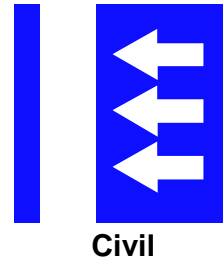**Taylor Thomson Whitting**

Consulting Engineers

Civil

Stormwater Analysis for Hornsby Ku-ring-gai Mental Health Campus Carpark

for Health Infrastructure

December 2010

TTW Job No: 101762

Taylor Thomson Whitting
48 Chandos Street
St Leonards NSW 2065
Ph: (02) 9439 7288
Fax   (02) 9439 3146
ACN: 001 282 711

Quality System

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Company
ISO 9001

SYDNEY

QEC 6625/01

CANBERRA

QEC 6625/02

MELBOURNE

QEC 6625/03

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                              (ii) Intensity-Frequency-Duration Table

                              (iii) Design Rainfall Intensity Chart

1.   INTRODUCTION

This report is submitted by Engineering Consultancy firm, Taylor Thomson Whitting (TTW) who have been engaged by Hassell Pty Ltd to prepare the stormwater drainage concept design for the proposed commercial development at the Hornsby Ku-ring-gai Hospital Campus.

2.   EXISTING DEVELOPMENT

The site is located at Hornsby Ku-ring-gai Hospital (HKH) and is bound by Lowe Road to the north, Burdett Street to the south, Derby Road to the east and Palmerston Road to the West (Refer to Site Plan in Appendix A).

The total site area is approximately 6.4 hectares. The site is fully developed consisting of pervious and impervious surfaces with access roads, gravel/bitumen car parks, buildings and landscaped areas.

3.   PROPOSED DEVELOPMENT

The proposed development encompasses an area of approximately 10,020m^2 (1 hectare) in the north-west of the site. It involves the construction of buildings in the very northwest corner near Lowe Road and Palmerston Road. Bordering this to the south along the Palmerston road side is a car park development consisting of approximately 150 car parking spaces. (Refer to Site Plan in Appendix A).

The areas of new development can be separated into 2 catchments (refer to Catchment Plans in Appendix B). Stormwater runoff from catchment 1 (the area of buildings to the north of the development area) falls steadily to the north and out to Lowe Road. Stormwater runoff from catchment 2 (the area of carpark to the south of the development area) falls to the north and east. There are existing stormwater links around the site. This infrastructure can be found to the north at the intersection of Lowe Road and Palmerston Road with an outlet pipe heading north and away from the site, and also to the east where the existing drainage infrastructure falls towards Derby road.

The finer workings of connecting these catchments to the existing drainage system will be determined during the detailed design stage of the project.

4. STORMWATER DRAINAGE SYSTEM AND OVERLAND FLOW ISSUES

4.1 Stormwater Design Parameters

Stormwater drainage includes all stormwater pipework, and overland flow paths from the building downpipes at the point where they enter the ground outside buildings to the site discharge points.

The stormwater drainage system has been designed to adequately protect all buildings and the environment from damage associated with stormwater and prevent ponding on paved surfaces. Water will be collected from both paved and unpaved surfaces so that the overland flow across areas that are roofed such as walkways are minimised.

Outlets shall be positioned to minimise water ponding outside the building, footpath, roads or in other areas and prevent water from flowing to descending steps.

The design will be such that in the event of blockage or other failure of the stormwater system, water will not enter the buildings but will escape over adjoining paved or ground surfaces in the manner of the major/minor system recommended by "Australian Rainfall and Runoff".

4.2 External Council System Adjacent to the Site

There is an existing road drainage system at the intersection of Lowe Road and Palmerston Road at the northern site boundary, consisting of kerb inlet pits and pipes. The external stormwater runoff falls to the north, from the northern site boundary. This is also the case at the intersection of Lowe Road and Derby Road. The existing buildings to the east of the development site currently drain to this discharge point. Public stormwater drainage can be seen at the intersection of Burdett Street and Derby Road.

4.3 Internal Site Stormwater System

The proposed internal site stormwater drainage system is designed to comply with Hornsby Shire Council's Medical Support Development Control Plan 1996 – Drainage Control. The stormwater pipes servicing the development will be designed to cater for the 1 in 20 year ARI event. This has been based on a time of concentration of 5 minutes. This is consistent with Hornsby Shire Council's requirements for drainage control. Rational method calculations have been used to generate site flows, which are shown in Appendix B.

