18	2.28	2.28	7.665	0.123	0.14	28.52	1.18	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF37	0.068	0.068	7.665	0.03	0.01	10.02	0.45	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF46	0.211	0.211	7.665	0.046	0.03	13.25	0.62	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF39	1.078	1.078	7.665	0.09	0.09	22.05	0.97	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF49	0.547	0.547	7.665	0.068	0.06	17.56	0.82	AR&R 100 year, 1.5 hours storm, average 63 mm/h, Zone 1
OF52	0.881	0.881	1.945	0.372	0.59	2.97	1.59	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF48	2.636	2.636	7.665	0.13	0.16	29.95	1.23	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF62	0.359	0.359	7.665	0.057	0.04	15.41	0.73	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF70	0.522	0.522	0.89	0.306	0.43	2.44	1.4	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF63	2.891	2.891	7.665	0.135	0.17	31.03	1.25	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF84	1.479	1.479	7.665	0.102	0.11	24.39	1.07	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF88	3.089	3.089	7.665	0.139	0.18	31.75	1.28	AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1
OF92	0.398	0.398	7.665	0.06	0.04	15.94	0.74	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF94	1.064	1.064	7.665	0.089	0.09	21.87	0.97	AR&R 100 year, 5 minutes storm, average 242 mm/h, Zone 1
OF95	0.324	0.324	7.665	0.055	0.04	15.05	0.69	AR&R 100 year, 20 minutes storm, average 140 mm/h, Zone 1
OF96	1.288	1.288	7.665	0.097	0.1	23.31	1.02	AR&R 100 year, 25 minutes storm, average 126 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin6	1.55	1242.2	1.018	0.807	0.211
Basin13	1.64	3382.8	2.156	1.275	0.881
Basin26	1.6	2022.3	0.909	0.387	0.522

CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 80 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
N1	2630.67	2630.67	0	0
N11	2630.67	2630.67	0	0
N2	7366.41	7366.41	0	0
N21	7366.41	7366.41	0	0
N3	2805.01	2805.01	0	0
N31	2805.01	2805.01	0	0
N4	3811.77	3811.77	0	0
N41	3811.77	3811.77	0	0
N46	3403.49	3403.49	0	0
N52	112.21	112.21	0	0
N55	3291.27	3291.27	0	0
N62	3403.49	3403.49	0	0
N63	8283.92	8283.92	0	0
N64	8283.92	8283.92	0	0
N65	7386.22	7386.22	0	0
N66	897.7	897.7	0	0
N67	7501.48	7501.48	0	0
N68	7501.47	7501.48	0	0
N69	3759.19	3759.19	0	0
N70	3742.28	3742.28	0	0
N76	3404.54	3404.54	0	0
N77	112.21	112.21	0	0
Basin6	3291.27	3292.33	0	0
N75	3404.54	3404.54	0	0
N88	897.7	897.7	0	0
N90	8072.29	8072.29	0	0
Basin13	7386.22	7179.88	208.44	0
N89	8077.58	8074.94	0	0
N106	723.22	723.22	0	0
N110	6979.52	6979.52	0	0
Basin26	3517.84	2713.98	805.23	0
N108	6983.71	6981.62	0	0
N120	2976.35	2976.35	0	0
N122	6616.78	6616.78	0	0
N123	6616.78	6616.78	0	0
N152	122.41	122.41	0	0
N153	910.73	910.73	0	0
N154	699.18	699.18	0	0
N155	1522.59	1522.59	0	0
N156	570.17	570.17	0	0
N163	1463.37	1463.37	0	0
N164	395.02	395.02	0	0
N165	1858.39	1858.39	0	0
N166	1858.39	1858.39	0	0

Run Log for 091109 OSD Calcs for PA Plans 600246.drn run at 08:03:33 on 13/11/2009

Appendix C

Email Martin Beveridge

Scott Brisbin (Sydney)

From: BEVERIDGE Martin [martin.beveridge@bankstown.nsw.gov.au]
Sent: Tuesday, 20 October 2009 11:09 AM
To: Scott Brisbin (Sydney)
Subject: RE: 600246 - Potts Hill - Water Quality

Scott

Thanks for the email.

