STORMWATER REPORT
for
PROPOSED SUBDIVISION

84 HOSPITAL ROAD
DUNGOG

LOT 181 in DP 661448

Prepared by
TATTERSALL LANDER PTY LTD
Development Consultants
October 2023

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Document Information

Version	Prepared By	Qualification	Date
1	Damian Sacco	B. Engineering (Civil), MIEAust	5/10/2022

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1.0 INTRODUCTION

This report has been prepared to support a one into three lot subdivision proposed for Lot 181 in DP 661448, 84 Hospital Road, Dungog.

Figure 1: Locality Diagram

1.1 SITE DESCRIPTION

The subject site is identified as Lot 181 in DP 661448 and is located at 84 Hospital Road, Dungog. The total site area is approximately 2024sq.m. The property is zoned R1 General Residential, and currently has a single dwelling and shed.

Pervious areas of the site are generally well grassed with a few trees. The site generally falls to the north where a landscape wall and fence line direct half the site towards Hospital Road. The remaining half of the site would flow through a depression in the rear of neighbouring properties.

A detail plan showing existing levels can be seen in Appendix B.

Photograph 1 – Subject Site

Photograph 2 – Subject Site

1.2 PROPOSED DEVELOPEMENT

The current proposal is for a one into three lot subdivision.

The concept stormwater management strategy involves;

- Installing rainwater tanks on the propose dwellings,
- Landform modification to allow collecting and treating roof water and ground surface runoff (hardstand and landscape areas), in a constructed biofilter adjacent to the driveway,
- Surface detention of all developed area within the common driveway, before controlled discharge to hospital road,
- Remaining areas that are not drainable to the street will continue to discharge into adjacent private lands. Removal of existing development from this area (demolition of existing sheds and driveway), along with the catchment diversion as described above results in all development (impervious surfaces) are drained to the legal point of discharge and the reduction of the catchment area draining to the rear by approximately 60%.

The proposed layout plan is included in Appendix A.

2.0 WATER QUALITY

2.1 BACKGROUND

The quality of stormwater runoff generated by the site is important to ensure the preservation of the downstream environments, due to an increased proportion of impervious area leading to a subsequent increase in the quantities of suspended solids, phosphorus and nitrogen entering storm water runoff.

This is particularly relevant to this site, which is situated in the mapped Williams River Drinking Water Catchment. Neutral or Beneficial Effect water quality targets for Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) have been adopted, in line with Hunter Water's Guidelines.

To assess the proposal with reference to these guidelines, a Water Quality model has been prepared using MUSIC to simulate pollution generation and treatment on the site for both existing site conditions and ultimate developed site, including treatment measures.

2.2 MUSIC MODELLING

MUSIC is the Model for Urban Stormwater Improvement Conceptualisation, developed by the Cooperative Research Centre for Catchment Hydrology. MUSIC provides the ability to model both quality and quantity of runoff generated by catchments. Therefore MUSIC can simulate annual stormwater volumes, and expected annual pollutant loadings.

MUSIC is designed to model stormwater runoff systems in urban catchments. It is used to simulate a range of temporal and spatial scales. Catchment modelling can be performed for areas up to 100 km^2, with times steps from 6 minutes to 24 hours to match the range of spatial scale. This enables long term modelling of continuous historical rainfall data from pluviograph sources, and reflects the ability to account for temporal variation in data for an annual rainfall series directly.

MUSIC also has the ability to model a number of treatment devices, and measure their effectiveness in terms of the quantity and quality of runoff downstream. This allows determination of the degree of reduction in annual pollutant loadings.

It is important to note that the MUSIC simulation relies heavily on input variables and MUSIC models can be calibrated to local conditions. However, for the scale of most urban development projects, it is generally considered unreasonable to perform a calibration and input parameters can be sourced from various guidelines, such as the current NSW MUSIC Modelling Guidelines.

2.3.1 CLIMATE / RAINFALL

To accurately model a site of this size a five year continuous rainfall record with a six minute timestep is required. The number of continuously recording rainfall stations in NSW that have a good quality, five-year continuous record of 6-minute rainfall data available is somewhat limited. Rainfall data was obtained from the Bureau of Meteorology in the form of historic pluviograph record from the Williamtown Rainfall gauge from 1 January 2000 to 31 December 2005. The average annual rainfall over this period was as 1,032mm. As reference, the long term average rainfall for Dungog (Post Office) is 986mm (BoM). The pluviograph data from this period was thus considered appropriate to approximate average conditions at the site.

