Woolacotts.
CONSULTING ENGINEERS

Curl Curl North Public School

Stormwater Management Report

3 May 2018 | 16-258

Contents

Document control

Rev	Date	Revision details	Approved	Verified	Prepared
A	20/04/17	Issued for DA	SDC	JL	JG
B	6/09/17	Amended for staging of works	SDC	JL	JL
C	02/05/18	Updated Draft Issue	SDC	AP	AP
D	03/05/18	Re-Issued for DA	SDC	AP	AP

1.0 Introduction

Curl Curl North Public School is an existing facility located on the corner of Playfair Road and Abbott Road. Currently the school facilities include games courts, outdoor learning areas, classroom blocks, a library, staff carpark and a series of demountable buildings.

Refer to Figure 1 below for the site location.

Figure 1 – Site location

The school is proposing a major redevelopment including demolition works and alterations and additions. This involves constructing new classrooms, playing fields, an administration and staff building, a library and a hall.

2.0 Existing Conditions

2.1 Site Conditions

The major redevelopment involves the whole site, with only two existing buildings and a covered outdoor learning area to remain.

The school site occupies approximately 2.8 hectares, approximately 43% of the site is currently impervious (1.2 hectares).

The site is bound by Playfair Road to the West, and Abbott Street to the South. The school neighbours a series of residential properties along its northern and eastern boundaries.

The site generally falls to the south-west at a grade of approximately 3%.

The site has been identified by Council to be within the medium flood risk planning precinct due to its proximity to Curl Curl Lagoon and location within the lower end of the larger catchment.

2.2 Existing Stormwater Drainage System

As part of the preparation of this report, the site was inspected on the 8th March 2017, to identify existing stormwater drainage structures within the site, and to gain further understanding of the overland flow paths.

Upon review of the available survey information and site visit, we believe stormwater runoff from the existing site drains to the south-eastern corner, collected by a series of pits and grated drains.

There is an existing 375 diameter pipe with inlet pits, located in the southern half of the site, which runs adjacent to the eastern boundary. This pipe system connects into the Council pit at the south eastern corner of the site on Abbott Road. The stormwater runoff not collected by this pipe system travels to Council's pit via overland flow, which is directed towards Curl Lagoon.

Council records indicate that there is an existing 750 diameter stormwater drainage pipeline traversing down the north eastern boundary of the site. However this pipeline or its corresponding pits were not identified on the survey plans by C.M.S Surveyors Pty Limited (DWG Name. 15728detail, Rev 3, dated 04/04/17) or during the site visit.

Council records also indicate a 900 diameter stormwater drainage pipeline traversing south along Playfair Road. Survey plans by C.M.S Surveyors Pty Ltd indicate that this pipe is a 1050 diameter concrete pipe that has a council pit just north of the intersection of Playfair Road and Abbott Road. Downstream of this pit is a 1200 diameter concrete pipe which heads south towards the Curl Curl Sports centre.

3.0 Proposed Development

The school is proposing a major re-development including demolition works and alterations and additions. This involves constructing new classrooms, playing fields, an administration and staff building, a library and a hall. The extent of works is as follows:

- Demolishing all existing buildings except Block L, Block M and the covered outdoor learning area towards the north-western corner of the site
- Constructing new blocks A and D along the western boundary of the site
- Constructing new blocks B, C and E along the eastern boundary of the site
- Refurbishments and additions to existing Blocks L and M
- Proposed sports field at the northern end of the site
- Proposed sports court with a covered outdoor learning area towards the north-western corner of the site
- Proposed car park and vehicular access at the southern end of the site
- Play areas and landscaping between the proposed Blocks
- A landscaped swale running down the middle of the site

Refer to Figure 2 below for the Proposed Site plan. For further details on the redevelopment works, refer to the architectural plans by TKD Architects and the landscape plans by Context Landscape.