Council supports the adoption of the water quality targets included in your email

Regards

Martin Beveridge
Bankstown Council

From: Scott Brisbin (Sydney) [mailto:Scott.Brisbin@cardno.com.au]
Sent: Monday, 19 October 2009 11:55 AM
To: BEVERIDGE Martin
Subject: 600246 - Potts Hill - Water Quality

Cardno (NSW) Pty Ltd | ABN 95 001 145 035
Level 3, Cardno Building
910 Pacific Highway Gordon NSW 2072
Tel:02 9496 7700 Fax:02 9499 3902

Martin,

Thank you for your time earlier.

Cardno has been engaged by Landcom to prepare the civil and utility design for the Potts Hill Residential Precinct (western precinct).

The Residential Precinct is bound to the railway to the north, Reservoir No 2 to the east, Brunker Road to the south and Cooper Road to the west.

We are in the process of preparing concept plans and wish to confirm Council's requirements in relation to water quality. I understand that Council does not currently have its own water quality guidelines.

As this is a Landcom project, we are proposing to adopted Landcom's Water Sensitive Urban Design (WSUD) guidelines. These guidelines have the following targets:

- 45% reduction in mean annual load of TN
- 65% reduction in mean annual load of TP
- 85% reduction in mean annual load of TSS

We note that these are more stringent than the standard DECC requirements of 45% TN, 45% TP and 80% TSS.

I have checked the DoP determination and cannot see any specific requirements of water quality.

Could you please confirm that the adoption of the Landcom WSUD targets will be acceptable to Council.

Thank you for your help and please give me a call should you wish to discuss or require any additional information.

Regards,

Scott Brisbin
Design Engineer

Phone:02 9496 7700
Fax:02 9499 3902
Mobile:0413 437 367
Email:scott.brisbin@cardno.com.au
Web:www.cardno.com.au

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The Association of Consulting Engineers Australia

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Appendix D

Email Vimal Vimalaratnam

Scott Brisbin (Sydney)

From: VIMALARATNAM Vimal [vimal.vimal@bankstown.nsw.gov.au]
Sent: Monday, 9 November 2009 10:20 AM
To: Scott Brisbin (Sydney)
Subject: RE: 600246 - Potts Hill Residential - GPTs

Hi Scott,

Everyone seems to have different preferences.

My preference is CDS, as GPTs they function well.

They function well specially where there are substantial drop in invert levels, e.g. drop structures in the system, Potts Hill's topography will suit CDS.

From a maintenance perspective:
CDS/Rocla units require suitable access for a truck with a crane.
Access should be to the side of the unit to enable a truck with a crane behind the truck's cabin to lift and empty the baskets.
Humes are suitable where there are access constraints.

Regards

Vimal

From: Scott Brisbin (Sydney) [mailto:Scott.Brisbin@cardno.com.au]
Sent: Friday, 6 November 2009 12:39 PM
To: VIMALARATNAM Vimal
Subject: 600246 - Potts Hill Residential - GPTs

Cardno (NSW) Pty Ltd | ABN 95 001 145 035
Level 3, Cardno Building
910 Pacific Highway Gordon NSW 2072
Tel:02 9496 7700 Fax:02 9499 3902

Vimal,

At our site meeting last week we spoke briefly regarding gross pollutant traps for the residential precinct at Potts Hill.

Could you please advise if Council has a preference as to GPT manufacturer (Humes, Rocla, CDS etc).

Thank you for your help.

Please give me a call should you wish to discuss.

