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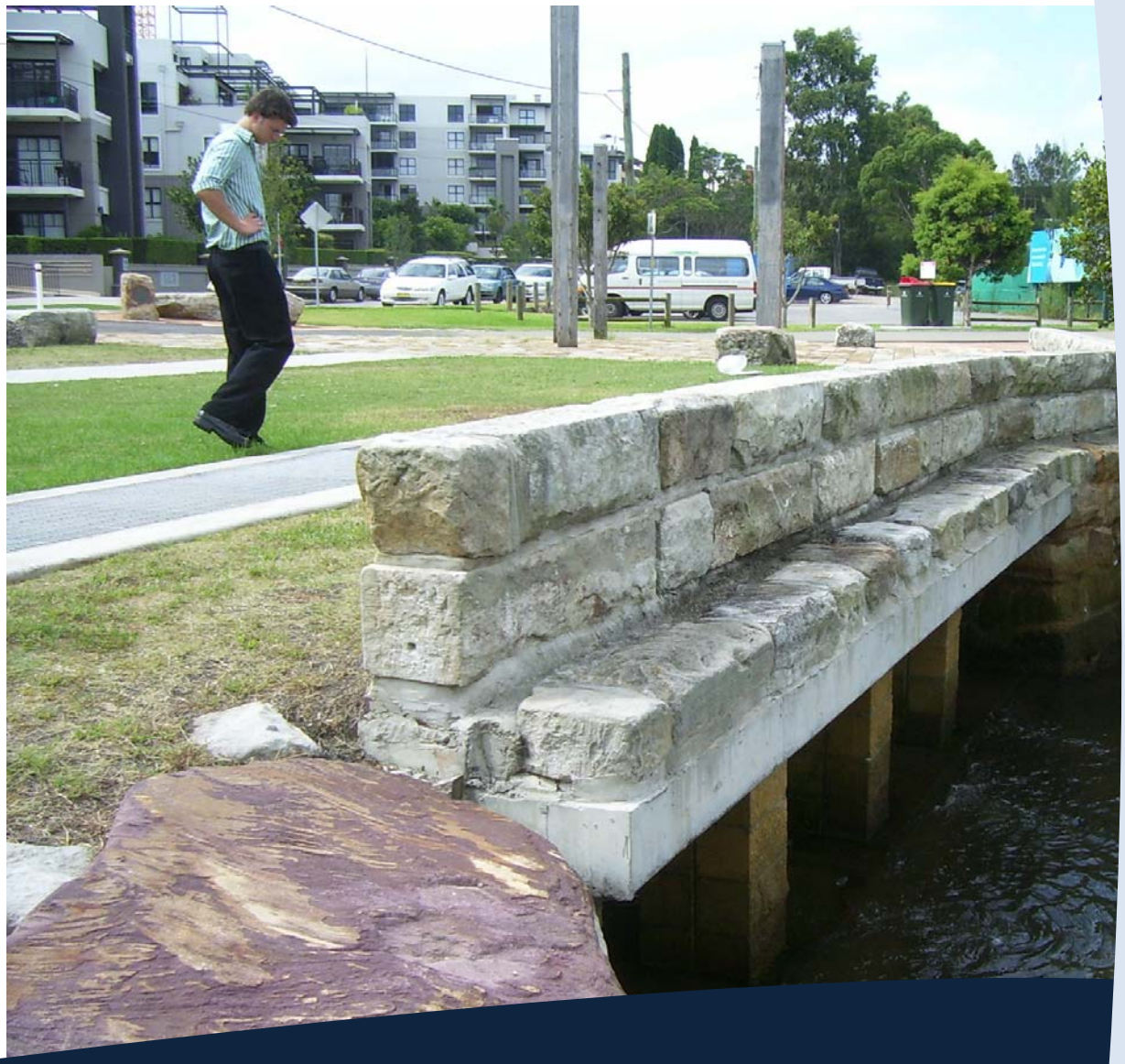

Integrated Water Management Report

Shepherds Bay Urban Renewal Stage 1

Ref 600283-R001A DRAFT

Prepared for Robertson Marks Architects

May 2010

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Version	Date	Author		Reviewer	
Rev A – Draft	26 Mar. 10	G Neville	GN		

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1 The Existing Site

The proposed Sheaphards Bay Urban Renewal Project will occupy several sites generally bounded by Constitution Road to the north, Belmore Street to the east, Sydney Harbour fronted Rothsay Avenue to the south and Bowden Street to the west.

The site will be developed over several years with an ultimate objective of providing upto 3,000 new dwellings proximate to public transport and main road corridors.

The site presently exists as a mix of industrial, warehouse and commercial buildings.

The topography of the site consists of a relatively steep gradient from Constitution Road towards the Harbour.

Stage 1 of the project is sited at the south eastern corner of the urban renewal area and has a fall of 12-14m from north to south and a site area of approximately 0.7 Hectares. The Stage 1 site presently drains to a low pint at the southern Rothsay Avenue frontage and thence to Parramatta River via pit and pipe network travelling under a recently constructed Council Car Park.

2 The Proposed Development

The proposed Stage 1 development comprises the construction of a new multi storey residential building with two basement car park levels.

The proposed lowest apartment floor level is RL5.2, with the lower level basement car park level positioned at RL1.7. The southern or lowest frontage of the site on Rothsay Avenue ranges in level form RL2.2m to RL3.2m.

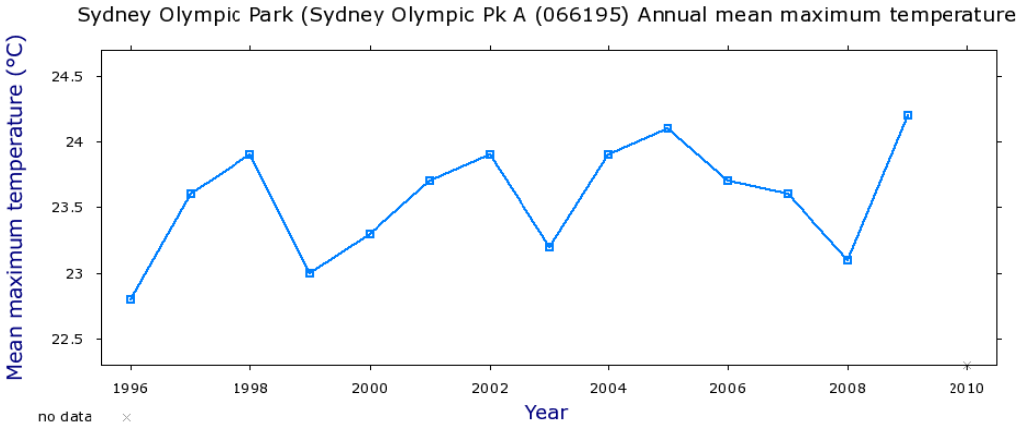
The driveway entry form the street to the basement car park levels is located on Belmore Street at approximately RL8.0.

