APPENDIX 1

Existing Site

CMC
CASHMERE MARLER & CAVANAGH PTY LTD
CONSULTING SURVEYORS

Marmong Point Marina

Existing Site Plan + Survey

1:500 @ a1

0 10 20 80m

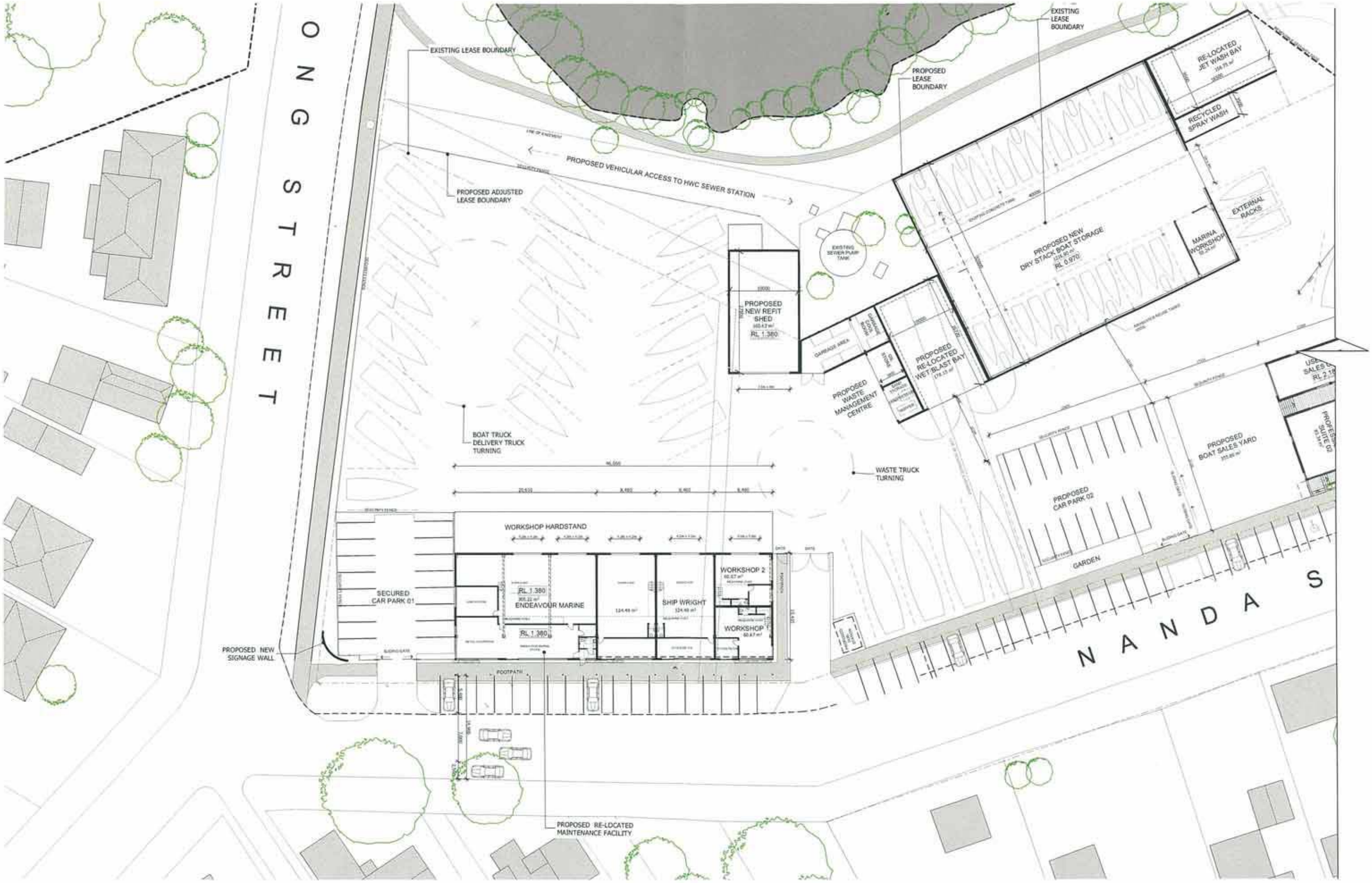
marmong point marina **address** 1 nanda street marmong point **project no.** 2707 **date** 24/07/08 **rev** a

MP20

aha
schreiber hamilton architecture

APPENDIX 2

Proposed Development



Marmong Point Marina

Floor Plan Part A

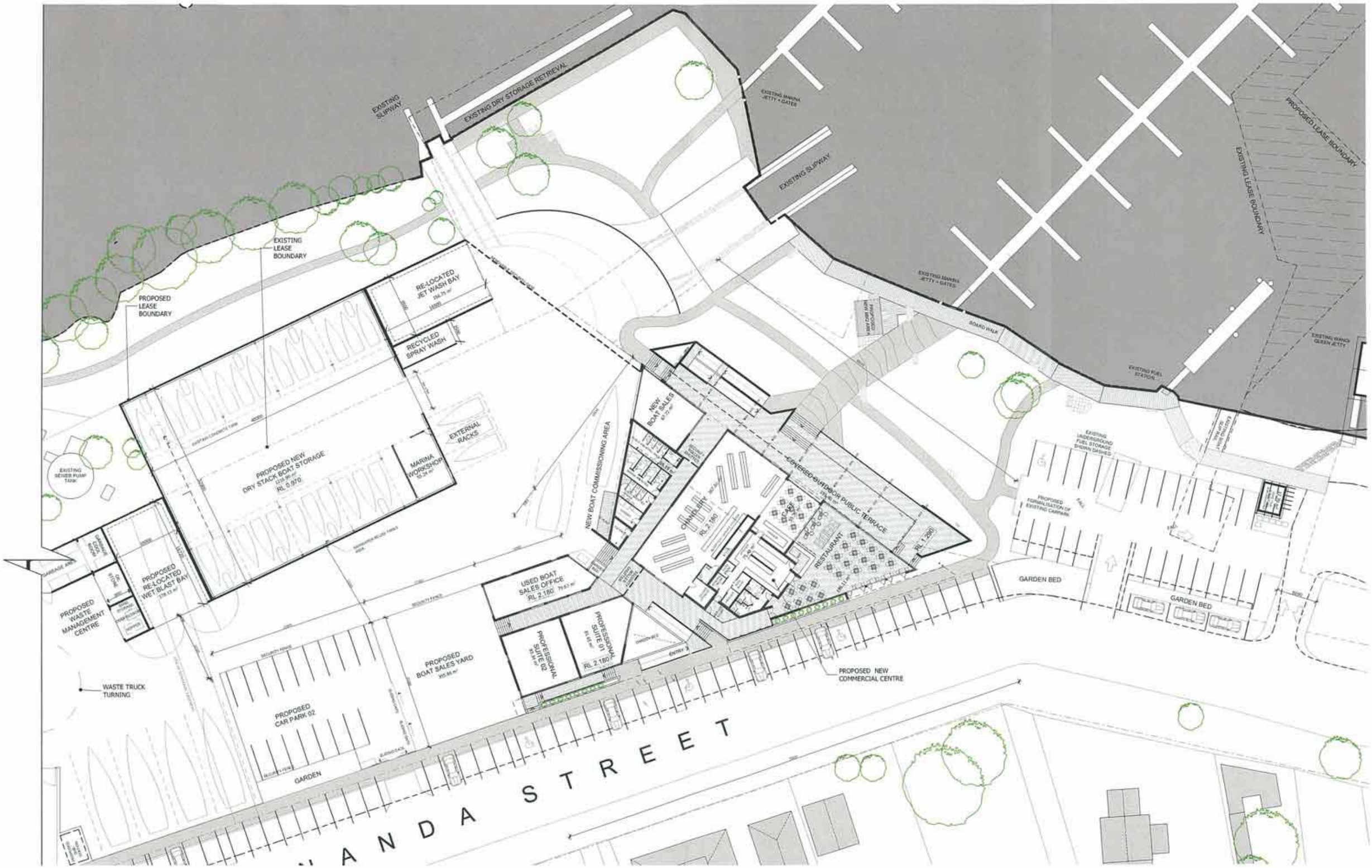
1:250 @ a1

0 5 10 40m

marmong point marina **address** 1 nanda street marmong point **project no.** 2707 **date** 24/07/08 **rev** c

MP05

schreiber hamilton architecture



Marmong Point Marina

Floor Plan Part B

1:250 @ a1

0 5 10 40m

marmong point marina **address** 1 nanda street marmong point **project no.** 2707 **date** 24/07/08 **rev** c

MP06

schreiber hamilton architecture

APPENDIX 3

Correspondence with Government Agencies

NSW GOVERNMENT
Department of Planning

Contact: Necola Hoare
Phone: (02) 9228 6484
Fax: (02) 9228 6540
Email: Necola.hoare@planning.nsw.gov.au
Our ref: 07_0138
Your ref:
File no: S07/01592

Mr Brian Eastoe
Eastoe Consulting Pty Ltd
PO Box 92
Stroud NSW 2425

Dear Mr Eastoe

Subject: Director General's Environmental Assessment Requirements for MP 07_0138 Proposed marina expansion at (Lot 100 DP1067106 & Lot 401 DP823128) 1-13 Nanda St, Marmong Point.

The Department has received your application for the above project (Application Number: 07_0138).

The Director General's Environmental Assessment Requirements (DGRs) for the environmental assessment of the project for a Project Application are attached to this correspondence at **Attachment 1**. These requirements have been prepared in consultation with the relevant government agencies including council.

Attachment 2 lists the relevant plans and documents which are likely to be required upon submission of your proposal, however, this should be confirmed with the Department prior to lodgement.

It should be noted that the DGRs have been prepared based on the information provided to date. Under section 75F(3) of the Act, the Director-General may alter or supplement these requirements if necessary and in light of any additional information that may be provided prior to the proponent seeking approval for the project.

It would be appreciated if you would contact the Department at least two weeks before you propose to submit the Environmental Assessment for the project to determine:

- the fees applicable to the application;
- whether the proposal requires an approval under the Commonwealth *Environment Protection and Biodiversity Act* (EPBC Act) and any assessment obligations under that Act;
- consultation and public exhibition arrangements that will apply; and
- number and format (hard-copy or CD-ROM) of the Environmental Assessment that will be required.

A list of some relevant technical and policy guidelines which may assist in the preparation of this Environmental Assessment are attached at **Attachment 3**.

Prior to exhibiting the Environmental Assessment, the Department will review the document to determine if it adequately addresses the DGRs. The Department may consult with other relevant government agencies in making this decision. If the Director-General considers that the Environmental Assessment does not adequately address the DGRs, the Director-General

may require the proponent to revise the Environmental Assessment to address the matters notified to the proponent.

Following this review period the Environmental Assessment will be made publicly available for a minimum period of 30 days. The Director-General's requirements will be placed on the Department's website along with other relevant information which becomes available during the assessment of the project. As a result, the Department would appreciate it if all documents that are subsequently submitted to the Department are in a suitable format for the web, and if you would arrange for an electronic version of the EA to be hosted on a suitable website with a link to the Departments website.

If your proposal includes any actions that could have a significant impact on matters of National Environmental Significance (NES), it will require an additional approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Commonwealth Department of Environment and Water Resources in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal is likely to have a significant impact on matters of NES and would require an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process for assessing any impacts on matters of NES. As a result, if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary DGRs will need to be issued.

Please note that under 75U of the Act, Part 3A applications do not require certain permits/approvals required under other legislation. These matters are assessed as part of the Part 3A process. For example, Section 87 permits and Section 90 consents under the *National Parks and Wildlife Act 1974* are not required for Part 3A applications. Section 75U applies from the date of issue of the DGRs.

Notwithstanding, the Department still requires an equivalent level of information within the Environmental Assessment as would ordinarily be required for any such permit/approval to enable an assessment of the relevant works. Please notify the Department should any sub-surface testing be required during the preparation of your EA.

A copy of the response from the Department of Environment & Climate Change to the Department's request for key issues and assessment requirements is enclosed at **Attachment 4.**

If you have any queries regarding these requirements, please contact Necola Hoare on 9228 6484 or email necola.hoare@planning.nsw.gov.au.

Yours sincerely

14.1.08

Chris Wilson
Executive Director
as delegate for the Director General

Attachment 1
Director-General's Environmental Assessment Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application number
07_0138
Project
Existing marina expansion
Location
(Lot 100 DP1067106 & Lot 401 DP823128) 1-13 Nanda St, Marmong Point
Proponent
Marmong Point Marina Pty Ltd
Date issued
January 2008
Expiry date
2 years from date of issue
General requirements

The Environmental Assessment (EA) for the **Project Application** must include:

1. An executive summary;
2. An outline of the scope of the project including:
   - any development options;
   - justification for the project taking into consideration any environmental impacts of the project, the suitability of the site and whether the project is in the public interest;
   - outline of the staged implementation of the project if applicable;
3. A thorough site analysis including constraints mapping and description of the existing environment;
4. Consideration of any relevant statutory provisions including the consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979*;
5. Consideration of impacts, if any, on matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
6. An assessment of the potential impacts of the project and a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project;
7. The plans and documents outlined in **Attachment 2;**
8. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading;
9. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project; and
10. An assessment of the key issues specified below and any other significant issues identified in the general overview of environmental impacts of the project. A summary table outlining how these key issues have been addressed should be provided.

Key Issues	
The EA must address the following key issues:	
1. Strategic Planning	
1.1	Justify the proposal and demonstrate consistency with reference to relevant local, regional and State planning strategies (including the recommendations set out in Appendix 2 – Sensitive Urban Lands of the *South Coast Regional Strategy*). Provide justification for any inconsistencies with these planning strategies.
2. Design, Layout and Desired Future Character	
2.1	Demonstrate the consistency of the proposal with the character of existing development in terms of the locality, street frontage, scale, building envelopes and future built form controls, aesthetics, energy and water efficiency and safety.
2.2	Demonstrate the consistency of the proposed marina design and layout with the *Coastal Design Guidelines for NSW*, NSW *Coastal Policy 1997* and SEPP 71 – Coastal Protection.
2.3	Provide details of potential building envelope, built form and design quality controls and the means for implementing them.
2.4	Outline the long-term management and maintenance of any areas of open space or conservation including ownership and control, management and maintenance funding, public access, revegetation and rehabilitation works and bushfire management.
3. Visual Impact	
3.1	Address the visual impact of the proposal (on the basis that the marina is ultimately developed to its full potential) in the context of surrounding development and relevant mitigation measures. Where relevant, address impacts on the amenity of the foreshore, overshadowing of public reserves, loss of views from public and private lands and cumulative impacts.
4. Infrastructure Provision	
4.1	Address existing capacity and requirements of the development for sewerage, water (including scope for recycled water), electricity, waste disposal, telecommunications and gas in consultation with relevant agencies. Identify and describe staging, if any, of infrastructure works.
4.2	Address and provide the likely scope of a planning agreement and/or developer contributions with Council/ Government agencies.
5. Traffic and Access	
5.1	Prepare a traffic impact study in line with relevant RTA and Council guidelines which addresses, but is not limited to the following matters: Capacity of the road network to safely and efficiently cater for the additional traffic generated; Access to and within the site; Servicing and parking arrangements; Intersection site distances; Connectivity to existing developments; Impact on public transport (including school bus routes); Provision of access for pedestrian and cyclists to, through and within the site; and Identification of suitable mitigation measures (if required to ensure the efficient functioning of the road network).
5.2	Demonstrate the public benefit of the on-street parking and why it is acceptable for commercial gain. Also demonstrate how the general public can use this parking for access to the public land and lake.
5.3	Address how a cycleway can be provided along Nanda St to allow unrestricted cycleway use and minimise any conflict between the cycleway users and marina equipment.