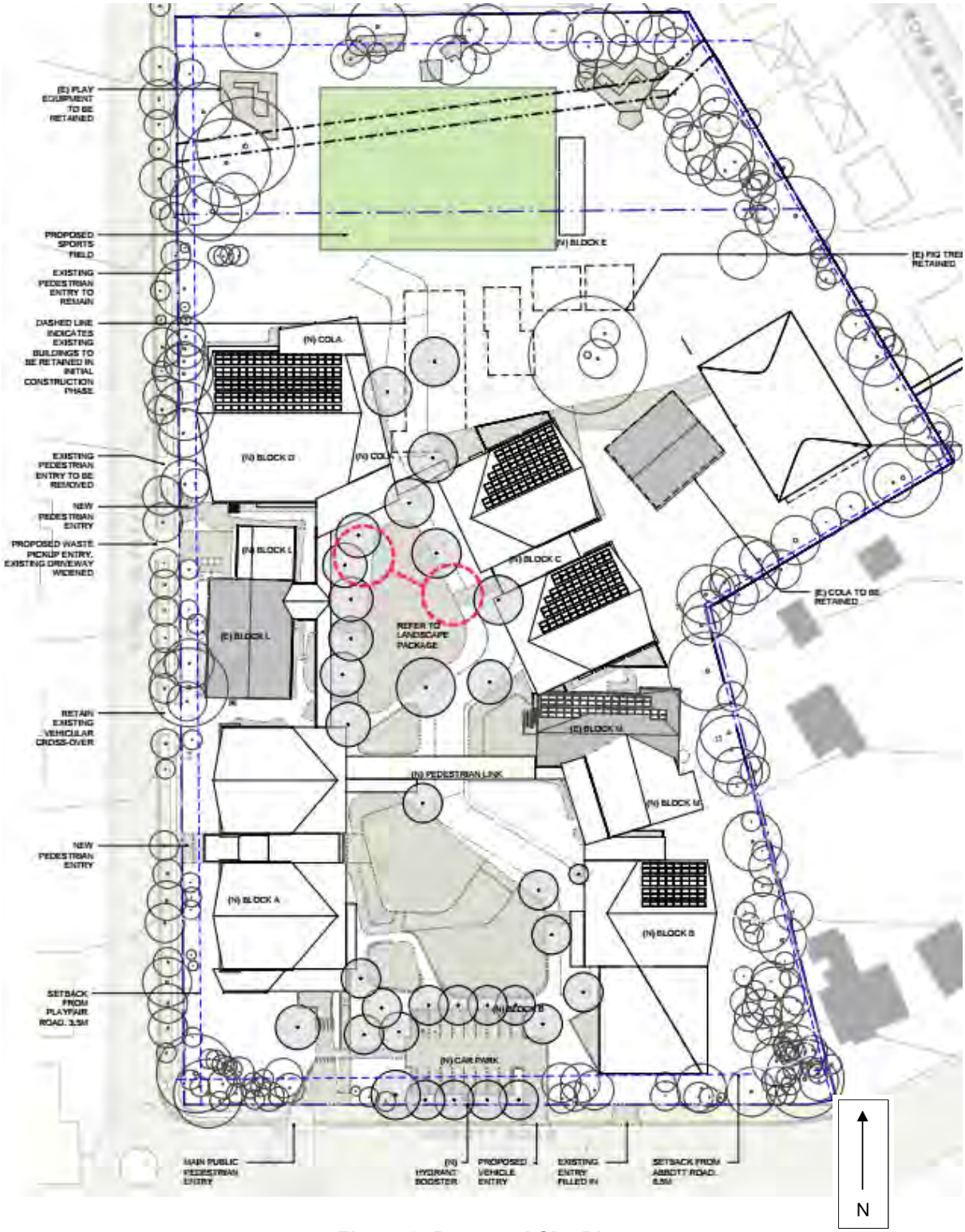


Figure 2: Proposed Site Plan

(Figure adopted from TDK Architect's Site Plans, Job No. 161029, Rev P4, Dated 05.04.18)

The proposed development is to take place in three stages as follows:

- Stage 1 involves:
    - The installation of construction fencing restricting public access to the southern half of the site
    - The demolition of Block A and playing field
    - The refurbishment of Block M
    - The Construction of new buildings on the southern half of the site including: Block A, Block B and Block C

    Refer to Figure 3 for the Stage 1 Site Plan

- Stage 2 involves:
    - The installation of construction fencing restricting public access to the northern half of the site
    - The removal of all, but 3, demountable buildings, which are located adjacent existing Blocks K and N.
    - The demolition of the remaining Blocks and playing fields, with the exception of Blocks K and N
    - The construction of buildings on the northern half of the site including: Block D and E
    - The construction of the proposed sports field and sports courts with covered outdoor learning area and
    - The refurbishment and expansion of Block L

    Refer to Figure 4 for the Stage 2 Site Plan

- Stage 3 involves:
    - The installation of construction fencing around existing Blocks K and N and the adjacent 3 demountable buildings
    - The removal of the remaining 3 demountable buildings
    - The demolition of Blocks K and N
    - The construction of landscaping areas and a Bush play Area

    Refer to Figure 5 for the Stage 3 Site Plan

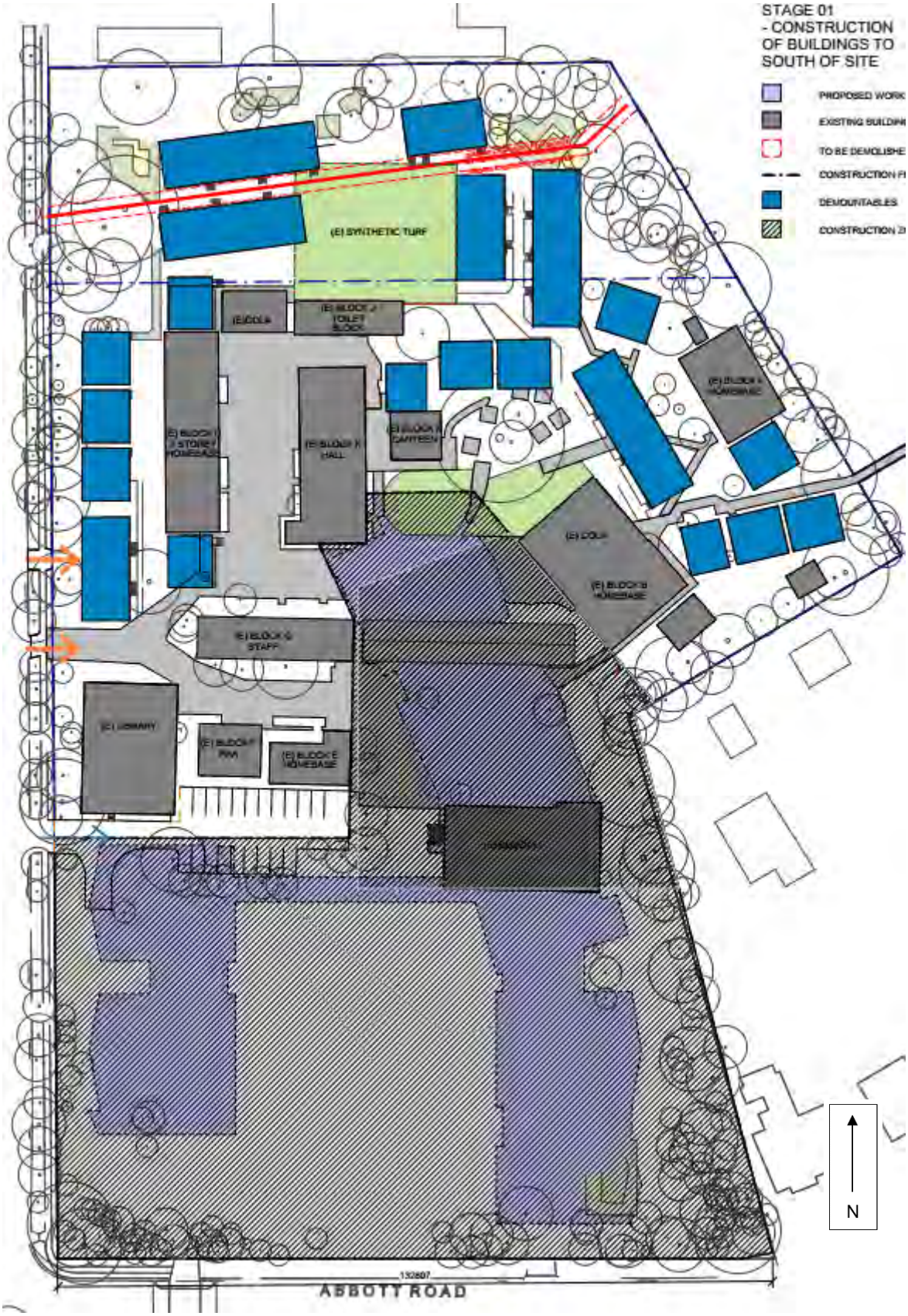


Figure 3: Stage 1 - Site plan

(Figure adopted from TDK Architect's Staging Sheet 1 of 2, Job No. 161029, Rev P2, Dated 11.04.18)