2.3.2 EVAPORATION

To accurately model the outcome of water quality treatment measures, monthly potential evapo-transpiration (PET) data is required. Monthly average areal potential evapotranspiration values were read from maps in the ‘Climate Atlas of Australia, Evapotranspiration’ (BoM, 2001), and are displayed below in Table 1:

Table 1: Monthly Areal Potential Evapotranspiration Figures

Month	Potential Evapotranspiration (mm)
January	180
February	135
March	135
April	90
May	70
June	50
July	50
August	70
September	95
October	135
November	150
December	175
Total	**1335**

2.3.3 NODE PARAMETERS

Rainfall-Runoff parameters and typical pollutant concentrations for a medium clay soil type were adopted from the NSW MUSIC modelling guidelines (2015). The adopted parameters can be seen in Figure 2 and Table 2 below.

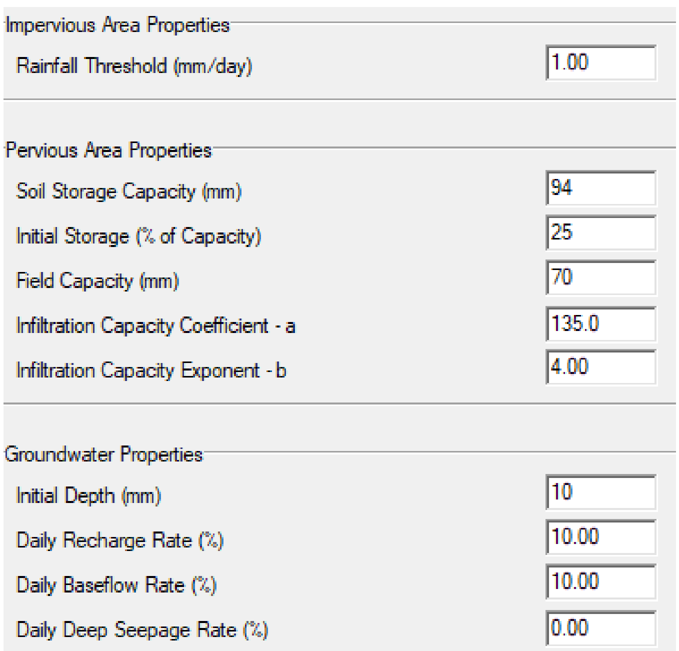


Figure 2: Adopted Rainfall-Runoff MUSIC Parameters

Table 2: Adopted MUSIC Pollutant Generation Parameters

	Industrial	Roof
Baseflow TSS Mean (mg/L)	16	-
Stormflow TSS Mean (mg/L)	140	20
Baseflow TP Mean (mg/L)	0.14	-
Stormflow TP Mean (mg/L)	0.25	0.13
Baseflow TN Mean (mg/L)	1.3	-
Stormflow TN Mean (mg/L)	2	2

2.4 FINDINGS

2.4.1 EXISTING POLLUTANT ANALYSIS

The existing site was modelled within MUSIC with various sub-catchments determined from site survey and aerial imagery.

- Roof areas (measured directly off design plans), and modelled as "Roof" nodes with 100% impervious area;
- Remaining pervious site areas as a 'residential' landuse;

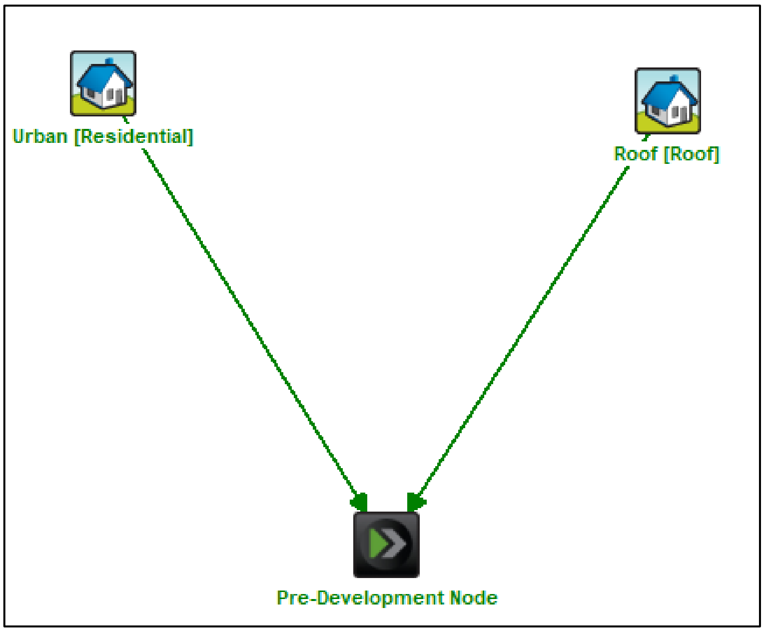


Figure 3: Existing State MUSIC Model

2.4.2 PROPOSED DEVELOPMENT

The proposed development was modelled to determine expected pollutant loads and the effectiveness of the proposed water treatment measures. The catchment was broken up into different areas depending on the surface type, including;