6. Water Cycle Management	
6.1	Address and outline measures for Integrated Water Cycle Management (including stormwater) based on Water Sensitive Urban Design principles which addresses impacts on the surrounding environment, water quality and water quantity for the catchment, and erosion and sedimentation controls at construction and operational stages.
6.2	Provide information regarding the re-use of roof water on site and the treatment of stormwater from hardstand area before discharged into the lake.
6.3	Assess the impacts of the proposal on surface and groundwater hydrology and quality (including adjacent SEPP 14 wetland) during both construction and occupation of the site.
6.4	Demonstrate consistency with relevant State Groundwater, Rivers, Wetlands and Estuary Policies, any relevant Statement of Joint Intent established by the Healthy Rivers Commission.
6.5	Provide an assessment of any flood risk on the site, taking into consideration any relevant Council requirements and the NSW Floodplain Development Manual (2005). This should include: determining flood hazard, the impact of flooding on the proposed development, the impact of the development on existing flood behaviour and the impact of flooding on the safety of people/users of the development. Implications of climate change on flooding (due to coastal inundation and sea level rise) should be considered.
7. Hazard Management and Mitigation	
Coastal Processes	
7.1	Address coastal hazards and the provisions of the Coastline Management Manual. In particular consider impacts associated with wave and wind action, coastal erosion, climate change, sea level rise and more frequent and intense storms.
Contamination	
7.2	Identify any contamination on site and appropriate mitigation measures in accordance with the provisions of SEPP 55 – Remediation of Land.
Acid Sulfate Soils	
7.3	Identify the presence and extent of acid sulfate soils on the site and, where relevant, appropriate mitigation measures.
Geotechnical	
7.4	Provide an assessment of any geotechnical limitations that may occur on the site and if necessary, appropriate design considerations that address these limitations.
7.5	The site is located within a Mine Substance District and a concurrence from the Mine Subsidence board is required.
Bushfire	
7.6	Address the requirements of "Planning for Bush Fire Protection 2006" (RFS).
Flooding	
7.7	Provide an assessment of any flood risk on the site, taking into consideration any relevant Council requirements and the NSW Floodplain Development Manual (2005). This should include: determining flood hazard, the impact of flooding on the proposed development, the impact of the development on existing flood behaviour and the impact of flooding on the safety of people/users of the development.

7.8	Implications of climate change on flooding (due to coastal inundation and sea level rise) should be considered.
7.9	Consider the potential impacts of any filling on the flood regime of the site and adjacent lands.

8. Heritage and Archaeology

8.1	Identify whether the site has significance to Aboriginal cultural heritage and identify appropriate measures to preserve any significance. Address and document information contained in *draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC 2005)*, with Aboriginal community consultation undertaken in accordance with the *Interim Community Consultation Requirements for Applicants.*
8.2	Identify any items of European heritage significance and, where relevant, provide measures for the conservation of such items.

9. Flora and Fauna

9.1	Outline potential impacts of the project on any threatened species, populations or ecological communities listed in the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994* in accordance with *the Draft Guidelines for Threatened Species Assessment (DEC 2005)*.
9.2	Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.
9.3	Demonstrate suitable riparian corridor management or buffering between the development and adjacent waterways or natural drainage lines and demonstrate adequate protection of riparian and aquatic habitats.
9.4	Address impacts of any native vegetation clearing and, if applicable, provide details of an offset strategy or other suitable mitigation measures to ensure that there is no net loss of native vegetation values.

10. Social and Community

10.1	Provide a social impact assessment for the development, addressing the social and economic impacts of the development as well as the impact with other water users.

11. Air Quality and noise

11.1	Address potential air quality impacts, in particular during the construction and operation of the marina and appropriate mitigation measures for these
11.2	Address potential noise impacts to the residential properties regarding the following: ▪ Construction phase ▪ Daily operation of the marina (including the restaurant) ▪ Traffic noise.

12. Aquaculture

12.1	Assess the impacts of the development on downstream aquaculture operations and recreational fishing with regard to NSW Oyster Industry Sustainable Aquaculture Strategy.

13. Navigation and safety

13.1	Include an assessment of the impacts on water based traffic.

Consultation

You should undertake an appropriate and justified level of consultation with the following agencies during the preparation of the environmental assessment:

(a) *Agencies or other authorities:*

- Lake Macquarie Shire Council;
- Department of Environment and Climate Change;
- Department of Primary Industries;
- Department of Water and Energy;
- Roads and Traffic Authority;
- NSW Maritime;
- Rural Fire Service;
- Local Aboriginal Land Council/s and other Aboriginal community groups; and
- relevant infrastructure providers.

(b) *Public:*
Document all community consultation undertaken to date or discuss the proposed strategy for undertaking community consultation. This should include any contingencies for addressing any issues arising from the community consultation and an effective communications strategy.

The consultation process and the issues raised should be described in the Environmental Assessment.

Deemed Refusal Period
60 days

Attachment 2
Plans and Documents to accompany the Application

Plans and Documents of the development	The following plans, architectural drawings and diagrams of your proposal as well as the relevant documents will be required to be submitted for your application: 1. The **existing site survey plan** is to be drawn to 1:500 scale (or other appropriate scale) and show: • the location of the land, the measurements of the boundaries of the land, the size of the land and north point; • the existing levels of the land in relation to buildings and roads; • location and height of existing structures on the site; and • location and height of adjacent buildings and private open space. 2. An **aerial photograph** of the subject site with the site boundary superimposed. 3. A **Site Analysis Plan** must be provided which identifies existing natural elements of the site (including all hazards and constraints), existing vegetation, property dimensions, footpath crossing levels and alignments, existing pedestrian and vehicular access points and other facilities, slope and topography, natural features such as watercourses, rock outcrops, utility services, boundaries, orientation, view corridors and all structures on neighbouring properties where relevant to the application (including windows, driveways etc.). 4. A **locality/context plan** drawn to 1:500 scale (or other appropriate scale) should be submitted indicating: • significant local features such as parks, community facilities and open space, water courses and heritage items; • the location and uses of existing buildings, shopping and employment areas; • traffic and road patterns, pedestrian routes and public transport nodes; and • The existing site plan and locality plan should be supported by a written explanation of the local and site constraints and opportunities revealed through the above documentation. 5. The **Environmental Assessment** in accordance with the Director-General's Environmental Assessment Requirements as outlined in Attachment 1. 6. The **Architectural drawings** are to be drawn to scale and illustrate the following: • the location of any existing building envelopes or structures on the land in relation to the boundaries of the land and any development on adjoining land; • the floor plans (including the location of lifts, stairs and corridors); • fenestrations, balconies and other features; • section plans illustrating detailed sections of the proposed facades; • public domain works, proposed communal facilities and servicing points; • indicative building heights shown as building envelopes in elevation significant level changes; • the height of the proposed development in relation to the land; • any changes that will be made to the level of the land by excavation, filling or otherwise; • the level of the lowest floor, the level of any yard or unbuilt area and the level of the ground; • parking arrangements, where vehicles will enter and leave the site, and

	how vehicles will move about the site; • pedestrian access to, through and within the site • shadow diagrams identifying overshadowing impacts of the proposed structures. 7. **Other Plans** including (where relevant): **Road Hierarchy & Open Space Network Plans** - illustrating indicative road and open space networks. **Stormwater Plan** – illustrating the stormwater management from the site. **Infrastructure Plans** – conceptual drawings indicating all proposed infrastructure including roads, water supply, water re-use, sewerage and earthworks. **Landscape Plan** – plan or drawing that shows the indicative planting design and plant species to be used, listing botanical and common names. **View Analysis** – artist's impression, photomontages, etc of the proposed development in the context of the surrounding development. **Flood Evacuation Plan** – plan showing the proposed access from the site during extreme flood events.
Specialist advice	• Specialist advice, where required to support your Environmental Assessment, must be prepared by suitably qualified and practising consultants in relation to issues.
Documents to be submitted	• Hard copies of the Environmental Assessment (number to be advised); • Sets of architectural and landscape plans to scale, including one (1) set at A3 size (to scale) (number to be advised); • 1 copy of the Environmental Assessment and plans on CD-ROM (PDF format), not exceeding 2Mb in size (see below); and • If the Environmental Assessment is bulky and lengthy in volume, you will be required to package up each Environmental Assessment ready for distribution by the Department to key agencies.
Electronic Documents	Electronic documents presented to the NSW Department of Planning for publication via the Internet must satisfy the following criteria:- • Adobe Acrobat PDF files and Microsoft Word documents must be no bigger that 1.5 Mb. Large files of more than 1.5 Mb will need to be broken down and supplied as different files. • File names will need to be logical so that the Department can publish them in the correct order. Avoid sending documents that are broken down in more than 10 files. • Image files should not be bigger than 2Mb. The file names will need to be clear and logical so the Department can publish them in the correct order. • Graphic images will need to be provided as [.gif] files. • Photographic images should be provided as [.jpg] files. • Large maps will need to be presented as individual files and will need to be calibrated to be no more than 2Mb each. • Images inserted into the document will need to be calibrated to produce files smaller than 1.5Mb. Large images will need to be presented as individual files and will need to be calibrated to be no more than 2Mb each. The file names will need to be clear and logical so the Department can publish them in the correct order. Alternatively, these electronic documents may be placed on your own web site with a link to the Department of Planning's website.

Attachment 3
State Government technical and policy guidelines

The following list provides relevant technical and Policy Guidelines which may assist in the preparation of the Environmental Assessment. It should be noted, however, that this list is not exhaustive as other documents and policies may need to be reviewed. It is also important to note that not of all of these guidelines may be relevant to your proposal.

The majority of these documents can be found on the relevant Departmental Websites, on the NSW Government's on-line bookshop at http://www.bookshop.nsw.gov.au or on the Commonwealth Government's publications website at http://www.publications.gov.au.

Aspect	Policy/Methodology
Biodiversity	
Flora and Fauna	Draft Guideline for assessment of impacts on Threatened Species under Part 3A (Department of Planning 2005)
Fish and Aquatic Ecosystems	Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries, 2003)
	Threatened Species Management Manual (NPWS, 1998)
Climate Change	
	Flood Plain Management Guideline: *Practical Consideration of Climate Change* (DECC, October 2007) For further information please contact the Coastal Branch of DECC.
Coastal Planning	
	NSW Coastal Policy 1997 - A sustainable Future for the New South Wales Coast, NSW Government, 1997
	Coastal Design Guidelines for NSW, PlanningNSW, February 2003
	NSW Wetlands Management Policy (DLWC, March 1996)
Bushfire	
	Planning for Bushfire Protection 2006 (NSW Rural Fire Service)
Contamination of Land	
	Best Practice in Contaminated Sites (Commonwealth DEH, 1999, ISBN 0 642 546460)
Environmental Management Systems	
	NSW Government Interim Water Quality and River Flow Environmental Objectives (DEC)
	Guidelines for the preparation of Environmental Management Plans (DIPNR, 2004)
Heritage	
Aboriginal	Draft Guideline for assessment of impacts on Aboriginal Heritage under Part 3A (Planning 2005)
	Interim Community Consultation Requirements for Applicants (DEC, 2004)
Non-Indigenous	Assessing Heritage Significance Update for Heritage Manual (Heritage Office, 2000)

Aspect	Policy/Methodology
	NSW Heritage Manual (NSW Heritage Office, 1996)
Noise	
	Environmental Criteria for Road Traffic Noise (EPA, 1999)
	Acoustics - Road traffic noise intrusion - Building siting and construction (Standards Australia, 1989, AS 3671-1989)
Rehabilitation	
	Managing Urban Stormwater: Soils & Construction (NSW Landcom, March 2004) - "The Blue Book"
Safety and Hazards	
	Electrical Safety Guidelines (Integral Energy)
Soils	
	Acid Sulfate Soil Manual (ASSMAC)
	Contaminated Sites: Sampling Design Guidelines (EPA, 1999)
Traffic & Transport	
	Guide to Traffic Engineering and Guide to Geometric Design of Rural Roads (Austroads, 2003, AP-G1/03)
	Guide to Traffic Generating Developments (RTA, 2002)
Urban Design: Cycleway/Pathway Design	
	Guidelines for the Design and Construction of Paths and Cycleways along Watercourses and Riparian Areas (Version 2) (DIPNR/DNR)
Water	
	Water quality guidelines for the protection of aquatic ecosystems for upland rivers. (ANZECC, 2000)
Floodplain	NSW Government Floodplain Development Manual - the Management of Flood Liable Land (DIPNR, 2005)
Groundwater	NSW State Groundwater Quality Protection Policy (DLWC, 1998, 0 7313 0379 2)
Stormwater	Managing Urban Stormwater: Soils & Construction (NSW Landcom, March 2004) - "The Blue Book"
Waterways	Waterways Crossing Design & Construction (Version 4 – DIPNR/DNR Draft Guidelines)
Community Consultation	
	NSW Department of Planning (2007) Guidelines For Major Project Community Consultation http://www.planning.nsw.gov.au/assessingdev/pdf/Dr3%20DOP%20GuideMajProjComConsult%20BRO.pdf

Industry Guidelines - For Reference

Marinas	EIS Guideline: Marinas and Related Facilities (DUAP)
	Best Management Practice for Marinas and Boat Repair Facilities (NSW EPA)
	AS 3962 - Guidelines for Design of Marinas

Attachment 4
Agency Responses to Request for Key Issues - For Information Only

APPENDIX 4

Developer Contributions

The Lake Macquarie Section 94 Contributions Plan No.1 - Citywide (2004) as amended

Effective from: 15/05/2008 to: 14/08/2008

Facility	Contribution						Dedication	
	Lot	1 Bedroom Dwelling	2 Bedroom Dwelling	3 Bedroom Dwelling	4+ Bedroom Dwelling	Hectare	Lot (m2)	Hectare (m2)
Open Space and Recreation								
Open Space Acquisition	$8,732	$3,842	$5,588	$8,383	$11,876	-	114.80	-
Recreation Facilities	$5,538	$2,437	$3,544	$5,316	$7,531	-	-	-
Community Facilities								
East Lake Capital	$2,191	$964	$1,402	$2,104	$2,980	-	-	-
East Lake Land	$611	$269	$391	$586	$830	-	4.11	-
North Lake Capital	$2,194	$965	$1,404	$2,106	$2,983	-	-	-
North Lake Land	$761	$335	$487	$730	$1,035	-	4.11	-
West Lake Capital	$2,156	$949	$1,380	$2,070	$2,932	-	-	-
West Lake Land	$553	$243	$354	$531	$752	-	4.11	-
Roadworks & Traffic Management Facilities - Garden Suburb								
Catchments 1 & 2 - Capital	-	-	-	-	-	$7,292	-	-
Catchment 2 - Capital	-	-	-	-	-	$27,994	-	-
Roadworks & Traffic Management Facilities - Mount Hutton								
Catchment 1 - Capital	$650	$650	$650	$650	$650	-	-	-
Catchment 1 - Land	$237	$237	$237	$237	$237	-	-	-
Catchment 2 - Capital	$572	$572	$572	$572	$572	-	-	-
Catchment 2 - Land	$531	$531	$531	$531	$531	-	-	-
Catchment 3 - Capital	$420	$420	$420	$420	$420	-	-	-
Roadworks & Traffic Management Facilities - Cardiff South								
Catchment 1 - Capital	$556	$556	$556	$556	$556	-	-	-
Roadworks & Traffic Management Facilities - Teralba								
Catchment 1 - Capital	-	-	-	-	-	$43,907	-	-
Catchment 2- Capital	-	-	-	-	-	$100,403	-	-
Drainage, Stormwater & Water Quality Control - Floraville								
Capital	-	-	-	-	-	$28,416	-	-
Land				-	-	$66,726	-	1,649
Drainage, Stormwater & Water Quality Control - Garden Suburb								
Capital	-	-	-	-	-	$82,973	-	-
Drainage, Stormwater & Water Quality Control - Mount Hutton								
Capital	-	-	-	-	-	$81,043	-	-
Land	-	-	-	-	-	$28,398	-	331
Management	$166	$73	$106	$159	$226			

The Lake Macquarie Section 94 Contributions Plan No.2 - Northlakes (2004)							
Facility	Effective from: 15/05/2008 to: 14/08/2008						
	Contribution					Dedication	
	Person	1/2 Bedroom Dwelling	3+ Bedroom Dwelling	Lot	Hectare	Dedication per Lot (m2)	Dedication per Hectare (m2)
Open Space	$3,409	$6,818	$8,863	$10,226	-	153.06	-
Recreation Facilities	$1,339	$2,679	$3,482	$4,018	-	-	-
Community Facilities Capital	$585	$1,170	$1,521	$1,755	-	-	-
Community Facilities Land	$292	$584	$759	$876	-	2.10	-
Roadworks and Traffic Management Capital (Catchment 1)	$453	$907	$1,179	$1,360	-	-	-
Roadworks and Traffic Management Land (Catchment 1)	$20	$40	$52	$60	-	12.27	-
Roadworks and Traffic Management Capital (Catchment 2)	$1,211	$2,422	$3,149	$3,633	-	-	-
Roadworks and Traffic Management Land (Catchment 2)	$741	$1,482	$1,927	$2,223	-	11.10	-
Conservation	$956	$1,911	$2,485	$2,867	-	88.71	-
Brush Box Creek Catchment - Drainage, Stormwater and Water Quality Control - Capital	-	-	-	-	$12,892	-	-
Brush Box Creek Catchment - Drainage, Stormwater and Water Quality Control - Land	-	-	-	-	$8,989	-	263.11
Cocked Hat Creek Catchment 1 – Drainage, Stormwater and Water Quality Control - Capital	-	-	-	-	$16,552	-	-
Cocked Hat Creek Catchment 1 – Drainage, Stormwater and Water Quality Control - Land	-	-	-	-	$1,077	-	57.27
Management	$55	$111	$144	$166	-	-	-