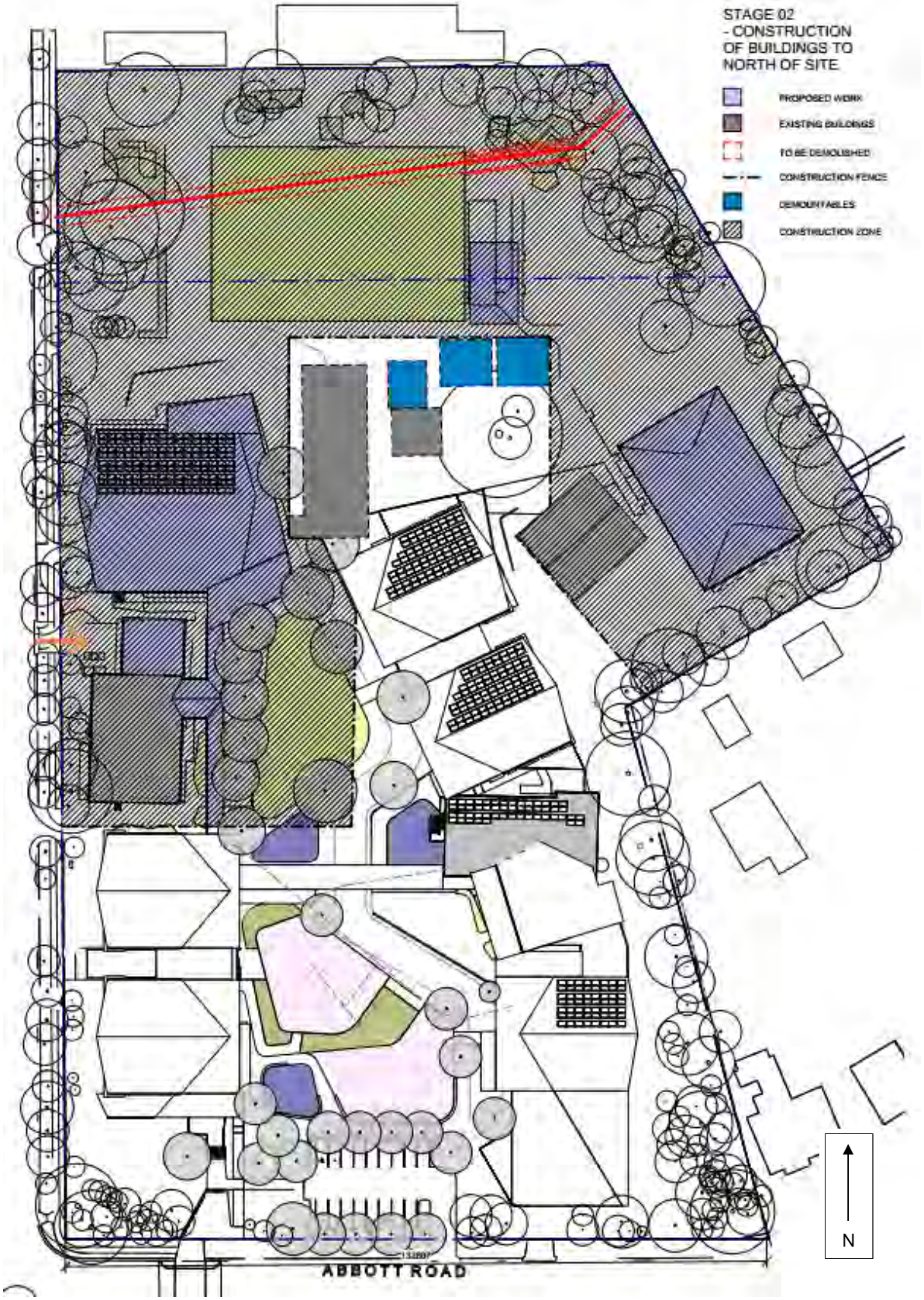


Figure 4: Stage 2 - Site plan

(Figure adopted from TDK Architect's Staging Sheet 1 of 2, Job No. 161029, Rev P2, Dated 11.04.18)

Figure 5: Stage 3 - Site plan

(Figure adopted from TDK Architect's Staging Sheet 2 of 2, Job No. 161029, Rev P2, Dated 11.04.18)

4.0 Stormwater Management

4.1 Proposed Stormwater Drainage System

The proposed stormwater drainage system has been developed to accommodate the redevelopment works. The proposed drainage system has been designed to carry runoff from storms up to and including the 5% AEP event (20 year ARI). This system will consist of grassed swales, grated inlet pits and pipes. For storm events greater than the 5% AEP up and including the 1% AEP refer to Section 4.3 Overland Flow Analysis below.

The majority of the proposed redeveloped site will discharge to Council's pit adjacent to the south western corner of the site (the pit located on the corner of Playfair Road and Abbott Road). The remainder of the site will discharge to the site's existing discharge point (the council pit along Abbott Road). Refer to Appendix A for the Stormwater Management Plan.

To determine if the existing 375 diameter pipe system that connects into the council pipe on Abbott Road has enough capacity to take the stormwater runoff from the eastern half of the site (for the 5% AEP event - 20 year ARI), a RAFTS-XP model was undertaken. This catchment area is approximately 0.9ha and approximately 22% impervious. The analysis resulted in a peak flow of 0.362m3/s for a 20 year ARI storm event. As this peak flow is greater than the capacity of a 375 diameter pipe at an assumed 2% slope, it is proposed connect straight into the Council pit on Abbott road which contains a 525 diameter pipe. Refer to Appendix A for the Stormwater Management Plan. Refer to Appendix B for the calculations and RAFTS output.

Note: The potential to connect into the existing 750 diameter pipeline traversing down the north eastern boundary of the site was investigated. However, as this pipeline is upstream of approximately 80% of the redevelopment works and its exact location/invert levels are unknown; it was not deemed feasible to use it as a discharge point.

