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'STORMWATER MANAGEMENT PLAN'

For:

307 – 321 Cranebrook Road, CRANEBROOK

PREPARED FOR: Bastac

OUR REFERENCE: REF-164814-A

ISSUE DATE: 19 December 2014

CONTROLLED DOCUMENT

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AUTHOR	TECHNICAL REVIEWER
	
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LIMITATIONS STATEMENT

EnviroTech Pty. Ltd. has undertaken the following report in accordance with the scope of works set out between EnviroTech Pty. Ltd. and the client. The impacts of future events may require future investigation of the site and subsequent data analysis, together with a re-evaluation of the conclusions and recommendations of this report.

In preparing this report, EnviroTech Pty. Ltd has relied upon, and assumed accurate, certain site information provided by the client and other persons. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. EnviroTech Pty. Ltd. accepts no liability or responsibility whatsoever for or in respect to any use or reliance upon this report by any third party.

TABLE OF CONTENTS

APPENDICES:

INTRODUCTION

Site Address: 307-321 Cranebrook Road, CRANEBROOK

(Hereafter referred to as "the site")

Proposed Development: Proposed dwelling and shed

(See attached 'Site Plan')

OBJECTIVE

The objective of this Stormwater Management Plan is:

- To provide a stormwater drainage system design for the proposed development which is robust, safe, low maintenance and will mitigate stormwater impacts on the drainage network and surrounding properties; and
- To determine the overland flow flood impact on the above property due to the proposed development and address the mitigation measures required.

SCOPE OF WORK

The scope of work addressed in this report includes the design, modelling & documentation for the following (where applicable):

- Drainage for roofing and hard paved areas
- Rainwater reuse system
- Flooding and overland flows
- Finished floor levels
- Flood safe access

SITE DESCRIPTION

Site Address *(see Locality Plan below)*	307-321 Cranebrook Road, CRANEBROOK
Site Inspection Date	3/12/2014
Soils	Soil sampling showed the following soil textures at this site: Depth (mm) Texture 400 Loam 600 Sandy Loam 1400 Sandy Clay Loam

OVERLAND FLOW STUDY

GENERAL

This section of the report addresses the Penrith development control planning requirement that:

- Floor levels of habitable rooms shall be at least 0.5m above the 1% AEP (100 year ARI) flood; i.e. the flood planning level.
- Flood safe access and emergency egress shall be provided to all new developments and for dwelling replacements where practicable.
    - Flood safe access means access that is generally considered satisfactory when the depth of flooding over vehicular driveways and roads is limited to approximately 0.25m with low velocities.

MODELLING

A HEC-RAS model has been developed to model the overland flow path through the site, using a steady flow simulation and a mixed flow regime (see appendix A). Cross sectional data for the length of the overland flow through the site was added to the model, using the contour mapping from provided site plans. Figure 1 below is an x-y-z perspective plot of the hydraulic model developed in HEC-RAS.

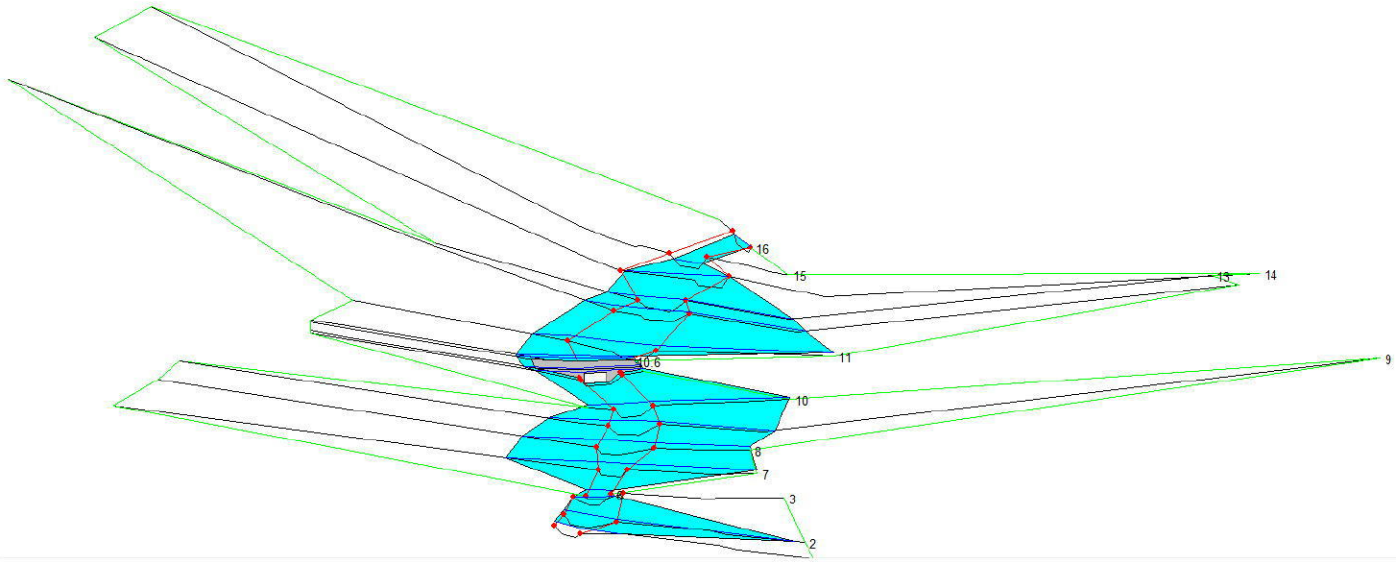


Figure 1 - 3D Perspective Plot of HEC-RAS Hydraulic Model Developed for the Site

Typical values were used for the Manning roughness parameter n, as provided in Table 1.1 in Book VII of *Australian Rainfall and Runoff* – Volume 1 (2001). A downstream slope of 0.04 was used for the normal depth computation for the downstream boundary condition (based on available contour data). An upstream slope of 0.01 was assumed for the normal depth computation for the upstream boundary condition.

The design flows for the two flow entry points to the site were calculated using a basic model in DRAINS (see appendix C). Overland flow catchment areas were delineated using available contour mapping for input into the DRAINS model (see appendix D).

FINISHED FLOOR LEVELS

The peak water level for the 1% AEP at the site is 29.62m. The finished floor levels for the garage and the dwelling are 33.314m and 33.40m respectively. This meets the minimum 500mm freeboard flood planning requirement.

FLOOD SAFE ACCESS

A box culvert bridge for flood safe access to the property has also been incorporated into the HEC-RAS model. The bridge culvert was assumed to have 250mm crown thickness, 50mm concrete cover and 250mm base slab thickness based on culvert manufacturer specifications (Appendix E). Standard drawings for the box culvert can be found in these specifications.

The maximum water depth during the 1% AEP flood at the roadway on the bridge is 0.22m which meets the maximum 0.25m water depth requirement for flood safe vehicular access. The flow velocity at the upstream side of the bridge is 0.86ms^{-1} and 1.03ms^{-1} at the downstream side of the bridge.

Figures 2 and 3 below are cross section of the culvert bridge during the 1% AEP flood event.