The Lake Macquarie Section 94 Contributions Plan No.4 - Commercial Centres		
Facility	Effective from: 15/05/2008 to: 14/08/2008	
	Contribution	
	Car Parking Space	Pedestrian & Vehicular Access Facilities (m2)
Belmont	$12,607	$13.02
Cardiff	$9,766	$20.89
Charlestown	$14,205	$2.95
Morisset	$9,529	$32.25
Swansea	$9,056	$13.99
Warners Bay	$12,607	$39.76

Note: *Management contributions are calculated at 1.5% of the total contributions.*

The Lake Macquarie Section 94 Contributions Plan No.5 - North Wallarah (2004)					
Facility	Effective from: 15/05/2008 to: 14/08/2008				
	Contribution				Dedication
	Person	1/2 Bedroom Dwelling	3+ Bedroom Dwelling / Lot	Tourism Unit	Dwelling/Lot (m^2)
Local Recreation	$2,001	$4,001	$5,001	$2,601	-
City-wide Recreation	$52	$104	$129	$67	-
Open Space Acquisition	-	-	-	-	56.75
Community Facilities	$807	$1,615	$2,018	$1,050	-
Community Facilities Land	$50	$99	$124	$64	2.83
Traffic Management Facilities	$268	$535	$669	$348	-
Conservation	-	-	-	-	116.15
Management	$66	$133	$166	$86	-

The Lake Macquarie Section 94 Contributions Plan No.6 - Hillsborough Rd (2007)		
Facility	Effective from: 15/05/2008 to: 14/08/2008	
	Contribution per m^2 of Gross Floor Area	
	Net New Development	BB Retail
Capital Works	$111.05	$104.4968
Land Acquisition	$30.68	$30.4820
Management	$10.23	$10.2277
Total	$151.96	$145.21

APPENDIX 5

Extracts from the Lake Macquarie Flood Study

FIGURE 4
STILL WATER DESIGN FLOOD LEVELS

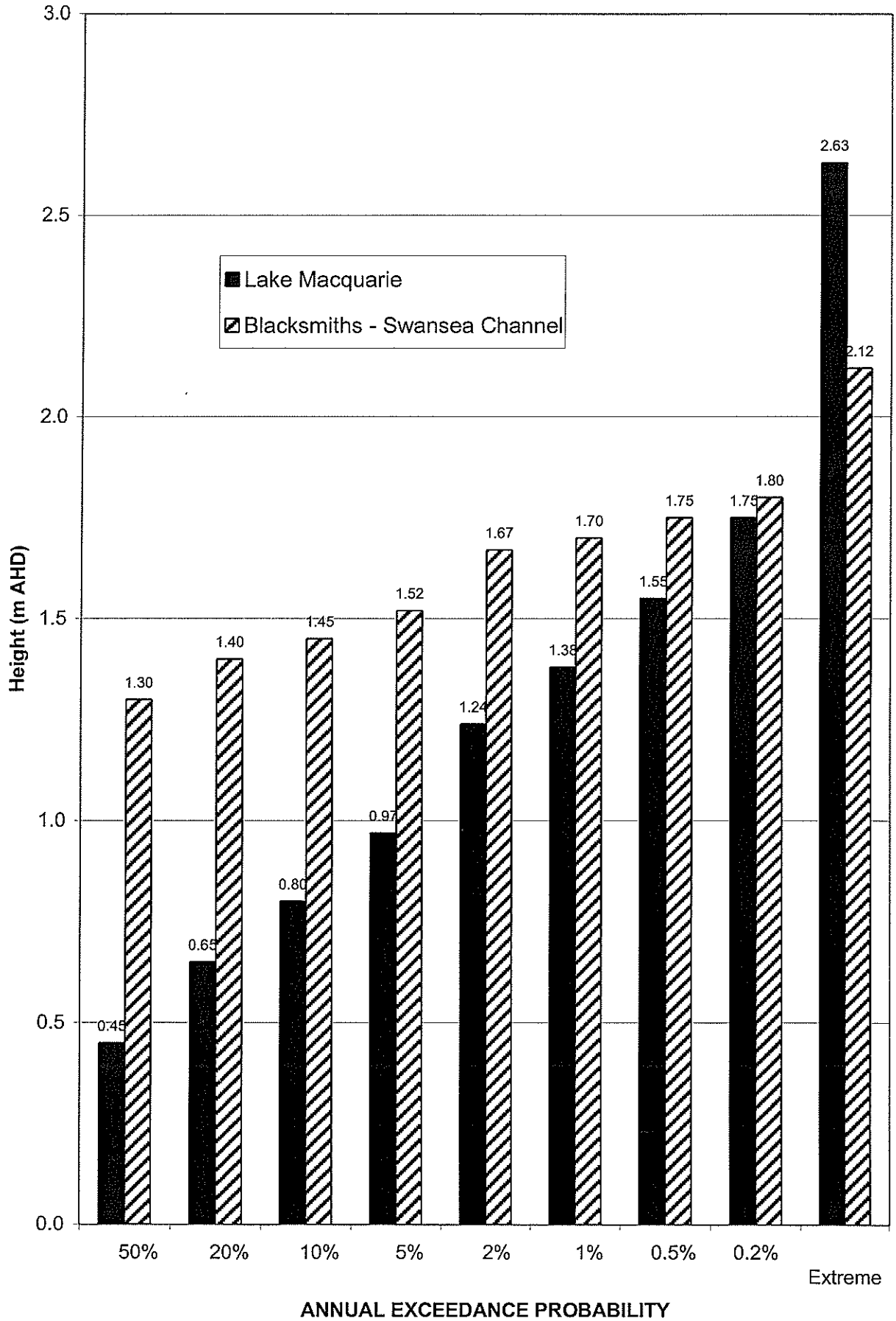


Table 1.3 - Locally Generated Wind Waves in Lake Macquarie

Site No	Max. Average Fetch (m)	Max. Average Fetch Direction	1-year ARI Hs (m)	1-year ARI Tp (sec)	20-year ARI Hs (m)	20-year ARI Tp (sec)	100-year ARI Hs (m)	100-year ARI Tp (sec)
1	3700	SSE	0.4	2.1	1.0	3.0	1.2	3.1
2	3350	ESE	0.3	2.0	0.9	2.8	1.0	3.0
3	7850	S	0.5	2.6	1.4	3.7	1.6	3.9
4	6500	SSE	0.5	2.5	1.4	3.6	1.6	3.8
5	8000	SSE	0.5	2.7	1.5	3.8	1.7	4.0
6	6200	SE	0.5	2.4	1.3	3.5	1.5	3.7
7	5200	SE	0.4	2.3	1.2	3.3	1.4	3.5
8	6100	N	0.5	2.5	1.1	3.3	1.3	3.5
9	5700	SSE	0.5	2.4	1.3	3.4	1.5	3.6
10	5150	SSE	0.4	2.3	1.2	3.3	1.4	3.5
11	3000	SE	0.3	2.0	1.0	2.9	1.2	3.1
12	5050	E	0.4	2.3	1.0	3.1	1.1	3.2
13	5850	ENE	0.5	2.4	1.0	3.2	1.2	3.4
14	5400	NE	0.4	2.4	1.1	3.2	1.3	3.4
15	6500	S	0.5	2.5	1.3	3.6	1.5	3.8
16	9000	SE	0.6	2.7	1.5	3.9	1.8	4.2
17	6450	E	0.5	2.4	1.0	3.2	1.2	3.4
18	5800	NE	0.5	2.4	1.1	3.2	1.2	3.4
19	5000	ENE	0.4	2.2	0.9	3.0	1.0	3.2
20	4400	NE	0.4	2.2	1.0	3.0	1.1	3.2
21	3700	ESE	0.4	2.1	0.9	2.9	1.1	3.1
22	1550	N	0.2	1.6	0.6	2.0	0.7	2.3
23	2500	NNW	0.3	1.8	0.8	2.6	0.9	2.7
24	3850	NE	0.4	2.1	0.9	2.9	1.0	3.0
25	4200	N	0.4	2.2	0.9	2.9	1.0	3.0
26	5600	NNW	0.4	2.4	1.1	3.3	1.3	3.4
27	4650	NNE	0.4	2.2	0.9	3.0	1.1	3.2
28	8150	NNE	0.5	2.7	1.2	3.6	1.4	3.8
29	6800	N	0.5	2.5	1.1	3.4	1.3	3.6
30	6550	NW	0.5	2.5	1.3	3.5	1.5	3.7
31	5850	NNW	0.4	2.3	0.9	3.1	1.1	3.3
32	6700	N	0.4	2.4	0.9	3.2	1.0	3.3
33	2500	N	0.3	1.8	0.7	2.4	0.8	2.6
34	-	-	-		-	-	-	-
35	-	-	-		-	-	-	-
36	4750	NNW	0.4	2.2	1.0	3.1	1.1	3.2
37	6400	NNW	0.5	2.5	1.2	3.4	1.4	3.6
38	5000	NW	0.4	2.3	1.1	3.3	1.3	3.4
39	5850	NW	0.5	2.4	1.3	3.4	1.4	3.6
40	5850	WSW	0.5	2.4	1.3	3.5	1.4	3.6
41	5400	WSW	0.4	2.3	1.2	3.4	1.4	3.5
42	6700	SSW	0.5	2.5	1.3	3.6	1.5	3.7
43	3650	N	0.4	2.1	0.8	2.8	1.0	3.0
44	2700	W	0.3	1.9	1.0	2.9	1.2	3.0
45	3600	WSW	0.4	2.1	1.1	3.0	1.2	3.2
46	4500	SSW	0.4	2.2	1.1	3.2	1.3	3.4
47	2750	WNW	0.3	1.9	1.0	2.8	1.1	3.0
48	3500	SSW	0.4	2.0	1.0	2.9	1.1	3.1

3.2.5 Type 5 - Gently Sloping Sandy Embankment - Wave Breaks Offshore

At this cross-section, characterised by a gently sloping sandy embankment, the design wave breaks offshore from the shoreline (Figure 3.1). Work by Hanslow and Nielson (1995) derived the following equation for runup, R_5 on natural beaches.

$$R_5 = 0.9\ H_s\ (L_s/H_s)^{0.5}\ \text{Tan}\ \beta$$

This equation was adopted for this study, with the foreshore flood level being defined as:

$$\textit{Design Flood Level} = \textit{Design Still Water Level} + R_5$$

3.2.5 Type 6 - Sudden Change in Bathymetry - Wave Breaks Close to Structure

With a sudden change in bathymetry and the wave breaking close to the shoreline, the wave runup on a near vertical structure is shown in Figure 3.7. This situation would apply to structures located on the foreshore, and the runup would estimate the likely flood level on the side of the structure. The runup, R_6 was calculated using the procedures given in CERC (1984). The flood level would be defined as:

$$\textit{Design Flood Level} = \textit{Design Still Water Level} + R_6$$

3.2.5 Type 7 - Sloping Embankment or Sea Wall - Wave Breaking Offshore and Reformed Wave Resulting in Overtopping of the Embankment

The typical cross-section for sites with a sloping embankment where waves break offshore and reform, with the reformed wave overtopping the embankment, is shown in Figure 3.8. This type is similar to Type 3, however the waves have broken offshore and reformed. Again, there is no published information to compute the flood level resulting from this type of overtopping. Studies undertaken to assess foreshore flooding in Pittwater (AWACS 1991) addressed this problem and outlined a solution to the problem

The following procedure was adopted to compute the likely flood level in this situation:

- The design wave height at break, H_b, water depth at break, d_b and distance of wave break, x_b from the sea wall were calculated using the procedure given in CERC (1984).

- During the wave breaking process considerable energy is dissipated and the reformed wave from the spilling/breaking process is unlikely to be more than half of the wave height when reaching the shoreline. When the wave breaks offshore the reformed wave, H_r was assumed to be $H_b/2$.

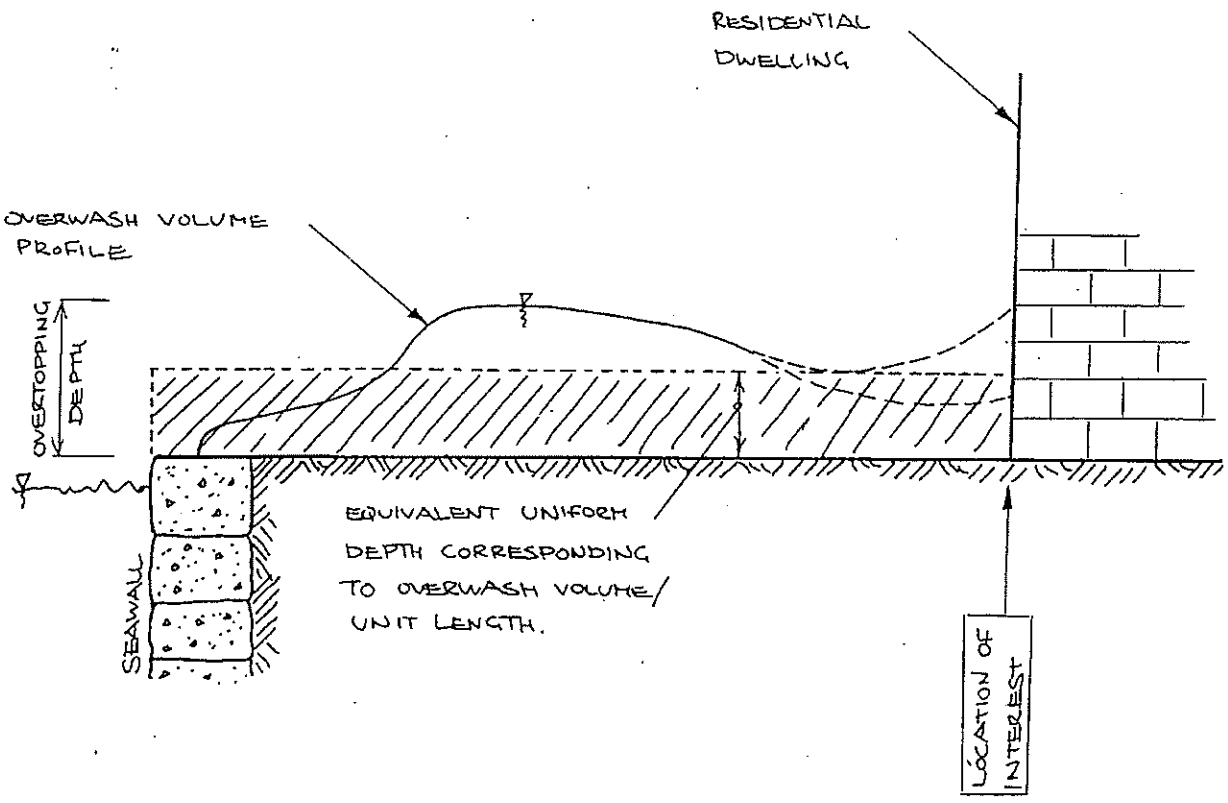
- The overwash volume would be the primary cause of any flooding behind the foreshore. The overwash from the breaking wave will move as a front landward, changing shape and height. A visualisation of the overwash versus time is shown in Figure 3.4. Prediction of the movement of the overwash once it passes the sea wall cannot be determined using standard procedures. However, an estimate of the possible depths of flooding at a set distance from the sea wall can be assessed by assuming the overwash volume is represented by an equivalent depth over the region between the sea wall and the set distance. To estimate the depth of overtopping, the overwash equivalent depth as shown in Figure 3.5 was adopted.

- It is estimated that the maximum depth is in the order of 0.2 m greater than the uniform water depth as shown in Figure 3.5.

- The overwash volume was calculated, taking into consideration the height of the breaking wave, H_b, the water level of the lake, the height of the foreshore structure and the wave period at the depth of break.

