NORTHROP

CIVIL ENGINEERING REPORT: STORMWATER MANAGEMENT REPORT

St. Luke's Grammar School

800 Pittwater Rd, Dee Why NSW 2099

PREPARED FOR

Midson Group
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Ref: SY191248-CR01
Rev: 2
Date: 29.05.2020

Civil Engineering Report: Stormwater Management Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
28.02.2020	1	Issue for Development Application	E. Flack	T. Howe
29.05.2020	2	Re-Issue for Development Application	E. Flack	T. Howe

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1. General

1.1 Introduction

Northrop Consulting Engineers Pty Ltd (Northrop) have been engaged by Midson Group on behalf of The Anglican Schools Corporation to prepare the Civil Engineering design and documentation in support of a Development Application (DA) submission to the Northern Beaches Council for the proposed St. Luke's Grammar School development at 800 Pittwater Road & 210 Headland Rd, Dee Why NSW 2099.

This report covers the works shown as the Northrop Drawing Package required for the development of the site including:

- Stormwater Drainage;
- Stormwater Detention;
- Stormwater Quality / Water Sensitive Urban Design;

1.2 Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

- Development Application (DA) Civil Documentation prepared by Northrop; Job Number 191248, Revision 1, dated 02.12.19
- Design Guideline, PL850 – Water Management Policy prepared by Northern Beaches Council;
- NSW MUSIC Modelling Guidelines prepared by NSW Local Land Services August 2015;
- Dee Why South Catchment Floodplain Risk Management Plan (2015) prepared by Warringah Council.

1.3 Existing Site Conditions

The Proposed works area is comprised of 2 existing sites; 800 Pittwater Road (Lot 6 DP523299) and 210 Headland Drive (SP45082) located within the suburb of Dee Why in the Northern Beaches Council Local Government Area (LGA). Refer to Figure 1 for the proposed works area location.

Figure 1 - Locality Plan

1.3.1 800 Pittwater Road

The Pittwater Road site has an area of 10,240m^2, bounded by Pittwater Road to the west, the botanic gardens to the north, and industrial sites to the south and east.

The existing site currently contains a large partially heritage building housing 3 commercial premises and an underground carpark located along the Eastern boundary of the site with on-grade car parking facilities and loading area surrounding the main building. Vehicular access to the site is provided by a single existing entrance along Harbour Road.

The existing stormwater system is made up of 2 in-ground pit and pipe systems, running into two separate OSD tanks. As shown below in Figure 2, the pit and pipe system starting in the northern carpark leads to the OSD tank in the central carpark to the West of the existing building and the majority of the roof water runs into the OSD tank in the loading bay area to the South of the existing building. Both OSD tanks and associated discharge control pits connect via a pit an in-ground pit and pipe system along the entrance driveway before discharging to the council stormwater main via a kerb inlet pit at the driveway entrance on Harbour Road.

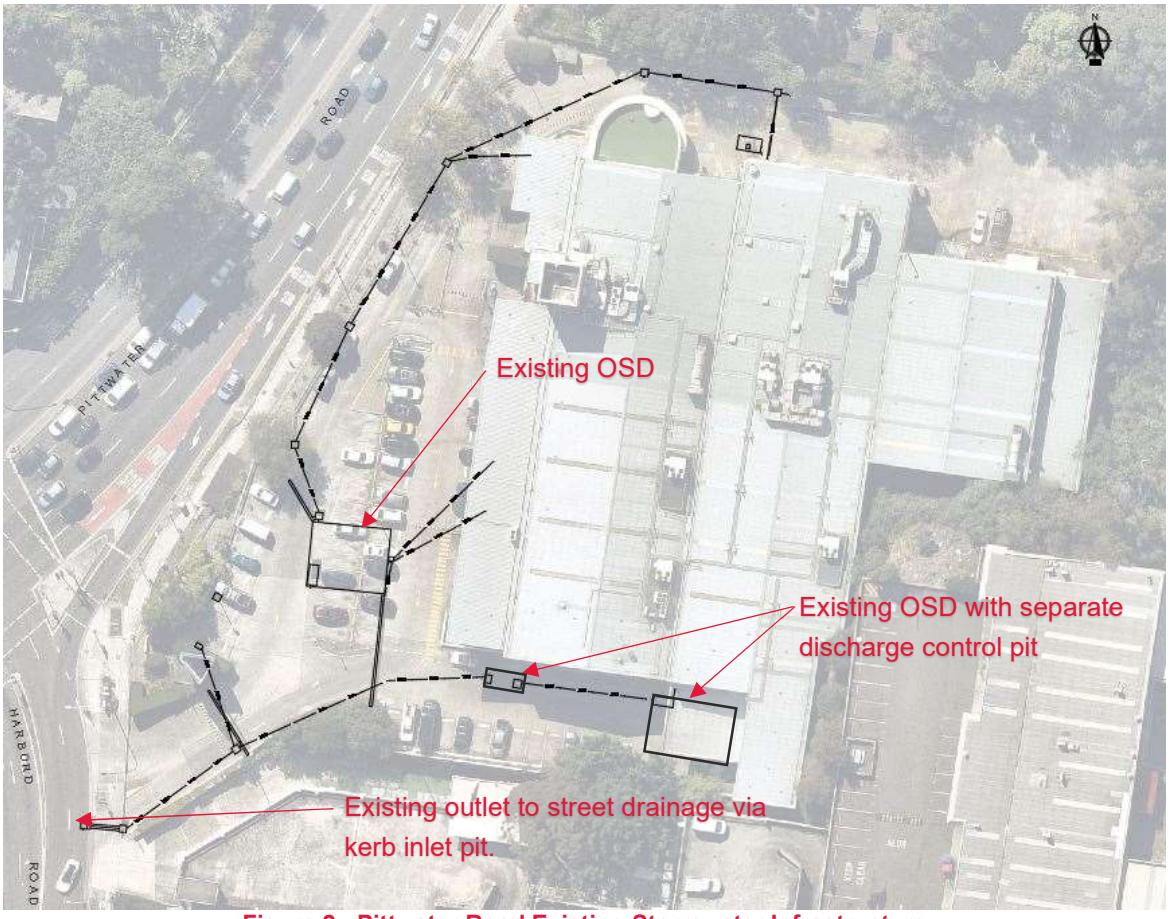

Figure 2 - Pittwater Road Existing Stormwater Infrastructure

Based on the survey undertaken by Stephen R. Carr, the general site levels fall from a maximum RL of approximately 41.3m AHD at the North Western corner of the carpark to a minimum RL of approximately 31.4m AHD at the entrance to the site in the South Eastern corner. The existing overland flow path generally follows the existing in-ground stormwater system.

1.3.2 224 Headland Road

The Headland Road site has an area of 5,236m^2, bounded by Headland Road to the South, the botanic gardens to the north, and industrial sites to the north, east and west.

The existing site currently contains a large industrial building located along the Eastern boundary of the site with car parking facilities and a driveway surrounding the main building. A large area of the existing car parking facility is suspended above natural ground level. Vehicular access to the site is provided by a single existing entrance on Headland Road.

Based on the survey undertaken by Stephen R. Carr, the general site levels fall from a maximum RL of approximately 57.3m AHD along the Eastern boundary of the carpark to a minimum RL of approximately 53.7m AHD at the entrance to the site in the South Western corner.

The existing stormwater system is made up of a combination of in-ground and suspended pipe and pit system. This network runs from the most Northern part of the carpark, towards the South and discharges into a kerb inlet pit on Harbour Road. The existing overland flow path generally follows the existing in-ground stormwater system.

1.4 Proposed Development

The proposed development includes the re-purposing of both existing buildings to be utilised for school premises. On the Pittwater Road site, the external carpark to the North and West of the

building is to be converted into external play areas, the carpark to the South will be reconfigured and the underground carpark will be extended. On the Headland Road site, the existing carpark will remain.

The proposed works will be undertaken in 3 separate stages, with the civil works as follows:

- Stage 1 – 224 Headland road – All civil works
- Stage 2 – 800 Pittwater Road Site – Repurposing of existing carpark area into external play area along Northern boundary
- Stage 3 – 800 Pittwater Road Site – Repurposing of remaining carpark area and loading bay into external play areas, drop off zone and new carparking area

Refer to the architectural drawings prepared by Tonkin Zulaikha Greer Architects (TZG) for more details.

A stormwater management strategy has been developed for the entire site to manage stormwater across the site. The strategy has been developed with consideration to Councils Water Management Policy. Details of the proposed stormwater strategy have been documented on Northrop's Civil DA drawing set.

2. Stormwater Management

2.1 Objectives and Controls

The stormwater strategy for the St. Luke's Grammar School development has been developed in accordance with Northern Beaches Council Water Management Policy and OSD Technical Specification.

The DCP outlines the following aims:

- Minimise the risk to public health and safety
- Reduce the risk to life and property from flooding
- Manage and minimise stormwater overland flow, nuisance flooding and groundwater related damage to properties
- Protect and improve the ecological condition or our beaches, lagoons, waterways, wetlands and surrounding bushland
- Encourage the reuse of water and alternative water sources
- Integrate water sensitive urban design measures into the built form to maximise amenity
- Protect Council stormwater drainage assets during development works and to ensure
- Council's drainage rights are not compromised
- Align development controls with the objectives of the Water Sensitive Warringah Strategic
- Plan and Environmental Sustainability Strategy Stormwater Management Overview

A stormwater management plan for the St. Luke's Grammar School development has been prepared by Northrop in order to satisfy the aims of the DCP as stated above. The key elements of the stormwater management include:

- Quantity (detention storage);
- Quality;
- Drainage network;

2.2 Proposed Stormwater Design

As there are no major changes being undergone for 224 Headland Road, there are no required changes for the existing stormwater system. Therefore, the following information is only regarding the site at 800 Pittwater Road.

For the Stage 2 works, stormwater runoff will be captured and conveyed predominantly via the existing in-ground stormwater pit and pipe network to one of the existing underground OSD tanks located in the carparking area. For the Stage 3 works the inground pit and pipe system will predominantly be new infrastructure located and sized to suit the reconfigured carpark.

For more details refer to Northrop's DA civil design Drawings (**Attachment A**).

2.3 Stormwater Quantity Management

The DRAINS software package has been used to model the hydrologic and hydraulic characteristics of stormwater runoff and flow across the site and determine the storage requirements for On-site Detention (OSD). This model has been prepared to assess the 5,10, 20, 50 and 100 year ARI storm event and determine the OSD size by restricting post development discharge to less than or equal to that of the pre development discharge.