A total of 236 units and 315 car spaces will be provided by the Stage 1 development.

3 Site Conditions

3.1 Climate and Rainfall

Site climate and rainfall was based on observed data at the nearest Bureau of Meteorology gauging station located at Olympic Park approximately 3.5km south of the site. Figures 3.1.1 to 3.1.3 summarise temperature and rainfall data referenced for this study*.



Note: Data may not have completed quality control
Observations made before 1910 may have used non-standard equipment

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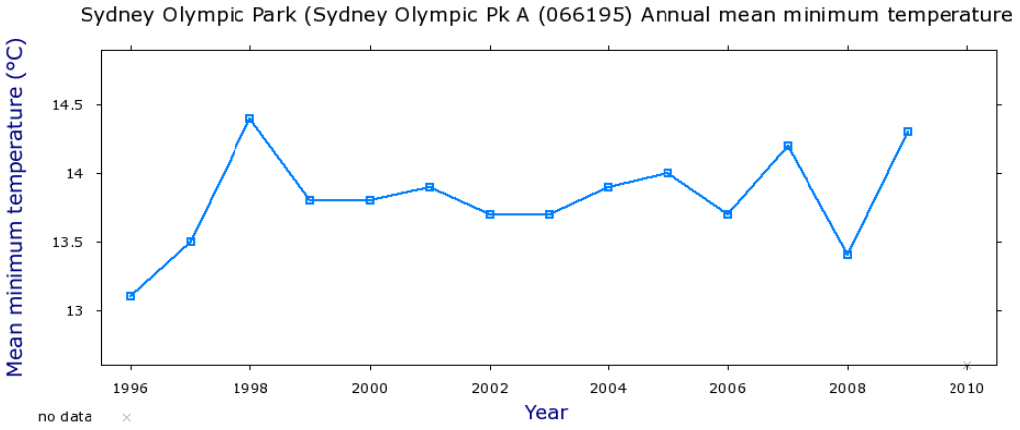
Figure 3. 1.1 : Mean Maximum Temperature



Note: Data may not have completed quality control
Observations made before 1910 may have used non-standard equipment

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Figure 3. 1.2 : Mean Minimum Temperature

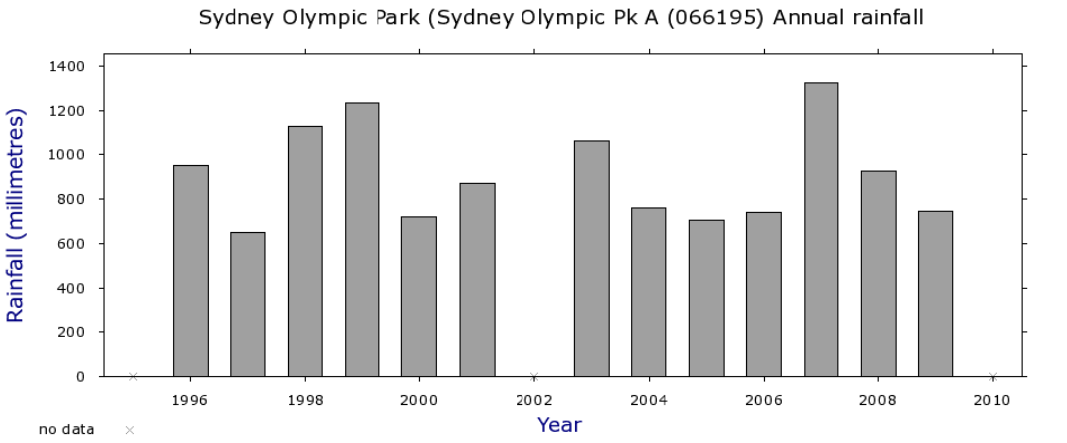

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Figure 3.1.3 : Mean Annual Rainfall

*It is noted that Sydney Airport gauging station is required to be referenced for Water Quality modelling work in accordance with Ryde Council's Draft MUSIC Modelling Guidelines

3.2 Catchment and Topography

The site is located in a relatively small sub-catchment draining directly to Parramatta River. The upstream catchment size is limited by a crest located in line with Hamilton Crescent to the east and Nancarrow Avenue to the west as shown in Figure 3.2.1. The total size of the sub catchment is approximately 2.3 hectares of which the Stage 1 development occupies 0.7 hectares.