The design flood level is therefore defined as:

Design Flood Level = Height of Sea Wall + Equivalent Overtopping Depth + 0.2



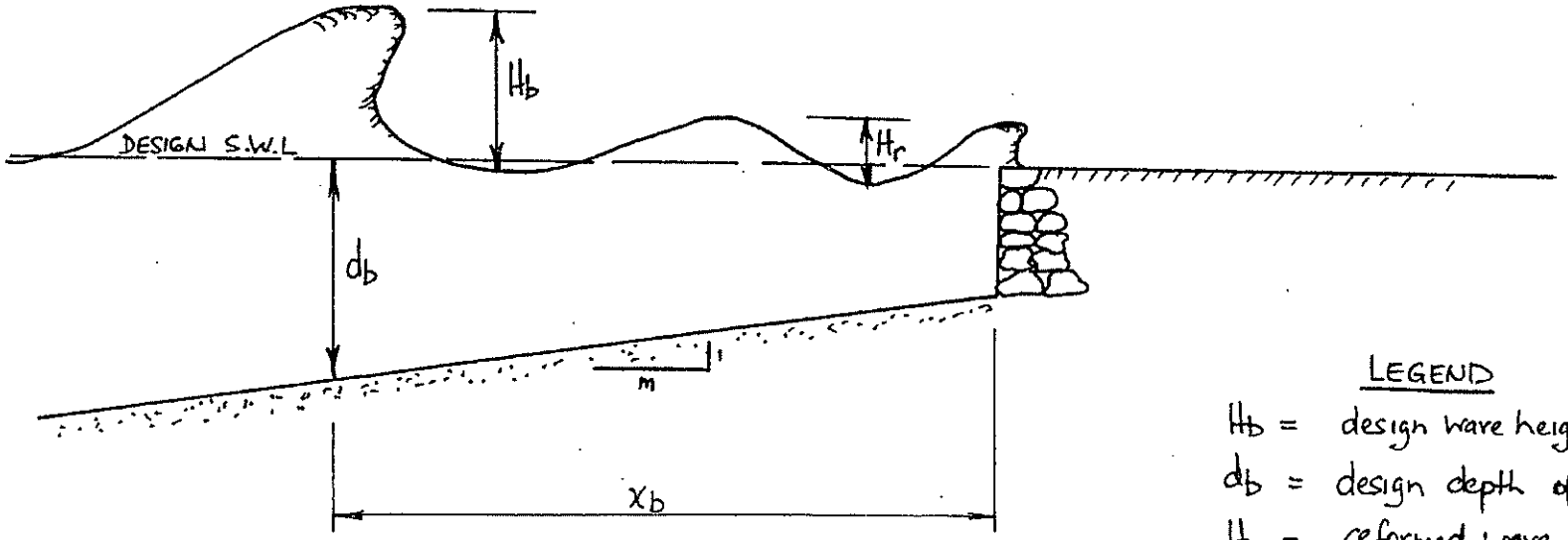
Manly Hydraulics Laboratory
Report 715
Department of Public Works and Services

TYPE 3 CROSS-SECTION
OVERWASH EQUIVALENT DEPTH

Figure 3.5

Manly Hydraulics Laboratory
Report 715
Department of Public Works and Services

TYPICAL CROSS-SECTION TYPE 7



LEGEND

H_b = design wave height at break

d_b = design depth of break.

H_r = reformed wave height

SWL = still water level

X_b = distance of wave break from sea wall

Figure 3.8

4.3 Marmong Point

Site Description

The site, shown in Figure 4.3, was characterised by a grass embankment which is higher than the floor level of the housing development. The housing development may be prone to flooding from the marina side depending on the actual floor level of the properties.

Design Flood Levels

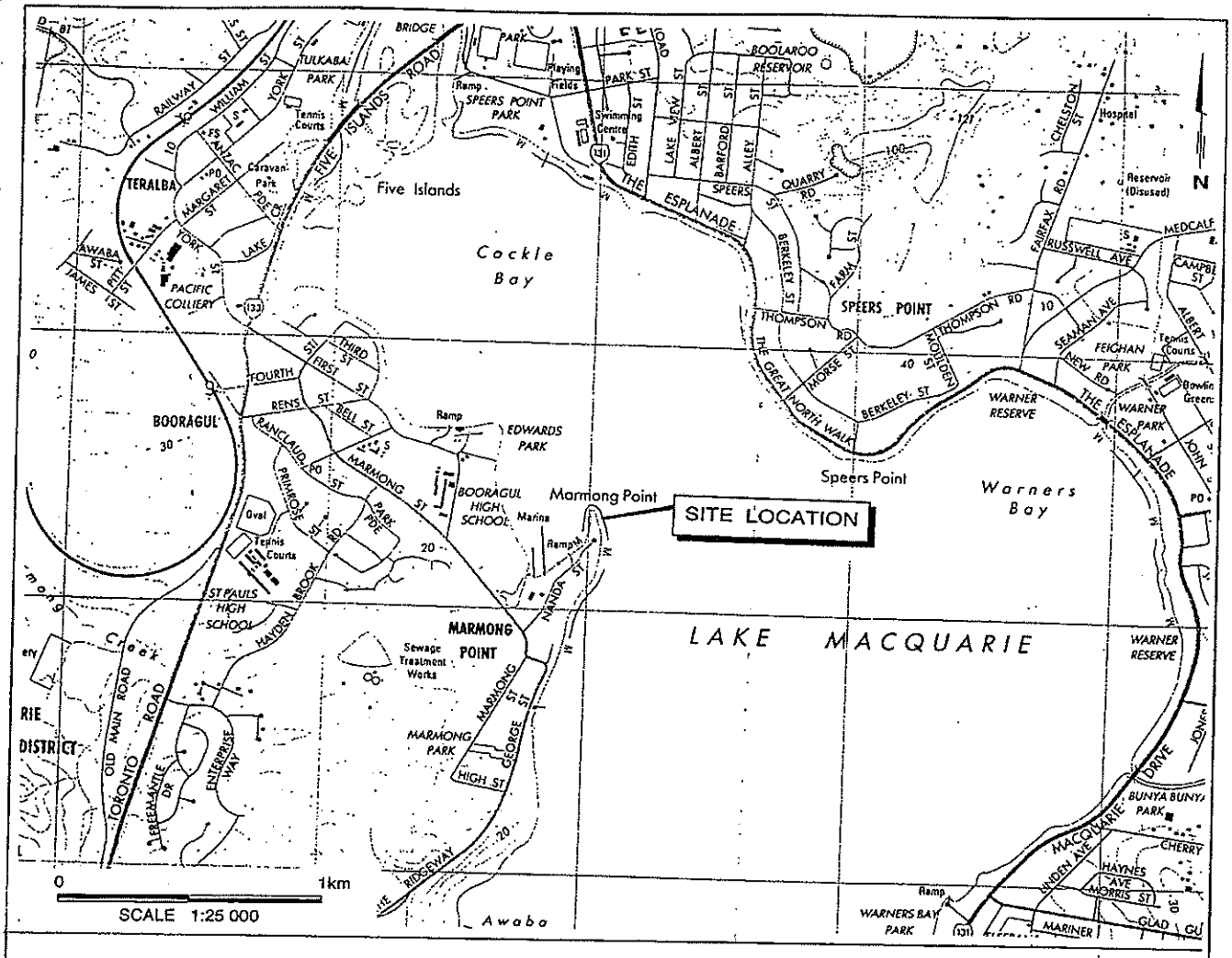
Estimated design flood levels are shown in Tables 4.3a and 4.3b for the cross-section observed at the site.

Table 4.3a - 1% AEP Design Flood Level, Marmong Point

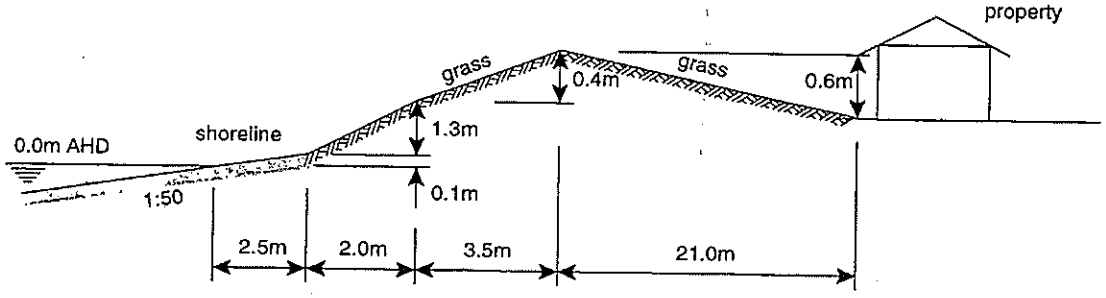
Design Water Level (m AHD)	Design Wind Wave Climate		Type of Cross-section	Flood Level (m AHD)	Recommended Design Flood Level) (m AHD)
	Hs (m)	Tp (sec)			
1.38	0.5	2.6	2	2.2	2.2
0.4	1.6	3.9	2	1.3	

Table 4.3b - 5% AEP Design Flood Level, Marmong Point

Design Water Level (m AHD)	Design Wind Wave Climate		Type of Cross-section	Flood Level (m AHD)	Recommended Design Flood Level) (m AHD)
	Hs (m)	Tp (sec)			
0.97	0.5	2.6	2	1.5	1.5
0.4	1.4	3.7	2	1.2	



LOCATION PLAN



NOT TO SCALE
DIAGRAMMATIC

REPRESENTATIVE CROSS SECTION

Manly Hydraulics Laboratory
Report 715
Department of Public Works and Services

SITE 3 - MARMONG POINT

Figure 4.3

4.22 Wyee Bay West

Site Description

The site, shown in Figure 4.22, was characterised by a sea wall and fairly long grass verge before a dwelling.

Design Flood Levels

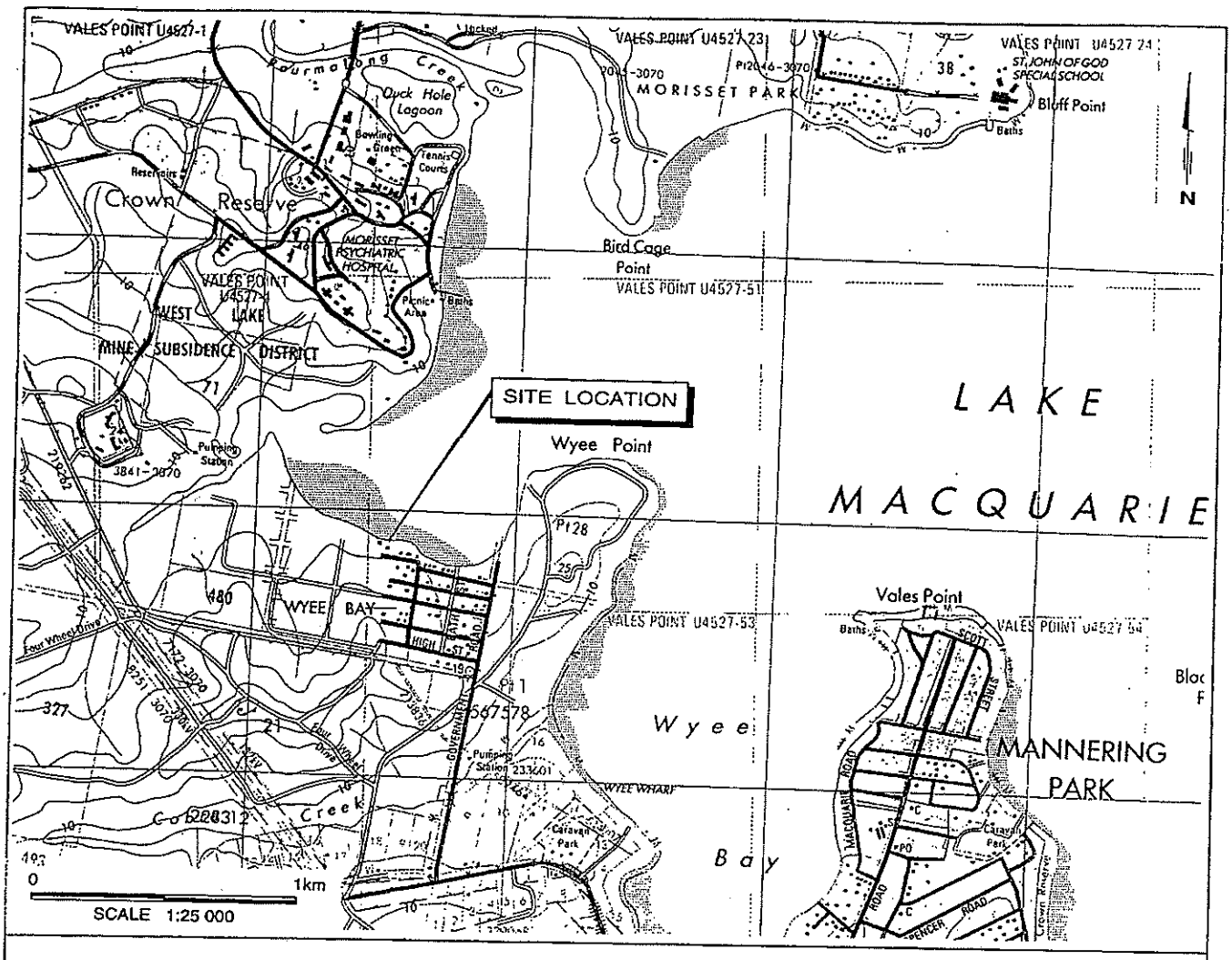
Estimated design flood levels are shown in Tables 4.22a and 4.22b for the cross-section observed at the site.

Table 4.22a - 1% AEP Design Flood Level, Wyee Bay West

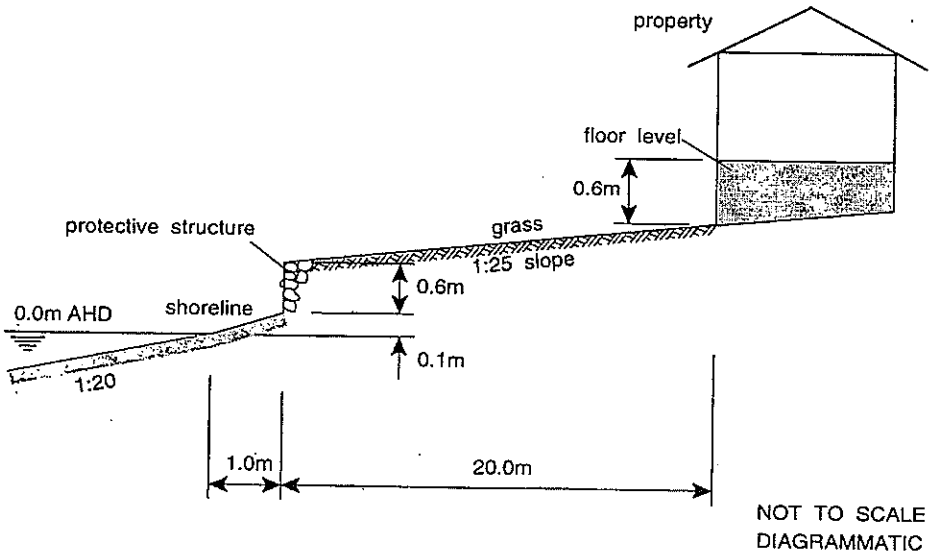
Design Water Level (m AHD)	Design Wind Wave Climate		Type of Cross-section	Flood Level (m AHD)	Recommended Design Flood Level) (m AHD)
	Hs (m)	Tp (sec)			
1.38 0.4	0.2 0.7	1.6 2.3	1 3	1.5 1.0	1.5

Table 4.22b - 5% AEP Design Flood Level, Wyee Bay West

Design Water Level (m AHD)	Design Wind Wave Climate		Type of Cross-section	Flood Level (m AHD)	Recommended Design Flood Level) (m AHD)
	Hs (m)	Tp (sec)			
0.97 0.4	0.2 0.6	1.6 2.0	1 3	1.1 0.9	1.1



LOCATION PLAN



REPRESENTATIVE CROSS SECTION

mhl Manly Hydraulics Laboratory Report 715
Department of Public Works and Services

SITE 22 - WYEE BAY WEST

Figure 4.22

APPENDIX 6

Trade Waste Agreement

HUNTER WATER

HUNTER WATER CORPORATION . PO BOX 5171 HRMC NSW 2310 . TEL 1300 657 657
36 HONEYSUCKLE DRIVE NEWCASTLE . ABN 46 228 513 446 . HUNTERWATER.COM.AU

16 March 2006

Reference: C18/7168
Telephone: 4979 9591
Facsimile: 4979 9711

Marmong Point Marina Pty Ltd
1 Nanda Street
MARMONG POINT NSW 2284

Dear Sir/Madam

RE: TRADE WASTEWATER AGREEMENT
Customer No: E-69106
Property : 1 Nanda Street, Marmong Point NSW 2284

Please find enclosed your Trade Wastewater Agreement to discharge to the Corporation's sewer under the conditions outlined in the Schedules contained in this Agreement. Also attached is a summary sheet of current charges as approved by the Independent Pricing and Regulatory Tribunal (IPART). Please examine these documents carefully.

This Agreement includes acceptance standards for discharge to sewer which limit the discharge of organic material, such as food waste, suspended solids, and also greases and oils.

It is a condition of the Agreement that a copy of this Agreement shall be displayed on the premises unless otherwise agreed with Hunter Water. It is also a condition of the Agreement that a record of cleaning dates for the maintenance of Trade Wastewater facilities be kept on the premises and made available for inspection.