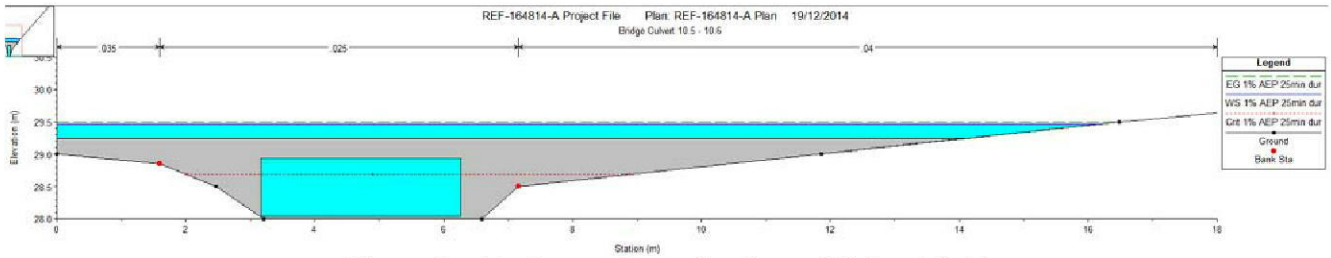


Figure 2 – Upstream Cross-Section of Culvert Bridge

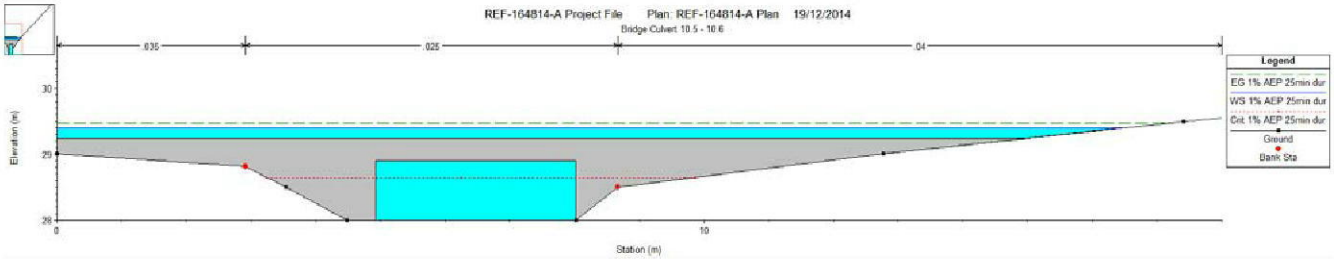


Figure 3 – Downstream Cross-Section of Culvert Bridge

STORMWATER CONCEPT PLAN

GENERAL NOTES

1. Downpipes locations are to be determined by builder/architect.
2. The drawings can be used in conjunction with architects and other consultants' drawings. Any differences are to be referred to the engineer before proceeding work.
3. All construction must meet *AS/NZS 3500.3:2003* stormwater drainage, BASIX and local council DCP.
4. These drawings are not to be scaled for dimensions nor to be used for setout purposes. The builder must level out dimensions prior to commencement of works. This includes existing services and/or other structures that may affect/be affected by this design prior to construction
5. All survey information and site details are based on drawings by others
6. These drawings depict the design of surface stormwater runoff drainage systems only and do not depict roof drainage or subsoil drainage systems unless noted otherwise. The design of roof and subsoil drainage systems is the responsibility of others.
7. It is the builder's responsibility to locate and level all existing services or other structures which may affect/be affected by this design prior to commencement of works.

PLAN SPECIFIC NOTES

ROOF DRAINAGE NOTES:

1. Eaves gutters & downpipes to be constructed accordingly to *AS 3500*. It is the responsibility of the plumber and/or builder to comply with this.
2. Roof gutters to have overflow provision set in accordance with *AS/NZS 3500.3:2003* and *sections 3.5.3, 3.7.5*

TREE PRESERVATION:

It is the responsibility of the builder to obtain any prior approval required from council with respect to potential impact on trees.

DRAINAGE NOTES

PIPE SIZE:

The minimum pipe size shall be:

1. 90mm dia. where the line only receives roofwater runoff; or
2. 100mm dia. where the line receives runoff from paved or unpaved areas on the property
3. The minimum pipe velocity should be 0.6 m/s and a maximum pipe velocity of 6.0 m/s during the design storm.

PIPE GRADE:
The minimum pipe grade shall be:

1. 1.0% for pipes less than 225mm diameter
2. 0.5% for all larger pipes

Pipes with a gradient greater than 20% will require anchor blocks at the top and bottom of the inclined section; and at intervals not exceeding 3.0m
Anchor blocks are designed according to *clause 3.5.3 of AS/NZS 3500.3-1990*

DEPTH OF COVER FOR PVC PIPES:
Minimum pipe cover shall be as follows:

Location	Minimum cover
Not subject to vehicle loading	100mm single residential
Subject to vehicle loading	450mm where not in a road
Under a sealed road	600mm
Unsealed road	750mm
Paved driveway	100mm plus depth of concrete

See *AS/NZS 2032* installation of UPVC pipes for further information.
Concrete pipe cover shall be in accordance with *AS3725-1989 loads on Buried concrete pipes,* however a minimum cover of 450mm will apply.
Where insufficient cover is provided, the pipe shall be covered at
Least 50mm thick overlay and shall then be paved with at least:

1. 150mm reinforced concrete where subject to heavy vehicle traffic;
2. 75mm thickness of brick or 100mm of concrete paving where subject to light vehicle traffic; or
3. 50mm thick brick

CONNECTIONS TO STORMWATER DRAINS UNDER BUILDINGS:
Shall be carried out in accordance with *section 3.10 of AS3500.3-1990*

ABOVE GROUND PIPEWORK:
Shall be carried out in accordance with *section 6 of AS3500.3-1990*

PIT SIZES AND DESIGN:

DEPTH (mm)	MINIMUM PIT SIZE (mm)
UP TO 450mm	450 x 450
450mm TO to 600mm	600 x 600
600mm TO 900mm	600 x 900
900mm TO 1500mm	900 x 900 (WITH STEP IRONS)
1500mm TO 2000mm	1200 x 1200 (WITH STEP IRONS)

1. All pipes should be cut flush with the wall of the pit.
2. Pits greater than 600mm deep shall have a minimum access opening of 600 x 600mm.
3. The grated covers of pits larger than 600 x 600mm are to be hinged to prevent the grate from falling into the pit.
4. The base of the drainage pits should be at the same level as the invert of the outlet pipe.
5. Rainwater should not be permitted to pond within the stormwater system.