The On Site Detention (OSD) system has been designed to capture all of the catchment runoff. The permissible site discharge has been calculated as the pre-development flow for the 1 in 5 year Average Recurrence Interval (ARI) event with 5 minute duration. This is to ensure that the peak discharge from the site does not exceed that prior to the development for all stormwater events up to and including the 20 year ARI event.

A mass curve analysis method has been applied in accordance with accepted industry practice. Hornsby Shire Council's policy for OSD storage was consulted while using Australian Rainfall and Runoff to determine detention volumes, pipe sizes and overland flow paths. Detailed mass curve analysis calculations and the results are shown in Appendix C. The calculations show that the peak site discharge does not exceed that prior to the new development.

The mass curve analysis resulted in the following required OSD detention volumes:

- Catchment 1 = 19m^3
- Catchment 2 = 25m^3

Detention of these volumes would be obtained through the construction of below ground reinforced concrete tanks. The OSD systems will utilise pre-treatment in a gross pollutant trap to remove rubbish, oils etc. The OSD discharges will be limited to pre-development 5yr ARI flows (5 minute storm duration). The OSD systems will retain stormwater volumes for all storms up to and including 20yr ARI storm (with any duration) in accordance with Hornsby Shire Council Drainage and OSD Policy.

5. CONCLUSION

The proposed development will not impact the existing Council stormwater system flow conditions for both the piped system and the overland flow system.

Prepared by: Authorised by:
TAYLOR THOMSON WHITTING   **TAYLOR THOMSON WHITTING**

ANDREW WALLACE   **PAUL YANNOULATOS**
Civil Engineer   **Technical Director - Civil**