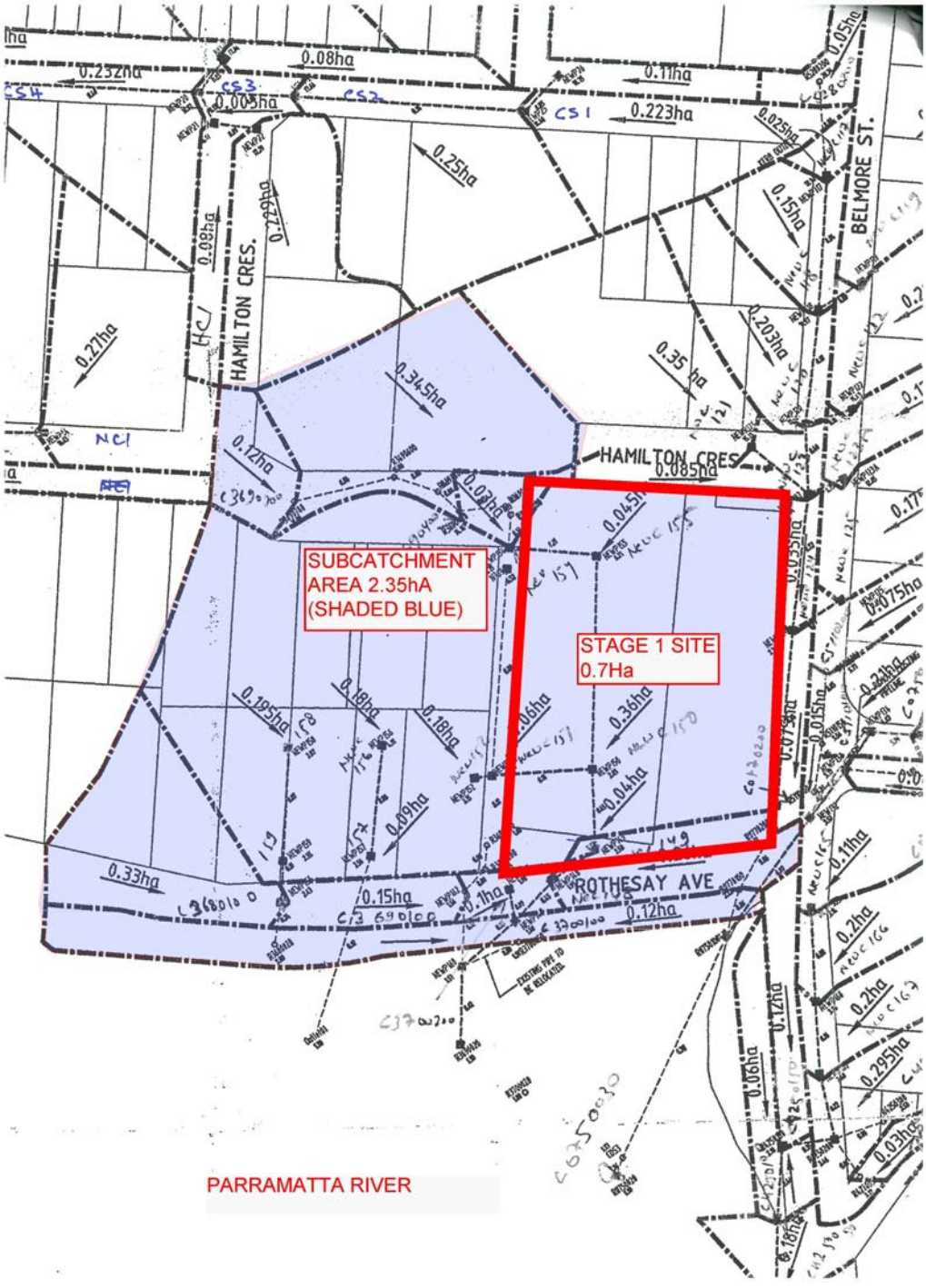

Figure 3.2.1 – Stage 1 Stormwater Catchment

The subcatchment gradients are generally 10 to 12% from north to south and 3% west to east. As the site is almost entirely occupied be a disused factory building, the existing site has been benched to a level of approx. RL7.6m, some 4m lower than the rear (Hamilton Crescent frontage) of the site and 5.5m lower than the front (Rothsay Avenue).

The sub catchment has three piped outlets to the river. While Councils records of the existing stormwater system are not definitive, it appears that based on; a) the information provided by Council, b)referenced form the topographic survey provided by Robertson Marks Architects and c) our inspection of the site, that the western portion of the catchment drains via a 600m diameter RCP (Outlet No.1 on Figure 3.2.2) and that the eastern portion which includes the whole of the subject site is connected to a 375mm diameter pipe at the Rothsay Avenue low point. This 375mm pipe appears to be connected to the recently upgraded Belmore Street stormwater system (Outlet No.2 on Figure 3.2.2) with a buried junction with the twin culverts, located approximately 15m upstream of the sea wall. A further 600mm diameter RCP outlet (Outlet No.3 on Figure 3.2.2) was recorded on the survey, however it is understood that this 600mm diameter pipe is no longer operational.

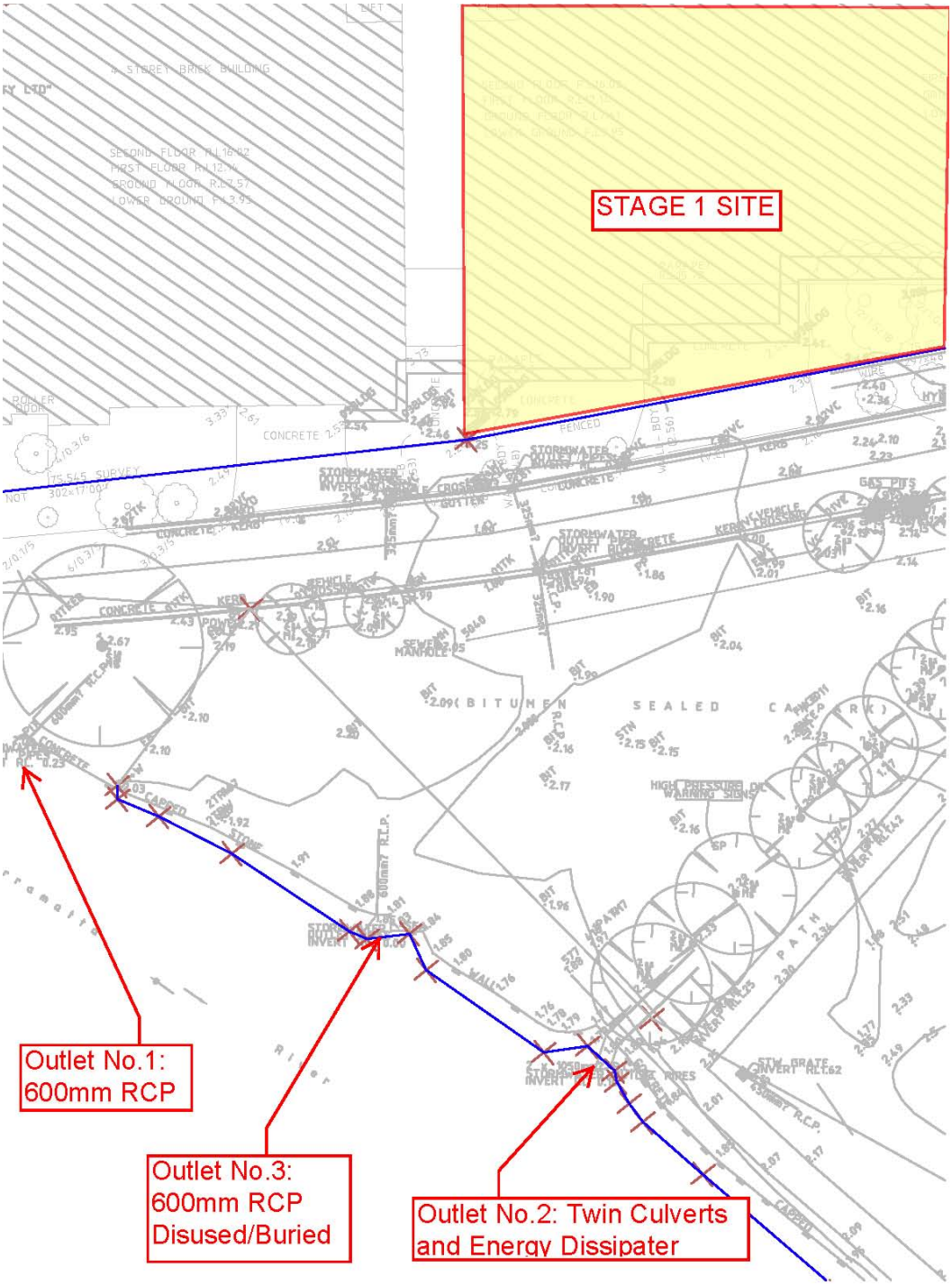

Figure 3.2.2 – Existing Catchment outlets to Parramatta River

3.3 Receiving Waters

As detailed in Section 3.2, the existing site drains directly to the river via underground pipes linked to outlet headwalls integral with the sea wall and by overland flow topping the crest of the sea wall. Stormwater pipes and overland flows from the site do not traverse any private property, flowing a short distance through public land (predominantly land associated with a Council Car Park).