Regards,

Scott Brisbin
Design Engineer

Phone:02 9496 7700
Fax:02 9499 3902
Mobile:0413 437 367
Email:scott.brisbin@cardno.com.au
Web:www.cardno.com.au

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Appendix E

MUSIC Model Data

MUSIC RESULTS

Flow (ML/y	39.9	39.9	0
Total Suspe	8.02E+03	370	95.4
Total Phosp	16.4	3.77	77
Total Nitrog	115	56.4	50.8
Gross Pollu	1.05E+03	0	100

Flow (ML/y	89.5	89.6	0
Total Suspe	1.79E+04	603	96.6
Total Phosp	36.7	7.29	80.1
Total Nitrog	256	118	54.1
Gross Pollu	2.36E+03	0	100

Flow (ML/y	42.6	42.6	0
Total Suspe	8.61E+03	337	96.1
Total Phosp	17.6	3.72	78.9
Total Nitrog	122	57.5	52.9
Gross Pollu	1.13E+03	0	100

Appendix F

Email from Steve Maxwell

Scott Brisbin (Sydney)

From: Debbie Staggs (Norwest)
Sent: Monday, 9 November 2009 10:02 AM
To: Scott Brisbin (Sydney); Russell Clark (Sydney)
Subject: Potts Hill tunnel

Gentlemen

Finally written advice from Sydney Water that there are no special requirements for building over the 3000mm water main at Potts Hill.

Regards

Debbie Staggs
WSC Project Manager
Phone:9496 7853
Fax:9499 3902
Email:debbie.staggs@cardno.com.au
Web:www.cardno.com.au

From: STEVE MAXWELL [mailto:STEVE.MAXWELL@sydneywater.com.au]
Sent: Monday, 9 November 2009 10:50 AM
To: Debbie Staggs (Norwest)
Subject: Re: Fwd: FW: Potts Hill tunnel

Debbie attached is the comments for potts hill there is no requirements and will be no charge please attach tyhis email to the PCP Package when submitted

cheers

Steve Maxwell

>>> LAL WICKRAMARACHCHI 6/11/09 11:48 am >>>
Steve,

There are no special requirements for building over this asset as it is in 30 m deep in the ground.

However, if the design requires very excessive excavations for foundations, design should be referred to the Water operations for comments.

Regards,

Lal Wickramarachchi
System Operations Officer
Southern Water
Strategic Operations - Business Services

Tel: 02 - 96440268 Fax: 02 - 96440420

Mobile: 0409247370
Email: Lal.Wickramarachchi@sydneywater.com.au

Lal further to our conversation to-day attached is the plans for the proposed subdivision @ potts hill please supply your comments/requirements for the purposes of BOS over the 3000 watermain

Regards

Steve Maxwell
Tec Services
Parramatta

>>> "Debbie Staggs (Norwest)" <Debbie.Staggs@cardno.com.au> 29/10/09 2:21 pm >>>
Hi Steve

Attached plan of proposed subdivision at Potts Hill as requested. Let me know if you need anything else.

Many thanks

Debbie Staggs
WSC Project Manager
Phone:9496 7853
Fax:9499 3902
Email:debbie.staggs@cardno.com.au
Web:www.cardno.com.au

From: Debbie Staggs (Norwest)
Sent: Wednesday, 28 October 2009 5:41 PM
To: steve.maxwell@sydneywater.com.au
Cc: Scott Brisbin (Sydney)
Subject: FW: Potts Hill tunnel

Hi Steve

Ditto with this one - didn't know Garrie was away (which would explain why he doesn't answer the phone).

Thanks for your help

Debbie Staggs
WSC Project Manager
Phone:9496 7853
Fax:9499 3902
Email:debbie.staggs@cardno.com.au
Web:www.cardno.com.au

From: Debbie Staggs (Norwest)
Sent: Monday, 26 October 2009 3:55 PM
To: 'garrie.mercer@sydneywater.com.au'
Subject: Potts Hill tunnel

Cardno (NSW) Pty Ltd|ABN 95 001 145 035
Level 3, Cardno Building
910 Pacific Highway Gordon NSW 2072
Tel:02 9496 7700 Fax:02 9499 3902

Hi Garrie

Cardno have been appointed by Landcom and are currently undertaking the civil design for the residential subdivision of the excess land at Sydney Water's Potts Hill reservoir site. Running through this site is a 3000mm water main

which appears to be at a depth of around 30m. Can you please confirm that there would be no special requirements for building roads etc over this main as the depth would preclude any impact?

You advice would be appreciated.