If you would like to discuss any of the conditions contained in the Agreement please do not hesitate to contact **Corry Haasnoot** on **4979 9596**.

Yours sincerely

Brett Lewis
Developer Services & Trade Wastewater
Engineering Manager
Business & Urban Development

Attached: 1. Trade Wastewater Agreement

Agreement under Section 37 of Hunter Water Act 1991

TRADE WASTEWATER AGREEMENT

AGREEMENT issued this **16th day of March 2006** by the **HUNTER WATER CORPORATION** (the "Corporation") to **MARMONG POINT MARINA PTY LTD** (" the Owner").

OCCUPIER'S TRADING NAME:	**Marmong Point Marina**
BUSINESS ACTIVITY:	**Marina**
CUSTOMER NO:	**E-69106**

INTRODUCTION:

"Trade Wastewater" means liquid waste or any substance contained in it, which may be discharged into the Corporation's sewerage system from a Non Residential property.

a The Applicant is the occupier/owner of premises at **1 Nanda Street, Marmong Point** and has applied to the Corporation to discharge Trade Wastewater from the premises to a sewer of the Corporation.

b Section 37 of the Hunter Water Act 1991 enables Hunter Water to enter into Agreements with customers proposing to discharge Trade Wastewater. This section of the Act enables Hunter Water to impose terms and conditions in addition to those stated in the Customer Contract.

c Section 31 of the Hunter Water Act 1991 provides that it is an offence to discharge any substance into the Corporation's works except by Agreement of the Corporation.

d Section 3.2.4 of the Customer Contract allows the discharge of Trade Wastewater to the Corporation only with written permission of the Corporation.

e The Corporation has agreed to Agreement the discharge of Trade Wastewater, to its sewer subject to the terms and conditions hereinafter contained.

TERMS AND CONDITIONS OF DISCHARGE: (Clause 1 to 17)

1. The Applicant may discharge Trade Wastewater, into the Corporation's sewer provided that such discharge is in accordance with the conditions contained in **SCHEDULE 1. (Acceptance standards)**

2. The Applicant shall not transfer or assign its rights under this Agreement.

3. The Applicant shall, at its own cost:-

I. Provide, operate and maintain to the Corporation's satisfaction the Trade Wastewater facility ie. **1 x 1,000 litre Vertical Separator, 1 x 600 litre Silt Trap, 1 Basket Trap and 1 x 12,000 litre First Flush Effluent Tank.**

II. Maintain a register for inspection by the Corporation with respect to the particulars as to the dates of cleaning and maintenance of the Trade Wastewater facility and the date and method of disposal of residue material there from.

4. The Applicant shall provide and make available to the Corporation for the purpose of sampling and analysis a sampling point located downstream of the Trade Wastewater facility and prior to the point of connection to the Corporation's sewer.

5. Charges payable for and in consideration of this Agreement and the terms by which that payment shall be made are contained in **SCHEDULE 2. (Charges)**

6. The Applicant shall allow the Corporation access to the premises at any time during which business or work is in progress or when discharge is occurring for the purpose of carrying out inspections or preventing the discharge of Trade Wastewater in contravention of this Agreement.

7. The Applicant must immediately report by telephone to the Hunter Water Corporation's Contact Centre (Ph: 1300 657 000) and by facsimile transmission to the Development Services & Trade Wastewater Engineering Manager (Fax 02 4979-9711) any event that causes or is likely to cause an exceedence of the standards set by Schedule 1 as soon as the occurrence becomes known to the Applicant or its agents or servants. **SCHEDULE 3. (Environmental Management Program)**

8. The Applicant shall not without prior approval of the Corporation vary any process of discharge of Trade Wastewater or alter any treatment process at the premises that will affect or is likely to affect the quantity or quality of Trade Wastewater discharged into the sewer.

9. The Applicant shall give the Corporation not less than fourteen (14) days' notice in writing of its intention to terminate its occupancy, ownership or usage of the premises or changes to business activity.

10. This Agreement shall commence on and from the date of issue of this Agreement and unless cancelled shall continue until the Corporation issues a new Agreement.

11. The Corporation may by notice in writing cancel this Agreement at any time if in its opinion the Applicant has repeatedly or substantially breached the conditions of this Agreement.

12. The Corporation may amend or vary the terms and conditions of this Agreement after notifying the Applicant of its intention to do so. Such notification being sufficient if sent by pre-paid post to the Applicant's address shown herein.

13. The Applicant shall pay the Corporation's costs associated with breaches of Agreement conditions.

14. The Applicant shall display a copy of this Agreement on the premises.

SCHEDULE 1

ACCEPTANCE STANDARDS

(Refer: Terms and Conditions - Clause 1)

A. List of Prohibited Substances for Discharge to Sewer

The Applicant **shall not discharge Prohibited Substances** into the Corporation's sewer unless otherwise allowed in accordance with the acceptance standards detailed in SCHEDULE 1 B. Listed below is an extract from the prohibited substances list from the Trade Wastewater Policy.

a Any substance which could cause an explosion or fire in any of the Corporation's works.

b Discrete oil.

c Any infectious or contagious substance, whether solid or liquid, which has not been disinfected.

d Any toxic substance.

e Any substance, whether or not a solvent, an enzyme, a mutant bacteria or an odour control agent, which could materially affect the operation of a grease arrestor or other device or equipment used for the treatment of waste.

f Any substance which is carcinogenic or mutagenic and could materially affect the environment.

g Any animal matter, wool, hair, fleshings, feathers, dust, ashes, soil, rubbish, grease, garbage, dead animal, vegetable or fruit parings, wood, rags, synthetic plastics, steam or any solid matter.

h Any matter which, in the opinion of the Corporation:-

I. is injurious to, or liable to form compounds injurious to, any part of the Corporation's works or to employees of the Corporation engaged in the operation or maintenance of the works; or

II. will impair or be liable to impair the operations or functions of the Corporation and which the Corporation has, by notice in writing, served personally or by post, requiring the Customer to cease or refrain from discharging

i Any other substance which may, within the meaning of the Protection of the Environment Operations Act 1997, cause pollution of any water.

j Any other substance which the Corporation may declare to be prohibited by notice published in a newspaper circulating generally in the area covered by the Operating Licence.

B Acceptance Standards for Discharge of Trade Wastewater to Sewer

The Applicant shall not discharge Trade Wastewater into the Corporation's sewer except if the nature and levels of the components and characteristics of Trade Wastewater **comply with the following specifications** at the point of discharge to the sewer ("acceptance standards").

Physical Characteristics

i Temperature - not to exceed 38^{o}C.

ii Discharge rate - as determined by the Corporation to be appropriate in view of the capacity of the works in question.

iii Odour - to be subject to such controls as may be deemed necessary by the Corporation.

Chemical Characteristics

i pH - not to be less than 6.5 or greater than 10.

ii Organic Strength - Five Day Biochemical Oxygen Demand (BOD) concentration not to exceed 500 mg/L unless the specific approval of the Corporation has been obtained and the waste is discharged under such conditions as may be specified in the Agreement. Chemical Oxygen Demand (COD) will be considered as an alternative to BOD where appropriate.

iii Suspended Solids (or NFR) - concentration not to exceed 500 mg/L.

iv Dissolved Solids (TDS) - concentration not to exceed 4000 mg/L.

v Total Grease and Oil (TOG) - no free or floating layer permissible. In addition, oil as Trichlorotrifluroethane Extractable Matter shall not exceed

- 150 mg/L in the case of animal or vegetable matter.
- 25 mg/L as a total concentration total sum of all hydrocarbon based products.(TPH)

Elements and Compounds

Metals - maximum allowable concentrations (mg/L) are set out in the following table:-

METAL mg/L	CONCENTRATION mg/L
Arsenic	0.5
Cadmium	0.5
Chromium	2.0
Cobalt	2.0
Copper	2.0
Iron	30.0
Lead	0.4
Manganese	2.0
Mercury	Not Agreementted
Molybdenum	10.0
Nickel	1.0
Selenium	2.0
Silver	0.5
Tin	2.0
Zinc	1.5

Not Agreementted - for the purposes of regulation will be taken as <1 ug/L provided the Corporation is satisfied that the discharger is taking all practical steps to prevent discharge.

Inorganic non-metallics - maximum allowable concentrations (mg/L) are as follows:-

Ammonia	50
Boron	25
Chlorine	5
Cyanide (rinse water only)	7
Fluoride	5
Sulphates	200
Sulphides	2
Sulphites	15

Organic Compounds - maximum allowable concentrations (mg/L) are as follows:-

Formaldehyde	50.0
Chlorinated Pesticides	Not Agreementted
Other Pesticides	0.1
Phenols	10.0
Surfactants	100.00

Solvents - volatile solvents miscible with water shall be allowed, subject to special approval. Other solvents are not allowed.

Chlorinated hydrocarbons are prohibited. Polycyclic aromatic hydrocarbons and aromatic hydrocarbons only allowed subject to special approval.

Nutrients - (Phosphates & Nitrates)
Limits may be set on these compounds due to restrictions placed on the Corporation's discharge to receiving waters by the EPA. Each Trade Wastewater discharged to Hunter Water Corporation's sewers will be assessed before acceptance.

SCHEDULE 2

CHARGES
(Refer: Terms and Conditions - Clause 5)

The Applicant shall pay the Corporation such amounts as the Corporation may from time to time determine in accordance with the following:-

a A Agreement Establishment Fee.

b An Annual Agreement Fee.

c Fees based on the number of samples collected and analysed by the Corporation following a breach of this Agreement.

d On the number of inspections carried out by the Corporation's officers or agents following a breach of this Agreement.

e Costs incurred by the Corporation associated with a breach of this Agreement.

f Payment shall be made to the Corporation on or before the expiration of twenty-one (21) days of service of account.

Hunter Water's charges are determined by the Independent Pricing and Regulatory Tribunal (IPART). The current charges are available by contacting Hunter Water.

SCHEDULE 3

ENVIRONMENTAL MANAGEMENT PROGRAM
(Refer: Terms and Conditions - Clause 7)

Staff Awareness and Training:

The Applicant is to ensure that all relevant staff are aware of this Agreement and to respond appropriately to incidents associated with the discharge of Trade Wastewater to sewer.

Signed for and on behalf of the HUNTER WATER CORPORATION in the presence of:)

.....

.....
WITNESS

APPENDIX 7

Site Geometry and Parameters Used in XP Storm Model

Table A5.1 - Catchment Data Used in XP - Storm Model Setup

Node	Catchment Area	Average Catchment Slope	Impervious Percentage			Link Length (m)	Height (mAHD)	Mannings 'n'	Cross Section			Culvert Information									
			Area Developed (ha)	Impervious Area (ha)	Percentage Impervious				Type	Base/Shape width (m)	Batter/ Diameter (1:V)	Barrels	Height (m)	Width (m)	Width between Chambers	Length (m) + (overbank flow lengths)	overflow above top of culvert (m)	Wing Walls (deg)	Water Depth	Sediment	Date/Time
M1	35.1	14%	0.0	0.0	0%	286	21.0	0.045	Trap	2	5										
M2	23.2	12%	0.0	0.0	0%	67	19.0	0.060	Trap	2	5										
M3	0.0		No catchment area			679	16.0	0.070	Trap	2	5										
M4	73.4	10%	0.0	0.0	0%	10	6.0	0.014	Conduit	Rect		3	0.8	2	0.1	10	0.9	45	0.1	0.1	26/05/2008 15:00
M5	0.0		No catchment area			214	5.9	0.060	Trap	2	3										
M6	27.7	7%	0.0	0.0	0%	30	5.5	0.014	Conduit	Rect		3	0.8	2	0.1	30	10	45			
M7	0.0		No catchment area			171	5.2	0.060	Trap	3	2										
M8	11.2	6%	7.1	4.6	41%	20	3.0	0.014	Conduit	Rect		3	1.5	2.2	0.3	20	0.6	45	0.4	0.05	26/05/2008 15:00
M9	0.0		No catchment area			126	2.8	0.060	Trap	5	5										
M10	37.1	5%	23.7	15.4	42%	536	1.9	0.070	Trap	4	4										
M11	61.2	2%	28.9	18.8	31%	344	0.2	0.060	Trap	30	10										
M12	6.8	1%	1.7	1.1	16%	133	-0.3	0.045	Trap	30	10										
M13	6.4	1%	2.8	1.8	28%	208	-0.3	0.060	Trap	30	10										
M14	9.6	6%	6.6	4.3	45%	10	-0.3	0.014	Culvert	Rect		4	1.2	2	0.1	10	0.65	45	0.5	0.1	26/05/2008 14:00
M15	0.0		No catchment area			115	-0.3	0.030	Refer to Spreadsheet							(95) 115 (75)					
M15a	0.0		No catchment area			20	-0.5	0.030	Refer to Spreadsheet							(15) 20 (28)					
M15b	0.0		No catchment area			15	-0.5	0.030	Refer to Spreadsheet							(15) 15 (30)					
M15c	0.0		No catchment area			25	-0.6	0.030	Refer to Spreadsheet							(30) 25 (20)					
M16	0.0		No catchment area			25	-0.6	0.030	Refer to Spreadsheet							(45) 25 (50)					
M17	5.3	3%	2.4	1.6	29%	40	-0.8	0.030	Trap	30	10										
M18	1.2	0%	0.8	0.5	44%	103	-1.2	0.030	Trap	30	20										
M19	0.0	0%	No catchment area			211	-2.0	0.030	Trap	30	30										
Outfall	0.0		No catchment area				-3.0		No cross section												
N1	10.1	12%	0.0	0.0	0%	511	26.0	0.045	Trap	5	5										
N2	24.4	10%	0.0	0.0	0%	30	6.0	0.014	Conduit	Rect	1	1	0.9	1.8	0	30	10				
N3	4.4	8%	3.8	2.5	56%	227	2.0	0.020	Trap	1	5										
N4	10.3	4%	4.5	2.9	28%	10	1.5	0.014	Culvert	Rect		1	0.9	1.8	0	10	0.75	30			
N5	0.0		No catchment area			296	1.4	0.014	Trap	2.5	10										
N6	12.2	5%	6.8	4.4	36%	20	0.5	0.014	Culvert	Rect		3	1.2	2.2	0.3	20	0.7	30	0.1	0.05	
N7	0.0		No catchment area			288	0.4	0.065	Trap	5	10										
S1	4.8	3%	3.3	2.1	45%	20	10.1	0.014	Conduit	Circular	0.6					20	1.2				
S2	0.0		No catchment area			231	10.0	0.060	Trap	2	2										
S3	35.7	12%	26.1	17.0	48%	588	16.0	0.060	Trap	0.5	3										
Total	400.1		118.5	77.0	19%																
Catchment Total	400.1																				

Notes: 1 Estimated from LPI 10 metres contour data and site inspection
2 Estimated developed Area Impervious was 65%

Table A5.2 - X-Section 1 - Node M15 - M15

Pre Developed			Post Developed	
y Values	x Values	Comment	y Values	x Values
3.8	-100	10H:1V (Based on Topo'	3.8	-100
0.4	-37.6		0.4	-37.6
-0.4	-10	Base	-0.4	-10
-0.4	10	Base	-0.4	10
0.2	41.4		0.2	41.4
0.62	43.7		0.62	43.7
0.97	53.6		0.8	54.2
1.2	53.8	Site Bund 0.2m and 0.2m capping (fil	1.3	54.2
1.29	95.8		1.3	60
1.45	124	Workshop - Min Floor RL 1.88 mAHD	1.88	108
1.3	132		3.8	108
1.3	147		3.8	124
3.8	147	<-- Model Exten	1.4	124
			1.4	126
			1.3	126
			1.3	147
		Model Extent -->	3.8	147

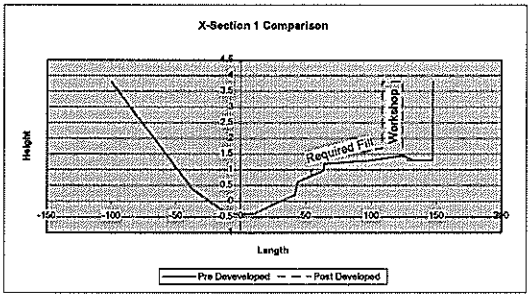


Table A5.3 - X-Section 2 - Node M15a - M15l

Pre Developed			Post Developed	
y Values	x Values	Comment	y Values	x Values
3.8	-100	10H:1V (Based on Topo'	3.8	-100
0.4	-32.3		0.4	-32.3
0.17	-26.4		0.17	-26.4
-0.45	-5	Base	-0.45	-5
-0.45	5	Base	-0.45	5
0.19	28.4		0.19	28.4
0.61	29.2		0.61	29.2
0.75	31.8		0.75	31.8
0.64	42.3		0.64	42.3
0.8	51	Site Bund 0.2 m and 0.2 m capping (fil	1.3	49.8
1.2	63.3	Refit Shed RL 1.38 mAHD -->	1.38	51
1.35	114		3.8	51
1.2	116.7		3.8	68.8
1.2	134.1		1.38	68.8
3.8	134.1	<-- Model Exten	1.4	114
			1.3	114
			1.3	134.1
		Model Extent -->	3.8	134.1