- Roof areas modelled as “Roof” nodes with 100% impervious area
    - 460sq.m measured directly off design plans, and
    - 190sq.m for the existing dwelling,
- Surface runoff areas as a ‘Residential’ landuse
    - 930sq.m @ 35% impervious measured directly off design plans, and
    - 450sq.m @ 0% impervious representing the residual western catchment bypassing treatment measures;

Modelled treatment nodes include;

- Biofiltration system - a 0.1m detention depth, 0.3m filter depth, and 8sq.m filter area. The detention depth also doubles to provide some stormwater detention capacity.
- Rainwater Tank – 2 x 2kL rainwater tanks have been modelled for the new dwellings. The existing dwelling has not been modelled with a rainwater tank. Reuse rates have been applied per the 2015 NSW MUSIC modelling guidelines.

Details are shown on the DA Engineering design plans in Appendix A.

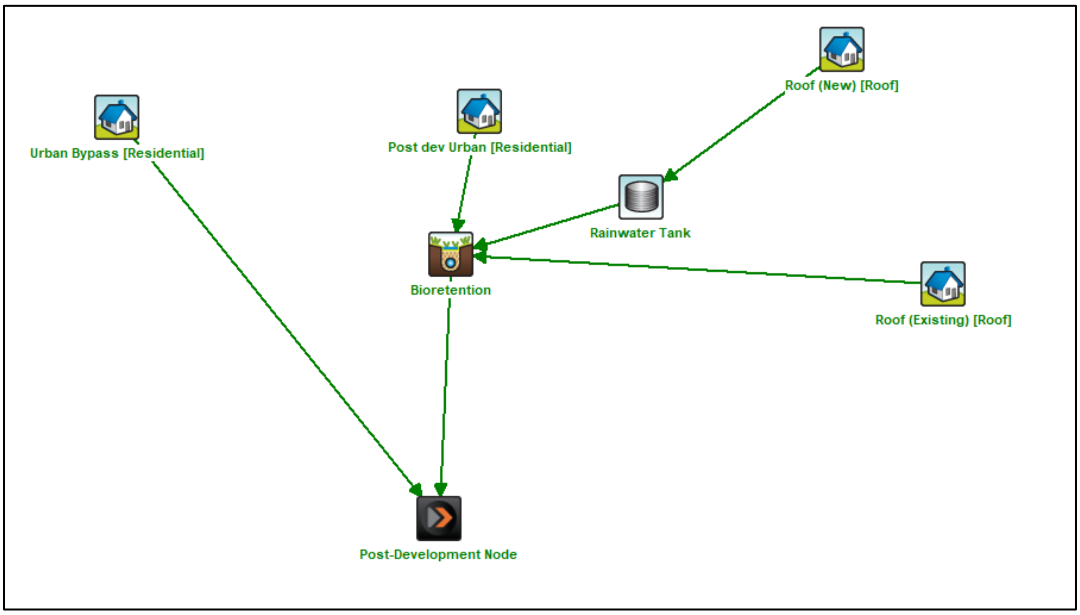


Figure 4: Proposed Development MUSIC Model

2.4.3 SUMMARY OF WATER QUALITY MODELS

Pre and post development pollutant loads are compared in the table below and illustrate that the Stormwater Quality Targets have been met.

Table 3: Comparison of Pre and Post-Development Pollutant Loads

	Pre-Developed	Post-Developed	NoBE Compliant
TSS (kg/yr)	54.3	28.4	Yes
TP (kg/yr)	0.145	0.116	Yes
TN (kg/yr)	1.42	1.36	Yes
GP (kg/yr)	12.8	0	Yes

* NoBE = Neutral or Beneficial Effect

3.0 MAINTENANCE

It is expected that all maintenance tasks would fall under the general works routinely and instinctively conducted by residents.

3.1 BIOFILTER

Regular minor maintenance is required to ensure water treatment measures continue to operate in an effective way. These tasks should be performed every three months or after heavy storm events, but the flat nature of the design of the development area means minimal sedimentation of the biofilter is expected once the site is finalised. Many of these tasks would be considered 'instinctive' every-day maintenance activities for residents with minimal associated costs, such as watering the garden during dry periods, weeding and clearing blockages of inlet and outlet structures.