4.2 On-site Detention

As the site is affected by the 1 in 100 year ARI flooding, on-site Stormwater detention for the development is not likely to provide significant benefit to the catchment with respect to flood mitigation. As a result, Council has advised that on-site detention is not required for this development.

4.3 Overland Flow Analysis

External Catchments

There is a large external catchment upstream of the site. For storm events larger than the 5% AEP up to and including the 1% AEP it is proposed to allow the runoff from this external catchment to pass safely through the site. Refer to Figure 6 below for the external catchment area.

This external catchment, as seen in Figure 6 below, has been subdivided into four areas. Catchments C and D, which enters the site via Playfield Road. Catchment B, which enters the site via the northern boundary and Catchment A which is the proposed development site.

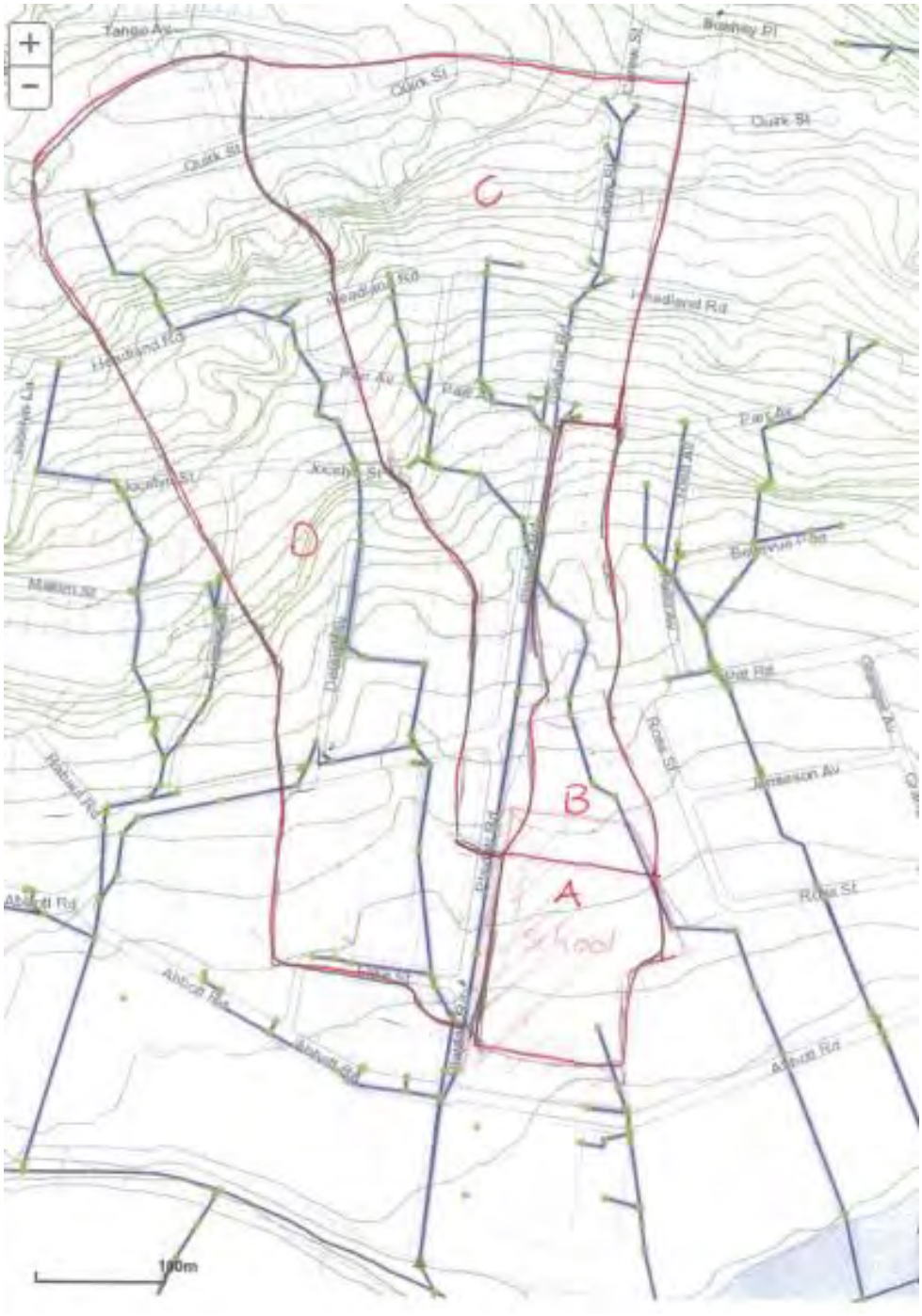


Figure 6: External Catchment Area

This external catchment was modelled in RAFTS-XP to determine the peak stormwater flows entering the site during the 1% AEP storm event (1 in 100 year ARI). Note: The external catchment was assumed to be 70% impervious. Refer to Table 1 below for the peak flows.

In regards to Catchment B, it was assumed the existing 750 diameter council stormwater drainage pipe servicing the area is at 50% capacity during the 1 in 100 year storm event due to blockage. This results in a remaining overland flowrate of 0.71m^3/s entering the northern boundary of the site. Refer to Table 1 below for the overland flow.

In regards to Catchments C and D, Playfield Road was modelled using computer program HEC-RAS to determine how much flow is carried by the road during the 1% AEP storm event before overtopping the kerb and entering the site. It was assumed that the existing street drainage was at 50% capacity due to blockage. The model revealed approximately 5m^3/s from catchments C and D, enters the north-western corner of the site via overland flow. Refer to Table 1 below for the overland flowrates and refer to Appendix B for the calculations.

Table 1 – 1% AEP Flowrates for External Catchments

Catchment	Total Area (ha)	Flowrate (m^3/s)	Overland Flowrates (m^3/s)
B	2.40	1.48	0.71
C	10.26	6.41	5.0
D	12.53	7.81	

Proposed Overland Flow Paths

The external catchments described above (Catchments B, C and D) result in two overland flow paths travelling through the site; one along the eastern boundary (Catchment B) and one through the centre of the site (Catchments C and D). In regards to the central flow path, it is proposed to construct a vegetated swale through the centre of the site to ensure that the overland flow path travels safely through the site for the 1 in 100 year ARI (1% AEP) storm event. In regards to the eastern flow path, it is also proposed regrade the existing levels to match into the natural contours as much as possible in order to allow the stormwater runoff to travel as sheet flow safely adjacent the eastern boundary.