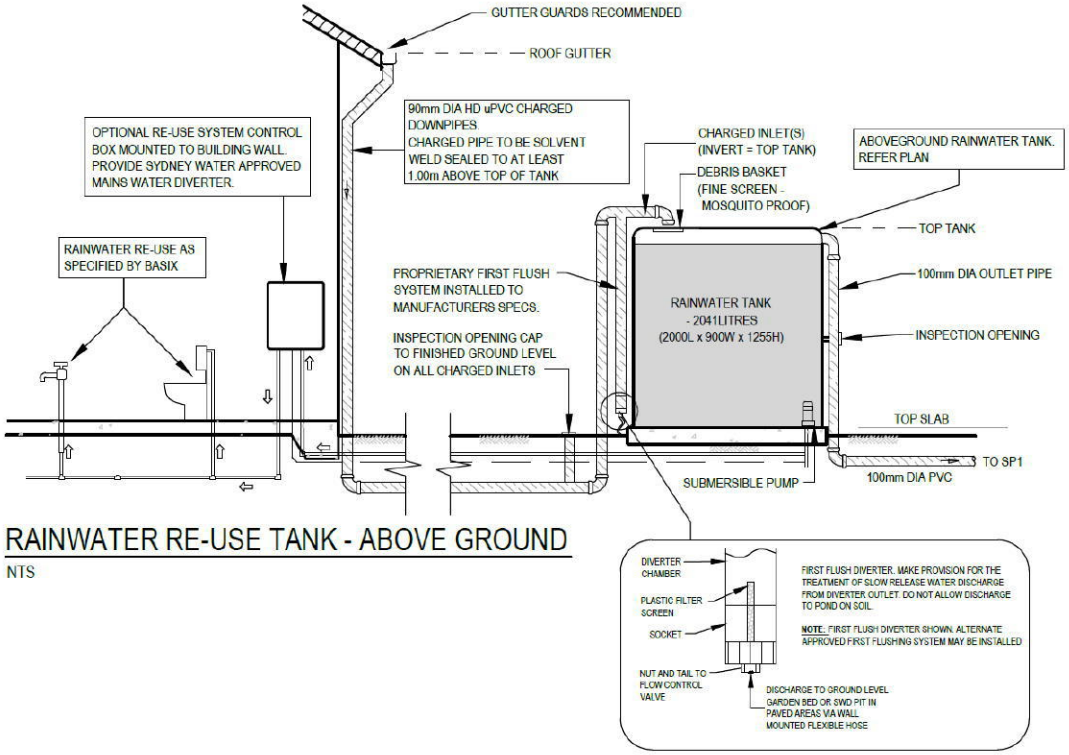
RAINWATER RE-USE TANK

Size: min. 1 x 5000L rainwater tank
Install to manufactures specifications, AS3500 and council requirements

1. For re-use as specified by BASIX certificate
2. Tank to be installed by licensed plumber in accordance with AS/NZS 3500:2003 and NSW code of practice plumbing and drainage 2006

STANDARD DETAILED DRAWINGS

Standard detailed drawing for a rainwater tank, roof gutters and downpipes are below.



RAINWATER RE-USE TANK - ABOVE GROUND
NTS

TYPICAL WARNING SIGN
NTS

EVERY EXTERNAL SUPPLY OUTLET FROM RAINWATER RE-USE TANK TO BE LABELLED WITH METALLIC WARNING SIGN

STORMWATER DRAINAGE MODELLING

The stormwater drainage for the site was modelled in DRAINS (See Appendix F). As the site is zoned as a rural site, Penrith Council (via Luke Calleja) have advised that on-site stormwater detention is not required for the development.

RECOMMENDATIONS

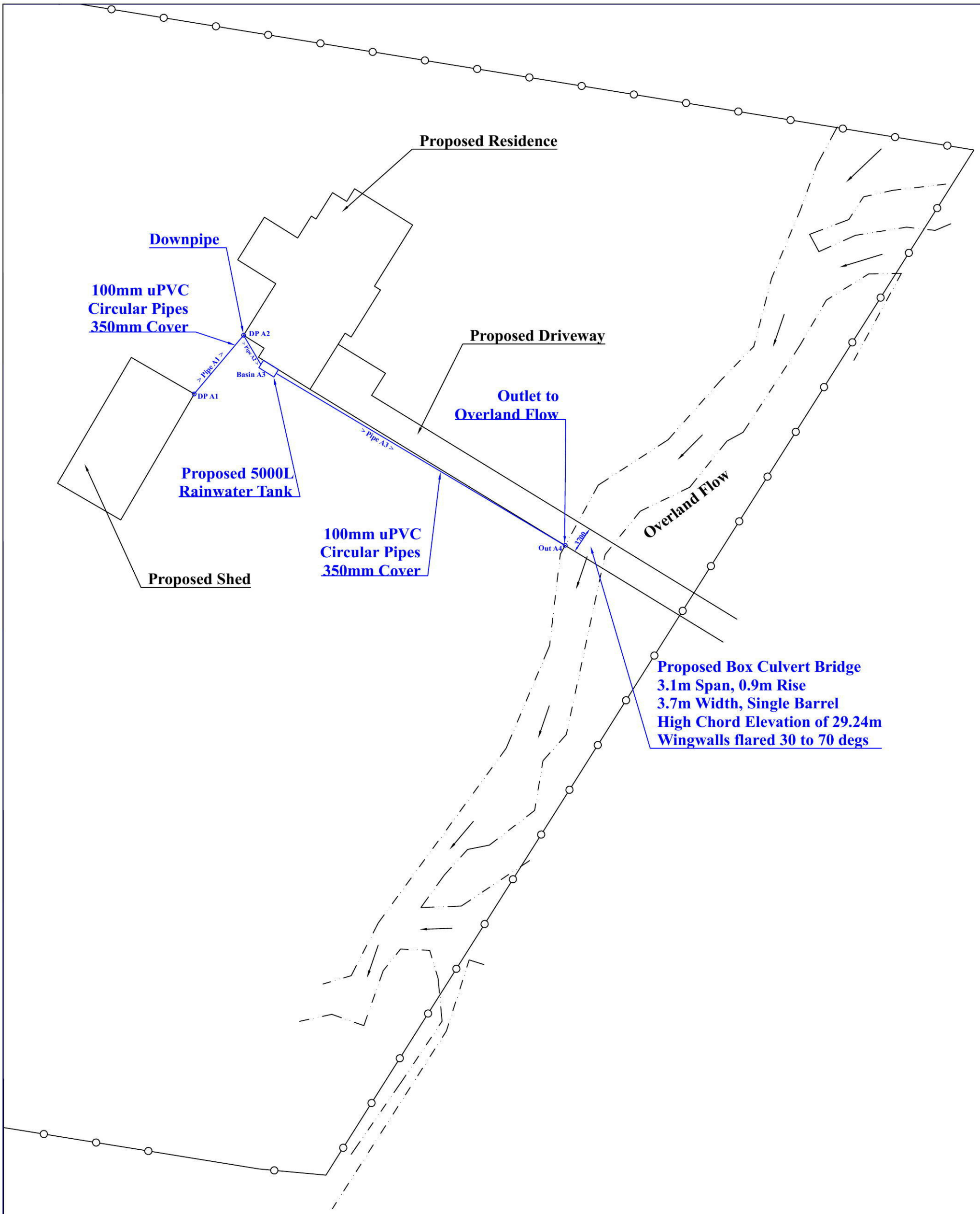
The drainage for the site is to be constructed as per the attached DRAINS model, site plan and long sections in Appendix B and F. This includes the following:

- Installation of 1 x 5000L Slimline™ Aquaslim® 5000 rainwater tank to manufacturer's specifications (see Appendix G), AS3500, council requirements, and BASIX requirements.
- Roof gutters must connect to the specified downpipe connected to the rainwater tank.
- The outlet for the rainwater tank shall be 100mm and placed at the top of the tank (no on-site stormwater detention space required for the rainwater tank.
- All pipes shall be 100mm diameter circular PVC pipes.
- Water from pipe A3 from the rainwater tank shall be released into the overland flow drainage channel at the front of the property.
- All pipes are to be installed with 350mm of cover.
- On-site stormwater detention is not required for this property as per Penrith Council's policy advice.