Water quality within Parramatta River and Sydney Harbour is well documented elsewhere and is not intended to form part of this study. The quality of the habitat and extent of biodiversity at the Shepherds Bay foreshore has been heavily compromised by decades of previous upstream industrial land use. Notwithstanding this, Mangrove vegetation does exist along the sea wall frontage. The newly constructed Belmore Street stormwater system has been constructed with concrete and stone energy dissipaters at the outlet in order to minimise scour on the harbour bed and limit the impact on the Mangrove vegetation.

The older stormwater system outlets further to the west do not include any such energy dissipation measures.

4 Integrated Water Management Considerations

4.1 Potable Water Supply and Wastewater Management

Potable water supply will be via connection to Sydney Water's piped reticulation network. Water will be supplied to the site via various amplifications to existing including mains in Well Street from 150mm diameter to 200mm diameter and mains in Belmore Street from 100mm to 200mm.

Sydney Water has indicated that they presently do not have any plans to supply re-cycled water via to the Shepherds Bay Urban Renewal Project and that it is unlikely that such a scheme will be implemented in the future.

Waste water from the proposed development will be connected to Sydney Water's sewer system via augmented reticulation.

4.2 Flooding

The Shepherds Bay Urban Renewal area is subject major overland flows from an extensive upstream catchment. A Flood Assessment Report ref: 489021 has been prepared by Cardno for the Shepherds Bay Urban Renewal project.

Extensive drainage upgrades are required to ensure flows from the Ann Thorne Park Catchment are conveyed safely through the development. The Stage 1 site is remote from the Ann Thorne Park Catchment and is situated in an isolated sub catchment as detailed in Section 3.2.

The Stage 1 site is therefore subject to inundation from flows from within the local subcatchment in excess of the downstream stormwater system and from overflows from the Belmore Street system at its intersection with Rothsay Avenue.

Flood behaviour for the Shepherds Bay Urban Renewal project was modelled by Cardno using a two dimensional flood model (TUFLOW). The results of depth velocity product analysis in the vicinity of the Stage 1 development, which is measure of safety for flood flows are shown in Figure 4.2.1. Note that a depth velocity product equal to or above 0.4m/s is considered unsafe for pedestrians.

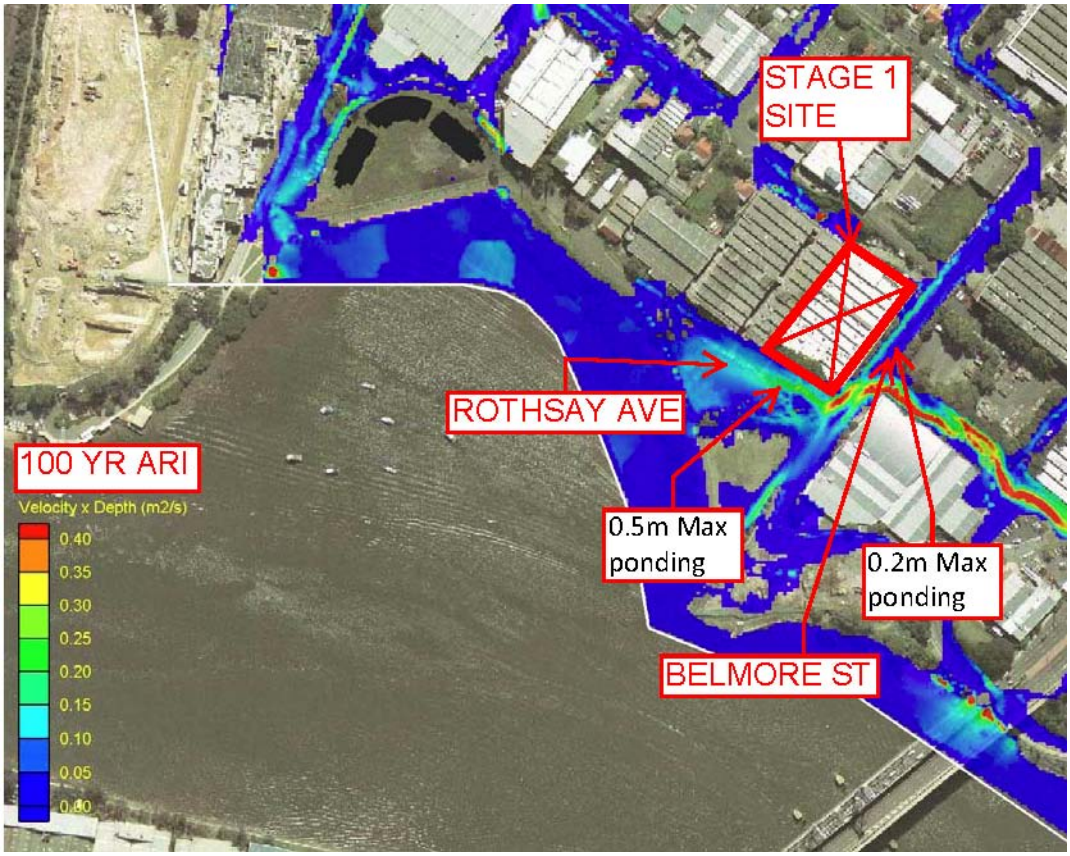

Figure 4.2.1 – 100 Yr ARI Existing Stormwater Inundation Profile – Depth Velocity Product

The safe depth velocity product is exceeded at the intersection of Rothsay Avenue and Belmore Street. The presence of a low point on Rothsay Avenue and a low capacity pit and pipe system in this location results in ponding dept up to 0.5m (approx RL 2.3m) at the frontage of the development. The minimum proposed ground floor apartment level is RL5.2m well above this level. The lowest habitable floor level of the proposed development is a ground floor lobby on the west wing at RL3.65m, which provides ample freeboard the 100 yr ARI flood level. All stair and driveway entries to basement levels will need to be a minimum of 0.3m above the flood level.