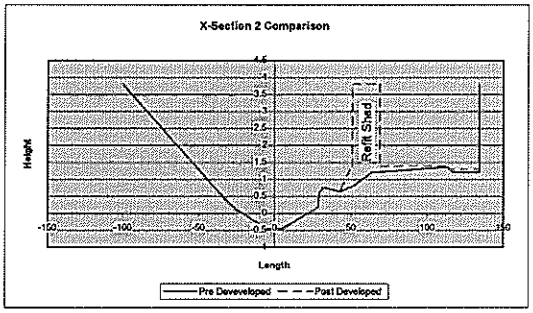


Table A5.4 - X-Section 3 - Node M15b - M15

Pre Developed			Post Developed	
y Values	x Values	Comment	y Values	x Values
3.8	-40	10H:1V (Based on Topo'	3.8	-40
0.4	-20		0.4	-20
0.14	-17		0.14	-17
-0.5	-5	Base	-0.5	-5
-0.5	5	Base	-0.5	5
0.15	17		0.15	17
0.49	18.9		0.49	18.9
0.68	23.5		0.68	23.5
0.78	47.3	Storage Shed Min RL 0.94 mAHD	0.97	34.2
3.8	47.3		3.8	34.2
3.8	69.2		3.8	69.2
1	69.2		1	69.2
1.17	103		1.17	103
1.02	103		1.02	103
1.02	122.5		1.02	122.5
3.8	122.5	Model Exten	3.8	122.5

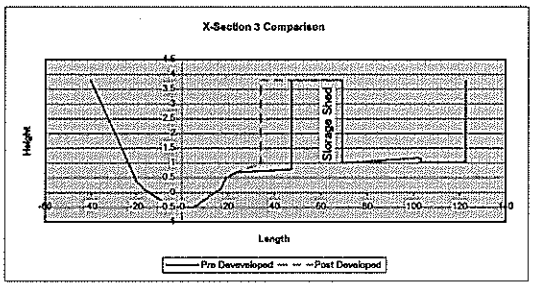


Table A5.5 - X-Section 4 - Node M15c - M1

Pre Developed			Post Developed	
y Values	x Values	Comment	y Values	x Values
3.8	-100	10H:1V (Based on Topo'	3.8	-100
0.4	-21.2		0.4	-21.2
0.26	-19.3		0.26	-19.3
-0.55	-5	Base	-0.55	-5
-0.55	5	Base	-0.55	5
0.1	19		0.1	19
0.55	20.5		0.55	20.5
0.65	23.7		0.65	23.7
0.85	30		0.85	30
0.75	35.4	Jet Wash Bay RL 0.98mAHD -->	0.97	32.9
0.75	44.8		3.8	32.9
0.88	64.5		3.8	46.8
1	75.1	<-- Existing Building RL 1.0 mAHI	0.97	46.6
3.8	75.1		1.1	81.2
3.8	95.1	Commercial Centre 2.13 mAHD -->	3.8	81.2
1	95.1		3.8	101.6
1.1	101.6		1.1	101.6
0.95	107.7		1.1	104
0.95	123.2		0.95	104
3.8	123.2	<-- Model Exten	0.95	123.2
		Model Extent -->	1.1	123.2

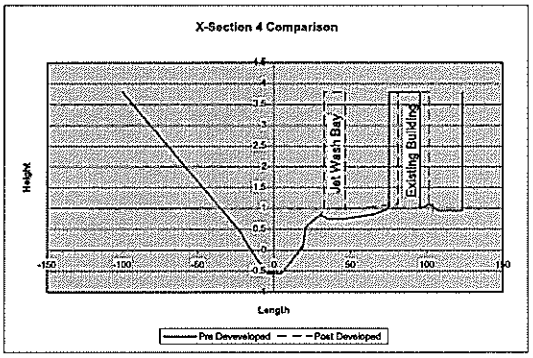
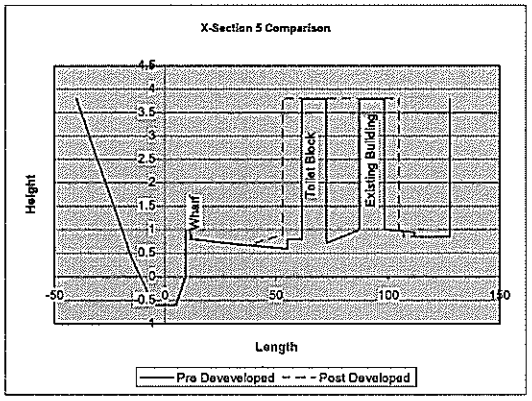


Table A5.6 X-Section 5 - Node M16 - Node M1

Link Length

Right Bank Length

Pre Developed			Post Developed	
y Values	x Values	Comment	y Values	x Values
3.8	-40	10H:1V	3.8	-40
0.4	-15		0.4	-15
0.2	-13		0.2	-13
-0.6	-5	Base	-0.6	-5
-0.6	5	Base	-0.6	5
0	9.4	Wharf	0	9.4
1	9.4		1	9.4
1	11.4		1	12.3
0.8	11.4		0.8	12.3
0.67	37.4		0.67	38.2
0.6	55	Commercial Centre RL 2.13 mAHD -->	0.9	53.2
0.8	55	<--Wash Bay	3.8	53.2
0.8	61.5	<-- Toilet Block	3.8	105
3.8	61.5		1	105
3.8	72.4		1	107
0.72	72.4		0.85	107
1	87.1	<-- Main Building Min RL 1.0 mAHI	0.85	127.5
3.8	87.1	Model Extent -->	3.8	127.5
3.8	98.2			
1	98.2			
0.95	111.6			
0.55	111.6			
0.55	127.5			
3.8	127.5	<-- Model Exten		



Horton Infiltration

This dialog is used to define a Global Database record for Horton infiltration parameters.

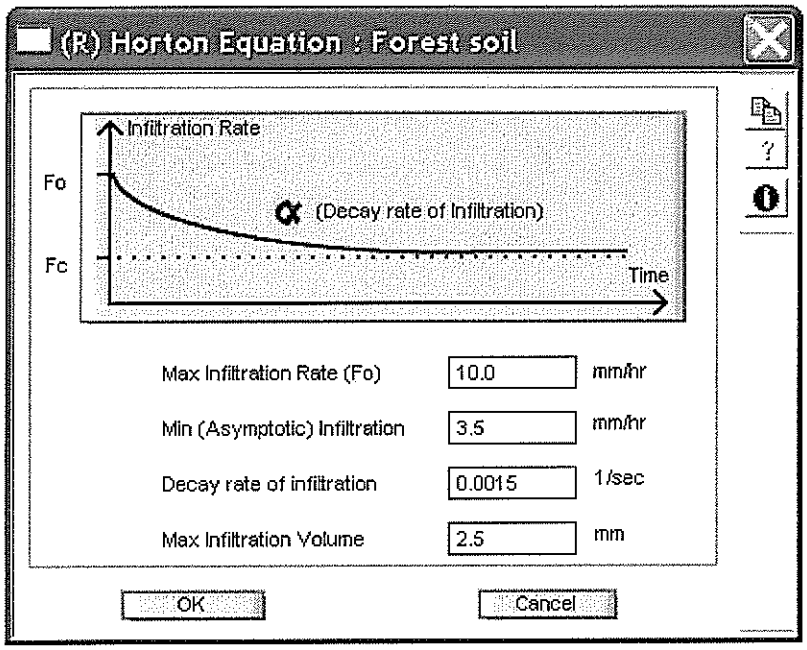
Horton's model is empirical and is perhaps the best known of the infiltration equations. Many hydrologists have a "feel" for the best values of its three parameters despite the lack of published information.

Horton gives infiltration capacity as a function of time as:

$$F_P = F_C + (F_0 - F_C)e^{-kt}$$

Where:
F_P = infiltration rate into soil, inch/hr (mm/hr)
F_c = minimum or asymtopic value of F_p, inch/hr (mm/hr)
F_0 = maximum or initial value of F_p, inch/hr (mm/hr)
t = time from beginning of storm, sec
k = decay coefficient, 1/sec

This equation describes the familiar exponential decay of infiltration capacity evident during heavy storms. However, the program uses the integrated form to avoid an unwanted reduction in infiltration capacity during periods of light rainfall.



Special values of k are used to specify the:
Proportional Loss rate,
Initial Loss/Continuing Loss rate,
Initial Loss/Proportional Loss rate, or
infiltration methods.

Continuous Simulation

For continuous simulation, infiltration capacity will be regenerated during dry weather. The recovery of the infiltration rate during dry weather is calculated by the equation:

$$F_P = F_0 - (F_0 - F_C)e^{-k_D(t - t_w)}$$

Where:
k_D = decay coefficient for the recovery curve = k * $REGEN$
tw = projected time at which $F_P = F_0$, sec
$REGEN$ = coefficient of soil regeneration

The value of for REGEN is typically << 1, suggesting that soil regeneration rate is much slower that initial decay rate. The input of REGEN is located in the **Runoff Job Control** dialog. The default value is 0.01. Further information may be found in Appendix V of the EPA SWMM User's Manual for Version 4.

Maximum (Initial) Infiltration Rate
Minimum (Asymptotic) Infiltration Rate
Decay rate of Infiltration

Maximum (Initial) Infiltration Rate, *Fo*

The maximum or initial infiltration capacity, in./hr [mm/hr]. This parameter depends primarily on soil type, initial moisture content and surface vegetation conditions. For single event simulation the initial moisture content is important. The values listed in the following table can be used as a rough guide.

Representative values of Maximum (Initial) Infiltration Capacity, *Fo*
in/hr mm/hr
A. DRY soils (with little or no vegetation)
Sandy soils: 5 12.7
Loam soils: 3 7.62
Clay soils: 1 2.54
B. DRY soils (with dense vegetation)
Multiply values given in A by 2
C. MOIST soils (for single event simulation)
Soils which have drained but not dried out:
divide values from A and B by 3
Soils close to saturation:
choose value close to saturated hydraulic conductivity
Soils partially dried out:
divide values from A and B by 1.5-2.5

Values of suggested by Akan (1993):

Soil Type	Maximum (Initial) Infiltration Capacity, *Fo* (in/hr)	(mm/hr)
Dry sandy soils with little or no vegetation	5.0	12.7
Dry loam soils with little or no vegetation	3.0	7.62
Dry clay soils with little or no vegetation	1.0	2.54
Dry sandy soils with dense vegetation	10.0	25.4
Dry loam soils with dense vegetation	6.0	15.2
Dry clay soils with dense vegetation	2.0	5.08
Moist sandy soils with little or no vegetation	1.7	4.32
Moist loam soils with little or no vegetation	1.0	2.54
Moist clay soils with little or no vegetation	0.3	0.76
Moist sandy soils with dense vegetation	3.3	8.38
Moist loam soils with dense vegetation	2.0	5.08
Moist clay soils with dense or no vegetation	0.7	1.78

Minimum (Asymptotic) Infiltration Rate, *Fc*

The minimum or ultimate value of infiltration capacity, in./hr [mm/hr]. This parameter is essentially the saturated hydraulic conductivity, or "permeability", of soils. The following table lists ranges of this parameter for various soil groups (Musgrave, 1955).

Hydrologic Soil Group	Minimum (Asymptotic) Infiltration Rate, *Fc* (in/hr)	(mm/hr)
A	0.30 - 0.45	0.76 - 1.14
B	0.15 - 0.30	0.38 - 0.76
C	0.05 - 0.15	0.13 - 0.38
D	0.00 - 0.05	0.00 - 0.13

Note that the Hydrological Soil Group corresponds to the classification given by the Soil Conservation Service. Well drained sandy soils are "A"; poorly drained clayey soils are "D". The texture of the layer of least hydraulic conductivity in the soil profile should be considered. Caution should be used in applying values from the above table to sandy soils (Group A) since reported values are often much higher.

Values of Horton Equation parameters have been suggested by Akan (1993):

Soil Type	Minimum (Asymptotic) Infiltration Capacity, *Fc* (in/hr)	(mm/hr)
Clay loam, silty clay loam, sandy clay, silty clay, clay	0.00 - 0.05	0.00 - 0.13
Sandy clay loam	0.05 - 0.15	0.13 - 0.38
Silt loam, loam	0.15 - 0.30	0.38 - 0.76
Sand, loamy sand, sandy loam	0.30 - 0.45	0.76 - 1.14

The minimum (asymptotic) infiltration rate is often close to the saturated hydraulic conductivity of the soil.

Decay Rate of Infiltration, *k*

The rate of decrease of infiltration capacity *k*, 1/sec. This parameter is independent of initial moisture content. The following table shows the rate of decay of infiltration for a range of parameter values.

Decay Rate 1/hr (1/sec)	Percent of decline of infiltration capacity towards limiting value after 1 hour
2 0.00056	76
3 0.00083	95
4 0.00115	98
5 0.00139	99

k can vary between 0.67 to 49/hr (0.000186 to 0.0136/sec). Most reported values are in the range 3 to 6 /hr (0.00083 to 0.00167/sec). If no field data is available an estimate of 4.14/hr (0.00115/sec) could be used (Akan, 1993).

Proportional Loss rate

Proportional loss rates are applied by selecting the Horton loss method and setting the decay rate to **1**.

The Maximum Infiltration Rate s then recorded as the proportional loss as a fraction of the rainfall loss to infiltration.

Initial loss / Continuing Loss rate

Initial loss / Continuing Loss rates are applied by selecting the Horton loss method and setting the decay rate to **2**.

The Max Infiltration Rate and Asymptotic Infiltration Rate are then recorded as the initial loss (inch or mm) and continuing loss (inch or mm /hr) rate respectively.

Initial Loss / Proportional Loss rate

Initial loss / Proportional Loss rates are applied by selecting the Horton loss method and setting the decay rate to **3**.

The Max Infiltration Rate and Asymptotic Infiltration Rate are then recorded as the initial loss (mm/inch) and continuing proportional loss (fraction of rainfall lost to infiltration) rate respectively.