2.3.1 Proposed OSD

As described in section 2.2, no stormwater changes will occur in stages 1 or 2, with the existing OSD tanks to be retained to service Stage 2. During stage 3, proposed works include the replacement of the existing loading bay with new carparking spaces and a new entrance into the existing basement carpark by lowering the existing surface level. This work conflicts with the existing loading bay OSD tank and as such this tank will be demolished. To achieve Council's OSD requirements, the underground OSD tank, which is in the carpark area to the West of the building, will be extended to provide a larger tank servicing the overall catchment.

Rainfall IFD data was obtained from the Bureau of Meteorology's 2016 data and an ILSAX model set up using the parameters given in the Council's OSD technical specification as seen below:

Table 1 – DRAINS model parameters

DRAINS parameter	Value
Paved storage	1 mm
Supplementary storage	1 mm (Not used in this model)
Pervious storage	5 mm
Soil type	2.5
Overland flow method	Kinematic Wave

The pre-development catchment is comprised of roofed structures, driveways, paving and landscaped areas. The post-development catchment is comprised of external landscaping, footpaths, driveway and the existing roof. A catchment plan for both pre- and post-development scenarios can be seen below in Figures 3 and 4.

Figure 3 – Pre-Development Catchment Plan

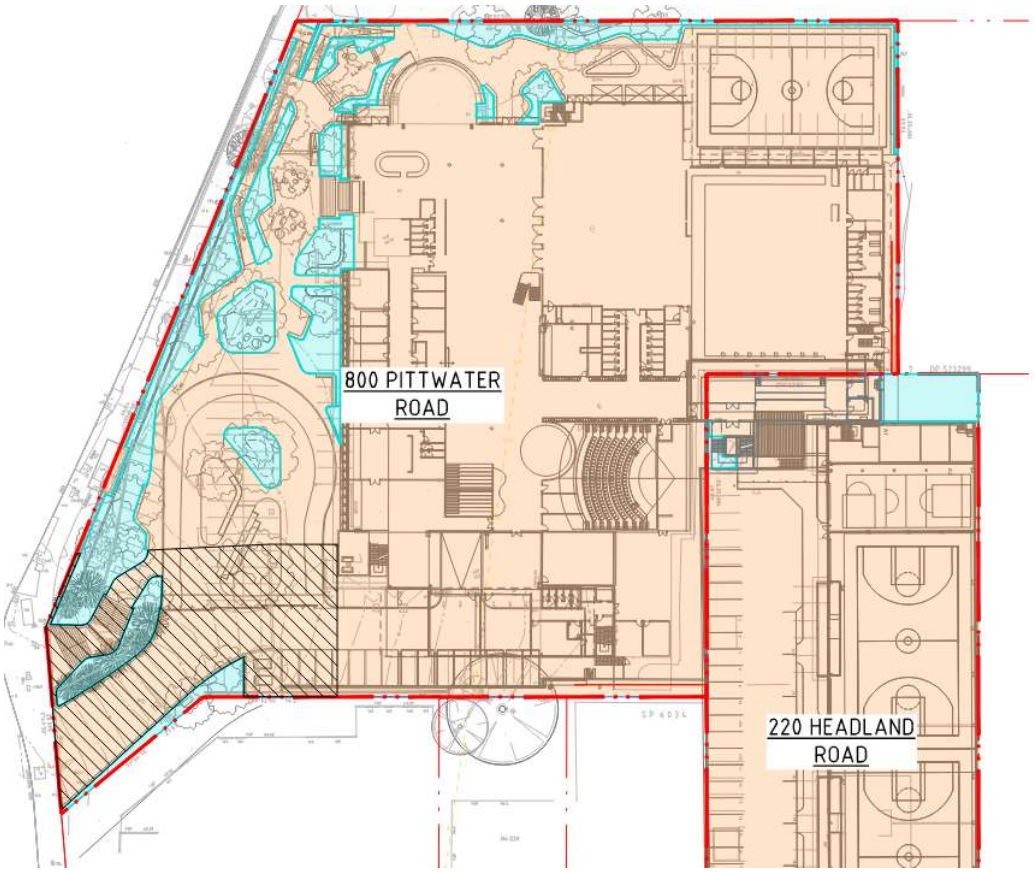

Figure 4 - Post-Development Catchment Plan

As illustrated in Figure 4, the post-development catchment has been divided into 2 sub-catchments; with the orange catchment representing the existing building and new proposed impervious areas, and the orange stripe catchments representing the proposed OSD bypass area. In accordance with Council's requirements, the pre-development site is considered to be green field (fully pervious) in determining the pre-development permissible site discharge. The total impervious and pervious areas for both pre and post-development for use in the DRAINS model are summarised in Table 2 below.

Table 2 - Catchment Areas for Pre & Post-Development

	Pre-Development	Post-Development
Total Area (m^2)	10,240	10,240
Impervious Area (m^2)	0	10,020
Pervious Area (m^2)	10,240	220

OSD must be designed to ensure the level of stormwater runoff discharged from the post development scenario does not exceed the peak stormwater discharge from the pre development scenario. The existing OSD tank is approximately 11m x 9m internally. The proposed OSD tank is 4.6m x 9m internally and is connected to the end of the existing OSD tank via 3 openings (1m wide and 0.5m high) making the combined total detention volume 183m^2. The proposed OSD utilises a series of low and high flow control measures including:

- Orifice 1 (Ø281mm) – Centreline RL 34.06
- Orifice 2 (Ø245mm) – Centreline RL 35.54
- Orifice 3 (Ø245mm) – Centreline RL 35.54

- Internal Wier Wall – RL 35.79

The results of the DRAINS model comparing the pre-development target flows and modelled post-development discharge is shown in the table below:

Table 3 – Site discharge summary

	Pre-Development L/s	Post Development (with OSD) L/s
0.2EY AEP	175	173
10% AEP	230	195
5% AEP	287	239
2% AEP	365	356
1% AEP	422	402

The results presented in Table 3 above indicate that the peak flows under proposed conditions can be appropriately managed to ensure that the peak stormwater flows do no exceed the pre development conditions.

2.4 Stormwater Quality Management

2.4.1 Adopted Water Quality Objectives

The stormwater quality management aims to reduce the pollutant load of stormwater runoff using a series of treatment devices prior to discharge into receiving waters.

Stormwater quality management measures have been modelled using MUSIC software. The targets for stormwater quality are outlined in the PL850 – Water Management Policy and are presented in Table 4 below:

Table 4 - Water Quality Targets

Pollutant	% Reduction Post-Development Average Annual Load Reduction
Gross Pollutants	90
Total Suspended Solids (TSS)	85
Total Phosphorous (TP)	65
Total Nitrogen (TN)	45

2.4.2 Stormwater Quality Management Scheme

The proposed water quality treatment train incorporated to meet the required targets includes proprietary stormfilters and proprietary pit baskets.

Pit baskets have been provided as a pre-treatment to target the pollutant reduction of gross pollutants, litter, grit, sediments and associated oils prior to stormwater discharging into OSD tank where the stormfilters are located to provide tertiary treatment .

2.4.3 Rainfall Data

Historical rainfall records were obtained from the Bureau of Meteorology and the MUSIC analysis was undertaken using a 6min time step for years 1981 – 1985 historical data.

The Evapotranspiration values have been entered as the industry standard for the Sydney area.

2.4.4 Methodology

The water quality modelling software MUSIC v6.3.0 was adopted for the study. Figure 5 shows the layout of the treatment train in the MUSIC Model.

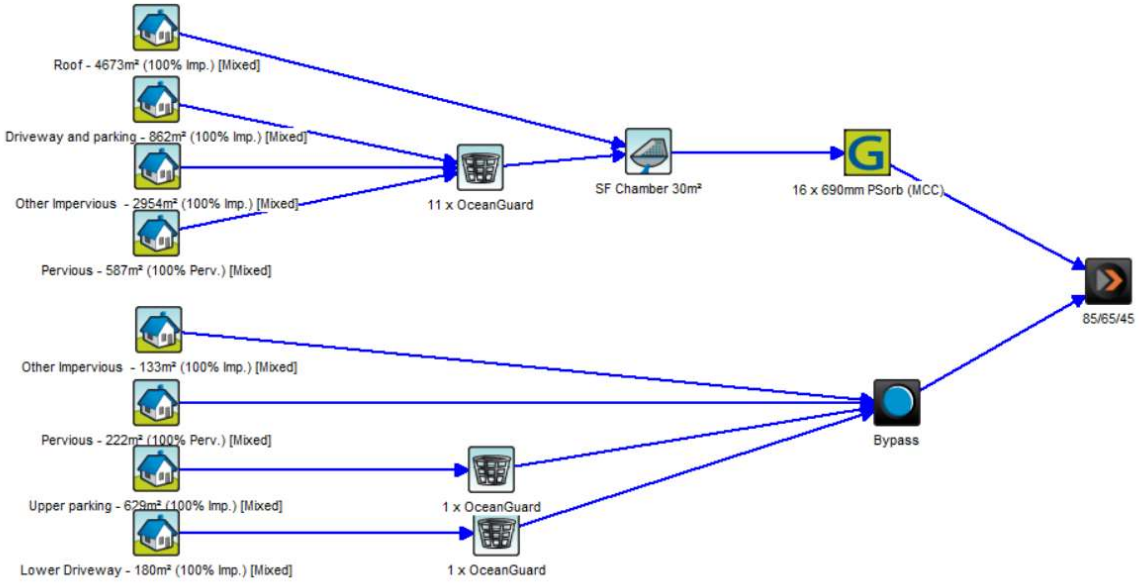

Figure 5 - MUSIC Link and Node Diagram

The following rainfall and runoff parameters have been adopted.

Table 5 - Rainfall Runoff Parameters

Parameter	Recommended Values
Rainfall Threshold (mm/day)	0.3
Soil Storage Capacity (mm)	108
Initial Storage (% of Capacity)	30
Field Capacity (mm)	73
Infiltration Capacity Coefficient – a	250
Infiltration Capacity Exponent – b	1.3
Initial Depth (mm)	10
Daily Recharge Rate (%)	60
Daily Baseflow Rate (%)	45
Daily Deep Seepage Rate (%)	0

The pollutant concentration parameters used in the model are listed in Table 6:

Table 6 - Water Quality Parameters for MUSIC Source Nodes

Land- Use Category		Log TSS (mg/L)		Log TP (mg/L)		Log TN (mg/L)	
		Storm Flow	Base flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Roof Areas	Mean	1.30	0.00	-0.89	0.00	0.30	0.00
	Std Dev	0.32	0.00	0.25	0.00	0.19	0.00
Road Areas	Mean	2.43	1.20	-0.30	-0.85	0.34	0.11
	Std Dev	0.32	0.17	0.25	019	0.19	0.12
Other Impervious Areas	Mean	2.15	1.20	-0.60	-0.85	0.30	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12
Pervious Areas	Mean	2.15	1.20	-0.60	-0.85	0.30	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12

2.4.5 MUSIC Model Results

The results of the analysis show the treatment train will achieve the water quality targets set out in Council's DCP. The water quality model provides an indication of the pollutant removal rates expected when the nominated treatment train of water quality measures is applied to the proposed development. The results are presented in Table 7.

