FINAL REPORT

MEINHARDT
INFRASTRUCTURE
& ENVIRONMENT

LONG BAY FORENSIC AND PRISON HOSPITALS

Supplementary Stormwater Report

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TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 GENERAL 1
1.2 PROPOSED DEVELOPMENT 1
1.3 SCOPE OF THE ANALYSIS 1
1.4 BACKGROUND 1
2 TECHNICAL INVESTIGATION 2
2.1 CHOICE OF MODEL 2
2.2 CATCHMENT DEFINITION 2
3 DRAINAGE SYSTEM 2
4 HYDROLOGIC AND HYDRAULIC MODELLING 4
5 CONCLUSIONS 4
6 REFERENCES 5
7 APPENDICES 6
APPENDIX A – CATCHMENT PLAN 7
APPENDIX B – LINK – NODE DIAGRAM 9
APPENDIX C – RAFTS MODEL RESULTS 11
APPENDIX D – AERIAL PHOTO OF SITE 16

1 INTRODUCTION

1.1 General

Meinhardt were commissioned by Mulitplex to undertake the detailed design of the Forensic and Prison Hospitals at Long Bay Correctional Centre which includes stormwater systems required for the proposed facility.

1.2 Proposed Development

The proposed development includes the construction of a Forensic and Prison Hospital within the Long Bay Correctional Facility (LBCC). The LBCC facility comprise about 22 hectares and is located in Malabar and bounded by Anzac Parade, Austral Street, Calga Avenue and Bilga Crescent as shown in Figure 1. The site is generally located on the crest of a hill which falls to each of its boundaries.

Figure 1 – Site locality Plan

The proposed Forensic and Prison Hospital developments are located on the western and southern boundaries respectively as shown in Figure 1.

1.3 Scope of the analysis

This report summarises the hydrological analysis undertaken to determine the affect of the as built works and subsequent flows from the site as well as analysing different combinations of future works which are required under the site masterplan prepared by the Department of Commerce.

1.4 Background

A previous stormwater management plan and design was prepared by the Department of Commerce (DOC) for Long Bay Correctional Centre (LBCC). The design proposed a suitable stormwater management regime for the proposed new development at LBCC to satisfy Randwick Council's Development Application (DA) requirement.

The report prepared by DOC assessed the stormwater discharges generated from the correctional complex site for the existing condition which recommended a suitable detention system to manage the stormwater runoff to cater for the new

development. As part of the Hospital project works detention basins 2, FH, 3, 1C SPC and PH have been built and completed. These basin locations are shown in Appendix A. The remaining works to be undertaken includes the stormwater collection system and diversion into the OSD3 basin as well as OSD4 basin near the carpark at the entry to the site.

2 TECHNICAL INVESTIGATION

2.1 Choice of Model

Given that the original modelling was undertaken in RAFTS by DOC it was agreed that DOC would revise their model based on the revised concept design prepared by Multiplex and Meinhardt.

RAFTS is a non-linear runoff routing model used extensively throughout Australasia and South East Asia. RAFTS is has been shown to work well on catchments ranging in size from a few square metres to 1000's of square kilometres of both urban and rural nature. RAFTS can model up to 2000 different nodes and each node can have any size subcatchment attached as well as a storage basin.

RAFTS uses the Laurensen non-linear runoff routing procedure to develop a stormwater runoff hydrograph from either an actual event (recorded rainfall time series) or a design storm utilising Intensity-Frequency-Duration (IFD) data together with dimensionless storm temporal patterns as well as standard AR&R 1987 data. Three loss models may be employed to generate excess rainfall. They are (1) Initial/Continuing, (2) Initial/Proportional and (3) the ARBM water balance model. A reservoir (pond) routing module allows routing of inflow hydrographs through a user-defined storage using the level pool routing procedure and allows modelling of hydraulically interconnected basins and on-site detention facilities.

Three levels of hydraulic routing are possible including simple Manning's based lagging in pipes and channels, the Muskingum-Cunge procedure to route hydrographs through channel or river reaches or the hydrographs may be transferred to the other Hydro- Dynamic simulation models.

2.2 Catchment Definition

Based on the previous analysis and modelling completed in 2006 the same catchment boundaries and data was retained in the model without modification as shown in Appendix A.

3 DRAINAGE SYSTEM

In order to determine the affect of the built detention basins on flows discharging from the site, five (5) models and options where analysed which assessed different combinations of works being undertaken. These options were analysed in RAFTS by modifying the original RAFTS models number 6 developed in 2006 which formed the basis for the detail design of the project works. This recent analysis involved deleting and adding basins and proposed pipelines within the model.