The proposed floor levels of the future buildings will be set a minimum 500mm above the top water level of these two overland flow paths for the 1 in 100 year ARI (1% AEP) Storm event. Where this not is achievable/practical, the part/s of the building/s below the 500mm freeboard will have a flood proof wall constructed adjacent to the building with a minimum top of wall height equal to the 500mm freeboard level, in order to prevent stormwater runoff from entering the building.

To determine this floor level, the two proposed overland flow paths were modelled using the computer program HEC-RAS for the 1 in 100 year ARI (1% AEP) storm event. The overland flowrates were adopted from Table 1 above. Refer to Figure 7 below for the overland flow path location and Table 2 and Table 3 below for the water levels. Refer to Appendix B for Calculations and cross sections.

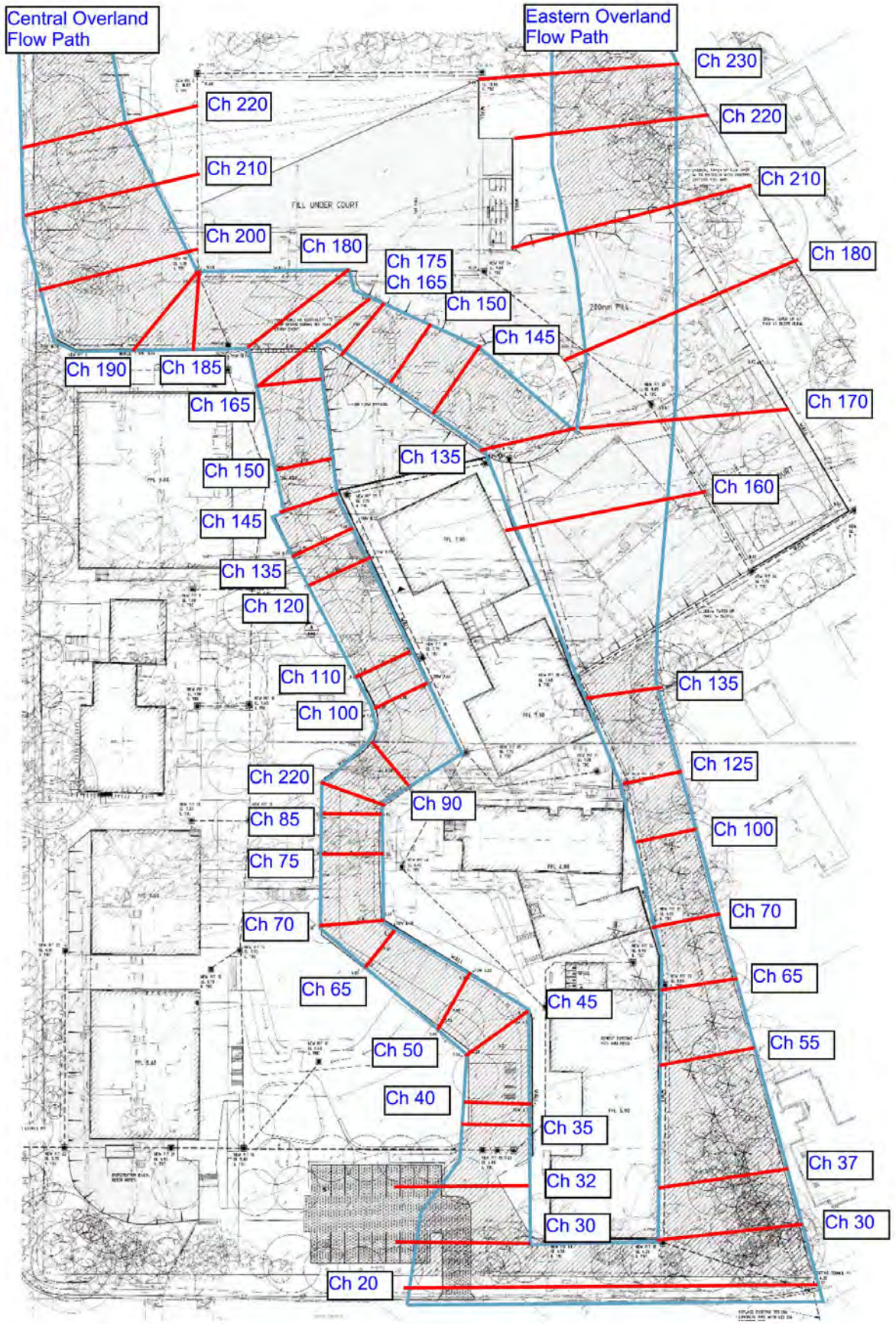


Figure 7: Overland Flow Paths Through Site

Table 2 – Minimum Floor Levels : Central Flowpath			
Chainage	**Water Level (RL)**	**Freeboard (mm)**	**Min Floor Levels (RL)**
220	10.60	500	11.1
210	10.18	500	10.68
200	10.04	500	10.54
190	9.71	500	10.21
185	9.65	500	10.15
180	9.50	500	10
175	9.45	500	9.95
165	9.21	500	9.71
150	8.06	500	8.56
145	7.74	500	8.24
135	7.70	500	8.2
120	7.58	500	8.08
110	7.38	500	7.88
100	7.14	500	7.64
90	6.72	500	7.22
85	6.50	500	7
75	6.23	500	6.73
70	6.05	500	6.55
65	5.98	500	6.48
50	5.73	500	6.23
45	5.44	500	5.94
40	5.27	500	5.77
35	4.95	500	5.45
32	4.76	500	5.26
30	4.63	500	5.13
20	4.22	500	4.72

Table 3 – Minimum Floor Levels : Eastern Flowpath			
Chainage	**Water Level (RL)**	**Freeboard (mm)**	**Min Floor Levels (RL)**
230	10.45	500	10.95
220	10.01	500	10.51
210	9.51	500	10.01
180	9.22	500	9.72
170	8.67	500	9.17
160	8.27	500	8.77
135	7.62	500	8.12
125	7.22	500	7.72
100	6.77	500	7.27
70	6.22	500	6.72
65	5.83	500	6.33
55	5.38	500	5.88
37	4.55	500	5.05
30	4.42	500	4.92
20	3.9	500	4.4
165	9.45	500	9.95
150	9.34	500	9.84
145	8.81	500	9.31
135	8.66	500	9.16

Velocity Depth Analysis

A velocity depth analysis was carried out on the two proposed overland flow paths using the above computer model HEC-RAS to ensure that the safety of the students during the 1 in 100 year ARI (1% AEP) storm event. The velocity depth was carried out in accordance with the Flood Plan Development Manual and AR&R 2016, so that the velocity x depth ratio was less than 0.4 and the depth was less than 0.5m. The results of this analysis are in Table 4 and 5 below.