Table 7 - MUSIC Model Results Extract from JWP's Report

Pollutant	Before Treatment	After Treatment	% Reduction	% Objective	Compliance
Gross pollutants (kg/yr)	277	3.69	98.7	90	OK
Total Suspended Solids (kg/yr)	1,440	175	87.8	85	OK
Total Phosphorus (kg/yr)	3.02	1.04	65.4	65	OK
Total Nitrogen (kg/yr)	24.7	13.2	46.5	45	OK

2.5 Flood Risk

Through the use of the Northern Beaches interactive mapping and the Dee Why South Catchment Floodplain Risk Management Plan, flood information was acquired for both sites. As seen in Figure 6 below (taken from the interactive mapping), neither site is within a flood risk precinct.

Figure 6 - Flood Risk Precincts

3. Conclusion

A stormwater management strategy has been derived for the proposed development in accordance with Council's Water Management Policy (PL 850). A 183m³ OSD storage system has been designed to ensure post development discharge is less than or equal to that of pre development discharge.

A treatment train has been developed using MUSIC software to demonstrate that the stormwater pollutant load reduction targets are achieved in accordance with Council's PL850 – Water Management Policy. The treatment train consists of proprietary pit baskets installed at each existing and proposed grated inlet pit and 16 proprietary stormfilter cartridges will be added to the OSD tank.

Attachment A – Civil DA Drawings

ST. LUKES GRAMMAR SCHOOL

NEW SENIOR SCHOOL CAMPUS
CIVIL ENGINEERING WORKS PACKAGE

SOURCE : NEARMAP.COM.AU (©2018)

DRAWING SCHEDULE	
DRG No.	DRAWING TITLE
DA1.01	COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN
DA1.11	GENERAL ARRANGEMENT PLAN
DA2.01	CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 1 - 224 HEADLAND RD
DA2.02	CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 2 - 800 PITTWATER RD
DA2.03	CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 3 - 800 PITTWATER RD
DA2.11	SEDIMENT AND EROSION CONTROL DETAILS
DA3.01	SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 1 - 224 HEADLAND RD
DA3.02	SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 2 - 800 PITTWATER RD
DA3.03	SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 3 - 800 PITTWATER RD
DA4.01	CATCHMENT PLAN
DA5.01	OSD DETAILS

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DESIGNED: E.FLACK
JOB MANAGER: E.FLACK
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DRAWING TITLE
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DRAWING NUMBER **DA1.01**

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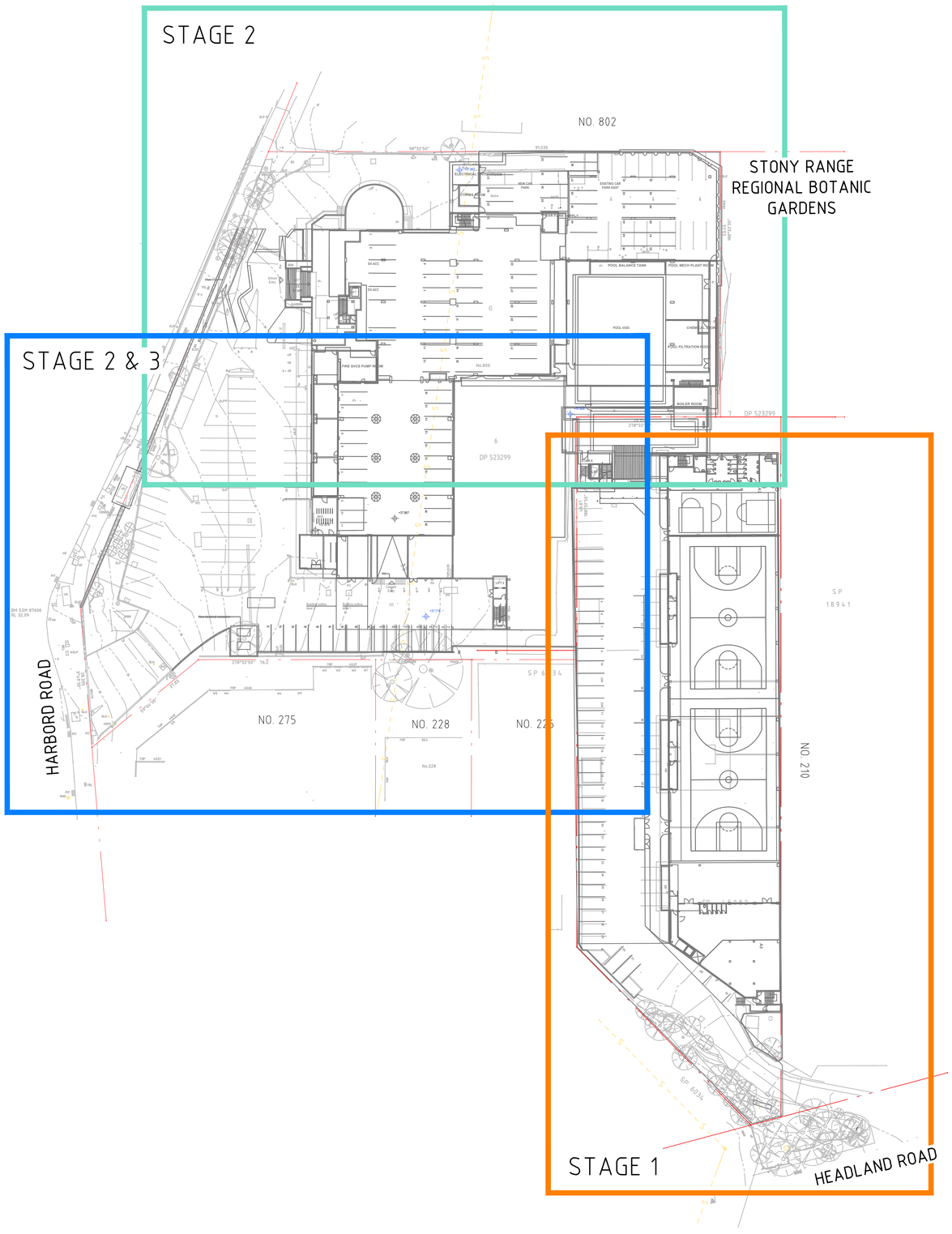

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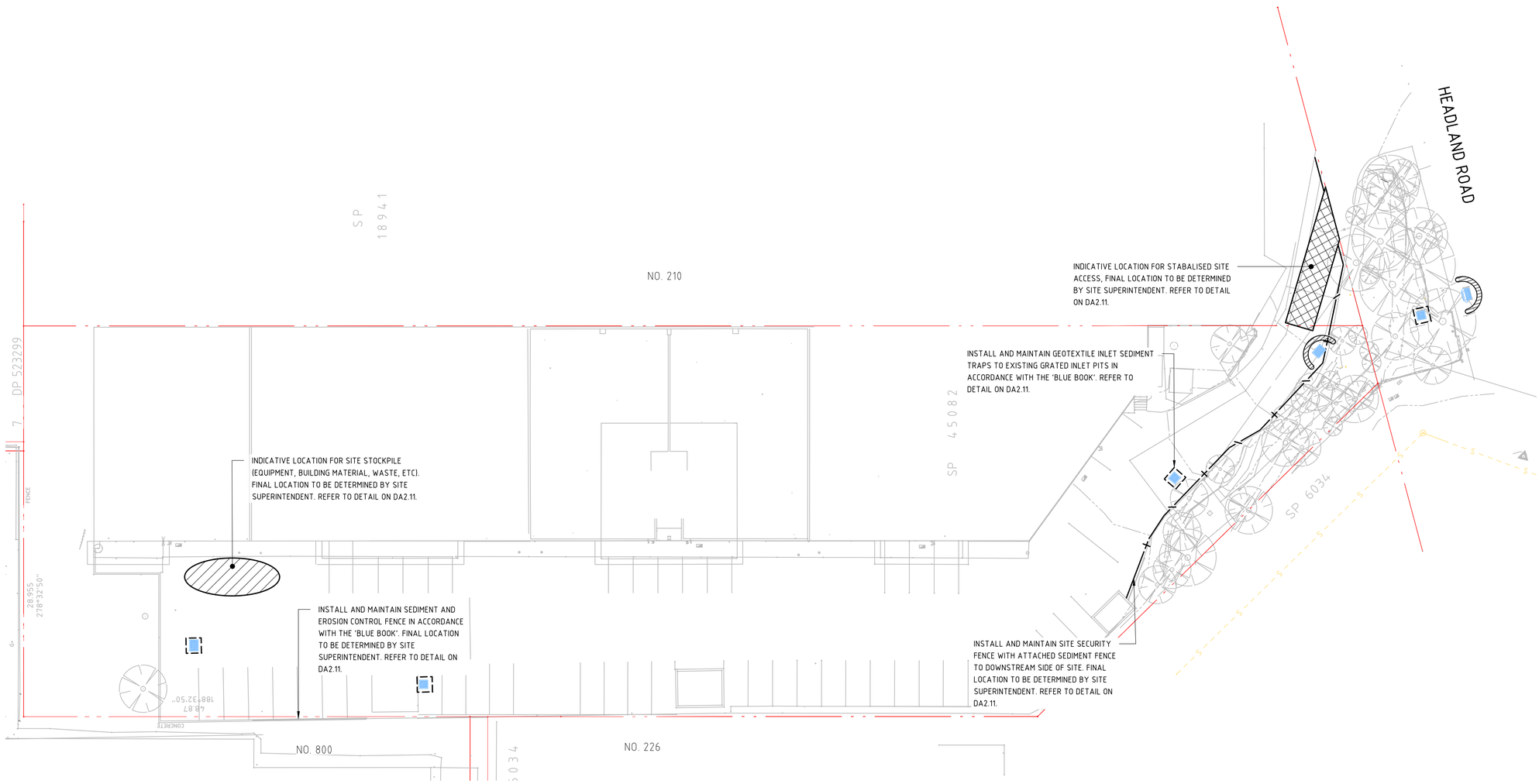

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- SEDIMENT FENCE
- SECURITY FENCE
- SEDIMENT FENCE ON SECURITY FENCE
- WIRE MESH AND GRAVEL SEDIMENT FILTER
- DROP INLET SEDIMENT TRAP
- STABILISED SITE ACCESS
- STOCKPILE