Works which have not been completed to date include:

- OSD4 basin in the carpark area near the entrance to the site, and
- The stormwater diversion pipeline which collects stormwater runoff and pipe flows from the catchment 1B located inside the prison complex and which is proposed to drain to OSD3.

Modelling has been undertaken to establish the hydraulic capacity achieved by the completed stormwater drainage system compared to requirements under the "On Site Detention Statement" dated 19 May 2006. The analysis was undertaken for he following scenarios:

Scenario 1 – Involved model 8 which evaluated the built basins without OSD4 and the stormwater diversion to OSD3. This represents the site drainage system now completed.

Scenario 2 – Involved model 11 which evaluated the built basins plus part of the stormwater diversion works (collecting about 30% of the catchment 1B) but without OSD4 and the remaining stormwater works in catchment 1B.

Scenario 3 – Involved model 10 which evaluated the built basins plus part of the stormwater diversion works (collecting about 60% of the catchment 1B) but without OSD4 and the remaining stormwater works in catchment 1B.

Scenario 4 - Involved model 9 which evaluated the built basins plus 100% of the stormwater diversion system to OSD3 but without OSD4 basin.

4 HYDROLOGIC AND HYDRAULIC MODELLING

The proposed system was modelled with DOC on 23 October 2008 at their office and using RAFTS model and data as shown in the Link-Node diagram in Appendix B.

The modelled comprised the 10 subcatchments and seven (7) OSD basins modelled previously without alteration to the model data.

Based on RCC's stormwater requirements the Permissible Site Discharge (PSD) for the Bilga Ave outlet is 0.55m^3/s and for the Anzac Pde outlet is and 2.1m^3/s.

Based on the previous modelling undertaken in 2006 the discharge proposed by the proposed works for the entire site is 1.69m3/s at Anzac Pde and 0.52m3/s at Bilga Avenue.

Results from the current stormwater model are summarised in Appendix C and are based on observed results recorded and limited review of the RAFTS model data by Meinhardt as the model and data was not available for detailed review.

Analysis of this data indicates that scenario 1 will achieve a 53% reduction in the predeveloped uncontrolled flows from the site for the 100 year ARI event. This reduced post developed flow for the 100 year ARI is about the equivalent to the 10 year ARI predeveloped flow. Scenario 5 will achieve a 79% reduction of predeveloped uncontrolled flows from the site for the 100 year ARI event. This reduced post developed flow for the 100 year ARI is about the equivalent to the 1-2 year ARI predeveloped flow.

5 CONCLUSIONS

As a result of the modelling undertaken by DOC and Meinhardt it can be seen that a significant reduction in sites flows discharging from site has been achieved.

6 REFERENCES

1. "Randwick City Council, Private Stormwater Code", Randwick City Council, City Engineer's Department, October 1992.

2. "Long Bay Correctional Complex, Stormwater Management Concept Plan (Updated report)", NSW Department of Commerce, August 2004

3. "Australian Rainfall and Runoff, A Guide to Flood Estimation", The Institution of Engineers, Australia, 1997