The proposed development footprint meets Council's flood planning level requirements.

The flood safe access for the site is to be constructed as per the attached HEC-RAS model (Appendix A), site plan (Appendix B) and culvert manufacturer's specifications (Appendix E). This includes the following:

- The culvert is to be a concrete box culvert with wingwalls flared 30 to 70 degrees.
- The culvert is to have a span of 3.1m and rise of 0.9m.
- The culvert and bridge roadway is to be 3.7m wide (width going along the stream)
- The high chord of the bridge roadway is to be at an elevation of 29.24m to provide adequate flood safe access.



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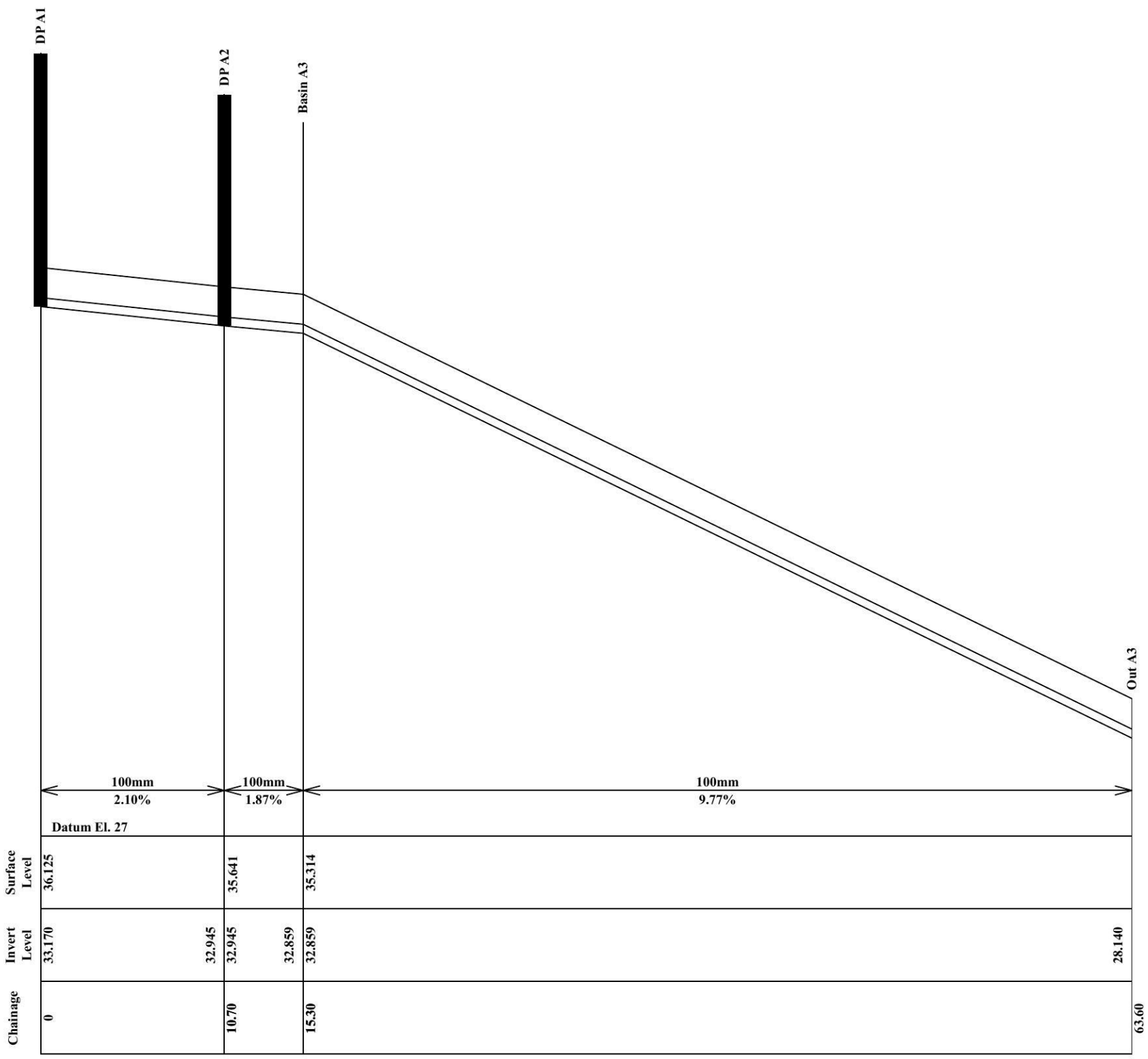
Appendix B - Site Plan

Bastac	Date 19/12/2014	Scale 1:500
307-321 Cranebrook Road, CRANEBROOK		
DWG-164814-A		Sheet 1/1



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Appendix B - DRAINS Long Section

Bastac	Date 19/12/2014	Scale 1:300
307-321 Cranebrook Road, CRANEBROOK		
DWG-164814-B		Sheet 1/1

85.2008 Ha
7.76m3/s worst case peak flow
1%AEP 25min storm

9.5111 Ha
1.01m3/s worst case peak flow
1%AEP 25min storm

CRANEBROOK RD

KURZEME

CRANE

Primary School

FS

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Appendix D - Catchment Delineation

Bastac	Date 19/12/2014	Scale 1:5000
307-321 Cranebrook Road, CRANEBROOK		
DWG-164814-C		Sheet 1/1

STORMWATER

Box Culverts

Rocla® Box Culverts

Rocla manufactures a wide range of reinforced concrete box culverts for small and large spans. Box culverts are an ideal alternative to pipes for limited fill height applications, precast open channels, underpasses and ducts for underground services. Dimensions of components vary depending on specification and manufacturing location.

Contact Rocla for actual product dimensions.

SPECIAL DESIGNS

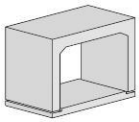
Rocla® small box culverts are designed to AS1597.1. Large box culverts are designed to AS1597.2 and as required by road and rail authority specifications. Special conditions such as aggressive soils and non-standard vehicle or construction loadings may require a specific design.

Box culverts can also be supplied with splayed ends, starter bars, block-outs for skylights, etc.

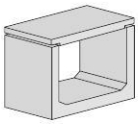
HYDRAULIC DESIGN

The CPAA publication "Hydraulics of Precast Conduits" assists designers with the hydraulic design of concrete pipes and box culverts.