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3. CONTRACTOR TO PROVIDE 'WIRE MESH AND GRAVEL SEDIMENT FILTER' TO ALL PAVED / ROAD AREAS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'.
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CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 1 - 224 HEADLAND RD

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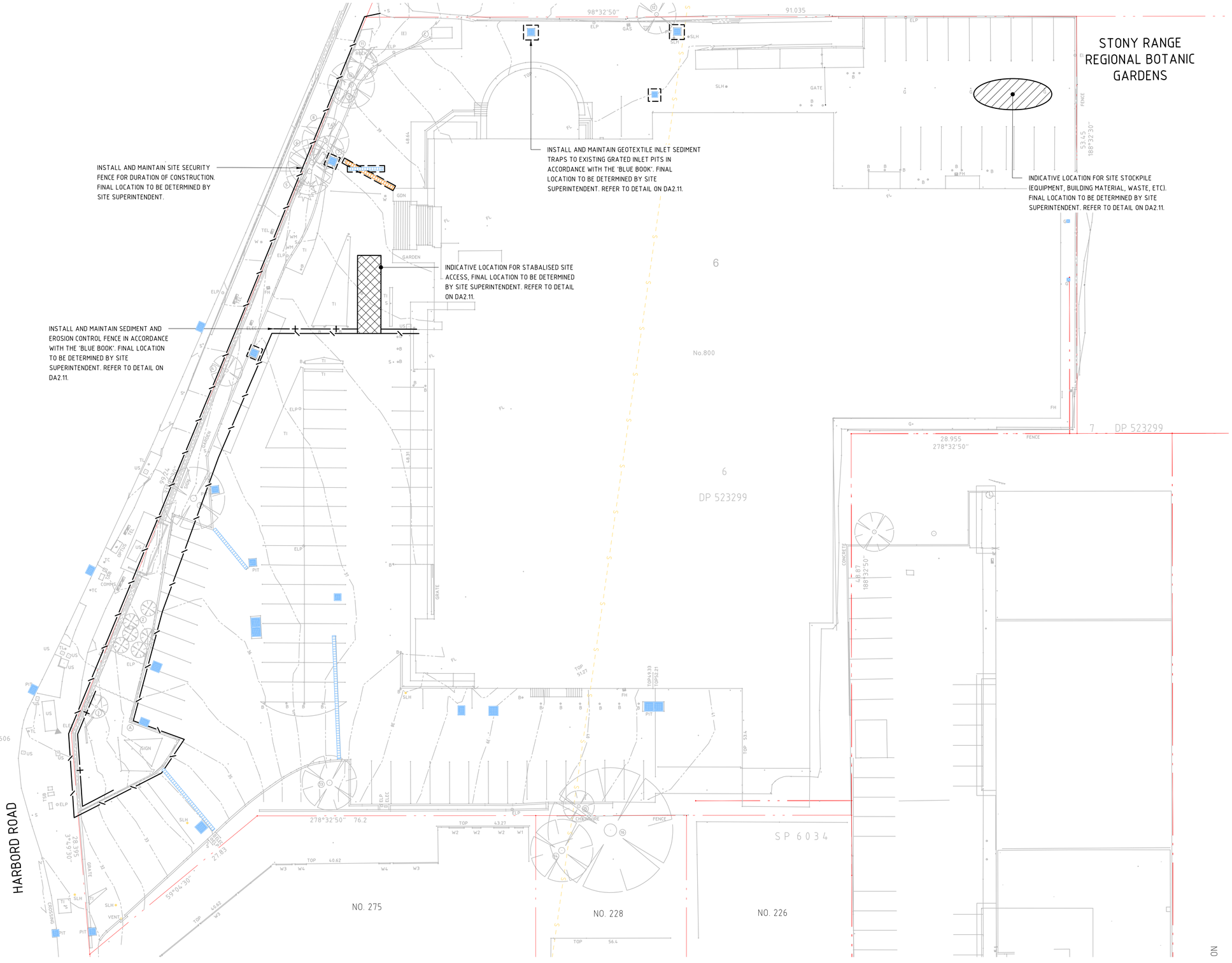

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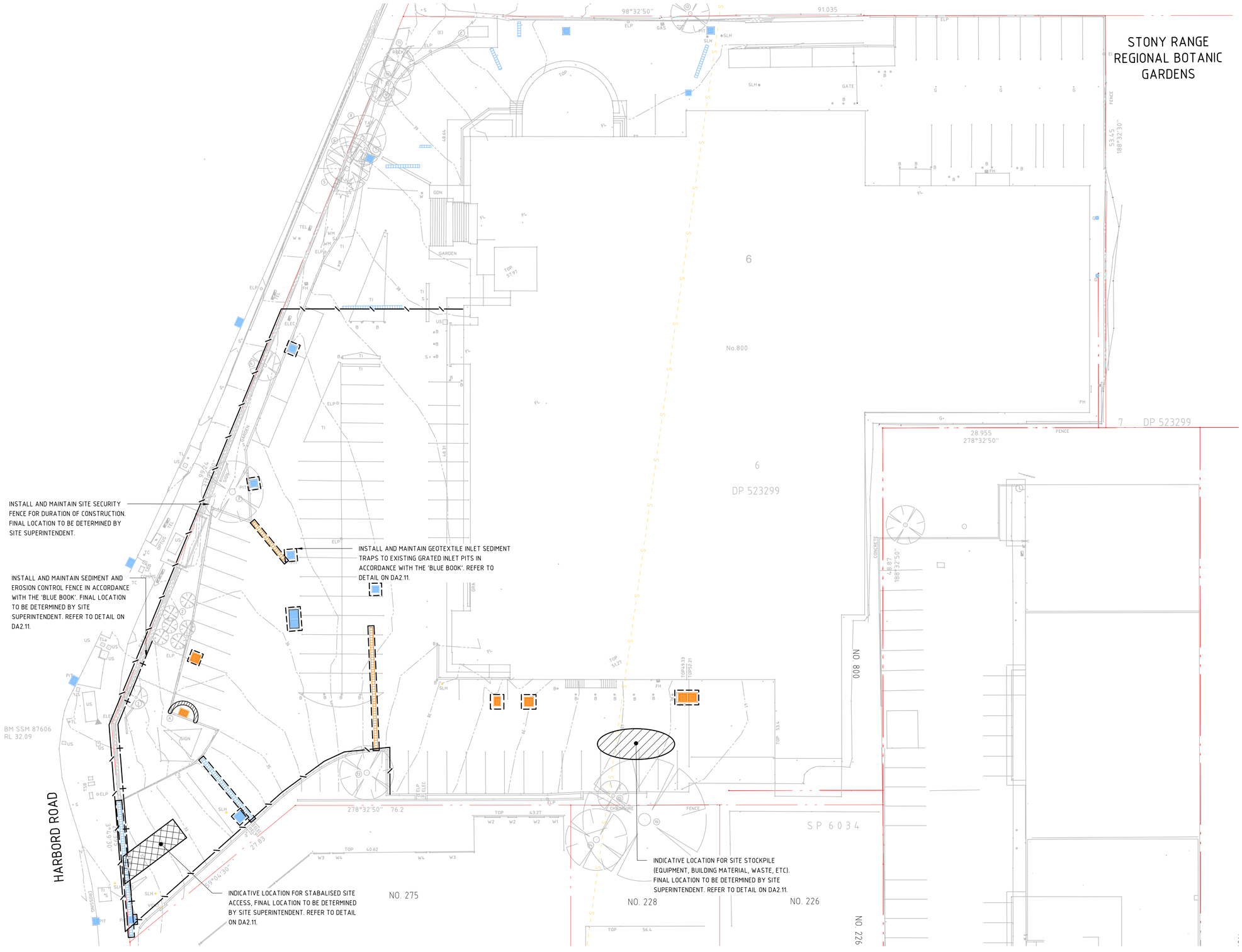

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- SEDIMENT FENCE
- SECURITY FENCE
- WIRE MESH AND GRAVEL SEDIMENT FILTER
- DROP INLET SEDIMENT TRAP
- STABILISED SITE ACCESS
- STOCKPILE

GENERAL NOTES:

1. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
2. ALL SEDIMENT AND SOIL EROSION CONTROL MEASURES TO BE INSTALLED IN ACCORDANCE WITH THE 'BLUE BOOK'. CONTRACTOR TO ENSURE THESE MEASURES ARE IN PLACE AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION WORKS.
3. CONTRACTOR TO PROVIDE 'WIRE MESH AND GRAVEL SEDIMENT FILTER' TO ALL PAVED / ROAD AREAS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'.
4. CONTRACTOR TO PROVIDE 'GEOTEXTILE INLET FILTER TRAPS' TO ALL STORMWATER DRAINAGE INLETS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'

VERIFIER:
JOB MANAGER: E.FLACK
DESIGNED: E.FLACK
DRAWN: C.DABIN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUE FOR DEVELOPMENT APPLICATION	C.D		E.F	02.12.19

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SCALE 1:250@A1 (0 2 4 6 8 10 12m)

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PROJECT
ST. LUKES GRAMMAR SCHOOL NEW SENIOR SCHOOL CAMPUS

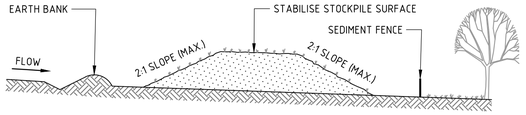
DRAWING TITLE
CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 3 - 800 PITTWATER RD

JOB NUMBER **191248**

DRAWING NUMBER **DA2.03** REVISION **1**

DRAWING SHEET SIZE = A1

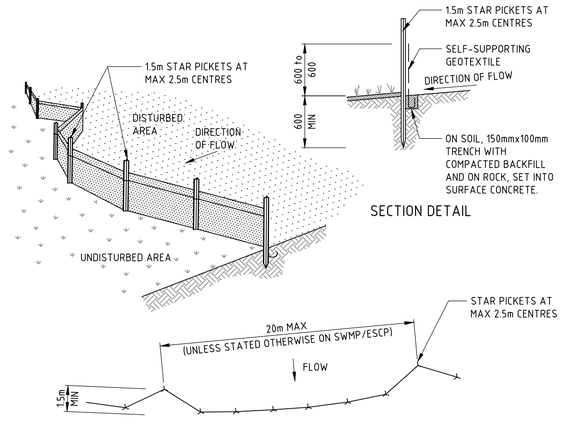
Date: 02-12-19 10:01am Plotted By: jphillips Found: W:\Mjobs\2019\191248 - St Lukes Grammar School\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\191248_DA2.03_CONCEPT SEDIMENT AND EROSION CONTROL PLAN - STAGE 3.dwg



CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE.