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APPENDIX A

(i) Site Plan
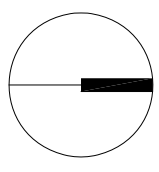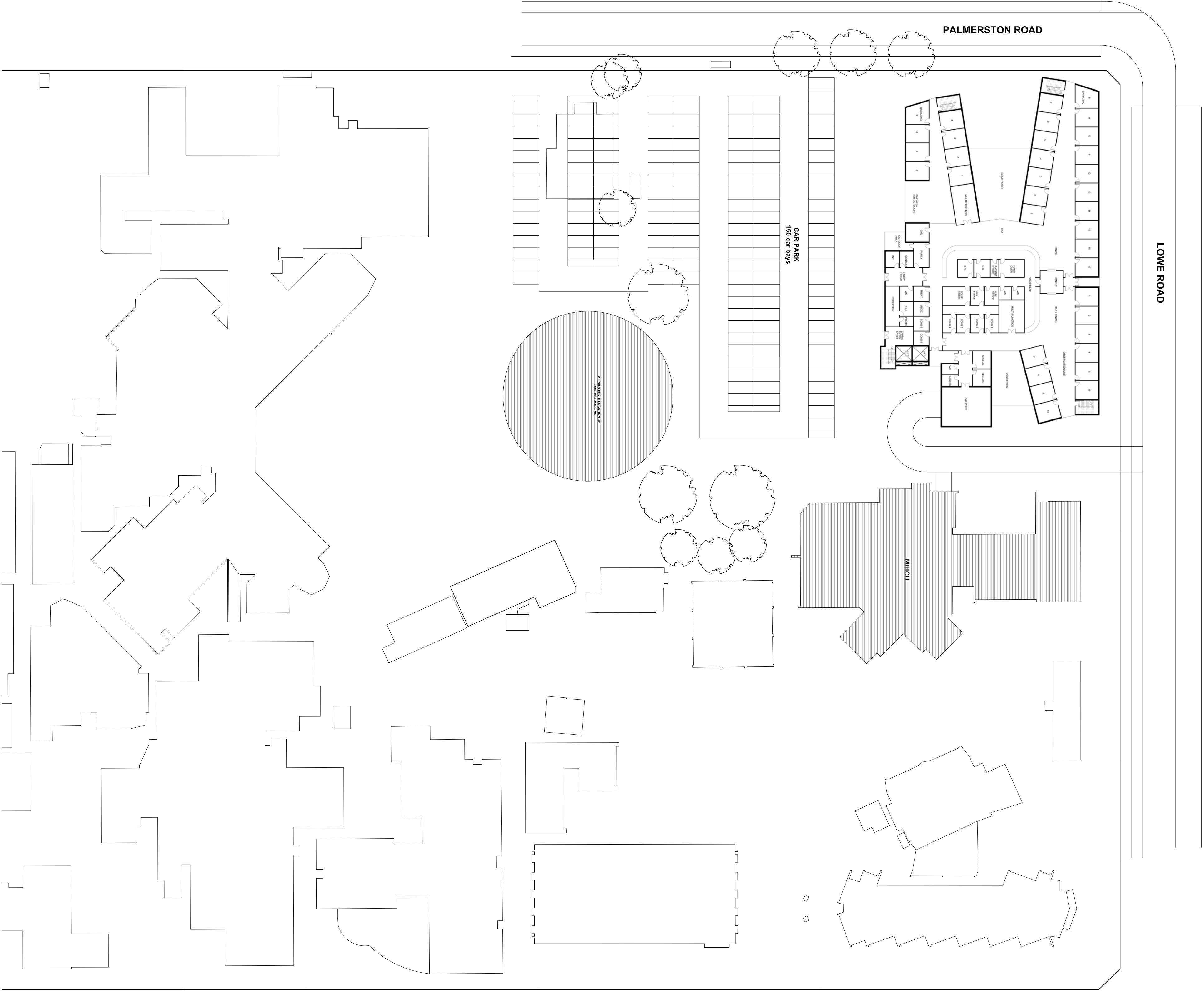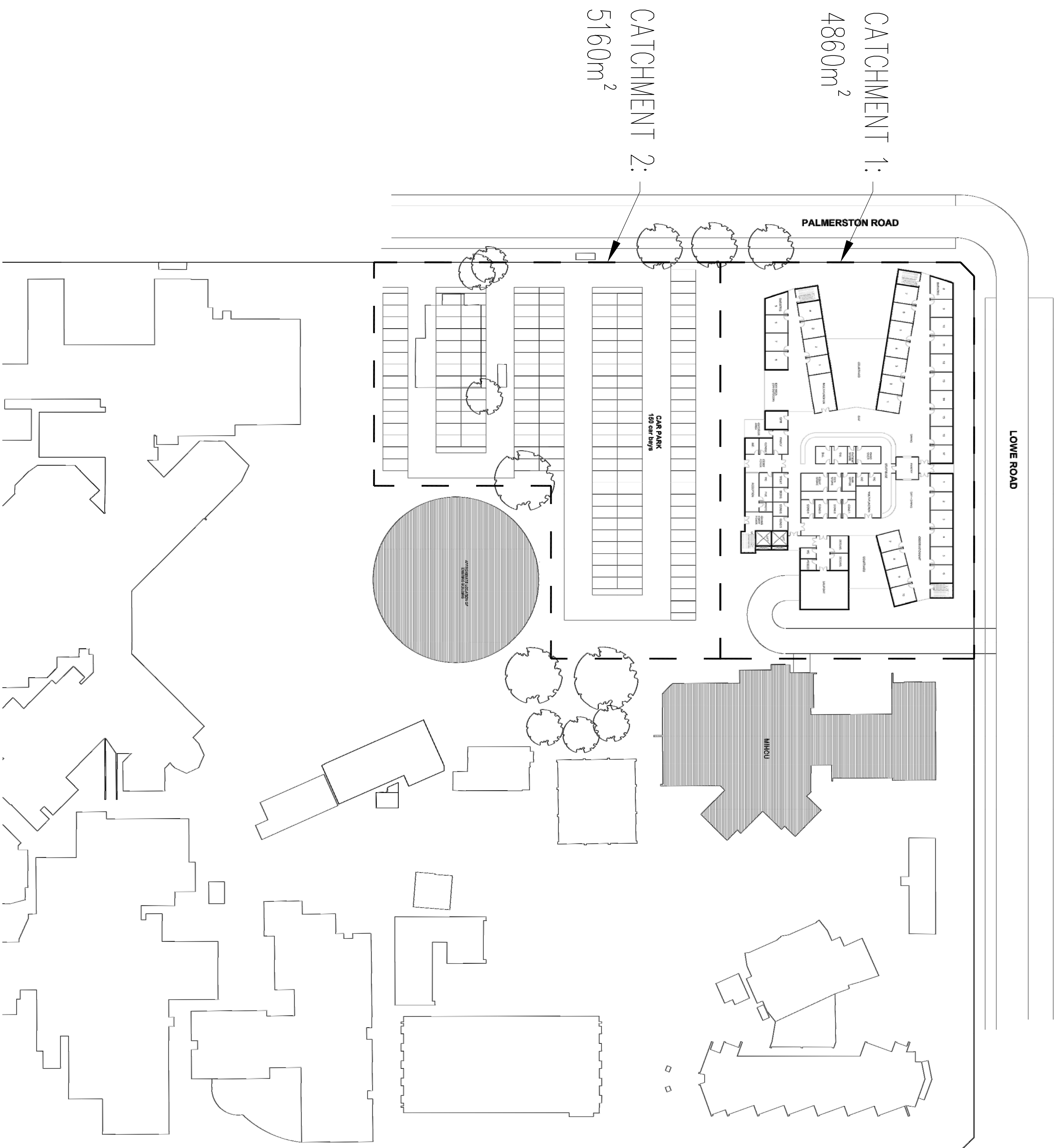
DRAWING :