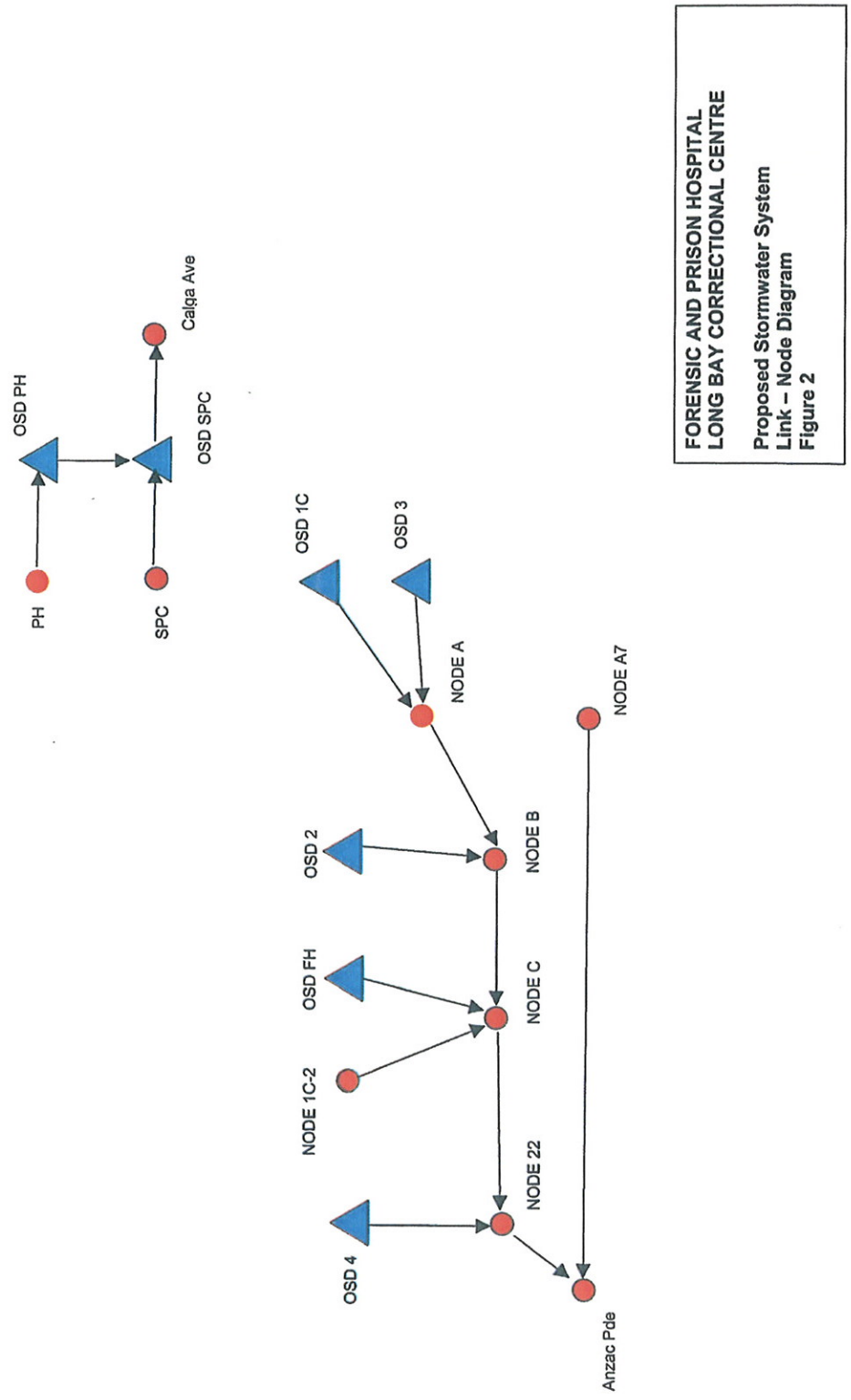
4. "Long Bay Correctional Centre, Forensic and Prison Hospitals, Stormwater System Report" Meinhardt Infrastructure and Environment Pty Ltd, Revision 01, dated 17 November 2006.

7 APPENDICES

APPENDIX A – Catchment Plan


CALGA AVENUE
BILGA CRESCENT
AUSTRAL STREET
ANZAC PARADE
PRISON HOSPITAL
OSD NURSERY
OSD PH
OSD SPC
OSD 3
OSD 1 EXISTING
OSD PH & OSD 2 BOUNDARY
OSD 3 : UNCONTROLLED AREA
OSD 4 BY OTHERS
OSD 1 CATCHMENT -INFERRED FROM SITE GRADING, BY INSPECTION.
THIS PART OF SUBCATCHMENT TO BE DIRECTED TO OSD 5 OR NURSERY, AS PER EXISTING DRAINAGE.
ABOVE GROUND,WITH BUNDS/LEVEES.
LEGEND
SYMBOL DESCRIPTION
NEW STORMWATER PIPE
CATCHMENT No.
CATCHMENT COLOR
CATCHMENT No.
PIT SCHEDULE AREA (m²)
PH 5140
SPC 14592
3 9487
2 21933
PH 22468
1B 81480
1C 18851
4 57852
1C-2 7182
A7 14059
MEINHARDT
PPP Solutions
MULTIPLEX
MULTIPLEX
FOR INFORMATION ONLY

APPENDIX B – Link – Node Diagram


FORENSIC AND PRISON HOSPITAL
LONG BAY CORRECTIONAL CENTRE
Proposed Stormwater System
Link – Node Diagram
Figure 2
OSD PH
OSD SPC
Calga Ave
PH
SPC
OSD 1C
OSD 3
NODE A
NODE A7
OSD 2
NODE B
OSD FH
NODE C
NODE 1C-2
NODE 22
OSD 4
Anzac Pde

APPENDIX C – RAFTS Model results

LONG BAY GAOL HOSPITAL WORKS
SUPPLEMENTARY POST CONSTRUCTION MODELLING
Appendix C.1

Model 8 - Includes As built but not OSD3 SW diversion or OSD4

Catchment	Predeveloped flows		Post- development flows (m3/s)		Post Devel. OSD3 Vol used (m3)
Storm Event	A	B	A	B	
Q100	12.00	3.00	5.70	0.52	*
Q20	7.60	2.20	4.47	0.49	*
Q5	4.70	1.30	3.33	0.48	*
Q1	2.00	*	*	*	*