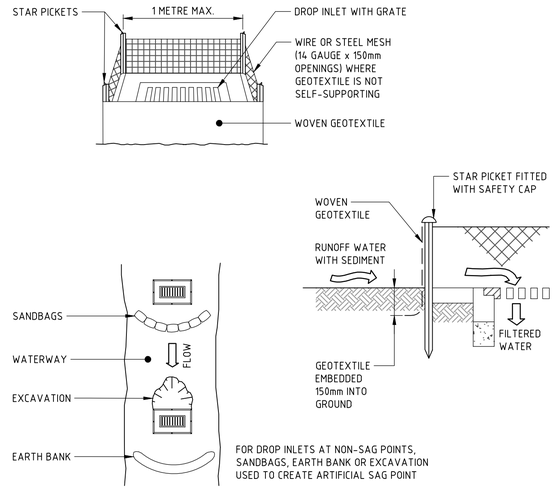
STOCKPILES (SD 4-1)



CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50 LITRES PER SECOND IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 1.5 METRE LONG STAR PICKETS INTO GROUND AT 2.5 METRE INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

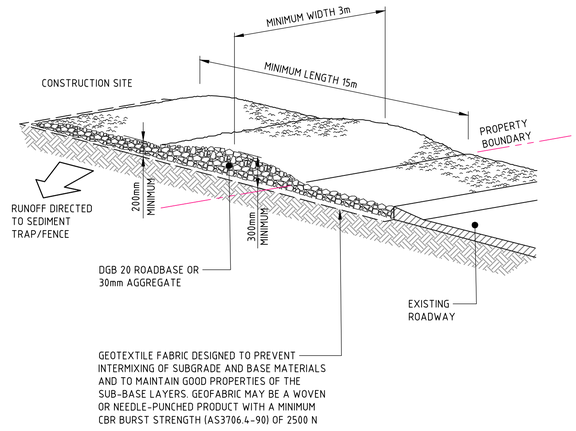
SEDIMENT FENCE (SD 6-8)



CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARD DRAWING 6-7 AND STANDARD DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR THE STRAW BALES OR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

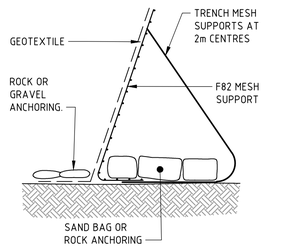
GEOTEXTILE INLET FILTER (SD 6-12)



CONSTRUCTION NOTES

1. STRIP THE TOPSOIL, LEVEL THE SITE AND COMPACT THE SUBGRADE.
2. COVER THE AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
3. CONSTRUCT A 200mm THICK PAD OVER THE GEOTEXTILE USING ROAD BASE OR 30mm AGGREGATE.
4. ENSURE THE STRUCTURE IS AT LEAST 15 METRES LONG OR TO BUILDING ALIGNMENT AND AT LEAST 3 METRES WIDE.
5. WHERE A SEDIMENT FENCE JOINS ONTO THE STABILISED ACCESS, CONSTRUCT A HUMP IN THE STABILISED ACCESS TO DIVERT WATER TO THE SEDIMENT FENCE.

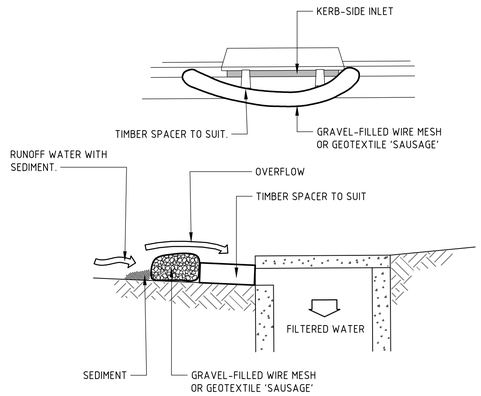
STABILISED SITE ACCESS (SD 6-14)



CONSTRUCTION NOTES

1. INSTALL THIS TYPE OF SEDIMENT FENCE WHEN USE OF SUPPORT POSTS IS NOT DESIRABLE OR NOT POSSIBLE. SUCH CONDITIONS MIGHT APPLY, FOR EXAMPLE, WHERE APPROVAL IS GRANTED FROM THE APPROPRIATE AUTHORITIES TO PLACE THESE FENCES IN HIGHLY SENSITIVE ESTUARINE AREAS.
2. USE BENT TRENCH MESH TO SUPPORT THE F82 WELDED MESH FACING AS SHOWN ON THE DRAWING ABOVE. ATTACH THE GEOTEXTILE TO THE WELDED MESH FACING USING UV RESISTANT CABLE TIES.
3. STABILISE THE WHOLE STRUCTURE WITH SANDBAG OR ROCK ANCHORING OVER THE TRENCH MESH AND THE LEADING EDGE OF THE GEOTEXTILE. THE ANCHORING SHOULD BE SUFFICIENTLY LARGE TO ENSURE STABILITY OF THE STRUCTURE IN THE DESIGN STORM EVENT, USUALLY THE 10 -YEAR EVENT.

ALTERNATIVE SEDIMENT FENCE (SD 6-9)



NOTE:THIS PRACTICE ONLY TO BE USED WHERE SPECIFIED IN APPROVED SWMP/ESCP.

CONSTRUCTION NOTES

1. INSTALL FILTERS TO KERB INLETS ONLY AT SAG POINTS.
2. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT AND FILL IT WITH 25mm TO 50mm GRAVEL.
3. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
4. PLACE THE FILTER AT THE OPENING LEAVING AT LEAST A 100mm SPACE BETWEEN IT AND THE KERB INLET. MAINTAIN THE OPENING WITH SPACER BLOCKS.
5. FORM A SEAL WITH THE KERB TO PREVENT SEDIMENT BYPASSING THE FILTER.
6. SANDBAGS FILLED WITH GRAVEL CAN SUBSTITUTE FOR THE MESH OR GEOTEXTILE PROVIDING THEY ARE PLACED SO THAT THEY FIRMLY ABUT EACH OTHER AND SEDIMENT-LADEN WATERS CANNOT PASS BETWEEN.

WIRE MESH AND GRAVEL SEDIMENT FILTER (SD 6-11)

DESIGNED: E.FLACK
DRAWN: C.DABIN
JOB MANAGER: E.FLACK
VERIFIER:

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1	ISSUE FOR DEVELOPMENT APPLICATION	C.D		E.F	02.12.19

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SCALE 1:10 @ A1 0.0 0.1 0.2 0.3 0.4 0.5m

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PROJECT
ST. LUKES GRAMMAR SCHOOL NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
SEDIMENT AND EROSION CONTROL DETAILS

JOB NUMBER **191248**

DRAWING NUMBER **DA2.11**

REVISION **1**

DRAWING SHEET SIZE = A1

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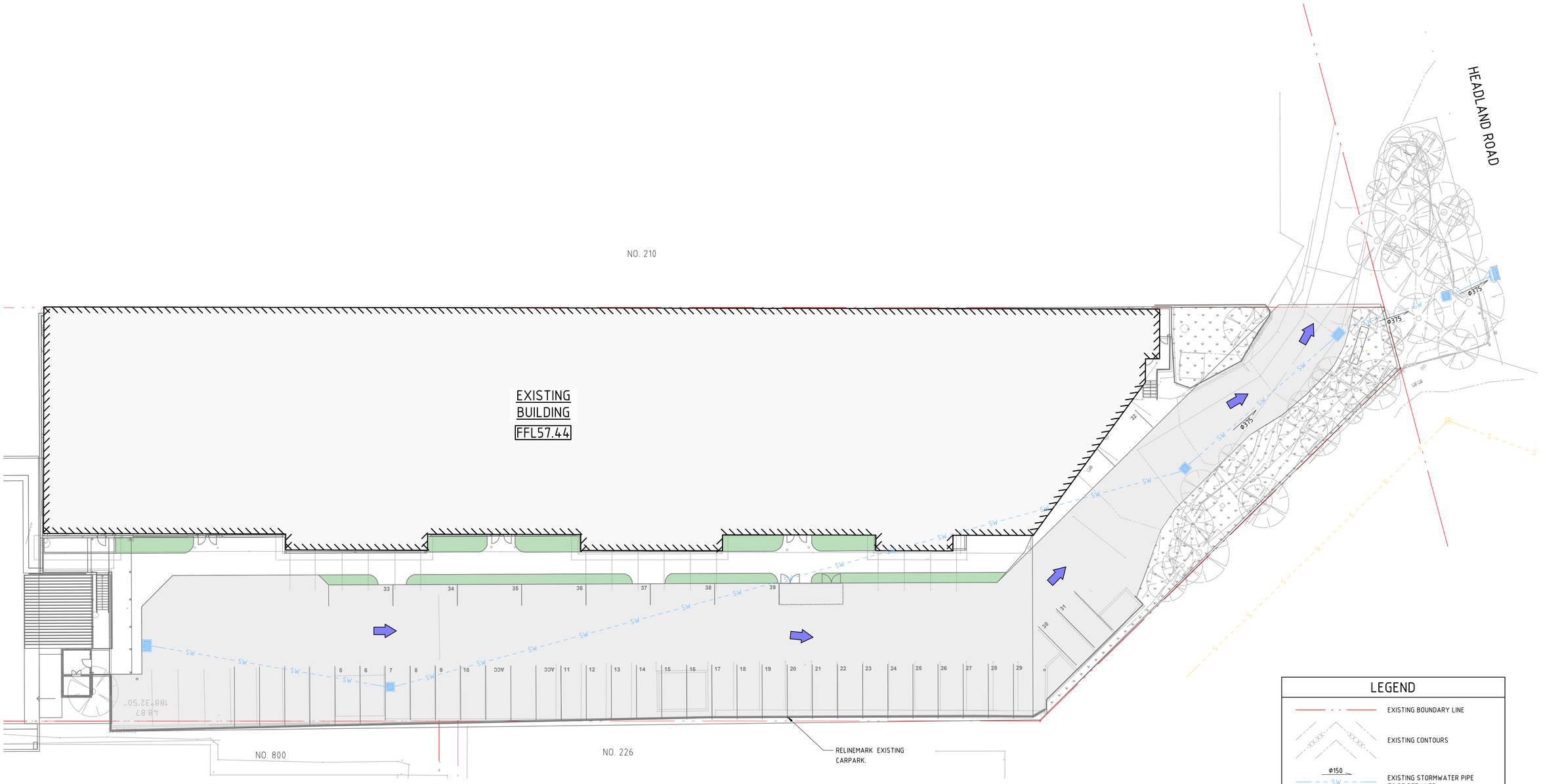

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- Ø150 SW — EXISTING STORMWATER PIPE TO BE RETAINED
- EXISTING GRATED INLET PIT TO BE RETAINED
- EXISTING KERB INLET PIT
- OVERLAND FLOW
- EXISTING VEHICULAR PAVEMENT ASPHALT
- EXISTING LANDSCAPING
- PROPOSED LANDSCAPE