APPENDIX 8

XP Storm Modelling Results and Outflow Hydrograph

Table A8-1 - Comparison of Modelled Pre and Post Development Downstream Peak Outflows (Between Nodes M17 and M18)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Flow (m^3/s)	Post Development Flow (m^3/s)	Pre Development Flow (m^3/s)	Post Development Flow (m^3/s)	Pre Development Flow (m^3/s)	Post Development Flow (m^3/s)
1	6.1	6.1	7.0	7.0	7.1	7.1
5	15.1	15.1	16.0	16.0	16.4	16.3
10	18.2	18.2	19.1	19.2	19.7	19.6
20	22.2	22.3	23.2	23.3	23.8	23.7
100	29.5	29.5	30.5	30.5	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.2 - Comparison of Modelled Pre and Post Development Downstream Velocities (Between Nodes M15 and M15a)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)
1	0.26	0.26	0.06	0.07	0.03	0.04
5	0.50	0.49	0.14	0.15	0.08	0.09
10	0.53	0.54	0.17	0.18	0.09	0.11
20	0.58	0.58	0.21	0.21	0.11	0.13
100	0.65	0.65	0.27	0.28	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.3 - Comparison of Modelled Pre and Post Development Downstream Velocities (Between Nodes M15a and M15b)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)
1	0.31	0.31	0.07	0.08	0.04	0.05
5	0.62	0.62	0.16	0.17	0.08	0.11
10	0.68	0.69	0.20	0.21	0.10	0.14
20	0.75	0.76	0.24	0.25	0.12	0.17
100	0.84	0.85	0.31	0.33	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.4 - Comparison of Modelled Pre and Post Development Downstream Velocities (Between Nodes M15b and M15c)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)
1	0.41	0.41	0.10	0.11	0.05	0.7
5	0.88	0.88	0.23	0.25	0.11	0.16
10	0.99	1.00	0.27	0.29	0.14	0.19
20	1.11	1.12	0.32	0.35	0.16	0.23
100	1.27	1.28	0.41	0.46	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.5 - Comparison of Modelled Pre and Post Development Downstream Velocities (Between Nodes M15c and M16)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)
1	0.36	0.36	0.08	0.09	0.04	0.06
5	0.81	0.81	0.18	0.21	0.09	0.14
10	0.92	0.93	0.22	0.25	0.12	0.17
20	1.05	1.06	0.26	0.30	0.14	0.21
100	1.22	1.23	0.34	0.39	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.6 - Comparison of Modelled Pre and Post Development Downstream Velocities (Between Nodes M16 and M17)

Local Catchment ARI Storm Event	Tail Water Level					
	0.1 mAHD		1.1 mAHD		1.68 mAHD	
	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)	Pre Development Velocity (m/s)	Post Development Velocity (m/s)
1	0.46	0.46	0.09	0.11	0.05	0.08
5	1.10	1.11	0.21	0.25	0.11	0.19
10	1.30	1.31	0.25	0.29	0.13	0.23
20	1.54	1.56	0.30	0.35	0.16	0.28
100	1.90	1.96	0.39	0.46	See note	

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.7 - Pre and Post Development Flood Levels at Node M15 (Invert Level -0.3 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.15	0.15	0.0	1.10	1.10	0.0	1.68	1.68	0.0
5	0.28	0.29	0.01	1.11	1.11	0.0	1.69	1.68	-0.01
10	0.33	0.33	0.0	1.11	1.11	0.0	1.69	1.69	0.0
20	0.39	0.38	-0.01	1.12	1.11	-0.01	1.69	1.69	0.0
100	0.48	0.48	0.0	1.13	1.12	-0.01	See note		

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.8 - Pre and Post Development Flood Levels at Node M15a (Invert Level -0.5 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.12	0.12	0.0	1.10	1.10	0.0	1.68	1.68	0.0
5	0.21	0.21	0.0	1.11	1.11	0.0	1.68	1.68	0.0
10	0.25	0.25	0.0	1.11	1.11	0.0	1.69	1.69	0.0
20	0.30	0.30	0.0	1.11	1.11	0.0	1.69	1.69	0.0
100	0.39	0.39	0.0	1.12	1.12	0.0	See note		

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.9 - Pre and Post Development Flood Levels at Node M15b (Invert Level -0.5 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.12	0.12	0.0	1.10	1.10	0.0	1.68	1.68	0.0
5	0.19	0.19	0.0	1.11	1.11	0.0	1.68	1.68	0.0
10	0.23	0.22	-0.01	1.11	1.11	0.0	1.69	1.69	0.0
20	0.27	0.27	0.0	1.11	1.11	0.0	1.69	1.69	0.0
100	0.36	0.36	0.0	1.12	1.12	0.0	See note		

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.10 - Pre and Post Development Flood Levels at Node M15c (Invert Level -0.6 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.11	0.11	0.0	1.10	1.10	0.0	1.68	1.68	0.0
5	0.18	0.17	-0.01	1.11	1.10	-0.01	1.68	1.68	0.0
10	0.21	0.20	-0.01	1.11	1.11	0.0	1.69	1.68	0.0
20	0.25	0.25	0.0	1.11	1.11	0.0	1.69	1.69	0.0
100	0.33	0.33	0.0	1.12	1.11	-0.01	See note		

- Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.11 - Pre and Post Development Flood Levels at Node M16 (Invert Level -0.6 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.11	0.10	-0.01	1.10	1.10	0.0	1.68	1.68	0.0
5	0.13	0.13	0.0	1.11	1.10	-0.01	1.68	1.68	0.0
10	0.15	0.15	0.0	1.11	1.10	-0.01	1.69	1.68	-0.01
20	0.18	0.18	0.0	1.11	1.11	0.0	1.69	1.69	0.0
100	0.25	0.24	-0.01	1.12	1.11	-0.01	See note		

Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible.

Table A8.12 - Pre and Post Development Flood Levels at Node M14 (Invert Level -0.4 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.16	0.16	0.0	1.10	1.10	0.0	1.68	1.68	0.0
5	0.33	0.33	0.0	1.12	1.12	0.0	1.69	1.69	0.0
10	0.38	0.38	0.0	1.13	1.12	-0.01	1.70	1.70	0.0
20	0.45	0.45	0.0	1.14	1.13	-0.01	1.71	1.71	0.0
100	0.57	0.56	-0.01	1.16	1.16	0.0	See note		

Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible

Table A8.13 - Pre and Post Development Flood Levels at Node M13 (Invert Level -0.4 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.34	0.34	0.0	1.11	1.11	0.0	1.69	1.69	0.0
5	0.64	0.64	0.0	1.16	1.16	0.0	1.71	1.71	0.0
10	0.72	0.72	0.0	1.18	1.17	-0.01	1.72	1.72	0.0
20	0.82	0.82	0.0	1.21	1.21	0.0	1.73	1.73	0.0
100	0.97	0.97	0.0	1.28	1.27	-0.01	See note		

Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible

Table A8.14 - Pre and Post Development Flood Levels at Node M12 (Invert Level -0.4 mAHD)

Local Catchment ARI Storm Event	Tail Water Level								
	0.1 mAHD			1.1 mAHD			1.68 mAHD		
	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)	Pre Development Peak Flood Levels (mAHD)	Post Development Peak Flood Levels (mAHD)	Difference Between Pre and Post Development (m)
1	0.37	0.37	0.0	1.12	1.11	-0.01	1.69	1.69	0.0
5	0.70	0.69	-0.01	1.17	1.17	0.0	1.71	1.71	0.0
10	0.78	0.78	0.0	1.20	1.19	-0.01	1.72	1.72	0.0
20	0.88	0.88	0.0	1.24	1.23	-0.01	1.74	1.74	0.0
100	1.04	1.04	0.0	1.31	1.31	0.0	See note		

Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible

Table A8.15 - Flood Hazard Category Over Marmong Road (Tail Water 1.68 mAHD)

ARI Storm Event	Pre Developed			Post Developed		
	Pre Development Peak Velocity Levels (m/s)	Post Development Peak Flood Depths (m)	Flood Hazard Category	Pre Development Peak Velocity Levels (m/s)	Post Development Peak Flood Levels (m)	Flood Hazard Category
1	0.15	0.13	1	0.14	0.13	1
5	0.33	0.14	1	0.33	0.14	1
10	0.39	0.15	1	0.39	0.15	1
20	0.48	0.16	1	0.47	0.16	1

Note that the 100 year ARI storm event for both the greater Lake Macquarie Catchment (tail water of 1.68 mAHD) and the local catchment has not been included as the probability of the peak flood levels occurring at exactly the same time across the two vastly different catchments is negligible

Table A8.16 - Flood Hazard Category along Nanda St (1.1 mAHD Tail Water Level)

ARI Storm Event	Pre Developed			Post Developed		
	Pre Development Peak Velocity Levels (m/s)	Pre Development Peak Flood Depths (m)	Flood Hazard Category	Post Development Peak Velocity Levels (m/s)	Post Development Peak Flood Depths (m)	Flood Hazard Category
Node M15b - M15c– Approximate Road RL 1.0 mAHD						
1	0.10	0.10	1	0.11	0.1	1
5	0.23	0.11	1	0.25	0.11	1
10	0.27	0.11	1	0.29	0.11	1
20	0.32	0.11	1	0.35	0.11	1
100	0.41	0.12	1	0.45	0.12	1
Node M15c – M16 – Approximate Road RL 0.85 mAHD						
1	0.08	0.25	1	0.09	0.25	1
5	0.18	0.26	1	0.21	0.25	1
10	0.22	0.26	1	0.25	0.26	1
20	0.26	0.26	1	0.30	0.26	1
100	0.34	0.27	2	0.39	0.26	2
Node M16 – M17 – Approximate Road RL 0.85 mAHD						
1	0.09	0.25	1	1.01	0.25	1
5	0.21	0.26	1	0.25	0.25	1
10	0.25	0.26	1	0.29	0.25	1
20	0.30	0.26	1	0.35	0.26	1
100	0.39	0.27	2	0.46	0.26	2

Note: Modelling indicates that link M15 – M15a is not flooded during the 1.1 mAHD tail water event

Table A8.17 - Flood Hazard Category along Nanda Street 1.68 mAHD Tail Water Level

ARI Storm Event	Pre Developed			Post Developed		
	Pre Development Peak Velocity Levels (m/s)	Pre Development Peak Flood Depths (m)	Flood Hazard Category	Post Development Peak Velocity Levels (m/s)	Post Development Peak Flood Levels (m)	Flood Hazard Category
Conduit Site 1 Node M15 –M15a– Approximate RL 1.3 mAHD						
1	0.03	0.38	2	0.04	0.38	2
5	0.08	0.38	2	0.09	0.38	2
10	0.09	0.38	2	0.11	0.39	2
20	0.11	0.38	2	0.13	0.39	2
Conduit Site 2 Node M15a - M15b– Approximate Road RL 1.3 mAHD						
1	0.04	0.38	2	0.05	0.38	2
5	0.08	0.38	2	0.11	0.38	2
10	0.10	0.39	2	0.14	0.39	2
20	0.12	0.39	2	0.17	0.39	2
Conduit Site 3 Node M15b – M15c – Approximate Road RL 1.0 mAHD						
1	0.05	0.68	2	0.07	0.68	2
5	0.11	0.68	2	0.16	0.69	2
10	0.14	0.69	2	0.19	0.69	2
20	0.16	0.69	2	0.23	0.69	2
Conduit Site 4 Node M15c – M16 – Approximate Road RL 0.85 mAHD						
1	0.04	0.83	3	0.06	0.83	3
5	0.09	0.83	3	0.14	0.83	3
10	0.12	0.84	3	0.17	0.83	3
20	0.14	0.84	3	0.21	0.84	3
Conduit Site 5 Node M16 – M17 – Approximate Road RL 0.85 mAHD						
1	0.05	0.83	3	0.08	0.83	3
5	0.11	0.83	3	0.19	0.83	3
10	0.13	0.84	3	0.23	0.83	3
20	0.16	0.84	3	0.28	0.84	3