Table 4 – Velocity x Depth Analysis: Central Flowpath			
Chainage	**Depth (m)**	**Velocity (m/s)**	**V x D**
220	0.27	1.27	0.34
210	0.14	1.92	0.27
200	0.24	0.99	0.24
190	0.35	1.11	0.39
185	0.4	0.91	0.36
180	0.36	0.96	0.35
175	0.41	0.73	0.30
165	0.22	1.36	0.30
150	0.16	1.97	0.32
145	0.19	1.6	0.30
135	0.4	0.68	0.27
120	0.28	1.04	0.29
110	0.28	1.02	0.29
100	0.24	1.24	0.30
90	0.22	1.36	0.30
85	0.3	0.95	0.29
75	0.23	1.27	0.29
70	0.25	1.17	0.29
65	0.33	0.85	0.28
50	0.23	1.26	0.29
45	0.24	1.2	0.29
40	0.27	1.04	0.28
35	0.23	1.35	0.31
32	0.16	1.5	0.24
30	0.13	1.73	0.22
20	0.12	2.2	0.26

Table 5 – Velocity x Depth Analysis: Eastern Flowpath			
Chainage	**Depth (m)**	**Velocity (m/s)**	**V x D**
230	0.12	0.99	0.12
220	0.06	0.86	0.05
210	0.06	0.98	0.06
180	0.07	0.69	0.05
170	0.07	1.46	0.10
160	0.12	1.1	0.13
135	0.22	1.1	0.24
125	0.22	1.46	0.32
100	0.27	0.98	0.26
70	0.22	1.46	0.32
65	0.28	1.12	0.31
55	0.43	0.57	0.25
37	0.2	0.94	0.19
30	0.17	1.15	0.20
20	0.1	2.65	0.27
165	0.41	0.64	0.26
150	0.23	1.29	0.30
145	0.16	2.19	0.35
135	0.16	0.97	0.16

5.0 Flooding

The site is affected by 1 in 100 year ARI flooding (to RL 3.7m AHD), as identified within the Northern Beaches Council flooding information report. A portion at the lower end of the site is located within the PMF and below the Flood Planning Level. As a result the site is identified to be within the medium flood risk planning precinct. Refer to Woolacotts Flood Risk Assessment Report – Curl Curl North Public School (2017), for additional information.

The Flood Risk Assessment Report identifies design flood levels and provides recommendations on precautions to minimise risk to personal safety of occupants, including the risk of property damage of the total development in the event of a flood.

The reports also nominates the minimum Flood Planning Level of 4.2m AHD, which is equal to the 1 in 100 year ARI (1% AEP) flood level plus a 500mm Freeboard. All proposed buildings will have a floor level greater than 4.2m AHD.

6.0 Water Sensitive Urban Design

6.1 Requirements

Water sensitive urban design (WSUD) measures are required in accordance with the Northern Beaches Council WSUD and MUSIC Modelling Guidelines June 2016. According to Section 2.2.1 of the guidelines, the following Stormwater quality requirements apply to this development.

- 65% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)
- 85% reduction in total suspended solids (TSS)
- 90% reduction in gross pollutants
- Ph level of 6.5-8.5
- The post-development peak discharge must not exceed the pre-development peak discharge for flows up to the 2 year ARI

6.2 Water Efficiency

Buildings not affected by BASIX are to have the following minimum Water Efficiency Labelling and Standards (WELS) rated fittings:

- 4-star dual-flush toilets
- 3 star showerheads
- 4 star taps (for all taps other than bath outlets and garden taps)
- 3 star urinals
- 3.5 star washing machines
- 4 star dishwashers

6.3 Rainwater Tanks

Preliminary MUSIC modelling assumed 75% of the proposed roof areas are draining to rainwater tanks. With Blocks B, M and L draining to a 10KL rainwater tank and Blocks D, C and A draining to a 10KL rainwater tank.

6.4 Stormwater quality

A range of stormwater quality improvement devices and other WSUD measures are proposed for the development, to meet Council's water quality objectives. These include:

- SPEL Stormsack Gross Pollutant Traps (GPTs) or equivalent to be provided in all grated inlet pits
- The use of grassed swales throughout the site
- Using Ecotrihex Permable Paving for the carpark or equivalent
- 2 x 10KL rainwater tanks
- A SPEL Bioretention BASIN with a 4.9m2 footprint or equivalent.

The locations of these measures are shown on Drawings SW1 and SW2. In order to determine the effectiveness of these measures, a MUSIC model was developed, in accordance with Council's requirements. This includes the rainfall and evaporation inputs from section 3.1 and the rainfall runoff parameters and pollutant generation parameters in Section 3.2.

A catchment map used for the MUSIC Model is shown in Appendix C, along with the MUSIC model.

From the Music modelling, the following reduction in pollutants loads will be achieved with the proposed measures:

- A reduction total phosphorus (TP) by 66.6%
- A reduction in total nitrogen (TN) by 52%
- A reduction in total suspended solids (TSS) by 85.1%
- A reduction in gross pollutants by 99.5%

6.5 Maintenance

The proposed measures required maintenance on a regular basis. The proposed maintenance schedule is:

- SPEL Stormsack
    - To be inspected and cleaned of rubbish on a 3monthly basis or after a large storm event
- The use of grassed swales throughout the site
    - To be mowed regular basis and removed of debris/litter
- Rainwater tanks
    - The tanks shall be inspected at least once a year, to assess the build up of sludge or other material in the tank. When the depth of material in the base of the tank is 500mm deep, the tank will be emptied and cleaned.
- SPEL Bioretention BASIN
    - The device will be inspected at 6months after installation, to determine the build up of material. At this point a schedule will be developed for regular maintenance, which will be between every 6months and 1 year. Maintenance of the device will be in accordance with the manufacturer's recommendations.