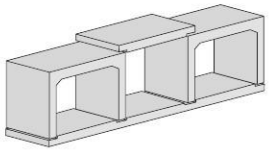
ROCLA® BOX CULVERT CROWN UNITS & BASES



Crown Unit & Base



Invert & Lid



Crown Units, Base Slab & Link Slab

Box culvert crowns are available in the following combinations of internal span and height:

Nom. Span (mm)	Nominal Internal Height (mm) 225	300	450	600	900	1200
300						
450						
600						
900						
1200						

Standard height/span combinations

Nom. Span (mm)	Nominal Internal Height (mm) 600	750	900	1200	1500	1800	2100	2400	2700	3000	3300	3600	4200
1500													
1800													
2100													
2400													
2700													
3000													
3300													
3600													

HANDLING

Rocla® box culverts are supplied with cast-in SwiftLift anchors of appropriate size. There are generally four anchors in the crown of the box culvert for handling and installation. Box culverts are generally lifted and transported in the "legs down" position ("legs-up" for inverts). Some culverts may be transported "on-edge" and must be turned to the installed position on site. For some large culverts, bracing may be provided to stabilise the legs during transport.

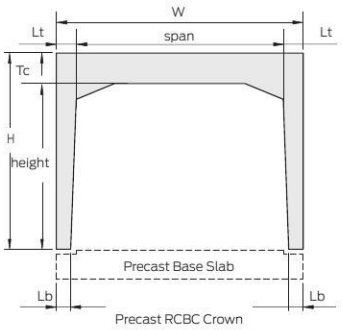
INSTALLATION

Installation should be in accordance with project-specific drawings and specifications.

Rocla® Small Box Culvert B1 Exposure

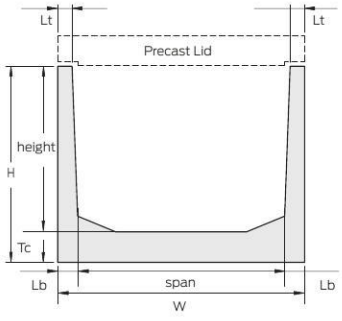
Rocla® box culvert (RCBC) crowns and bases are manufactured in accordance with AS1597.1-2010. Proof load 112kN and ultimate load 202kN. Culverts are manufactured to RTA Specifications.

Note: The product codes shown are for 2.4m-long culverts and lids. To order 1.2m lengths, replace the "5" at the end of the product code with "2", e.g., BANC0450302 and BANBS0452.
Other small RCBC sizes available on request.



Precast RCBC Crown


Small Box Culvert Crowns



Precast RCBC Invert

ROCLA® SMALL BOX CULVERT CROWNS (1.2m AND 2.4m LENGTHS) AS1597.1-2010 EXPOSURE CLASS B1

Product Code	Nominal Size	Crown Thickness	Leg Thick Top	Leg Thick Bottom	Overall Width	Overall Height	Lifting Arrange-ments
2.4m Length	Width x Height	Tc	Lt	Lb	W	H	
BANC0300225	300 x 225	100	69	62	438	325	2 x 1.3t
BANC0450305	450 x 300	110	72	62	594	410	2 x 1.3t
BANC0600305	600 x 300	115	77	67	754	415	2 x 1.3t
BANC0600455	600 x 450	115	77	62	754	565	2 x 1.3t
BANC0900305	900 x 300	135	87	77	1074	435	4 x 1.3t
BANC0900605	900 x 600	135	87	67	1074	735	4 x 1.3t
BANC1200305	1200 x 300	150	105	95	1410	450	4 x 2.5t
BANC1200605	1200 x 600	150	105	85	1410	750	4 x 2.5t
BANC1200905	1200 x 900	150	105	75	1410	1050	4 x 2.5t
BANC1201205	1200 x 1200	150	105	65	1410	1350	4 x 2.5t

ROCLA® SMALL BOX CULVERT BASES (1.2m AND 2.4m LENGTHS) AS1597.1-2010 EXPOSURE CLASS B1

Product Code	Nominal Width	Slab Thickness	Overall Width	Rebate Width	Lifting Arrange-ments
2.4m Length		Tb	W	R	
BANBS0305	300	105	438	74	2 x 1.3t
BANBS0455	450	120	594	77	2 x 1.3t
BANBS0605	600	135	754	82	2 x 1.3t
BANBS0905	900	155	1074	92	4 x 1.3t
BANBS1205	1200	180	1410	115	4 x 1.3t

ROCLA® SMALL BOX CULVERT INVERTS (1.2m AND 2.4m LENGTHS) AS1597.1-2010 EXPOSURE CLASS B1

Product Code	Nominal Size	Crown Thickness	Leg Thick Top	Leg Thick Bottom	Overall Width	Overall Height	Lifting Arrange-ments
2.4m Length	Width x Height	Tc	Lt	Lb	W	H	
BCNC0300225	300 x 225	100	69	62	438	325	2 x 1.3t
BCNC0450305	450 x 300	110	72	62	594	410	2 x 1.3t
BCNC0600305	600 x 300	115	77	67	754	415	2 x 1.3t
BCNC0600455	600 x 450	115	77	62	754	565	2 x 1.3t
BCNC0900305	900 x 300	135	87	77	1074	435	4 x 1.3t
BCNC0900605	900 x 600	135	87	67	1074	735	4 x 1.3t
BCNC1200305	1200 x 300	150	105	95	1410	450	4 x 2.5t
BCNC1200605	1200 x 600	150	105	85	1410	750	4 x 2.5t
BCNC1200905	1200 x 900	150	105	75	1410	1050	4 x 2.5t
BCNC1201205	1200 x 1200	150	105	65	1410	1350	4 x 2.5t

ROCLA® SMALL BOX CULVERT LIDS (1.2m AND 2.4m LENGTHS) AS1597.1-2010 EXPOSURE CLASS B1

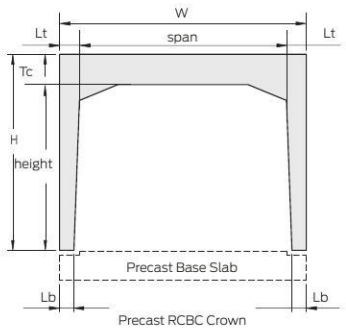
Product Code	Nominal Width	Slab Thickness	Overall Width	Rebate Width	Lifting Arrange-ments
2.4m Length		Tb	W	R	
BANLD0305	300	105	438	74	2 x 1.3t
BANLD0455	450	120	594	77	2 x 1.3t
BANLD0605	600	135	754	82	2 x 1.3t
BANLD0905	900	155	1074	92	4 x 1.3t
BANLD1205	1200	180	1410	115	4 x 1.3t

Note: Dimensions are based on AS1597 and must not be used for set-out. Set-out, including cast rebates in base slab, should only be done in accordance with project-specific drawings and specifications.

Rocla® Small Box Culvert B2 Exposure

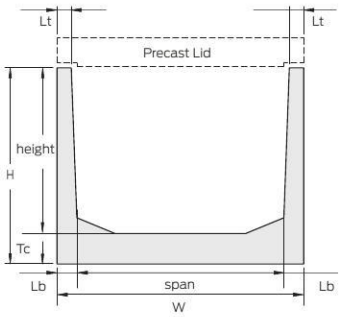
Rocla® reinforced crowns and bases are manufactured in accordance with AS1597.1-2010. Proof load 112kN and ultimate load 202kN. Culverts are manufactured to RTA Specifications.