NOT FOR CONSTRUCTION

VERIFIER:
JOB MANAGER: E.FLACK
DESIGNED: E.FLACK
DRAWN: C.DABIN

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUE FOR DEVELOPMENT APPLICATION	C.D		E.F	02.12.19

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SCALE 1:200@A1 — 0 2 4 6 8 10m

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PROJECT
ST. LUKES GRAMMAR SCHOOL
NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 1 - 224 HEADLAND RD

JOB NUMBER **191248**
DRAWING NUMBER **DA3.01**
REVISION **1**
DRAWING SHEET SIZE = A1

Date: 02-12-19 11:01am Plotted By: jphillips
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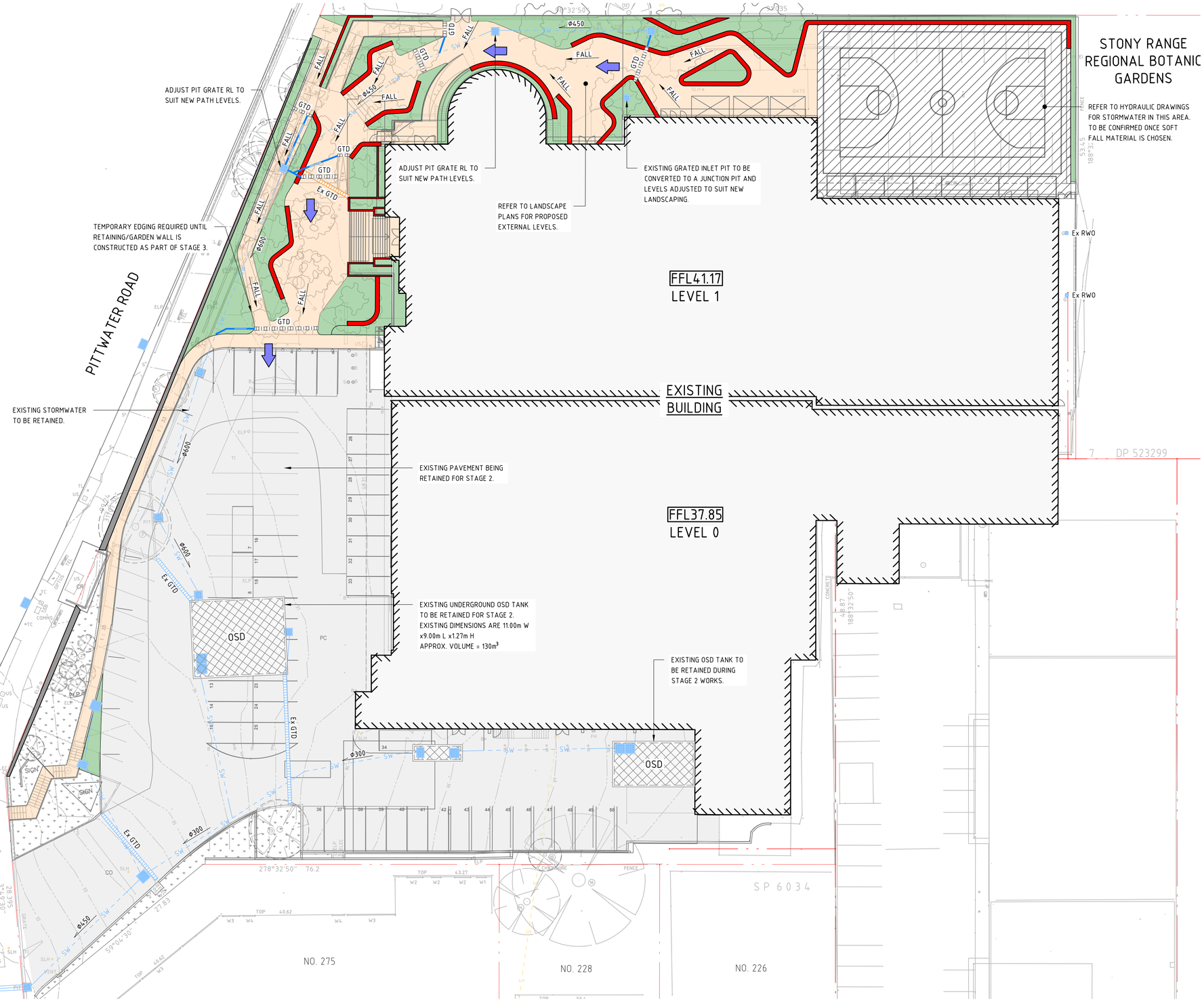

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- PROPOSED RETAINING/GARDEN WALL
- EXISTING RETAINING/GARDEN WALL
- Ø150 SW — EXISTING STORMWATER PIPE TO BE REMOVED
- EXISTING GRATED INLET PIT TO BE REMOVED
- Ex GTD — EXISTING GRATED TRENCH DRAIN TO BE REMOVED
- Ø150 SW — EXISTING STORMWATER PIPE TO BE RETAINED
- EXISTING GRATED INLET PIT TO BE RETAINED
- Ex RWO — EXISTING RAINWATER OUTLET TO BE RETAINED
- Ex GTD — EXISTING GRATED TRENCH DRAIN TO BE RETAINED
- Ø150 — PROPOSED STORMWATER PIPE
- GTD — PROPOSED GRATED TRENCH DRAIN
- OVERLAND FLOW
- FALL — DIRECTION OF GRADE
- OSD — EXISTING ON-SITE DETENTION TANK
- EXISTING VEHICULAR PAVEMENT ASPHALT
- EXISTING LANDSCAPING
- PROPOSED PEDESTRIAN PAVEMENT - REFER TO LANDSCAPE ARCHITECTS
- PROPOSED LANDSCAPE - REFER TO LANDSCAPE ARCHITECTS
- PROPOSED SOFTFALL - REFER TO LANDSCAPE ARCHITECTS

GENERAL NOTES

1. ALL DRAINAGE LINES SHALL BE UPVC (CLASS SN4) SEWER GRADE DRAINAGE PIPE, U.N.O.
2. ALL DRAINAGE LINES SHALL BE LAID AT 1% MIN. FALL, UNO.
3. ALL LEVELS ARE AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL DOWNPIPES GUTTERS TO BE DESIGNED IN ACCORDANCE WITH AS/NZS 3500.3.2 - 2003 'STORMWATER' DRAINAGE.
5. THE STORMWATER DRAINAGE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH AS/NZS 3500.3.2-2003 'STORMWATER' DRAINAGE.
6. ANY VARIATIONS TO THE NOMINATED LEVELS SHALL BE REFERRED TO ENGINEER IMMEDIATELY.
7. SUBSOIL DRAINAGE SHALL BE PROVIDED TO ALL RETAINING WALLS & EMBANKMENTS, WITH THE LINES FEEDING INTO THE STORMWATER DRAINAGE SYSTEM.
8. ALL GRATES TO BE GALVANISED STEEL WITH HINGES AND CHILD PROOF LOCK.
9. ALL GRATES TO BE HEEL SAFE WITHIN AGED CARE DEVELOPMENTS.
10. THE STORMWATER DRAINAGE IS DESIGNED IN ACCORDANCE WITH NORTHERN BEACHES COUNCILS STORMWATER CODE.
11. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH OTHER SUCH WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
12. DETAIL SURVEY DATA WAS SUPPLIED BY STEPHEN R. CARR, DRAWING DATED 28.8.19 AND SURESEARCH, DATED 14.10.19.
13. EXISTING SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM SUPPLIED DATA AND SUCH THEIR ACCURACY CAN NOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF WORK.
14. ALL DIMENSIONS ARE IN MILLIMETRES & ALL LEVELS ARE IN METRES, UNO (UNLESS NOTED OTHERWISE).
15. NO DIMENSION SHALL BE OBTAINED BY SCALING THE DRAWINGS.

ALL STORMWATER MANAGEMENT MEASURES SHOWN ON THIS DRAWING HAVE BEEN PREPARED FOR DEVELOPMENT APPLICATION PURPOSES TO DEMONSTRATE FEASIBILITY. ALL MEASURES WILL BE SUBJECT TO DETAIL DESIGN AT THE CONSTRUCTION CERTIFICATE STAGE AND MAY BE SUBJECT TO VARIATION PROVIDED THAT THE DESIGN INTENT IS MAINTAINED.

NOT FOR CONSTRUCTION

DESIGNED: E.FLACK
DRAWN: C.DABIN
JOB MANAGER: E.FLACK
VERIFIER:

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SCALE 1:250@ A1 (0 2 4 6 8 10 12m)

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PROJECT
ST. LUKES GRAMMAR SCHOOL NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 2 - 800 PITTWATER RD

JOB NUMBER **191248**

DRAWING NUMBER **DA3.02** REVISION **1**

DRAWING SHEET SIZE = A1

Date : 02.12.19 11:07am Plotted By : jphillips Found : W:\Mjobs\2019\191248 - St Lukes Grammar School\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\191248_DA302_SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 2.dwg

STONY RANGE REGIONAL BOTANIC GARDENS

PITTWATER ROAD

HARBORD ROAD

FFL41.17
LEVEL 1

EXISTING BUILDING

FFL37.85
LEVEL 0

REFER LANDSCAPE FOR PROPOSED EXTERNAL LEVELS.

EXISTING GRATED INLET PIT TO BE CONVERTED TO A KERB INLET PIT TO SUIT PROPOSED KERB AND GUTTER

EXISTING OSD TANK TO BE EXTENDED TO ALLOW FOR A TOTAL VOLUME OF 183m³. REFER TO INSET A, DETAILS ON SHEET DA5.01 AND CALCULATIONS ON SHEET DA4.01.

OSD TANK TO BE REMOVED DUE TO CLASH WITH PROPOSED FINISHED LEVELS.

BM SSM 87606
RL 32.09

NO. 275

NO. 228

NO. 226

INSET 'A'

ALL STORMWATER MANAGEMENT MEASURES SHOWN ON THIS DRAWING HAVE BEEN PREPARED FOR DEVELOPMENT APPLICATION PURPOSES TO DEMONSTRATE FEASIBILITY. ALL MEASURES WILL BE SUBJECT TO DETAIL DESIGN AT THE CONSTRUCTION CERTIFICATE STAGE AND MAY BE SUBJECT TO VARIATION PROVIDED THAT THE DESIGN INTENT IS MAINTAINED.