4.3 Stormwater Quantity

4.3.1 Stormwater Network

The proposed stormwater network will be augmented to the Shepherds Bay Urban Renewal Project. Due to its proximity to Parramatta River and wholesale upgrade of trunk drainage infrastructure that will be implemented to the development, On-Site Detention (OSD) is not proposed for this development.

The development of the Stage 1 stormwater system (refer Cardno drawings ref 600283-100 to 140) will involve the removal of the stormwater network on within the Stage 1 boundary (private property) and replacement with a network to suit the proposed multistorey residential building configuration and to meet current accepted best practice performance standards. The proposed system will involve a network of downpipes to drain the 0.5Ha roof surface to the re-use system and

system outlet (refer Section 4.3.2). Courtyard drainage and planter bed drainage will be diverted to a dedicated biofitration area (rain garden) for treatment prior to connection to an upgraded Council system.

The piped system network was sized for the 20 year ARI (downpipes to 100 yr ARI) and the network modelling using DRAINS software. The DRAIN model network is shown in Figure 4.3.1 and output data included as Appendix A.

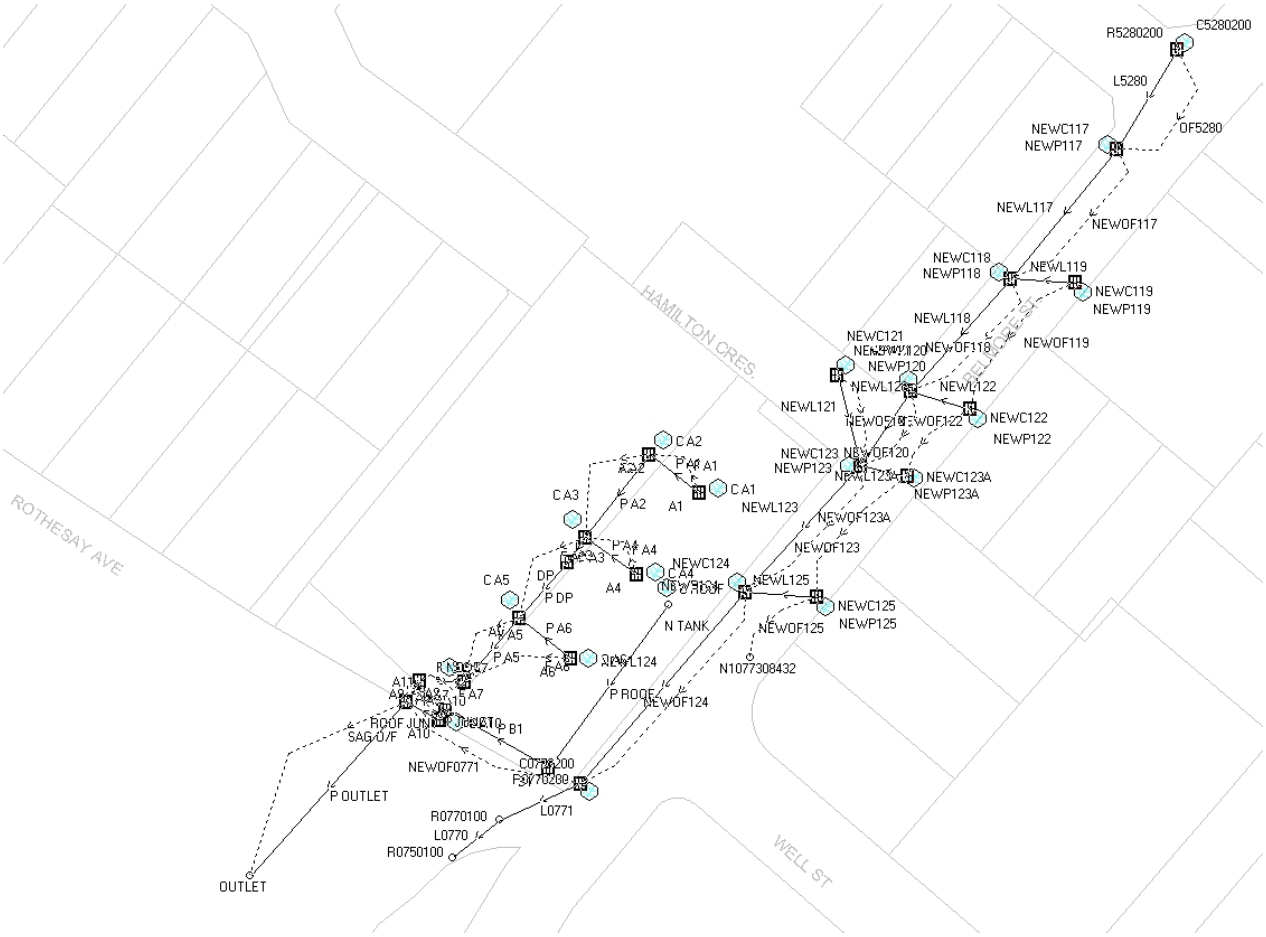

Figure 4.3.1 – Stage 1 DRAINS Model Network

The main outlet to the system will involve the reconstruction of the existing 600mm diameter outlet to the sea wall (refer Outlet No.3 Figure 3.2.2). A new energy dissipater similar in construction to the recently completed Belmore Street system outlet will be constructed in order to manage flow velocities and minimise impact to the foreshore vegetation.

These drainage upgrades will improve Depth Velocity Products noted in Section 4.2 and therefore result in improvement to pedestrian safety during severe storm events.

4.3.2 Stormwater Re-Use

The proposed Stage 1 development will utilise stormwater runoff from the roof surface for use in a car washing bay and for irrigation of 1,500 sq.m of garden and turfed areas within the site.

The size of the tank required has been calculated in accordance with the procedures prescribed by the NSW Governments "Guidance on Use of Rainwater Tanks". A tank with a storage volume of 50kL is satisfactory for the harvested water demands noted. The tank will be positioned under a basement driveway ramp as detailed on drawing 600283-110 and connected to a rainwater reticulation network and irrigation system to deliver water the demand locations. An automatic top up will be connected to Sydney Water's potable water network to guard against severe dry periods (noting >95% reliability of rain water system).

A tank overflow will be provided to pipe runoff in excess of the storage volume by gravity to the network of new pipes and pits and ultimately to Parramatta River

4.4 Stormwater Quality and WSUD

A MUSIC stormwater quality model was established for Stage 1 of the project to ensure that Water Sensitive Urban Design (WSUD) measures were sized to meet Council's pollutant removal targets. All subsequent stages of the Shepherds Bay Urban Renewal project will adopt a similar approach to management of water quality to that described below.