PRELIMINARY

0   2.5   7.5   12.5   25m
1:500 @ A1
1:1000 @ A3

SCALE :   1:250 @ A1
DATE :   30/11/10

OPTION 5
GROUND FLOOR

PALMERSTON ROAD

LOWE ROAD

CAR PARK
150 car bays

MHICU

APPENDIX B

(i) Catchment Plans

CATCHMENT 1:
4860m^2

CATCHMENT 2:
5160m^2

PALMERSTON ROAD

LOWE ROAD

CAR PARK
160 car bays

MHOU

Rev   Description   Eng   Draft   Date
P1   PRELIMINARY   -   -

Architect

Project
HORNSBY HOSPITAL, MENTAL
HEALTH UNIT

Sheet Subject
CATCHMENT PLAN

PRELIMINARY

Scale : A1
1:500

Drawn
MK

Authorised

Job No
101762

Drawing No
SKC01

Revision
P

Plot File Created: Dec 09, 2010 - 3:44pm

APPENDIX C

(i) Mass Curve Analysis (5yr-20yr ARI) – OSD sizing

(ii) Intensity-Frequency-Duration Table

(iii) Design Rainfall Intensity Chart

HORNSBY KU-RING-GAI MENTAL HEALTH HOSPITAL OSD1-Catchment 1
Mass Curve Detention Analysis

Existing 5 year discharge data

Catchment Area = 4860 sq.m	Impervious 3900 sq.m =	80 percent
Time of concentration = 5 min	I_s= 145 mm/hr	
Runoff Coefficient = 0.9	C_s= 0.86	
ARI = 20 Years		
Discharge rate = 0.17 cu.m/s	Pre-development 5 year discharge	

Time	I mm (15 Min) 121.8	Q cu.m	SUMQ	Cumulative Discharge	Storage Required	I mm (20 Min) 107	Q cu.m	SUMQ	Cumulative Discharge	Storage Required	I mm (25 Min) 95.7	Q cu.m	SUMQ	Cumulative Discharge	Storage Required
0	117	43	43	43	**0**	81	30	30	30	**0**	81	30	30	30	**0**
5	183	67	109	93	**16**	184	67	97	80	**17**	134	49	78	78	**0**
10	66	24	133	133	**0**	128	47	144	131	**13**	187	68	147	129	**17**
15			133	133	**0**	34	12	156	156	**0**	43	16	162	162	**0**
20			133	133	**0**			156	156	**0**	33	12	174	174	**0**
25			133	133	**0**			156	156	**0**			174	174	**0**
30			133	133	**0**			156	156	**0**			174	174	**0**
35			133	133	**0**			156	156	**0**			174	174	**0**
40								156	156	**0**			174	174	**0**
45								156	156	**0**			174	174	**0**
50													174	174	**0**
55															
60															
65															
70															
75															
80															
85															
90															
95															
100															
105															
110															
115															