Model 9 - Includes As Built + OSD3 SW diversion but not OSD4

Catchment	Predeveloped flows		Post- development flows (m3/s)		Post Devel. OSD3 Vol used (m3)
Storm Event	A	B	A	B	
Q100	12.00	3.00	2.55	0.52	4881
Q20	7.60	2.20	2.03	0.49	3239
Q5	4.70	1.30	1.55	0.48	2050
Q1	2.00	*	*	*	*

Model 10 - Includes As built, part OSD3 SW diversion (ie 60% catchment) but excludes OSD4 and Katingal

Catchment	Predeveloped flows		Post- development flows (m3/s)		Post Devel. OSD3 Vol used (m3)
Storm Event	A	B	A	B	
Q100	12.00	3.00	3.74	0.52	2997
Q20	7.60	2.20	2.93	0.49	1962
Q5	4.70	1.30	2.21	0.48	1208
Q1	2.00	*	*	*	*

Model 11 - Includes As built, part OSD3 SW diversion (ie 30% catchment) but excludes OSD4, and Katingal

Catchment	Predeveloped flows		Post- development flows (m3/s)		Post Devel. OSD3 Vol used (m3)
Storm Event	A	B	A	B	
Q100	12.00	3.00	4.16	0.52	2303
Q20	7.60	2.20	3.26	0.49	1493
Q5	4.70	1.30	2.45	0.48	899
Q1	2.00	*	*	*	*

* denotes data not recorded / noted
A = Catchment draining to Anzac Pde
B = Catchment drainng to Bilga Ave

LONG BAY GAOL HOSPITAL WORKS
SUPPLEMENTARY POST CONSTRUCTION MODELLING
Appendix C.2

Catchment	Catchment area (ha)	Catchment areas controlled			
		Run 8	Run 9	Run 10	Run 11
PH	5.18	5.18	5.18	5.18	5.18
SPC	1.46	1.46	1.46	1.46	1.46
Subtotal	6.64	6.64	6.64	6.64	6.64
3	0.95	0.95	0.95	0.95	0.95
2	2.19	2.19	2.19	2.19	2.19
FH	2.25	2.25	2.25	2.25	2.25
1B	6.15	-	6.15	3.69	1.84
1C	1.90	1.90	1.90	1.90	1.90
4	5.76	-	-	-	-
1C-2	0.72	0.72	0.72	0.72	0.72
A7	1.40	1.40	1.40	1.40	1.40
Subtotal	21.31	9.40	15.55	13.09	11.25
Total	27.95	16.05	22.19	19.73	17.89
% Catchment controlled		57%	79%	71%	64%

LONG BAY GAOL HOSPITAL WORKS
SUPPLEMENTARY POST CONSTRUCTION MODELLING
Appendix C.3

TABLE C.3.1 - Ranking of catchment areas controlled

Scenario	Model No.	% catch't controlled
4	9	79%
3	10	71%
2	11	64%
1	8	57%

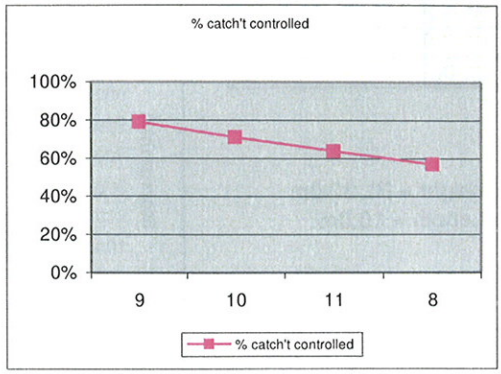
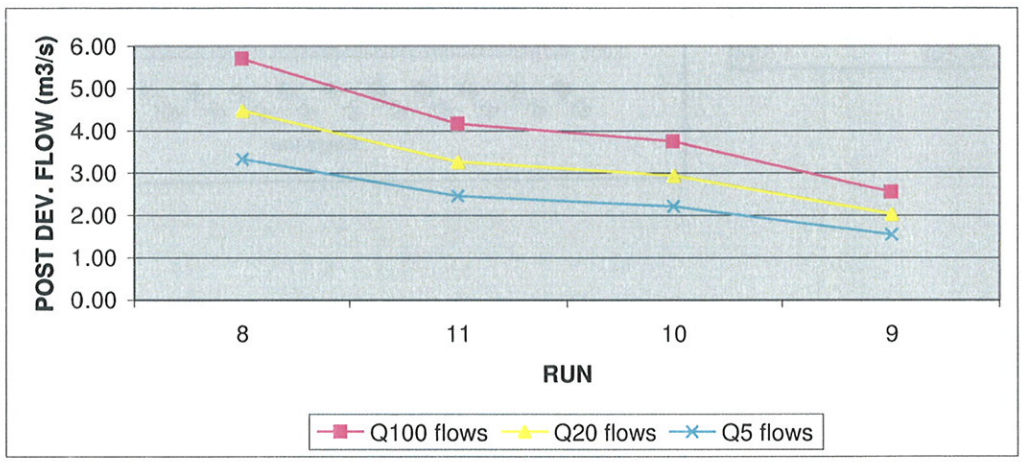