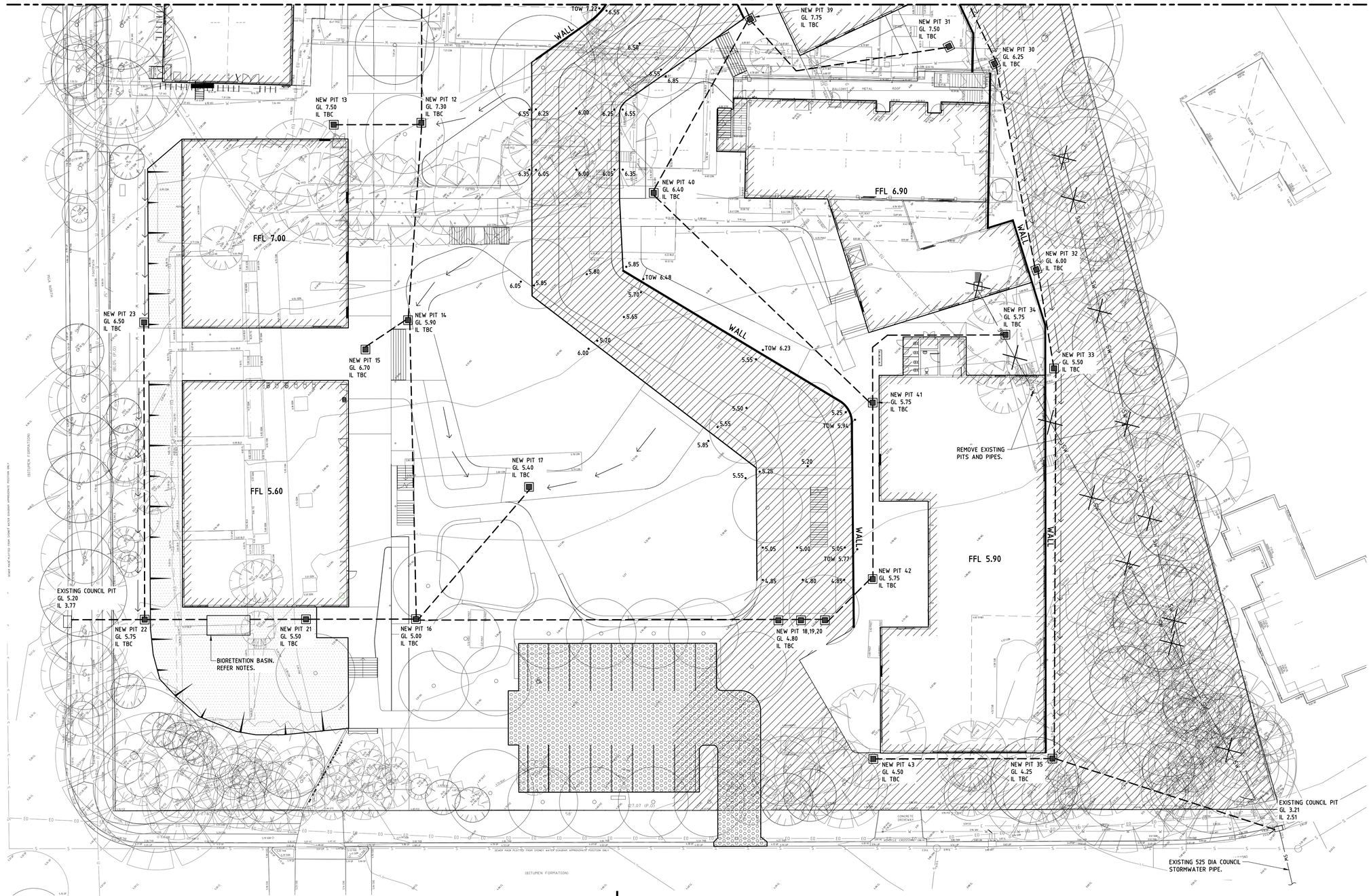
7.0 Erosion and Sediment Control

During construction, erosion and sediment control measures will be provided in accordance with the requirements of “Managing Urban Stormwater Soils and Construction, 4th Edition (Blue Book)”. These measures will include:

- Silt fences on the low side of the site
- Silt traps at Stormwater pits
- Two construction exits to remove silt from vehicles before they leave the site.
- Rock check dams for the swale until it has been revegetated
- Dust control measures will also be provided.

Refer to Appendix A – Drawings, ES1 and ES2 for the Erosion and Sediment Control Plan.

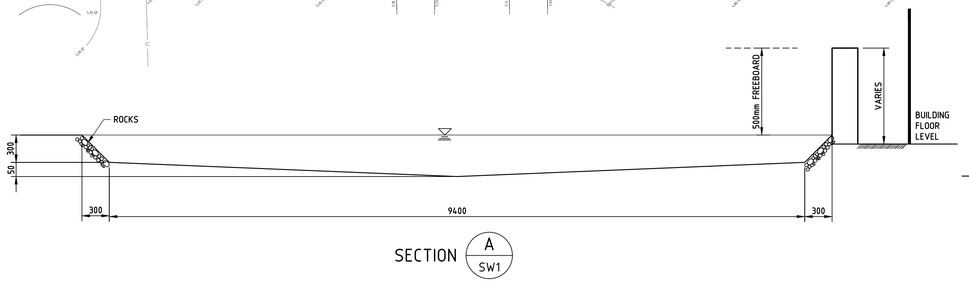
FOR CONTINUATION REFER DRAWING SW1



LEGEND

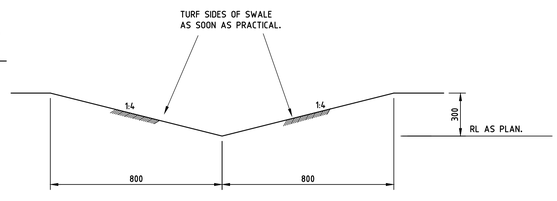
- TAPER AND FILL
- OVERLAND FLOW PATH
- ECOTRIHEX PERMABLE PAVING OR EQUIVALENT.
- NEW STORMWATER PIPE
- SW — EXISTING STORMWATER PIPE REMOVED
- PROPOSED WALL
- EDGE OF SWALE
- NEW SWALE
- NEW STORMWATER PIT
- EXISTING STORMWATER PIT
- GL — GRATE LEVEL
- IL — INVERT LEVEL
- TOW — MINIMUM TOP OF WALL LEVEL ADJACENT SWALE
- 3.80 — PROPOSED SPOT LEVEL
- EX 3.80 — EXISTING SPOT LEVEL

WSUD FEATURES
- SPEL STORMSACK OR EQUIVALENT TO BE PROVIDED IN ALL GRATED INLET PITS.
- BIORETENTION BASIN TO BE SPEL BASIN 4.9m² FOOTPRINT OR EQUIVALENT.
- ASSUMED 10kl RAINWATER TANKS FOR BLOCKS B, M AND 10kl FOR BLOCKS D, C, A.