Regards

Debbie Staggs
WSC Project Manager
Phone:9496 7853
Fax:9499 3902
Email:debbie.staggs@cardno.com.au
Web:www.cardno.com.au

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Water Wise Rules now replace drought restrictions in Sydney, the Blue Mountains and the Illawarra. To know more, visit sydneywater.com.au.

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Appendix G

SWC Feasibility Letter (JWP)

Case Number: 115230

24 June 2009

Landcom
c/- Qalchek Pty Ltd

FEASIBILITY LETTER

Developer:	**Landcom**
Your reference:	**PM5961**
Development:	**Cooper Road Birrong**
Development Description:	**Subdivision of Lots 106-108**
Your application date:	**11 May 2009**

Dear Applicant

This Feasibility Letter (Letter) is a guide only. It provides general information about what Sydney Water's requirements could be if you applied to us for a Section 73 Certificate (Certificate) for your proposed development. **The information is accurate at today's date only.**

If you obtain development consent for that development from your consent authority (this is usually your local Council) they will require you to apply to us for a Section 73 Certificate. You will need to submit a new application (and pay another application fee) to us for that Certificate by using your current or another Water Servicing Coordinator (Coordinator).

Sydney Water will then send you either a:
- Notice of Requirements (Notice) and Works Agreement (Agreement); or
- Certificate.

These documents will be the definitive statement of Sydney Water's requirements.

There may be changes in Sydney Water's requirements between the issue dates of this Letter and the Notice or Certificate. The changes may be:

- if you change your proposed development, e.g. the development description or the plan/site layout, after today, the requirements in this Letter could change when you submit your new application; and

- if you decide to do your development in stages then you must submit a new application (and pay another application fee) for each stage.

No warranties or assurances can be given about the suitability of this document or any of its provisions for any specific transaction. It does not constitute an approval from Sydney Water and to the extent that it is able, Sydney Water limits its liability to the reissue of this Letter or the return of your application fee. You should rely on your own independent professional advice.

What You Must Do To Get A Section 73 Certificate

To get a Section 73 Certificate you must do the following things. You can also find out about this process by visiting www.sydneywater.com.au ➢ Building and Developing ➢ Developing Your Land.

1. **Obtain Development Consent from the consent authority for your development proposal.**

2. **Engage a Water Servicing Coordinator (Coordinator).**

   You must engage your current or another authorised Coordinator to manage the design and construction of works that you must provide, at your cost, to service your development. If you wish to engage another Coordinator (at any point in this process) you must write and tell Sydney Water.

   For a list of authorised Coordinators, either visit www.sydneywater.com.au ➢ Building and Developing ➢ Developing Your Land or call **13 20 92.**

   The Coordinator will be your point of contact with Sydney Water. They can answer most questions that you might have about the process and developer charges and can give you a quote or information about costs for services/works (including Sydney Water costs).

3. **Works Agreement**

   After the Coordinator has submitted your new application, they will receive the Sydney Water Notice and Works Agreement. You will need to sign and lodge **both originals** of that Agreement with your nominated Coordinator.

   The agreement sets out for this development:
   - your responsibilities;
   - Sydney Water's responsibilities; and
   - the Coordinator's responsibilities.

   You must do all the things that we ask you to do in that Agreement. This is because lots in your subdivision do not have water and sewer services and you must construct and pay for the following works extensions under this Agreement to provide these services.

   After Sydney Water has signed the documents, one of them will be returned to your Coordinator.

   Note: The Coordinator must be fully authorised by us for the whole time of the Agreement.

4. Water and Sewer Works.

4.1 Water

Each lot in your subdivision must have:

- a frontage to a water main that is the right size and can be used for connection; and
- its own connection to that water main and a property service (main to meter) that is available for the fitting of a meter.

Sydney Water has assessed your application and found that:

For lots1-6 Bagdad Street & Lots in subdivision scheme Plan 8547/SK20(A) or alternate Plan 8547/SK1(B)

You must construct a 100mm water main extensions to serve the proposed lots

Lots shown as reserves on the subdivision plans do not need water services, and as such no water servicing requirements have been made.