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING CONTOURS
- KG — KERB AND GUTTER
- PROPOSED RETAINING/GARDEN WALL
- EXISTING RETAINING/GARDEN WALL
- Ø150 SW — EXISTING STORMWATER PIPE TO BE REMOVED
- EXISTING GRATED INLET PIT TO BE REMOVED
- Ex GTD — EXISTING GRATED TRENCH DRAIN TO BE REMOVED
- Ø150 SW — EXISTING STORMWATER PIPE TO BE RETAINED
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- Ex GTD — EXISTING GRATED TRENCH DRAIN TO BE RETAINED
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- PROPOSED GRATED INLET PIT
- PROPOSED KERB INLET PIT
- GTD — PROPOSED GRATED TRENCH DRAIN
- OSD — PROPOSED/EXISTING ON-SITE DETENTION TANK
- OVERLAND FLOW
- X.X — DIRECTION OF GRADE
- EXISTING PEDESTRIAN PAVEMENT
- EXISTING LANDSCAPE
- EXISTING SOFTFALL
- PROPOSED VEHICULAR PAVEMENT - REFER TO LANDSCAPE ARCHITECTS
- PROPOSED PEDESTRIAN PAVEMENT - REFER TO LANDSCAPE ARCHITECTS
- PROPOSED LANDSCAPE - REFER TO LANDSCAPE ARCHITECTS

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3. ALL LEVELS ARE AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL DOWNPIPES GUTTERS TO BE DESIGNED IN ACCORDANCE WITH AS/NZS 3500.3.2 – 2003 'STORMWATER' DRAINAGE.
5. THE STORMWATER DRAINAGE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH AS/NZS 3500.3.2-2003 'STORMWATER' DRAINAGE.
6. ANY VARIATIONS TO THE NOMINATED LEVELS SHALL BE REFERRED TO ENGINEER IMMEDIATELY.
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9. ALL GRATES TO BE HEEL SAFE WITHIN AGED CARE DEVELOPMENTS.
10. THE STORMWATER DRAINAGE IS DESIGNED IN ACCORDANCE WITH NORTHERN BEACHES COUNCILS STORMWATER CODE.
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15. NO DIMENSION SHALL BE OBTAINED BY SCALING THE DRAWINGS.

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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SCALE 1:250@ A1 — 0 2 4 6 8 10 12m
SCALE 1:200@ A1 — 0 2 4 6 8 10m

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PROJECT
ST. LUKES GRAMMAR SCHOOL NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
SITEWORKS AND STORMWATER MANAGEMENT PLAN - STAGE 3 - 800 PITTWATER RD

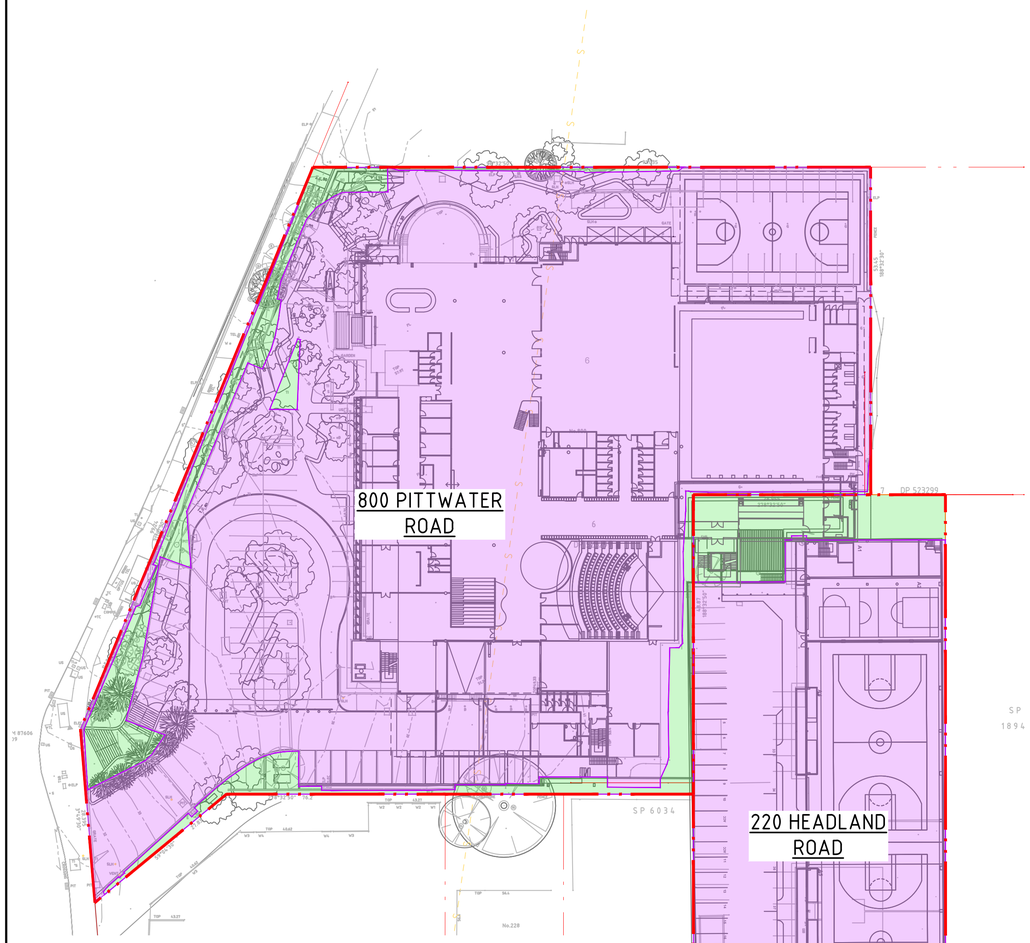
JOB NUMBER **191248**

DRAWING NUMBER **DA3.03** | REVISION **1**

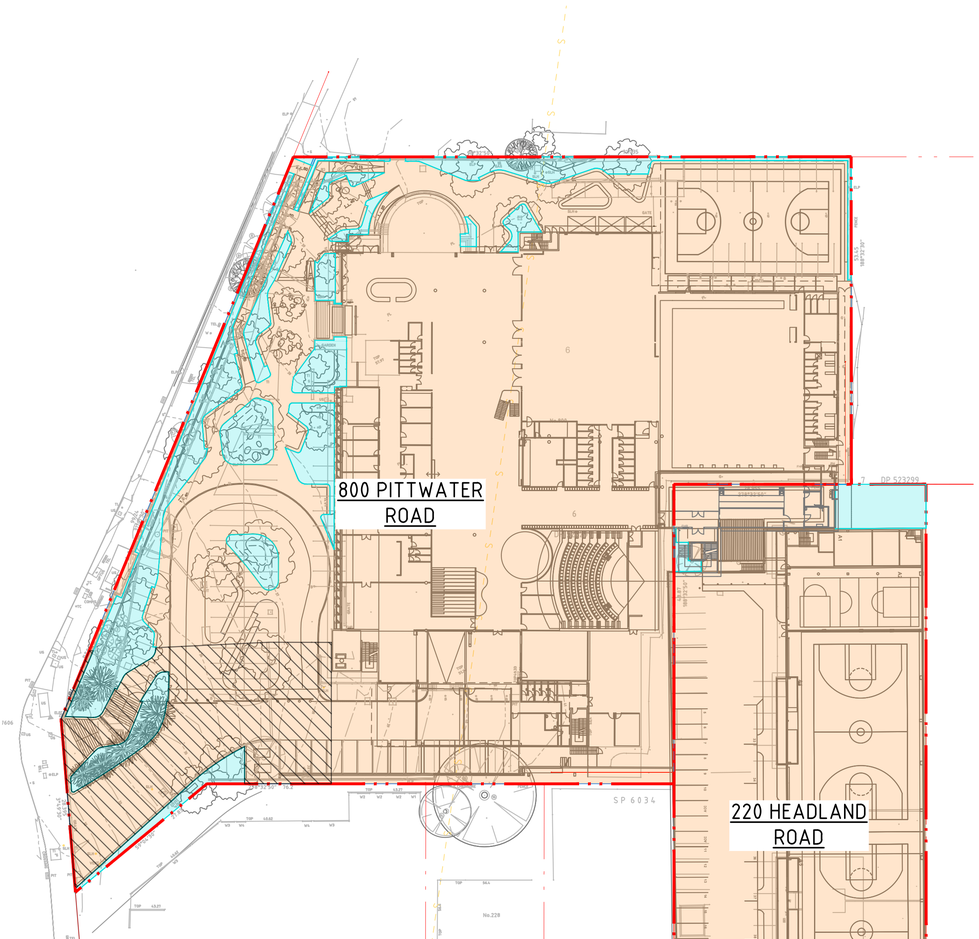
DRAWING SHEET SIZE = A1

VERIFIER:
JOB MANAGER: E.FLACK
DESIGNED: E.FLACK
DRAWN: C.DABIN

Date: 02-12-19 10:01am Plotted By: jphillips Found: W:\Mjobs\2019\191248 – St Lukes Grammar School\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\191248_DA3.03_SITEWORKS AND STORMWATER MANAGEMENT PLAN – STAGE 3.dwg



PRE - DEVELOPMENT CATCHMENTS



POST - DEVELOPMENT CATCHMENTS

LEGEND

- EXISTING BOUNDARY LINE
- PRE DEVELOPMENT - IMPERVIOUS
- PRE DEVELOPMENT - PERVIOUS
- POST DEVELOPMENT - IMPERVIOUS
- POST DEVELOPMENT - PERVIOUS
- POST DEVELOPMENT - OSD BY-PASS

DESIGN SUMMARY

CATCHMENT CALCULATIONS:
220 HEADLAND ROAD

	PRE-DEVELOPMENT	POST-DEVELOPMENT
TOTAL AREA	5236m²	5236m²
IMPERVIOUS AREA	4554m² (87%)	4837m² (92%)
PERVIOUS AREA	681m² (13%)	349m² (8%)

NO CIVIL WORKS TO BE COMPLETED ON 220 HEADLAND ROAD.
800 PITTWATER ROAD

	PRE-DEVELOPMENT	POST-DEVELOPMENT
TOTAL AREA	10240m²	10240m²
IMPERVIOUS AREA	9431m² (92%)	9194m² (90%)
PERVIOUS AREA	809m² (8%)	1046m² (10%)

ON-SITE DETENTION:

DESIGN BASIS:
- NORTHERN BEACHES (FORMER WARRINGAH) PL 850 WATER MANAGEMENT POLICY 2017
- PRE TO POST POST DEVELOPMENT CONDITIONS, ALLOWING FOR PRE TO BE A GREENFIELD SITE.