Figure A8-1 – Critical Storm Duration Outflow Hydrograph

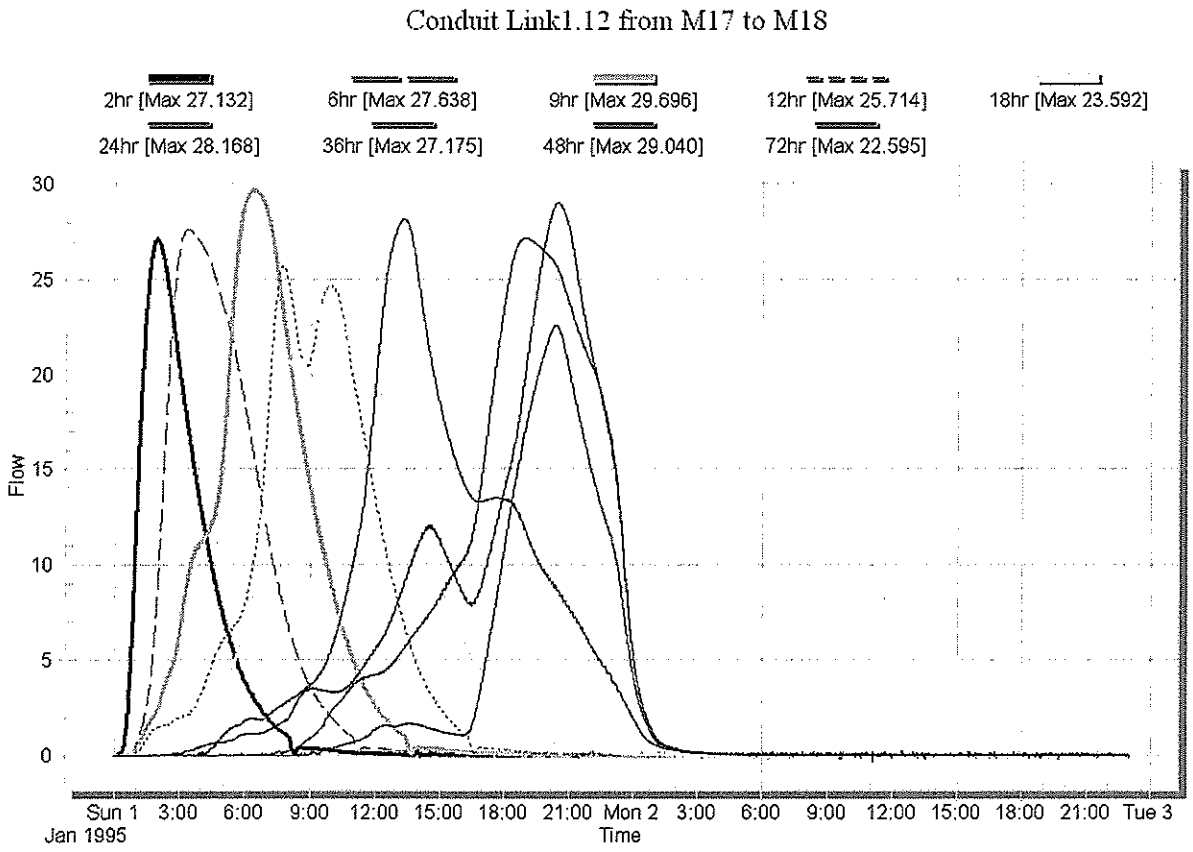


Figure A8-2 – 0.1 mAHD Tail Water - Pre-Developed Outflow Hydrograph

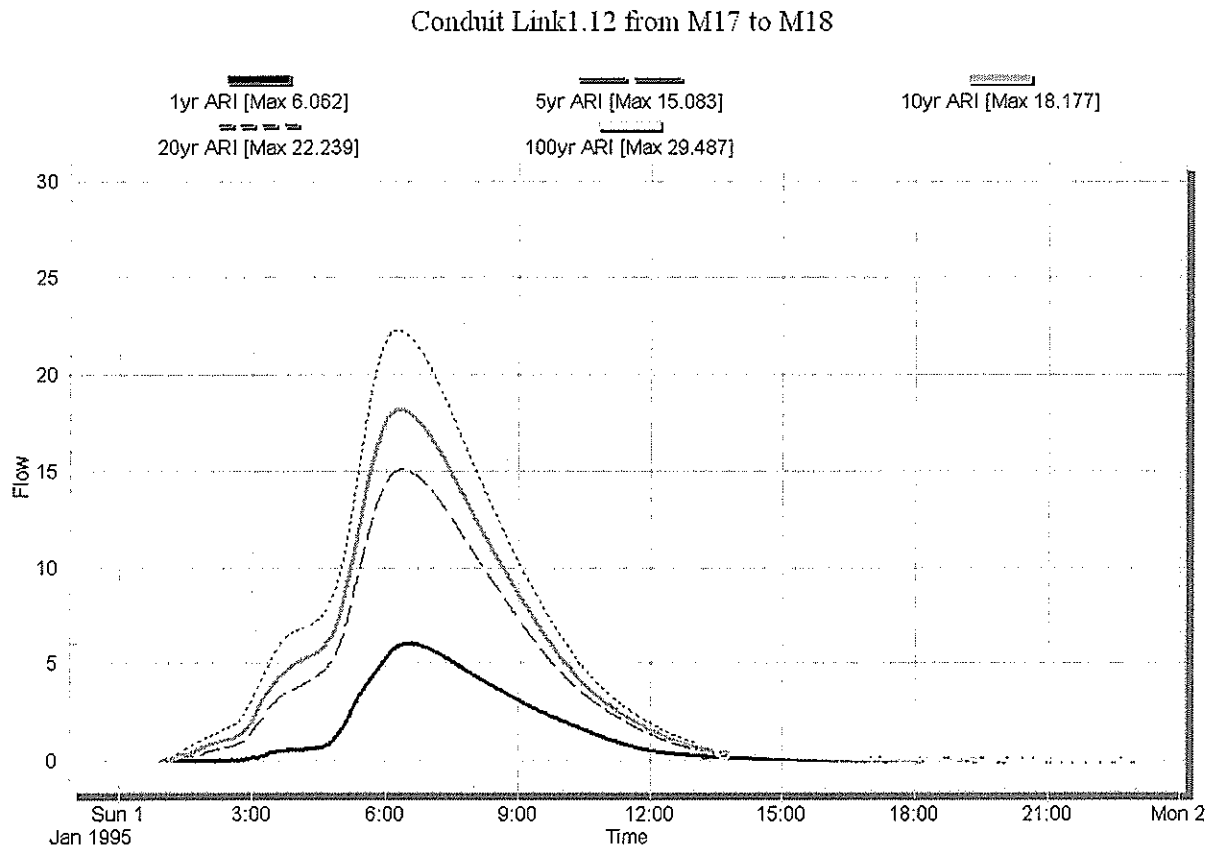


Figure A8-3 – 0.1 mAHD Tail Water - Post-Developed Outflow Hydrograph

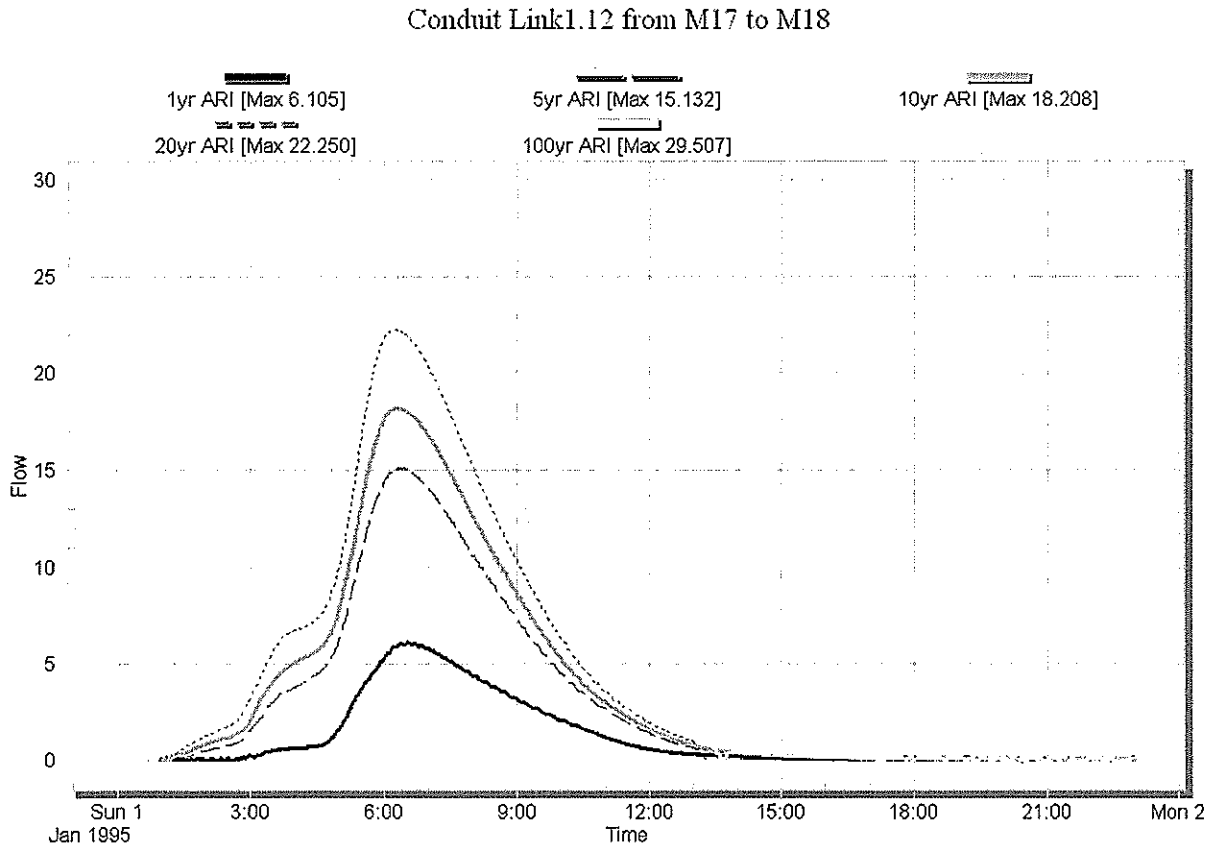


Figure A8-4 – 1.1 mAHD Tail Water - Pre-Developed Outflow Hydrograph

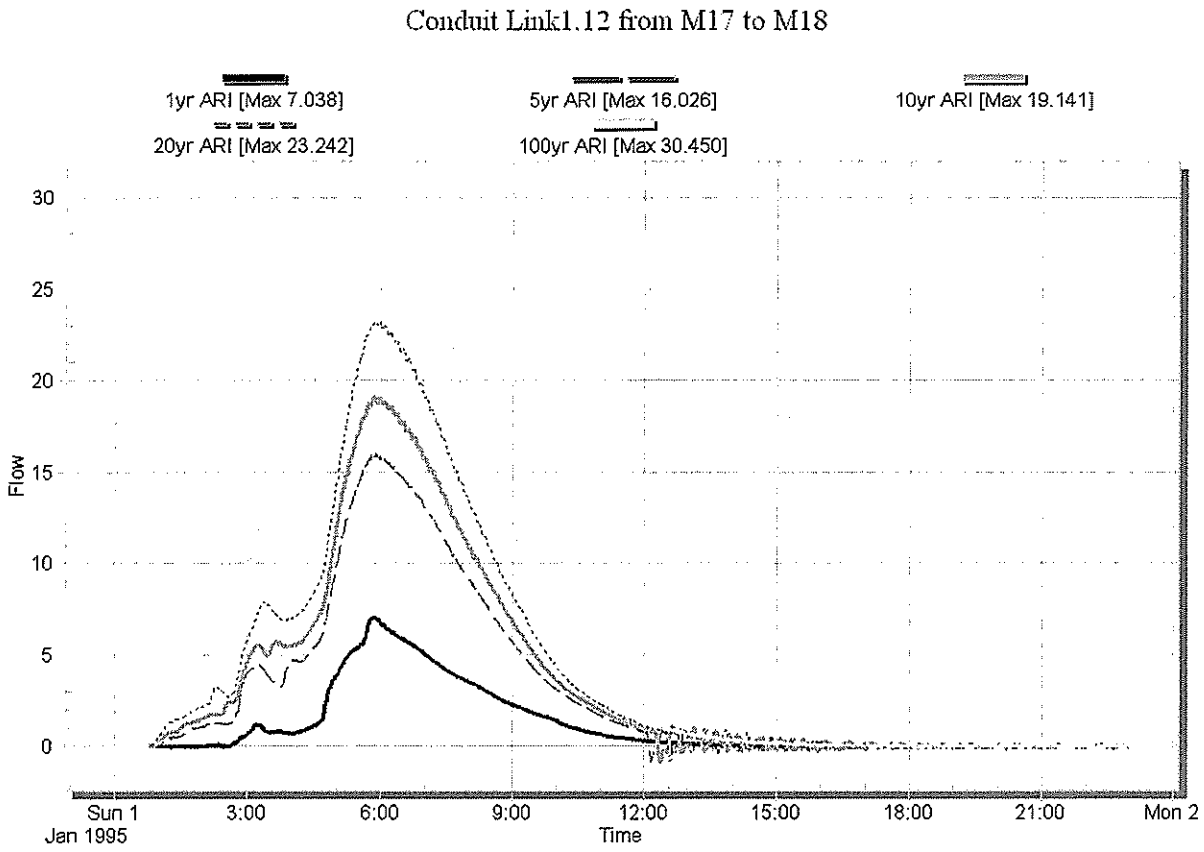


Figure A8-5 – 1.1 mAHD Tail Water - Post-Developed Outflow Hydrograph

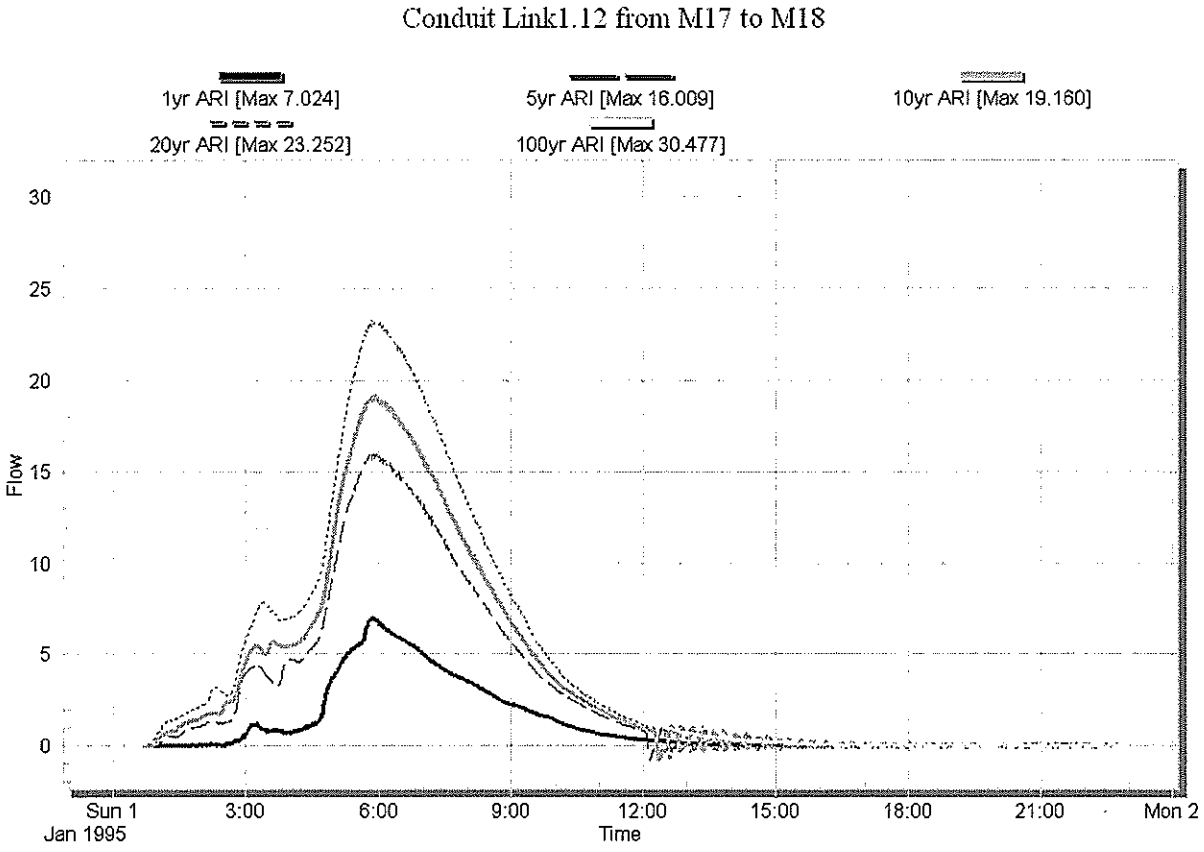


Figure A8-6 – 1.68 mAHD Tail Water - Post-Developed Outflow Hydrograph

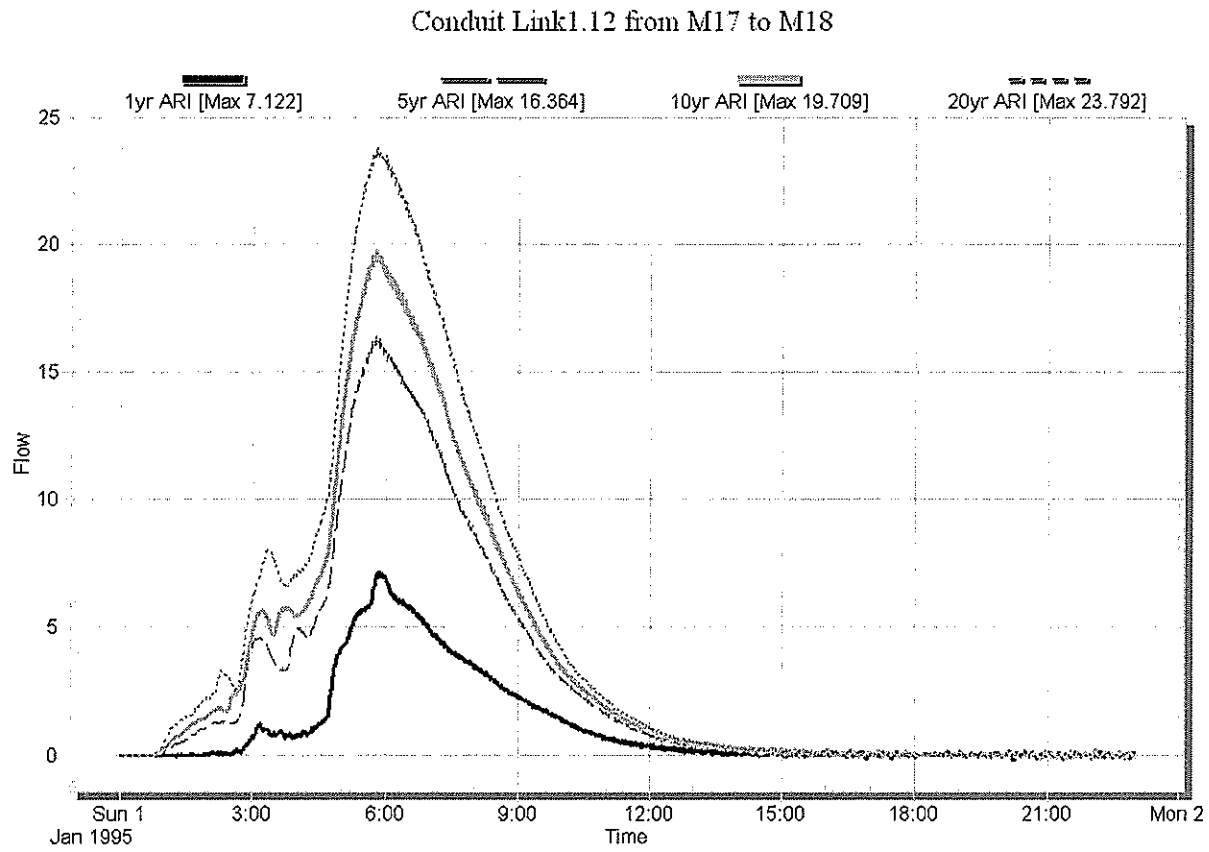
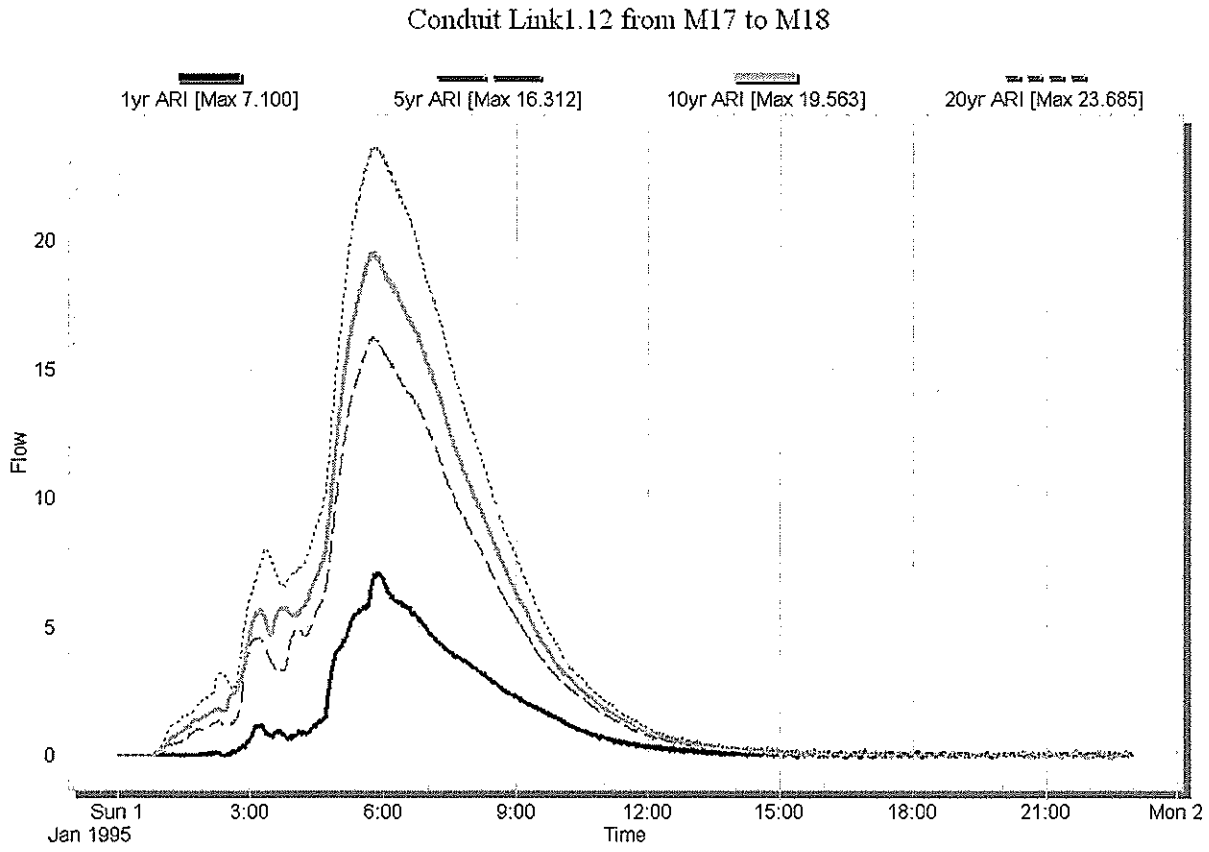


Figure A8-7 – 1.68 mAHD Tail Water - Post-Developed Outflow Hydrograph



Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph. 02 4950 5322
Fax 02 4950 5737