4.4.1 MUSIC Model Assumptions

In accordance with Council's MUSIC Modelling Guidelines (the Modelling Guidelines) the closest rain gauging station at Homebush Bay was ignored in favour of the Sydney Airport gauging station which is considered to be closely representative of the long term average rainfall in the Ryde area.

The source node data and soil node parameters recommended by the Modelling Guide were adopted.

Given the large footprint of the development and the impervious areas at or above podium level, a percent impervious of 100% was adopted. Courtyard and planter bed areas drain to the bioretention area. The extent of this catchment is shown on Drawing 600283-135.

The MUSIC model network is show in Figure 4.4.1

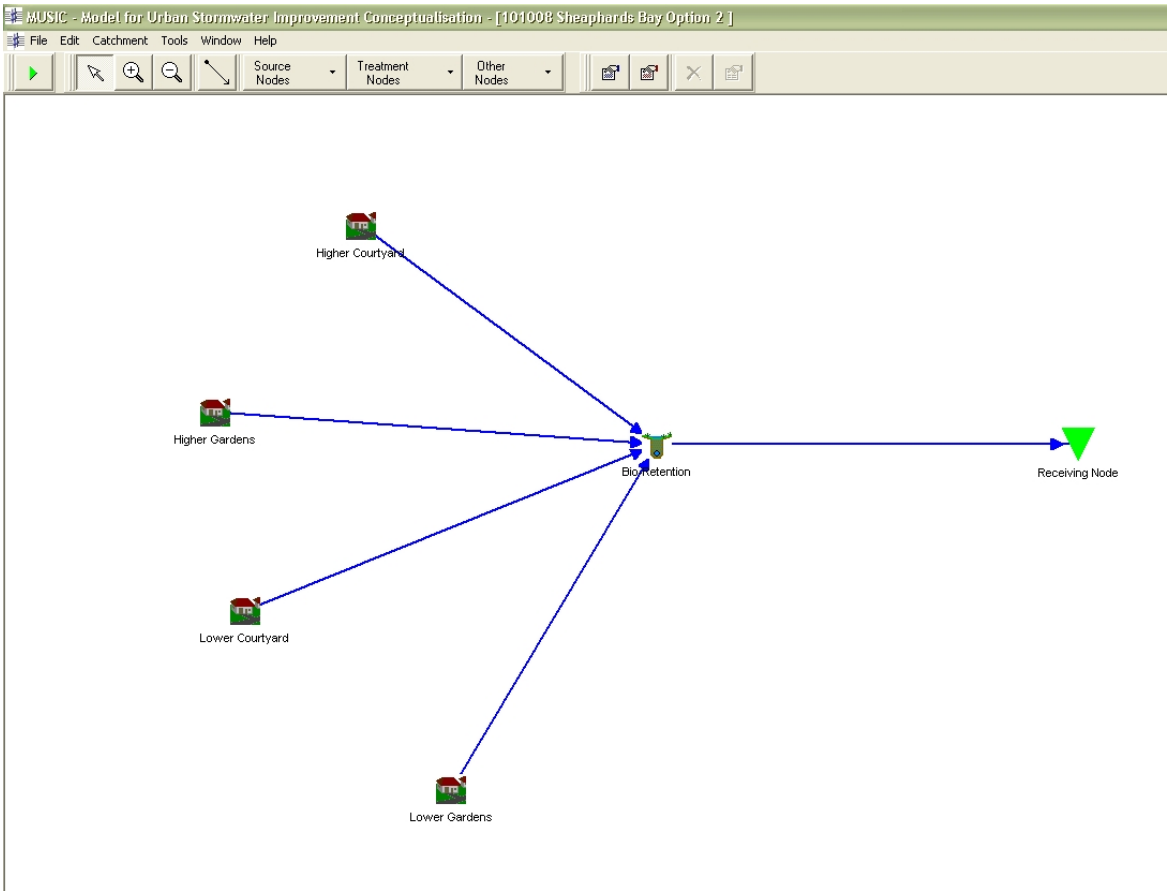

Figure 4.4.1 – Stage 1 MUSIC model network

4.4.2 Water Quality Modelling Results

The MUSIC modelling results indicated that a 40 sq.m by 0.5m deep bio retention area was required to achieve the following pollutant removal rates and compliance with Council's standards. The bio retention area will be located on the western side of the Rothsay Ave frontage of the site as show on drawing 60023-110 and has performance characteristics shown in Table 4.4.2

	Volume Total	Volume Treated	% Treated	Council Target Treatment %
Flow (ML/yr)	0.983	0.984	**0.1**	
Total Suspended Solids (kg/yr)	154	13.2	**91.4**	>85
Total Phosphorus (kg/yr)	0.266	7.29E-02	**72.6**	>65
Total Nitrogen (kg/yr)	2.02	1.08	**46.8**	>45
Gross Pollutants (kg/yr)	15.8	0	**100**	

Table 4.2.2 Bioretention performance

4.5 Soil and Water Management during Construction

Given the location of the works immediately adjacent to Parramatta River it is essential that appropriate sediment and erosion control measure are implemented and maintained during construction.

As Soil And Water Management Plan has been prepared for Stage 1 of the development (refer Cardno drawing 600283-120) and is aimed at a multi-staged approach to managing sediment laden runoff in accordance with Council standards and the NSW Governments "Managing Urban Stormwater Manual – Soils and Construction".

Diversion drains have been incorporated where appropriate to divert clean upstream runoff around disturbed areas in order to limit flow rated from exposed soil surfaces. Runoff from disturbed surfaces will be managed by the provision of sediment traps to pit inlets. Further protection of downstream waters will be achieved by the provision of silt fences and finally a floating silt boom as an emergency capture measure. The boom will be installed in a "U" shape linked to the bank and will ensure that any silt plume resulting from an unexpected failure of the on-site measures will be contained in a discreet area.

Basement areas will act as temporary sediment basis. Water will be pumped to Council's stormwater system only when water quality meeting NSW Office of Water Requirements can be met.

4.6 Climate Change

The stormwater system for Stage 1 of the development has been designed with a tail water level for Parramatta River based on the 2050 climate change sea level rise scenario and 20 year and 100 year river flood event. The tail water level for this situation is estimated to beRL1.48m in the 100 yr ARI event. In this scenario, upwelling is evident in one stormwater pit only, located at the low point in Rothsay Avenue. As discussed in Section 4.2, habitable floor levels have adequate freeboard to the ponded water in this area. More detailed discussion regarding climate change is contained in Cardno's Flooding Report Ref 489021.