4.1.1 Property Service (Main to Meter) Installation Details.

The property service connection must be carried out by a Sydney Water listed Driller and the installation of the property service must either be carried out or supervised by a licensed plumber. They must meet the:

(a) Administrative requirements of the New South Wales Code of Practice for Plumbing and Drainage; and
(b) Sydney Water Property Service (Main to Meter) Installations Technical Requirements.

You will also need to do the things we talk about below.

Before the Certificate can issue, your Coordinator must give Sydney Water:

- All the "Work as Constructed" information that shows what was constructed; and
- Certification that the property service works comply with Sydney Water's requirements.

4.2 Sewer

Each lot in your subdivision must have a sewer main that is the right size and can be used for connection. That sewer must also have a connection point within each lot's boundaries.

Sydney Water has assessed your application and found that:

You must construct sewer main extensions to serve all the lots in your proposed subdivision (See 4.2.1 below for details).

For lots in plan 8547/SK50 the 225mm sewer is available for connection (a sewer adjustment may be necessary).

The lots in Plans 8547/SK20A or 8547/SK1B can connect to the 150mm sewer in Cooper Road

Lots shown as reserves on the subdivision plan do not need sewer services, and as such no sewer servicing requirements will be made.

4.2.1 Sewer main extension

Your Coordinator will determine the works scope and location and prepare a documented design servicing solution.

The documented design servicing solution will ensure that the works:
- meet Sydney Water's requirements; and
- adequately drain the property.

It will also enable you to select an appropriately accredited Constructor to construct the works. Your Coordinator can assist you.

Note: The Minor Works Agreement also tells you which type of Constructor can be used.

The Constructor MUST tell Sydney Water of the construction starting date at least TWO (2) working days before they start. (Remember that the local Council must be contacted before working in, on or over a public road.)

When the works have been finished, your Coordinator must give Sydney Water all the "Work As Constructed" information that shows what was constructed.

4.3 Ancillary Matters

4.3.1 Asset adjustments.

After Sydney Water issues this Notice (and more detailed designs are available), Sydney Water may require that the water main/sewer main/stormwater located in the footway/your property needs to be adjusted/deviated. If this happens, you will need to do this work as well as the extension we have detailed above at your cost. The work must meet the conditions of this Notice and you will need to complete it **before we can issue the Certificate**. Sydney Water will need to see the completed designs for the work and we will require you to lodge a security. The security will be refunded once the work is completed.

4.3.2 Entry onto neighbouring property

If you need to enter a neighbouring property, you must have the written permission of the relevant property owners and tenants. You must use Sydney Water's **Permission to Enter** form(s) for this. You can get copies of these forms from your Coordinator or the Sydney Water website. Your Coordinator can also negotiate on your behalf. Please make sure that you address all the items on the form(s) including payment of compensation and whether there are other ways of designing and constructing that could avoid or reduce their impacts. You will be responsible for all costs of mediation involved in resolving any disputes. Please allow enough time for entry issues to be resolved.

4.3.3 Costs

Construction of these works will require you to pay project management, survey, design and construction costs **directly to your suppliers**. Additional costs payable to Sydney Water may include:

- water main shutdown and disinfection;
- connection of new water mains to Sydney Water system(s);
- design and construction audit fees;
- **contract administration, Operations Area Charge & Customer Redress prior to project finalisation;**
- creation or alteration of easements etc.; and
- water usage charges where water has been supplied for building activity purposes prior to disinfection of a newly constructed water main.

Note: Payment for any Goods and Services (including Customer Redress) provided by Sydney Water will be required prior to the issue of the Section 73 Certificate or release of the Bank Guarantee or Cash Bond.

5. Stamping and Approval of your Building Plans.

You must have your building plans stamped and approved **before the Certificate can be issued. Building construction work MUST NOT commence until Sydney Water has granted approval.** Approval is needed because construction/building works may affect Sydney Water's assets (e.g. water and sewer mains).