Note: The product codes shown are for 2.4m-long culverts and lids. To order 1.2m lengths, replace the "5" at the end of the product code with "2", e.g., BENC0450302 and BCNBS0452. Other small RCBC sizes are available on request.



Precast RCBC Crown


Small Box Culvert Crown



Precast RCBC Invert

ROCLA® SMALL BOX CULVERT CROWNS (1.2m & 2.4m LENGTHS) AS 1597.1-2010 EXPOSURE CLASS B2

Product Code	Nominal Size	Crown Thickness	Leg Thick Top	Leg Thick Bottom	Overall Width	Overall Height	Lifting Arrange-ments
1.2m Length	Width x Height	Tc	Lt	Lb	W	H	
BENC0300222	300 x 225	110	92	85	484	335	2 x 1.3t
BENC0450302	450 x 300	120	95	85	640	420	2 x 1.3t
BENC0600302	600 x 300	120	100	90	800	420	2 x 1.3t
BENC0600452	600 x 450	120	100	85	800	570	2 x 1.3t
BENC0900302	900 x 300	135	110	100	1120	435	4 x 1.3t
BENC0900602	900 x 600	135	110	90	1120	735	4 x 1.3t
BENC1200302	1200 x 300	165	120	110	1440	465	4 x 1.3t
BENC1200602	1200 x 600	165	120	100	1440	765	4 x 1.3t
BENC1200902	1200 x 900	165	120	90	1440	1065	4 x 1.3t
BENC1201202	1200 x 1200	165	120	80	1440	1365	4 x 1.3t

ROCLA® SMALL BOX CULVERT BASES (1.2m & 2.4m LENGTHS) AS 1597.1-2010 EXPOSURE CLASS B2

Product Code	Nominal Width	Slab Thickness	Overall Width	Rebate Width	Lifting Arrange-ments
1.2m Length		Tb	W	R	
BCNBS0302	300	115	484	97	2 x 1.3t
BCNBS0452	450	130	640	100	2 x 1.3t
BCNBS0602	600	145	800	105	2 x 1.3t
BCNBS0902	900	165	1120	115	4 x 1.3t
BCNBS1202	1200	190	1440	130	4 x 1.3t

ROCLA® SMALL BOX CULVERT INVERTS (1.2m AND 2.4m LENGTHS) AS1597.1-2010 EXPOSURE CLASS B2

Product Code	Nominal Size	Crown Thickness	Leg Thick Top	Leg Thick Bottom	Overall Width	Overall Height	Lifting Arrange-ments
1.2m Length	Width x Height	Tc	Lt	Lb	W	H	
BGNC0300222	300 x 225	110	92	85	484	335	2 x 1.3t
BGNC0450302	450 x 300	120	95	85	640	420	2 x 1.3t
BGNC0600302	600 x 300	120	100	90	800	420	2 x 1.3t
BGNC0600452	600 x 450	120	100	85	800	570	2 x 1.3t
BGNC0900302	900 x 300	135	110	100	1120	435	4 x 1.3t
BGNC0900602	900 x 600	135	110	90	1120	735	4 x 1.3t
BGNC1200302	1200 x 300	165	120	110	1440	465	4 x 1.3t
BGNC1200602	1200 x 600	165	120	100	1440	765	4 x 1.3t
BGNC1200902	1200 x 900	165	120	90	1440	1065	4 x 1.3t
BGNC1201202	1200 x 1200	165	120	80	1440	1365	4 x 1.3t

ROCLA® SMALL BOX CULVERT LIDS (1.2m & 2.4m LENGTHS) AS 1597.1-2010 EXPOSURE CLASS B2

Product Code	Nominal Width	Slab Thickness	Overall Width	Rebate Width	Lifting Arrange-ments
1.2m Length		Tb	W	R	
BCNLD0302	300	115	484	97	2 x 1.3t
BCNLD0452	450	130	640	100	2 x 1.3t
BCNLD0602	600	145	800	105	2 x 1.3t
BCNLD0902	900	165	1120	115	4 x 1.3t
BCNLD1202	1200	190	1440	130	4 x 1.3t

Rocla® Large Span Box Culvert Crowns

Large span box culverts range from 1500mm to 4200mm span. They are designed to AS1597.2 and can be manufactured to conform to RTA specification R16. Precast base slabs and link slabs are also available. Standard box culverts are based on B1 exposure classification, 0-2m fill and live loading based on W7, T44, HLP320 and SM1600. Designs for non-standard applications and loadings can be produced to requirements.

HEADWALLS

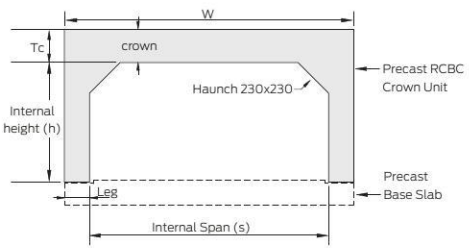
Precast headwalls are available to suit single or multi-cell RCBC structures. Contact Rocla for further details.

ROCLA® LARGE BOX CULVERTS

Nom. Size Internal Dimension (Span x Height)	Tc (mm)	W (mm)	Lifting Arrange-ments
1500 X 600	175	1710	4 x 2.5t
1500 X 750	175	1710	4 x 2.5t
1500 X 900	175	1710	4 x 2.5t
1500 X 1200	175	1710	4 x 2.5t
1500 X 1500	175	1710	4 x 2.5t
1800 X 600	190	2010	4 x 2.5t
1800 X 750	190	2010	4 x 2.5t
1800 X 900	190	2010	4 x 2.5t
1800 X 1200	190	2010	4 x 2.5t
1800 X 1500	190	2010	4 x 2.5t
1800 X 1800	190	2010	4 x 2.5t
2100 X 600	190	2340	4 x 2.5t
2100 X 750	190	2340	4 x 2.5t
2100 X 900	190	2340	4 x 2.5t
2100 X 1200	190	2340	4 x 2.5t
2100 X 1500	190	2340	4 x 2.5t
2100 X 1800	190	2340	4 x 2.5t
2100 X 2100	190	2340	4 x 2.5t
2400 X 600	205	2670	4 x 2.5t
2400 X 750	205	2670	4 x 2.5t
2400 X 900	205	2670	4 x 2.5t
2400 X 1200	205	2670	4 x 2.5t
2400 X 1500	205	2670	4 x 2.5t
2400 X 1800	205	2670	4 x 2.5t
2400 X 2100	-	-	-
2400 X 2400	205	2670	4 x 5.0t
2700 X 600	220	3000	4 x 2.5t
2700 X 750	-	-	-
2700 X 900	220	2910	4 x 2.5t
2700 X 1200	-	-	-