SITE STORAGE REQUIREMENT = 180m³ (DETERMINED FROM DRAINS)
<NOTE: SITE CURRENTLY HAS 2 DETENTION TANKS, TANK 1 VOLUME IS 130m³ AND TANK 2 VOLUME IS UNKNOWN. >

TANK 2 IS TO BE REMOVED AS PART OF DEVELOPMENT STAGE 3.
THEREFORE ADDITIONAL SITE STORAGE REQUIREMENT = 50m³
ADDITIONAL 3m³ ADDED TO ACCOMMODATE PROVISION OF STORMWATER TREATMENT SYSTEM

TOTAL ON-SITE DETENTION STORAGE PROVIDED = 183m³

ON-SITE DETENTION SUMMARY:
- EXTENSION OF EXISTING BELOW GROUND BLOCK WORK TANK
- NEW ORIFICES AND OUTLET PIPE IN NEW SECTION OF TANK

TOP WATER LEVEL = RL35.94
OVERFLOW LEVEL = RL36.18
ORIFICE 1 CENTERLINE = RL34.06
ORIFICE 1 DIAMETER = Ø281mm
ORIFICE 2 CENTERLINE = RL35.54
ORIFICE 2 DIAMETER = Ø245mm
ORIFICE 3 CENTERLINE = RL35.54
ORIFICE 3 DIAMETER = Ø245mm
INTERNAL WIER LEVEL = RL35.79

SITE DISCHARGE CALCULATIONS:

	PRE-DEVELOPMENT	POST DEVELOPMENT (WITH OSD)
0.2EY AEP	175 L/s	173 L/s
10% AEP	230 L/s	195 L/s
5% AEP	287 L/s	239 L/s
2% AEP	365 L/s	356 L/s
1% AEP	422 L/s	402 L/s

TREATMENT NODES:

- ON-SITE DETENTION TANK
- 16x690mm PSORB STORMWATER FILTER CARTRIDGES (OCEAN PROTECT)
- 13x OCEAN GUARD PIT BASKETS (TO BE INSERTED IN EVERY EXISTING & NEW GRATED PITS)

TREATMENT STANDARDS:

POLLUTANT	REDUCTION STANDARDS	REDUCTION ACHIEVED
GROSS POLLUTANTS	90%	98.7%
TOTAL SUSPENDED SOLIDS	85%	87.6%
TOTAL PHOSPHORUS	65%	65.2%
TOTAL NITROGEN	45%	46.3%

MUSIC MODEL PARAMETERS IN ACCORDANCE WITH NORTHERN BEACHES COUNCILS PL 850 WATER MANAGEMENT POLICY 2017 AND THE DRAFT NSW MUSIC MODELLING GUIDELINES REF: R.B17048.001.01 DATED AUGUST 2010.

VERIFIER:
JOB MANAGER: E.FLACK
DESIGNED: E.FLACK
DRAWN: C.DABIN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUE FOR DEVELOPMENT APPLICATION	C.D		E.F	02.12.19

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SCALE 1:500@A1 0 5 10 15 20 25m

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PROJECT
ST. LUKES GRAMMAR SCHOOL
NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
CATCHMENT PLAN

JOB NUMBER 191248
DRAWING NUMBER DA4.01
REVISION 1
DRAWING SHEET SIZE = A1

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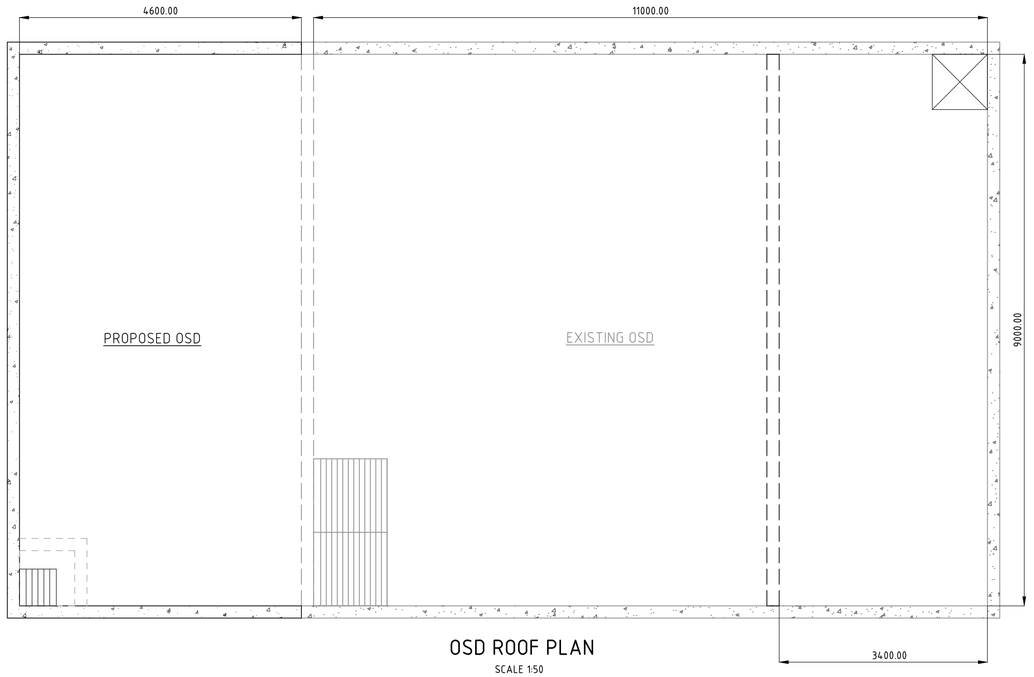
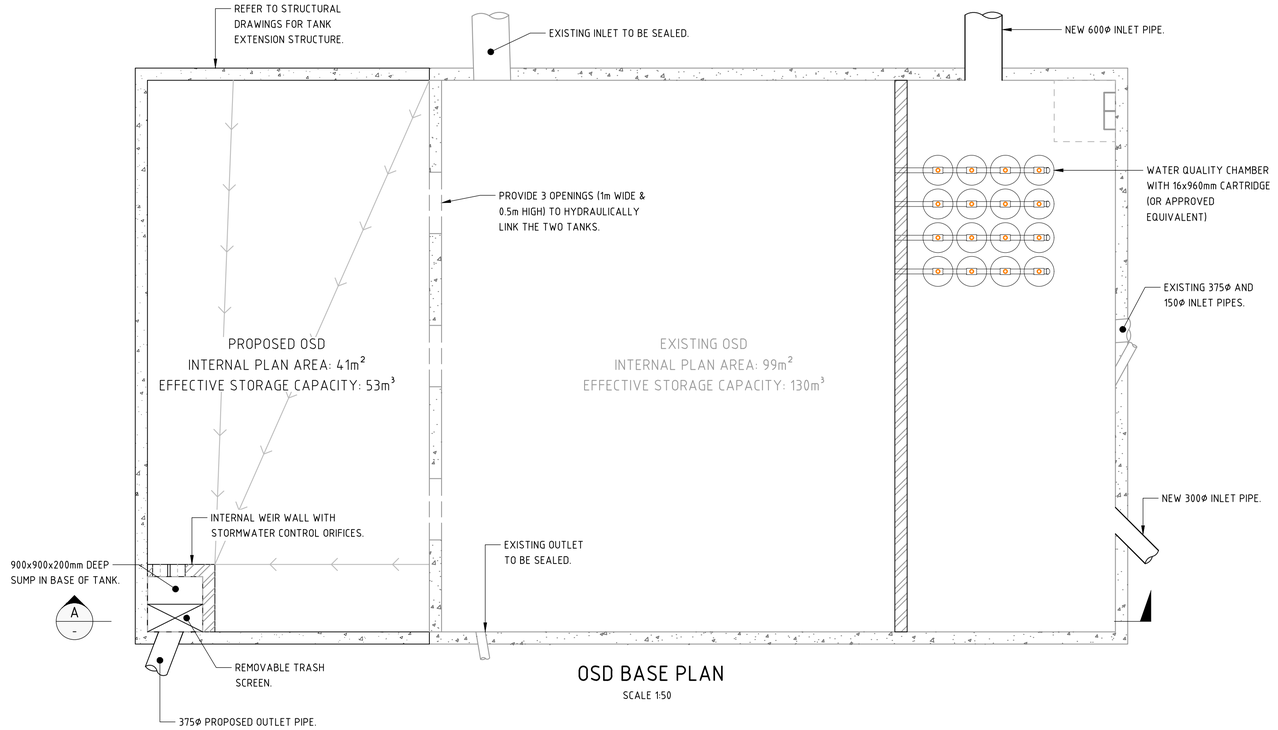
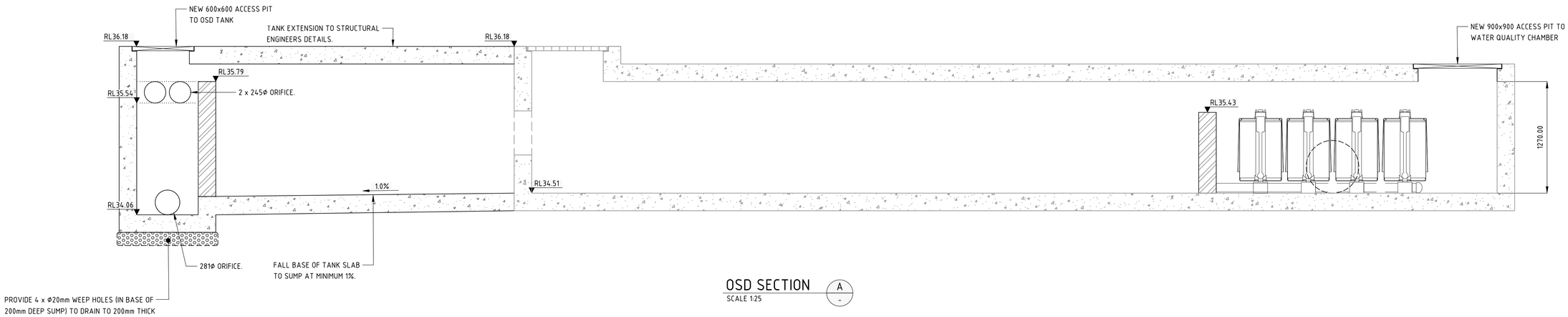


OSD ROOF PLAN
SCALE 1:50



OSD BASE PLAN
SCALE 1:50



OSD SECTION
SCALE 1:25
A

DRAWN: CDABIN
DESIGNED: E.FLACK
JOB MANAGER: E.FLACK
VERIFIER:

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUE FOR DEVELOPMENT APPLICATION	C.D		E.F	02.12.19

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SCALE VARIES

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PROJECT
ST. LUKES GRAMMAR SCHOOL
NEW SENIOR SCHOOL CAMPUS

DRAWING TITLE
OSD DETAILS

JOB NUMBER **191248**
DRAWING NUMBER **DA5.01**
REVISION **1**
DRAWING SHEET SIZE = A1

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