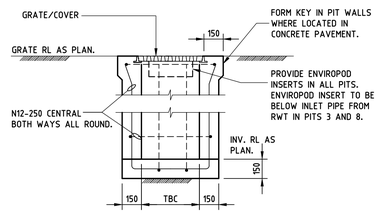


SECTION A / SW1

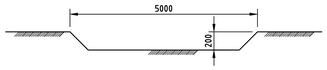
TYPICAL SWALE LONG SECTION
SCALE 1:20



SWALE DETAIL



STANDARD PIT DETAIL



HIGH FLOW BYPASS DETAIL

No.	Date	Description	Ver.	Appr.

Architect
TKD
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SURRY HILLS, NSW, 2010

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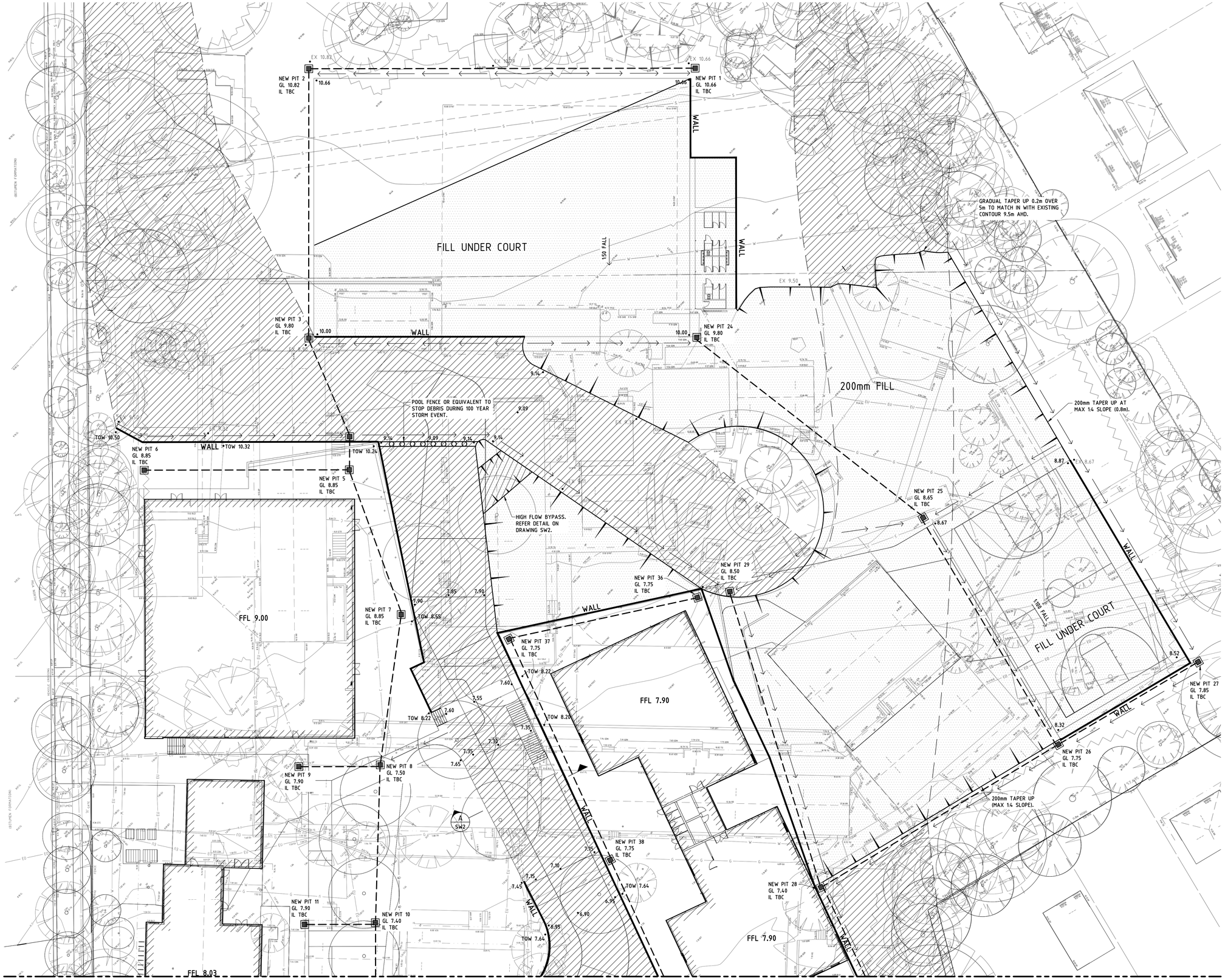
Ground Floor, 12a Brown Street, Chatswood, NSW 2067

CURL CURL NORTH PUBLIC SCHOOL

STORMWATER MANAGEMENT PLAN SHEET 2

Date	Approved	Verified	Prepared
MAY 2018	S.D.C	A.P	J.K
Scale @ B1 1:200, 20	02.05.18	02.05.18	02.05.18
Job number 16-258	Drawing number SW2		Amendment

Appendix A
Drawings



LEGEND

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No.	Date	Description	Ver.	Appr.

Architect
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CURL CURL NORTH PUBLIC SCHOOL

STORMWATER MANAGEMENT PLAN & DETAILS SHEET 1

Date	Approved	Verified	Prepared
MAY 2018	S.D.C 02.05.18	A.P 02.05.18	J.K 02.05.18
Scale @ B1: 1:200			
Job number: 16-258	Drawing number: SW1		Amendment