Time	I mm (30 Min) 87.5	Q cu.m	SUMQ	Cum. Disch.	Storage Req	I mm (45 Min) 70.8	Q cu.m	SUMQ	Cum. Disch.	Storage Req	I mm (60 Min) 60.7	Q cu.m	SUMQ	Cum. Disch.	Storage Req	I mm (90 Min) 50.82	Q cu.m	SUMQ	Cum. Disch.	Storage Req	I mm (120 Min) 41.3	Q cu.m	SUMQ	Cum. Disch.	Storage Req
0	84	31	31	31	**0**	31	11	11	11	**0**	28	10	10	10	**0**	29	11	11	11	**0**	22	8	8	8	**0**
5	131	48	78	78	**0**	90	33	44	44	**0**	51	19	29	29	**0**	54	20	30	30	**0**	53	19	27	27	**0**
10	173	63	142	129	**13**	157	57	101	95	**7**	122	45	74	74	**0**	134	49	79	79	**0**	31	11	38	38	**0**
15	47	17	159	159	**0**	117	43	144	144	**0**	87	32	105	105	**0**	75	27	106	106	**0**	49	18	56	56	**0**
20	58	21	180	180	**0**	61	22	166	166	**0**	169	62	167	156	**11**	95	35	141	141	**0**	95	35	91	91	**0**
25	32	11	191	191	**0**	74	27	193	193	**0**	74	27	194	194	**0**	192	70	211	192	**19**	52	19	109	109	**0**
30			191	191	**0**	48	17	210	210	**0**	65	24	217	217	**0**	49	18	229	229	**0**	178	65	175	160	**15**
35			191	191	**0**	39	14	225	225	**0**	42	15	233	233	**0**	48	18	247	247	**0**	123	45	219	211	**9**
40			191	191	**0**	21	8	232	232	**0**	35	13	245	245	**0**	40	15	261	261	**0**	56	20	240	240	**0**
45			191	191	**0**			232	232	**0**	23	8	254	254	**0**	28	10	272	272	**0**	31	11	251	251	**0**
50			191	191	**0**			232	232	**0**	19	7	260	260	**0**	39	14	286	286	**0**	33	12	263	263	**0**
55			191	191	**0**			232	232	**0**	14	5	266	266	**0**	31	11	297	297	**0**	42	15	278	278	**0**
60								232	232	**0**			266	266	**0**	19	7	304	304	**0**	43	16	293	293	**0**
65								232	232	**0**			266	266	**0**	22	8	312	312	**0**	21	8	301	301	**0**
70								232	232	**0**			266	266	**0**	20	7	320	320	**0**	22	8	309	309	**0**
75													266	266	**0**	12	4	324	324	**0**	34	12	321	321	**0**
80																14	5	329	329	**0**	19	7	328	328	**0**
85																12	4	333	333	**0**	12	4	332	332	**0**
90																		333	333	**0**	10	4	336	336	**0**
95																		333	333	**0**	23	8	344	344	**0**
100																					9	3	348	348	**0**
105																					13	5	352	352	**0**

Storage Required = 19 cu.m

101762 - Mass curve analysis.XLS 10/12/2010 12:01 PM

HORNSBY KU-RING-GAI MENTAL HEALTH HOSPITAL   OSD2-Catchment 2
Mass Curve Detention Analysis

Existing 5 year discharge data

Catchment Area =	5160 sq.m	Impervious 4150 sq.m =	80 percent
Time of concentration =	5 min	I_5= 145 mm/hr	
Runoff Coefficient =	0.95 (max 100% impervious)	C_5= 0.86	
ARI =	20 Years		
Discharge rate =	0.18 cu.m/s	Pre-development 5 year discharge	

Time	15 Min I mm (121.8)	Q cu.m	SUMQ	Cumulative Discharge	Storage Required	20 Min I mm (107)	Q cu.m	SUMQ	Cumulative Discharge	Storage Required	25 Min I mm (95.7)	Q cu.m	SUMQ	Cumulative Discharge	Storage Required
0	117	48	48	48	**0**	81	33	33	33	**0**	81	33	33	33	**0**
5	183	75	122	101	**21**	184	75	108	87	**22**	134	55	88	87	**1**
10	66	27	149	149	**0**	128	52	161	141	**20**	187	76	164	141	**24**
15			149	149	**0**	34	14	175	175	**0**	43	18	182	182	**0**
20			149	149	**0**			175	175	**0**	33	14	195	195	**0**
25			149	149	**0**			175	175	**0**			195	195	**0**
30			149	149	**0**			175	175	**0**			195	195	**0**
35			149	149	**0**			175	175	**0**			195	195	**0**
40								175	175	**0**			195	195	**0**
45								175	175	**0**			195	195	**0**
50													195	195	**0**