Your Coordinator can tell you about the approval process including:

- Your provision, if required, of a "Services Protection Report" (also known as a "pegout"). This is needed to check whether the building and engineering plans show accurately where Sydney Water's assets are located in relation to your proposed building work. Your Coordinator will then either approve the plans or make requirements to protect those assets before approving the plans;
- Possible requirements;
- Costs; and
- Timeframes.

Your can also find information about this process (including technical specifications) if you either:

- visit www.sydneywater.com.au ➢ Building and Developing ➢ Building and Renovating. Here you can find Sydney Water's *Guidelines for Building Over/Adjacent to Sydney Water Assets;* or
- call 13 20 92.

Notes:

- **The Certificate will not be issued until the plans have been approved and, if required, Sydney Water's assets are altered or deviated;**

- **You can only remove, deviate or replace any of Sydney Water's pipes using temporary pipework if you have written approval from Sydney Water's Development Operations Branch. You must engage your Coordinator to arrange this approval; and**
- **You must obtain our written approval before you do any work on Sydney Water's systems. Sydney Water will take action to have work stopped on the site if you do not have that approval. We will apply Section 44 of the *Sydney Water Act 1994*.**

OTHER THINGS YOU NEED TO DO.

Shown below are other things you need to do that are NOT a requirement for the Certificate. They may well be a requirement of Sydney Water in the future because of the impact of your development on our assets. You must read them before you go any further.

(1) Stamping and approval of your building plans

Please note that the building plans must be stamped and approved when each lot is developed. This can be done at a Quick Check agency. For an agency list visit www.sydneywater.com.au ➢ Building and Developing ➢ Quick Check or call 13 20 92.

This is not a requirement for the Certificate but the approval is needed because the construction/building works may affect Sydney Water's assets (e.g. water, sewer and stormwater mains).

Your Coordinator can tell you about the approval process including:

- Possible requirements;
- Costs; and
- Timeframes.

(2) The water service for your development.

Sydney Water does not consider whether the existing water main(s) talked about above is adequate for fire fighting purposes for your development. We cannot guarantee that this water supply will meet your Council's fire fighting requirements. The Council and your hydraulic consultant can help.

You must make sure that each dwelling/ lot has its own 20mm meter.

When access to the water supply is required, the property owner or agent must apply to Sydney Water online. Sydney Water must install a water meter before any water is used. It is illegal for anyone other than a Sydney Water employee to remove the locking mechanism on the water meter.

The online application can be found by visiting our website www.sydneywater.com.au ➢ Plumbing. The applicant will need to have the:

1. Account (Property) Number which can be obtained from the Coordinator; and
2. Serial Number which can be found on the metal tag on your property service.

You can find more information by using the "Ask Sydney Water" section of our website.

(3) Soffit requirements

You must make sure that floor levels meet Sydney Water's soffit requirements for property connection and drainage.

(4) Possible future costs.

The requirements in this Notice relate to your Certificate application only. Sydney Water may be involved with other aspects of your development and there may be other fees or requirements. These include:

- construction/building plan stamping fees;
- plumbing and drainage inspection costs;
- the installation of backflow prevention devices;
- trade waste requirements;
- large water connections; and
- council fire fighting requirements. (It will help you to know what the fire fighting requirements are for your development as soon as possible. Your hydraulic consultant can help you here.)

No warranties or assurances can be given about the suitability of this document or any of its provisions for any specific transaction. It does not constitute an approval from Sydney Water and to the extent that it is able, Sydney Water limits its liability to the reissue of this Letter or the return of your application fee. You should rely on your own independent professional advice.

END

Appendix H

Energy Australia Advice

570 George Street
Sydney NSW 2000

Address all mail to
GPO Box 4009 Sydney
NSW 2001 Australia

Telephone +61 13 15 25
Facsimile +61 2 9269 2830

EnergyAustralia®

24.11.2009

Cardno
910 Pacific Hwy
Gordon NSW 2072

Project Number: SC-01224

Attention: Russell Clark

Dear Russell

Electricity Network Connection at: Potts Hill Underground Residential Development - Cnr Brunker Rd & Cooper Rd, Yagoona.