Nom. Size Internal Dimension (Span x Height)	Tc (mm)	W (mm)	Lifting Arrange-ments
2700 X 1500	-	-	-
2700 X 1800	220	2940	4 x 5.0t
2700 X 2100	220	2970	4 x 5.0t
2700 X 2400	220	3000	4 x 5.0t
2700 X 2700	-	-	-
3000 X 1200	235	3240	4 x 5.0t
3000 X 1500	235	3240	4 x 5.0t
3000 X 1800	235	3240	4 x 5.0t
3000 X 2100	-	-	-
3000 X 2400	235	3270	4 x 5.0t
3000 X 2700	235	3330	4 x 5.0t
3000 X 3000	235	3330	4 x 5.0t
3300 X 1200	250	3540	4 x 5.0t
3300 X 1500	250	3540	4 x 5.0t
3300 X 1800	250	3540	4 x 5.0t
3300 X 2100	250	3570	4 x 5.0t
3300 X 2400	-	-	-
3300 X 2700	-	-	-
3300 X 3000	-	-	-
3300 X 3300	-	-	-
3600 X 1200	265	3840	4 x 5.0t
3600 X 1500	250	3840	4 x 5.0t
3600 X 1800	250	3840	4 x 5.0t
3600 X 2100	250	3870	4 x 5.0t
3600 X 2400	250	3900	4 x 5.0t
3600 X 2700	-	-	-
3600 X 3000	265	3990	4 x 10.0t
3600 X 3300	-	-	4 x 10.0t
3600 X 3600	-	-	-

Larger sizes may be available. Contact Rocla for more information.
Dimensions may vary between branches. Contact your local branch for confirmation.



Note: Dimensions are based on AS1597 and must not be used for set-out. Set-out, including cast rebates in base slab, should only be done in accordance with project-specific drawings and specifications.

Rocla® Large Box Culvert Base Slabs

Rocla® Precast Box Culvert (RCBC) base slabs are a cost-effective alternative to in-situ base slabs and are available for Rocla® box culverts for all spans. Check with project drawings and specifications to ensure they can be used. Base slabs should be installed in accordance with project drawings and specification.

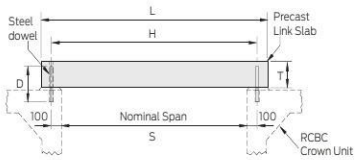
ROCLA® PRECAST BASE SLABS

Nominal Width	Slab Thickness	Overall Width	Rebate Width	Lifting Arrangements
	Tb (mm)	W (mm)	R (mm)	
1500	175	1710	125	4 x 1.3t
1800	190	2100	175	4 x 1.3t
2100	205	2370	150	4 x 1.3t
2400	220	2670	165	4 x 2.5t
2700	220	2940	145	4 x 2.5t
3000	250	3270	180	4 x 2.5t
3300	250	3540	150	4 x 2.5t
3600	280	3900	170	4 x 2.5t

Standard Lengths: 1.22m, 2.44m and 2.50m (other lengths on request).

BOX CULVERT LINK SLABS

Precast RCBC link slabs reduce the installation cost of multi-cell box culverts. and use dowel joints/pins into the crowns.



ROCLA® BOX CULVERT LINK SLABS

Nominal Span	L	T	H	D	Lifting Arrange-ments
(mm)	(mm)	(mm)	(mm)	(mm)	
1500	1900	205	1700	250	4 x 1.3t
1800	2200	220	2000	250	4 x 1.3t
2100	2500	220	2300	250	4 x 2.5t
2400	2800	235	2600	250	4 x 2.5t
2700	3100	250	2900	250	4 x 2.5t
3000	3400	280	3200	280	4 x 2.5t
3300	3700	295	3500	280	4 x 5.0t
3600	4000	310	3800	280	4 x 5.0t

Note: Dimensions are based on AS1597 and must not be used for set-out. Set-out, including cast rebates in base slab, should only be done in accordance with project-specific drawings and specifications.

TECHNICAL NOTE

TECHNICAL INFORMATION FROM THE CONCRETE PIPE ASSOCIATION OF AUSTRALASIA

March 2011 – No.1

UPDATE – SMALL BOX CULVERTS & AS 1597.1

The Australian Standard AS1597.1-2010 **"Precast reinforced concrete box culverts – small"** was revised in 2010 for the first time since 1974. The Concrete Pipe Association of Australasia worked alongside Australian Standards to assist with the ultimate release of an up to date specification to benefit the construction industry in Australia.

The revision of the Standard means that there are a number of significant changes and additions that will affect manufacturers, designers, specifiers and contractors. This Technical Note will outline the significant sections of the document that will impact industry and alert specifiers and contractors of changes related to manufactured product.

1. The previous version of AS1597.1 was released in 1974. The 2010 version standardises the following practices that currently take place and new requirements for the manufacture and design of small box culverts:

- It states that culverts manufactured in accordance with the Standard can expect to achieve a design life in excess of 100 years.
- The maximum height of fill for a culvert under a road is 2m and under a railway is 5m.
- Materials used for small box culvert manufacture are now referenced to the current material Standards.
- A table of truncated preferred internal dimensions for small box culverts is provided. CPAA manufacturers will be looking to align their production in line with the new Standard (see Table 2.5 from AS 1597.1 below).

TABLE 2.5

PREFERRED INTERNAL DIMENSIONS – CULVERT UNITS

Size class	Nominal span (mm)	Nominal height (mm)
300 × 225	300	225
450 × 300	450	300
600 × 300	600	300
600 × 450	600	450
900 × 300	900	300
900 × 600	900	600
1200 × 300	1200	300
1200 × 600	1200	600
1200 × 900	1200	900
1200 × 1200	1200	1200

NOTES:
1: The size class is designated as 'the nominal span' × 'the nominal height' in millimetres, for example '450 × 300'.
2: Other size culverts may be made to a specific order.
3: Actual size should be checked with manufacturers.

Concrete Pipe Association of Australasia

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- Ductility Class L reinforcement is specifically referenced as being suitable for use in box culverts when designed and tested in accordance with the Standard. Alternatively, when designed by calculation, Class L reinforcement must meet the requirements of the appropriate clauses in AS3600-2009.
- Performance test loads have increased and are based on AS5100 design loads. This includes:
  - Proving load (previously known as Proof Load) – 112 kN (was 90 kN)
  - Ultimate load – 202 kN (was 135kN)
- The sampling scheme for routine testing now includes alternative acceptance criteria based on numbers produced.
- The four culvert types currently manufactured in Australia, including link slabs, are now covered by the Standard.

2. The specification in the Standard for durability has been aligned with the concrete bridge Standard AS5100. The major changes include:

- Durability details have been updated to align with AS5100 and to reflect current design requirements. This includes:
  - Specification of durable concrete materials (e.g. aggregate durability, restriction on chemical content, use of blended cement).
  - With blended cements the Standard allows individual authorities to specify minimum percentages for supplementary cementitious materials.
  - Exposure classifications, concrete strength and cover to reinforcement. This includes:
    - B1 classification 40 MPa, 30mm cover 50 MPa, 25mm cover
    - B2 classification 40 MPa, 45mm cover 50 MPa, 35mm cover
    - C classification 50 MPa, 50mm cover
- Minimum curing requirements for various methods (e.g. time, maturity, concrete strength) have been updated to reflect current practice and requirements.
- Provisions for moist, membrane and accelerated curing have all been provided in the Standard.