5 Conclusions

The Shepherds Bay Ubran Renewal project will enable rejuvenation of what is presently a poorly controlled urban catchment into one that meets current best practice standards with respect to flood management, sustainable water management, Water Sensitive Urban Design and water quality management.

The Integrated Water Management Plan presented above will result in improvements to public safety during flood events, improvements to runoff quality to Parramatta River, more sustainable use of water to and compliance with current urban catchment management standards.

These objectives can be met by the measures described in this report that are proposed for Stage 1. Subsequent stages of the Shepherds Bay Urban Renewal project will be developed to an equivalent standard and which will evolve with improvements in water management technology

and practices over the extended timeframe for wider development.

APPENDIX A

DRAINS STOMRWATER MODEL OUTPUT

DRAINS results prepared 12 October, 2010 from Version 2010.08

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
R5280200	20.37	20.74	0.026	0.3	0.31	0	None
NEWP117	19		0.013		1.2	0.003	Inlet Capacity
NEWP118	16.98		0.08		1.02	0.016	Inlet Capacity
NEWP120	13.98		0.12		1.02	0.024	Inlet Capacity
NEWP123	12.25		0.12		1.25	0.024	Inlet Capacity
NEWP124	7.31		0.042		1.19	0.008	Inlet Capacity
R0770200	2.31		0.047		1.41	0.035	Inlet Capacity
R0770100	2.14		0				
R0750100	2.05		0				
NEWP122	15.43		0.138		1.07	0.028	Inlet Capacity
NEWP121	15.13		0.18		1.37	0.052	Inlet Capacity
NEWP125	7.66		0.113		1.34	0.023	Inlet Capacity
NEWP119	17.46		0.116		1.04	0.023	Inlet Capacity
NEWP123A	12.66		0.117		1.09	0.023	Inlet Capacity
A1	7.7		0.01		0.5	0.004	Inlet Capacity
A2	7.67		0.015		0.53	0.006	Inlet Capacity
A3	7.58		0.024		0.62	0.011	Inlet Capacity
DP	4.67		0		3.53		None
A5	3.68		0.023		1.32	0.01	Inlet Capacity
A7	3.02		0.028		1.98	0.012	Inlet Capacity
A8	1.97		0.012				
A4	7.62		0.013		0.58	0.006	Inlet Capacity
A6	4.28		0.013		0.72	0.006	Inlet Capacity
N TANK	4.25		0.247				
B1	3.8		0		-0.2		Outlet System
ROOF JUNT	2.26		0		0.34		None
A10	1.99		0.015		0.16	0.015	Inlet Capacity
A11	1.54	1.91	0.083	0.5	0.27	0	None
OUTLET	1.2		0				
A9	1.79		0.083		0.51	0.034	Inlet Capacity

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
C5280200	0.026	0.026	0	1	0	0	AR&R 20 year, 5 minut
NEWC117	0.013	0.01	0.003	1	1	0	AR&R 20 year, 5 minut
NEWC118	0.077	0.058	0.019	1	2	0	AR&R 20 year, 5 minut
NEWC120	0.104	0.079	0.026	1	3	0	AR&R 20 year, 5 minut
NEWC123	0.044	0.037	0.006	1	1	0	AR&R 20 year, 5 minut
NEWC124	0.018	0.015	0.003	1	1	0	AR&R 20 year, 5 minut
C0770200	0.039	0.029	0.01	1.5	1	0	AR&R 20 year, 5 minut
NEWC122	0.115	0.087	0.028	1	4	0	AR&R 20 year, 25 minu
NEWC121	0.18	0.136	0.044	1	3	0	AR&R 20 year, 5 minut

NEWC125	0.09	0.068	0.022	1	3	0	AR&R 20 year, 5 minut
NEWC119	0.116	0.093	0.023	1	1	0	AR&R 20 year, 5 minut
NEWC123A	0.09	0.068	0.022	1	1	0	AR&R 20 year, 5 minut
C A1	0.01	0.008	0.002	5	5	0	AR&R 20 year, 25 minu
C A2	0.01	0.008	0.002	5	5	0	AR&R 20 year, 25 minu
C A3	0.013	0.01	0.003	5	5	0	AR&R 20 year, 25 minu
C A5	0.013	0.01	0.003	5	5	0	AR&R 20 year, 25 minu
C A7	0.013	0.01	0.003	5	5	0	AR&R 20 year, 25 minu
C A4	0.013	0.01	0.003	5	5	0	AR&R 20 year, 25 minu
C A6	0.013	0.01	0.003	5	5	0	AR&R 20 year, 25 minu
C ROOF	0.247	0.247	0	5	0	0	AR&R 20 year, 25 minu
C A10	0.015	0.011	0.005	5	5	0	AR&R 20 year, 25 minu

Outflow Volumes for Total Catchment (2.00 impervious + 0.45 pervious = 2.45 total ha)

Storm	Total Rainf	Total Runo	Impervious	Pervious Runoff
	cu.m	cu.m (Runc	cu.m (Runc	cu.m (Runoff %)
AR&R 20 ye	379.24	335.42 (88.	289.80 (93.	45.62 (65.7%)
AR&R 20 ye	586.7	541.76 (92.	459.27 (95.	82.49 (76.8%)
AR&R 20 ye	739.91	693.85 (93.	584.43 (96.	109.42 (80.8%)
AR&R 20 ye	864.14	816.97 (94.	685.91 (97.	131.06 (82.8%)
AR&R 20 ye	969	920.72 (95.	771.58 (97.	149.14 (84.1%)
AR&R 20 ye	1061.21	1011.80 (9!	846.90 (97.	164.90 (84.9%)
AR&R 20 ye	1285.2	1232.43 (9!	1029.86 (9!	202.57 (86.1%)
AR&R 20 ye	1463.9	1407.81 (9(	1175.86 (9!	231.95 (86.5%)
AR&R 20 ye	1744.2	1681.36 (9(	1404.80 (9!	276.56 (86.6%)
AR&R 20 ye	1968.19	1898.61 (9(	1587.77 (9!	310.84 (86.2%)
AR&R 20 ye	2328.05	2245.22 (9(	1881.87 (9!	363.36 (85.2%)