Further to your enquiry dated 02.10.2009. We have now completed the assessment of our electrical network. This assessment indicates that an alteration of our network will be required to provide the electrical connection you have requested. These works are classified as contestable. Your application for connection will now be processed in accordance with Energy Australia document *ES10: Requirements for Electricity Connections to Developments*.

We anticipate that the developer/customer will be required to contribute to the construction of the following:

- ❑ Two KL type kiosk substations. In addition to other costs, the developer/customer is responsible for the cost of substation equipment that cannot be recovered or reused. Refer to ES8: *Capital Contributions Guidelines* for details.
- ❑ High Voltage and Low Voltage reticulation of the urban subdivision.

The above item(s) will become part of the EnergyAustralia electricity distribution network and remain the property of EnergyAustralia.

This letter is not to be construed as a final offer. Upon submission of further detail or changes to your proposal we reserve the right to alter our design requirements. Any such changes may alter the design information fees payable, particularly where EnergyAustralia needs to undertake additional investigations.

Notice of Arrangement Letter

Payment of the fees and charges detailed on the enclosed *Summary of Charges for Customer Connection Works* is required before EnergyAustralia can process and issue a Notification of Arrangements (NOA) Form. Please return the completed form with your payment.

What to Do Next

To advance the arrangements you need to complete the following items and provide the following information to EnergyAustralia: -

Complete and return the enclosed Application for Provision of Electricity Network Connection Services.

Pay the initial fees and charges detailed on the enclosed *Summary of Charges for Customer Connection Works* and return the form with your payment.

Provide the following (if available):

- A complete set of the plans for the development.
- A copy of the local Council's (or other development consent authority's) Development Consent conditions if a Development Application for the site has been considered.
- A copy of the development layout and dimensions in digital DGN, DWG or DXF format.

Should you require any further information please contact EnergyAustralia on the above phone number and quote the project number.

Yours sincerely,

Jonathan Simpson
Contestability Officer
EnergyAustralia

Direct Telephone Number (02)9585 5740
Facsimile: (02)9585 5797

Email: jsimpson@energy.com.au

Enclosures: Summary of Charges for Customer Connection Works
Application for Provision of Electricity Network Connection Services

SCHEDULE OF PAYMENTS
NON-CONTESTABLE FEES AND CHARGES

EnergyAustralia™ We're on it

Date Issued 24/11/2009
Last Date for Acceptance * 23/01/2010

ABN: **67 505 337 385**

Project Potts Hill Underground Residential Development
Project Address Cnr Brunker Rd & Cooper Rd, Yagoona

Project No. **XCO-016226**

Customer Landcom
c/o Cardno
Customer's Address 910 Pacific Hwy
Gordon NSW 2072

Originating Officer *Jonathan Simpson*
Telephone 02 95855740
Fax 02 95855670

A TAXATION INVOICE WILL BE ISSUED UPON PAYMENT OF THE FOLLOWING FEES AND CHARGES

PAYMENT NOTIFICATION

ITEM	DETAILS	FEE / QUOTATION		
		GST Exclusive	GST	GST Inclusive
1	∞ Non-Contestable Design Information fee	$2,280.00	$228.00	$2,508.00
2	∞ Non-Contestable Administration fee	$425.60	$42.56	$468.16
3	∞ Non-Contestable Certification of Electrical Design fee	$1,118.40	$111.84	$1,230.24
3a				
4				
5				
6				
7				
8				
9				
10				
12				
13				
16				
	TOTALS	$3,824.00	$382.40	$4,206.40

Cheques to be made payable to EnergyAustralia and forwarded to our office at 33-45 Judd Street Oatley, NSW, 2223, and marked for the attention of Jonathan Simpson

* Charges may be reviewed if payment is not received by the indicated date.

∞ The Non-Contestable fees above are outlined in EnergyAustralia's 'ES 5' publication "Network Miscellaneous Connection Charges" and are payable regardless of who the customer selects as the installation designer and /or installer, however the fees may vary depending on the work practices and grading of the Accredited Service Provider chosen.
The fees stated above are for EnergyAustralia to complete the works. Should other Accredited Service Providers be engaged, the relevant fees will be advised upon application and may vary from those stated above.