Time	30 Min I mm (87.5)	Q cu.m	SUMQ	Cum Disch	Storage	45 Min I mm (70.8)	Q cu.m	SUMQ	Cum Disch	Storage	60 Min I mm (60.7)	Q cu.m	SUMQ	Cum Disch	Storage	90 Min I mm (50.82)	Q cu.m	SUMQ	Cum Disch	Storage	120 Min I mm (41.3)	Q cu.m	SUMQ	Cum Disch	Storage
0	84	34	34	34	**0**	31	12	12	12	**0**	28	12	12	12	**0**	29	12	12	12	**0**	22	9	9	9	**0**
5	131	54	88	88	**0**	90	37	49	49	**0**	51	21	32	32	**0**	54	22	34	34	**0**	53	21	30	30	**0**
10	173	71	159	142	**17**	157	64	114	103	**11**	122	50	82	82	**0**	134	55	89	88	**1**	31	13	43	43	**0**
15	47	19	178	178	**0**	117	48	161	157	**5**	87	36	118	118	**0**	75	31	119	119	**0**	49	20	63	63	**0**
20	58	24	202	202	**0**	61	25	186	186	**0**	169	69	187	172	**15**	95	39	158	158	**0**	95	39	102	102	**0**
25	32	13	214	214	**0**	74	30	216	216	**0**	74	30	217	217	**0**	192	78	237	212	**25**	52	21	123	123	**0**
30			214	214	**0**	48	20	236	236	**0**	65	26	244	244	**0**	49	20	257	257	**0**	178	73	196	176	**19**
35			214	214	**0**	39	16	252	252	**0**	42	17	261	261	**0**	48	20	277	277	**0**	123	50	246	230	**16**
40			214	214	**0**	21	9	260	260	**0**	35	14	275	275	**0**	40	16	293	293	**0**	56	23	268	268	**0**
45			214	214	**0**			260	260	**0**	23	9	284	284	**0**	28	12	305	305	**0**	31	13	281	281	**0**
50			214	214	**0**			260	260	**0**	19	8	292	292	**0**	39	16	321	321	**0**	33	13	294	294	**0**
55			214	214	**0**			260	260	**0**	14	6	298	298	**0**	31	13	333	333	**0**	42	17	311	311	**0**
60								260	260	**0**			298	298	**0**	19	8	341	341	**0**	43	17	329	329	**0**
65								260	260	**0**			298	298	**0**	22	9	350	350	**0**	21	9	337	337	**0**
70								260	260	**0**			298	298	**0**	20	8	358	358	**0**	22	9	346	346	**0**
75													298	298	**0**	12	5	363	363	**0**	34	14	360	360	**0**
80																14	6	369	369	**0**	19	8	368	368	**0**
85																12	5	374	374	**0**	12	5	373	373	**0**
90																		374	374	**0**	10	4	377	377	**0**
95																		374	374	**0**	23	9	386	386	**0**
100																					9	4	390	390	**0**
105																					13	5	395	395	**0**

Storage Required =   25   cu.m

Intensity-Frequency-Duration Table

Location: 33.700S 151.100E NEAR.. Hornsby Mental Health Campus Issued: 9/12/2010

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	89.1	114	145	163	187	218	241
6Mins	83.5	107	137	153	176	205	227
10Mins	68.4	87.8	112	126	145	169	188
20Mins	49.8	64.1	82.3	92.9	107	125	139
30Mins	40.5	52.1	67.2	76.0	87.5	103	114
1Hr	27.6	35.7	46.3	52.5	60.7	71.4	79.6
2Hrs	18.6	24.0	31.4	35.7	41.3	48.7	54.4
3Hrs	14.7	19.0	24.9	28.3	32.9	38.8	43.3
6Hrs	9.81	12.7	16.7	19.1	22.2	26.3	29.4
12Hrs	6.51	8.48	11.2	12.9	15.0	17.8	20.0
24Hrs	4.23	5.54	7.45	8.59	10.1	12.1	13.6
48Hrs	2.65	3.49	4.79	5.58	6.60	7.98	9.04
72Hrs	1.96	2.60	3.61	4.23	5.03	6.11	6.96

(Raw data: 35.65, 8.51, 2.6, 71.27, 17.81, 6.11, skew=0.00, F2=4.3, F50=15.85)