PIPE DETAILS

Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
L5280	0.026	1.3	20.338	20.038	AR&R 20 year, 5 minutes storm, average 185.!
NEWL117	0.036	3.1	18.961	16.977	AR&R 20 year, 5 minutes storm, average 185.!
NEWL118	0.193	5	16.942	13.978	AR&R 20 year, 5 minutes storm, average 185.!
NEWL120	0.399	6.1	13.943	12.253	AR&R 20 year, 25 minutes storm, average 95 r
NEWL123	0.716	8.4	12.218	7.309	AR&R 20 year, 25 minutes storm, average 95 r
NEWL124	0.84	7.4	7.274	2.308	AR&R 20 year, 25 minutes storm, average 95 r
L0771	0.852	2.9	2.273	2.14	AR&R 20 year, 25 minutes storm, average 95 r
L0770	0.852	2.8	2.14	2.05	AR&R 20 year, 25 minutes storm, average 95 r
NEWL122	0.111	4.8	15.398	13.978	AR&R 20 year, 25 minutes storm, average 95 r
NEWL121	0.129	5.9	15.095	12.253	AR&R 20 year, 5 minutes storm, average 185.!
NEWL125	0.091	2.9	7.621	7.309	AR&R 20 year, 5 minutes storm, average 185.!
NEWL119	0.093	3	17.422	16.977	AR&R 20 year, 5 minutes storm, average 185.!
NEWL123A	0.094	3	12.623	12.253	AR&R 20 year, 25 minutes storm, average 95 r
P A1	0.006	0.4	7.666	7.666	AR&R 20 year, 25 minutes storm, average 95 r
P A2	0.014	0.7	7.592	7.585	AR&R 20 year, 25 minutes storm, average 95 r
P A3	0.035	1.7	7.381	7.328	AR&R 20 year, 25 minutes storm, average 95 r
P DP	0.035	3.5	4.365	3.675	AR&R 20 year, 25 minutes storm, average 95 r
P A5	0.055	3.8	3.285	3.02	AR&R 20 year, 25 minutes storm, average 95 r

P A7	0.071	4.1	2.688	1.968	AR&R 20 year, 25 minutes storm, average 95 r
P A4	0.007	0.4	7.588	7.585	AR&R 20 year, 25 minutes storm, average 95 r
P A6	0.007	1.1	4.158	4.123	AR&R 20 year, 25 minutes storm, average 95 r
P ROOF	0.247	2.2	4.252	3.799	AR&R 20 year, 25 minutes storm, average 95 r
P B1	0.247	4.1	3	2.259	AR&R 20 year, 25 minutes storm, average 95 r
P JUNCT	0.247	1.6	2.013	1.993	AR&R 20 year, 25 minutes storm, average 95 r
P B7	0.247	1.6	1.686	1.545	AR&R 20 year, 25 minutes storm, average 95 r
P OUTLET	0.375	1.3	1.329	1.2	AR&R 20 year, 25 minutes storm, average 95 r
P A9	0.049	1.4	1.549	1.545	AR&R 20 year, 25 minutes storm, average 95 r

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 Stor
OF5280	0	0.013	8.928	0.015	0	6.09	0.28	AR&R 20 ye
NEWOF117	0.003	0.08	0.703	0.077	0.13	1.7	1.62	AR&R 20 ye
NEWOF118	0.016	0.12	0.703	0.088	0.15	2.05	1.76	AR&R 20 ye
NEWOF120	0.024	0.068	0.565	0.069	0.13	1.41	1.9	AR&R 20 ye
NEWOF123	0.024	0.042	0.565	0.06	0.1	1.12	1.69	AR&R 20 ye
NEWOF124	0.008	0.047	0.703	0.067	0.09	1.35	1.41	AR&R 20 ye
NEWOF077	0.035	0.035	1.188	0.075	0.06	1.61	0.77	AR&R 20 ye
NEWOF122	0.028	0.117	0.565	0.081	0.17	1.82	2.13	AR&R 20 ye
NEWOF121	0.052	0.096	8.018	0.024	0.02	9.53	0.84	AR&R 20 ye
NEWOF125	0.023	0.023	0.565	0.049	0.08	0.75	1.58	AR&R 20 ye
NEWOF119	0.023	0.138	0.703	0.091	0.17	2.16	1.83	AR&R 20 ye
NEWOF123	0.023	0.113	0.565	0.08	0.17	1.79	2.11	AR&R 20 ye
F A1	0.004	0.015	1.24	0.05	0.01	2.01	0.29	AR&R 20 ye
F A2	0.006	0.019	1.24	0.056	0.02	2.25	0.3	AR&R 20 ye
F A3	0.011	0.023	1.196	0.044	0.03	1.78	0.58	AR&R 20 ye
F A5	0.01	0.022	1.24	0.059	0.02	2.36	0.32	AR&R 20 ye
F A7	0.012	0.012	0.96	0.025	0.02	1	0.96	AR&R 20 ye
F NODE	0.083	0.083	0.877	0.109	0.04	4	0.35	AR&R 20 ye
F A4	0.006	0.018	1.24	0.055	0.02	2.21	0.3	AR&R 20 ye
F A6	0.006	0.018	1.24	0.055	0.02	2.21	0.3	AR&R 20 ye
F A10	0.015	0.015	0.955	0.053	0.05	0.89	0.86	AR&R 20 ye
SAG O/F	0	0	6.313	0	0	0	0	
F A9	0.034	0.034	1.149	0.046	0.04	1.86	0.79	AR&R 20 ye

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 95 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
R5280200	19.29	19.29	0	0
NEWP117	28.67	28.67	0	0

NEWP118	152.11	152.11	0	0
NEWP120	308.29	308.29	0	0
NEWP123	539.07	539.07	0	0
NEWP124	618.1	618.1	0	0
R0770200	646.05	646.05	0	0
R0770100	619.27	619.27	0	0
R0750100	619.27	619.27	0	0
NEWP122	100.7	100.69	0	0
NEWP121	130.39	130.39	0	0
NEWP125	82.26	82.26	0	0
NEWP119	84.44	84.44	0	0
NEWP123A	85.35	85.34	0	0
N1077308	16.45	16.45	0	0
A1	7.5	7.49	0	0.1
A2	15	14.99	0	0
A3	33.74	33.73	0	0
DP	25.86	25.86	0	0
A5	48.4	48.39	0	0
A7	61.86	61.86	0	0
A8	61.86	61.86	0	0
A4	9.38	9.37	0	0.1
A6	9.38	9.37	0	0.1
N TANK	185.2	185.2	0	0
B1	185.2	185.22	0	0
ROOF JUNT	185.22	185.54	0	-0.2
A10	196.63	196.59	0	0
A11	285.22	285.2	0	0
OUTLET	285.2	285.2	0	0
A9	61.86	61.86	0	0

Run Log for 101008 Shephards Bay v8.drn run at 11:12:26 on 12/10/2010

No water upwelling from any pit. Freeboard was adequate at all pits.