¤ The quotation for the Construction of the Electrical Works will be subject to the completion of the Electrical Design.

** Information on the Use of Out-of-Service Reticulation Assets is outlined in EnergyAustralia's 'ES 8' publication. The charge for the Use of Idle Assets (Ducts) is payable regardless of who the customer selects as the installation designer and /or installer.

EnergyAustralia Office Use Only:

Cashier: ### Please notify Jonathan Simpson 02 95855740 before receipting payment ###

Receipt No : ..... Received By : ..... Date : .....

Appendix A Application Form

APPLICATION FOR PROVISION OF ELECTRICITY CONNECTION TO A DEVELOPMENT

DETAILS OF THE ANTICIPATED ELECTRICAL DEMAND SHOULD BE PROVIDED ON A SEPARATE ATTACHMENT

(Delete clauses if they are not applicable)

Constituent Council Ref. No. ..... ……

Development Location Street .....

Town/Suburb .....

Type of Development (See clause 5 of ES 10) .....

Subdivision DP or Title Reference .....

Torrens/Strata/Community .....

Nearest Cross Street .....

Name of Developer .....

Name of Developer's Representative .....

Address for all Correspondence .....

Telephone No ..... Fax No .....

Is EnergyAustralia requested to digitise the Plans? Yes/No

Name of the Designer .....

Name of Accredited Service Provider .....

Telephone No ..... Fax No .....

The drawings specified in clause 8 of ES 10 are attached.

Lot Numbers of Residential Building Lots .....

..... Total .....

Lot Numbers of Existing Dwellings to be retained .....

Lot Numbers of Medium Density Areas - No. of Units .....

Lot Numbers of Dual Occupancy Lots .....

Lot Numbers of Special Use Areas (include details if any) .....

Lot Numbers of Residue Lots .....

Lot Numbers of Public Reserves, Road Reserves etc. .....

Anticipated Date of Completion of Subdivision/Development .....

Lot Numbers affected by Existing Overhead Powerline Easements .....

(also show on plan)

Programmed Date of Completion of Road Construction .....

Anticipated Date of Commencement of House/Unit/Building Construction .....

Is private generation to be installed in this development Yes/No

If Yes, is it intended to run this generator in parallel with EnergyAustralia's system for extended periods - provide full details (type and rating) Yes/No

Is gas Reticulation to be installed in this Development? Yes/No

Is common trenching with other utilities proposed? Yes/No - Show on Plan

a) I/We hereby submit the above information and drawings and wish to be advised of EnergyAustralia's requirements with regard to the provision of electricity to the above development.

b) I/We agree that, at all times, this application is subject to the conditions of the Agreement for Connection of Developments (EnergyAustralia publication ES 9) and the Requirements for Electricity Connection to Developments as determined by EnergyAustralia from time to time and detailed in publication ES 10.

c) In particular I/we agree that notwithstanding the issue of a Notice of Arrangement by EnergyAustralia I/we may be subject to a further Payment as detailed in the Agreement (ES 9) and in ES 10.

d) I/WE ACKNOWLEDGE THAT I/WE HAVE READ THE REQUIREMENTS CONTAINED IN PUBLICATION ES 10 AS IN FORCE AT THE DATE OF THIS APPLICATION AND AM/ARE FAMILIAR WITH ITS CONTENTS.

e) I am a proper officer of the Developer - Company/Owner, duly authorised to sign this application on behalf of such Company.

f) I/WE agree to enter into a formal Agreement (refer to ES 9) with regard to reticulation works where required by the above Requirements.

DEVELOPER

Date: ..... / ..... / .....

Signature of Developer .....

Position Held .....
(Manager, Owner)

COMPANY

The Common Seal of)
)
was hereunto affixed in accordance with) Director
the Articles of Association and by)
authority of the Board in the presence)
of:)
)

DEVELOPER'S REPRESENTATIVE

Date: ..... / ..... / .....

Signature of Developer's Representative .....

The Company Seal of .....