TABLE C.3.2 - Ranking of Post Devel. Flows

Scenario	Model No.	Q100 flows	Q20 flows	Q5 flows	% reduction of flows (1)
1	8	5.70	4.47	3.33	53%
2	11	4.16	3.26	2.45	65%
3	10	3.74	2.93	2.21	69%
4	9	2.55	2.03	1.55	79%

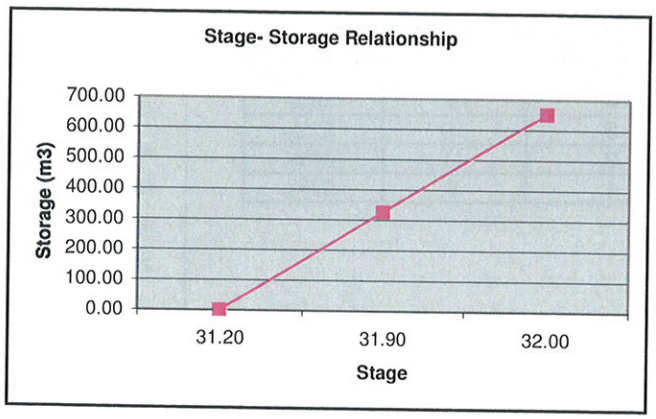
Note: (1) flows are based on a reduction of the 100 year ARI predeveveloped flows.



LONG BAY GAOL HOSPITAL WORKS
SUPPLEMENTARY POST CONSTRUCTION MODELLING
Appendix C.4

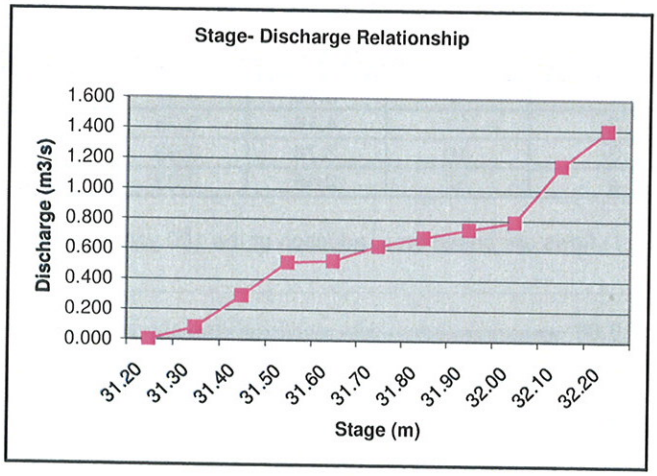
OSD 4 BASIN DESIGN CHARACTERISTICS

Stage (m)	Storage (m3)
31.20	0.00
31.90	326.20
32.00	651.20



Weir height = RL 32.0m
Weir Length = 10.0m

Stage (m)	Discharge (m3/s)
31.20	0.000
31.30	0.082
31.40	0.293
31.50	0.514
31.60	0.526
31.70	0.623
31.80	0.682
31.90	0.737
32.00	0.788
32.10	1.159
32.20	1.394



APPENDIX D – Aerial Photo of site


Malabar
Ireton St
Mitchell St
Warburton St
Wells St
Gilles St
Eyre St
Dampier St
Forrest St
Wills St
Macquarie St
Hastings Ave
Lasseter Ave
Mawson Pde
Anzac Pde
Raglan St
McGowen Ave
Victoria Ln
Victoria St
Fox St
Bay Pde
Bacre St
Bacre Ln
Howe St
Bonnie St
Austral St
Prince Edward St
Zions Ave
Lucas Ave
Nix Ave
Calga Ave
Bilga Cres
Eyna St
Nyrin St
Adams Ave
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Image © 2008 Sinclair Knight Merz
33°58'10.88" S 151°14'46.03" E
elev 29 m
Jan 20, 2007
Eye alt 1.51 km
Google