3. The Standard now includes an installation section which details the requirements for:

- Excavation geometry, foundation preparation, placement of precast units, compaction, backfilling, and construction loads.

With the introduction of any new Standard a reasonable period of time is required to phase out previous manufacture and specification methods. However, CPAA members are well advanced in updating their quality processes and manufacturing requirements to comply with the new version of AS1597.1.

It is expected that specifiers and contractors throughout Australia will also amend current practice to comply with the latest requirements outlined in the Standard.

The latest version of **AS1597.1-2010 "Precast reinforced concrete box culverts – small"** is now available through SAI Global on **www.saiglobal.com** or through your organisation's direct link to Standards Australia.

Concrete Pipe Association of Australasia

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The innovative new SLIMLINE SQUARED END tank has been engineered to save space, allowing tanks to more effectively link together and is designed to complement today's architectural trends

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NEW!

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Timeless COLORBOND® corrugated steel complements contemporary and traditional architectural styles and designs and keeps its good looks longer.

SLIMLINE RAINWATER TANKS are made from highest quality BlueScope® steel with food grade Aquaplate® lining to ensure water quality. Superior construction, with full stainless steel internal fittings vital to water quality and to the longevity of the tank, ensure exceptional durability to meet Australian Standards. The tank top and base are also constructed of BlueScope® Aquaplate® - a quality requirement to meet the BlueScope® 20 year warranty.

Available in a range of sizes and volumes, all tanks have engineering certification and fire rating and meet all Council reqirements.

SLIMLINE SQUARED

MODEL No.		VOLUME (L)	DIMENSIONS (m)
AQUASLIM	2200	2200 Litre	1.75L x 0.88W x 1.56H
	3000	3000 Litre	1.75L x 0.88W x 2.15H
	3100	3000 Litre	2.16L x 0.88W x 1.84H
	4000	4000 Litre	2.42L x 1.20W x 1.56H
	4800	4800 Litre	2.42L x 1.20W x 1.84H
	5000	5000 Litre	2.42L x 1.20W x 2.00H
AQUALONG	3070	3000 Litre	2.98L x O.66W x 1.56H
	3300	3300 Litre	2.98L x O.66W x 1.84H
	4100	4100 Litre	2.93L x O.88W x 1.56H
	4700	4700 Litre	2.93L x 0.88W x 1.84H
	5030	5000 Litre	3.20L x 1.20W x 1.56H
	5050	5000 Litre	2.93L x 0.88W x 2.17H
	5400	5400 Litre	2.90L x 1.20W x 1.84H
	6000	6000 Litre	2.90L x 1.20W x 2.00H
	7000	7000 Litre	3.20L x 1.20W x 2.00H

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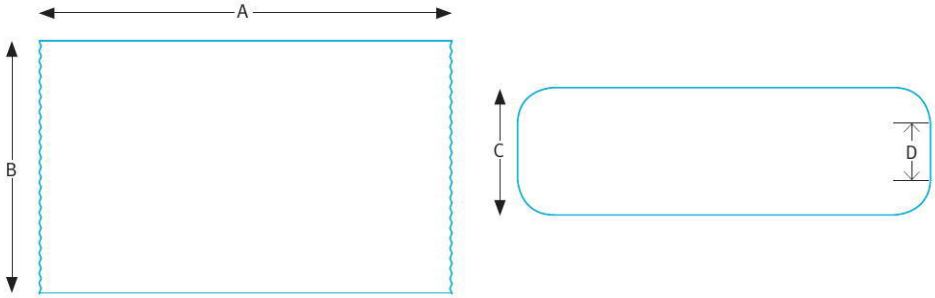


		DIMENSIONS (metres)				
MODEL	**VOLUME (L)**	**A**	**B**	**C**	**D**	**OUTLETS(mm)**
AQUASLIM 2200	2200	1.750	1.560	0.880	0.400	19 - 200
3000	3000	1.750	2.150	0.880	0.400	19 - 200
3100	3000	2.160	1.840	0.880	0.400	19 - 200
4000	4000	2.420	1.560	1.200	0.400	19 - 200
4800	4800	2.420	1.840	1.200	0.400	19 - 200
5000	5000	2.420	2.000	1.200	0.400	19 - 200
AQUALONG 3070	3000	2.980	1.560	0.660	0.400	19 - 200
3300	3300	2.980	1.840	0.660	0.400	19 - 200
4100	4100	2.930	1.560	0.880	0.400	19 - 200
4700	4700	2.930	1.840	0.880	0.400	19 - 200
5030	5000	3.200	1.560	1.200	0.400	19 - 200
5050	5000	2.930	2.170	0.880	0.400	19 - 200
5400	5400	2.900	1.840	1.200	0.400	19 - 200
6000	6000	2.900	2.000	1.200	0.400	19 - 200
7000	7000	3.200	2.000	1.200	0.400	19 - 200

CONSTRUCTION

The tanks are constructed using corrugated Aquaplate® sheeting curved to the specific tank sizes. Sections are riveted together using a Henrob self piercing riveting system. The internal seams and rivet penetrations are meticulously sealed with Bostik silicones approved for potable water applications (AS 4020).

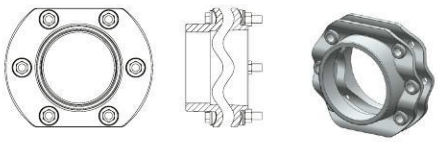
The stability of the slim line tank shape is achieved using 304 Stainless Steel rod sets including blind nuts, curved washers and backing nuts with neoprene separating washers against the tank material. Positioning of the rods is defined by the structural engineering design and certification relating to each particular tank.

The Square end tanks are designed with a 400mm flattened end section, which can accommodate outlet boss fittings up to 250mm internal diameter.

FITTINGS

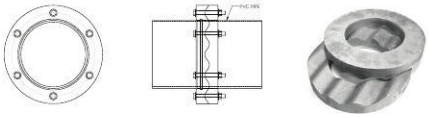
Outlet fittings are cast zinc alloy, constructed in two halves with 6 x ½" hot dipped galvanised nuts, bolts and washers passing through the tank wall. The outer half has a female thread up to 150mm. Larger diameter pipe can be attached by the use of welded flanges.. The outside diameter of the fitting is approximately 350mm. PVC overflows are available to suit up to 150mm pipe and can be positioned at the ends of the tank for direct coupling. Larger overflows of up to 250mm can be fitted using cast alloy flanges milled to receive PVC stormwater pipe.

OUTLETS



Outlets can be specified in the following sizes:
1", 1¼, 1½", 2", 3", 4", 6" amd 8"

OVERFLOWS TO SUIT PVC PIPE



Overflows to suit PVC pipe:
50mm, 70mm, 90mm, 100mm, 150mm, 225mm and 250mm

CERTIFICATION

Certified for structural adequacy to resist water pressures as manufactured by Slimline Rainwater Tanks. Compliant to Standards:
AS/NZS 1170.0, 1 & 2 - 2002 Structural Design Actions - Part 0: General Principles, - Part 1: Permanent, Imposed and Other Actions; AS4100-1998 Steel Structures and AS/NZS 4600 : 1996 Cold Formed Steel Structures.