The maintenance schedule in Appendix C has been prepared as a typical template to direct future owners, and is based on Raingardens and Bioretention Tree Pits Maintenance Plan Example, prepared by the Facility for Advancing Water Biofiltration, Monash University. Relevant sections have been reproduced and/or modified for the specific site conditions.

All biofilter maintenance activities will need to commence as soon as biofilters are planted and brought online and continue for the life of the development.

3.2 DETENTION AREA

All flows entering the detention area have first have a chance to be filtered as they pass across the biofilter. As such, maintenance is expected to be limited to cleaning out the trash screen on the outlet pit periodically as required.

3.3 WATER QUALITY DURING CONSTRUCTION

A critical time for increase pollutant loads is during construction, and with this in mind, current practice recommends guidelines from Landcom's "Blue Book". Erosion and sediment control measures should be designed and specified in accordance with the "Blue Book" guidelines.

Water quality controls should also meet Council requirements, and be inspected to their satisfaction during the construction phase. This will assist in ensuring adherence to pollutant prevention measures, particularly the removal of suspended solids (sediment).

Ideally bio-retention devices should be constructed after the majority of site construction works are completed, as disturbance of the site during road and shed construction could badly damage bio-filtration systems, silting up the filter media and rendering them ineffective. Extreme care should be taken during any site disturbance that occur one the biofilters have been brought online, including protection with all necessary devices (sediment fencing, physical exclusion fencing to prevent vehicle damage etc). The biofilter should remain offline until other site works are completed, permeable areas have been stabilised and roof and hardstand areas have been washed down.

4.0 HYDROLOGY

The nature of urban development is that it usually increases the amount of impervious surface in a catchment, which in turn can decrease runoff times and create higher peak flow rates. It is important with new developments that measures are put in place to prevent increases in peak discharge rates that may impact downstream properties.

The front of the existing site including the original dwelling drains towards Hospital Road. The rear, including existing sheds falls away from the street draining through the back of surrounding lots.

Hospital Road has no street drainage across the frontage and there is no interallotment drainage to the rear. With these constraints the legal point of discharge is to the kerb in Hospital Road. To achieve water quality and detention measures the development footprint needs to be filled to allow the necessary depth of the water quality system to discharge to the kerb.

The proposed development redirects the developed footprint to Hospital Road reducing the area draining through adjoining properties from 1062 m^2 to 445 m^2. The developed footprint is directed to a surface detention area limiting the overall site discharge to predeveloped rates.

A DRAINS hydrological and hydraulic routing model has been prepared to quantify the effects of the proposal.

4.1 MODEL SETUP

IFD, temporal data and loss data was downloaded from the BOM and ARR Data Hub for the site (Latitude,-32.399 Longitude,151.747) and used to create a 1D hydrologic and hydraulic DRAINS model. The complete model will be made available to Council with the submission of this report, so model inputs and setup can be reviewed in detail. A general summary of various model inputs is provided below.

4.1.1 LOSSES

The NSW eSPADE portal provides hydrologic soil group mapping, which shows the site to be Group B ‘Moderate Infiltration’.

The following values were entered into the DRAINS model:

- Paved Depression Storage = 1mm
- Supplementary Depression Storage = 1mm
- Grassed Depression Storage = 5mm
- Soil Type = 2
- Antecedent Moisture Condition = 3

4.1.2 TOTAL IMPERVIOUS AREA (TIA)/ EFFECTIVE IMPERVIOUS AREA

The pre-developed site has had impervious areas assessed as 20% Total Impervious Area via analysis of the survey and aerial imagery.

On the post-development site, this has been measured directly off the design plans. 100% of the impervious area is directed to the surface detention area. The West of the site that is not proposed to be filled has been modelled as pervious due to removal of existing structures.

4.1.3 TIME OF CONCENTRATION

A minimum time of concentration of 5 minutes was adopted for all catchments

4.1.4 AREAL REDUCTION FACTOR

The total catchment area is less than $1km^2$ so the ARF was set to 1.

4.1.5 TAILWATER CONDITIONS

With all drainage structures situated above the reach of the regional flood impacts, a free outfall condition has been applied to the model.

4.2 PRE-CONDITION MODEL

The Pre-condition model for the site discharge is split between the rear of the property and Hospital Road. A catchment plan can be seen below, defined by detail survey data. This was able to represented as two catchments in the DRAINS model. To allow comparison of overall site discharge the catchment draining to the rear of the property has been added to a downstream length of kerb and gutter

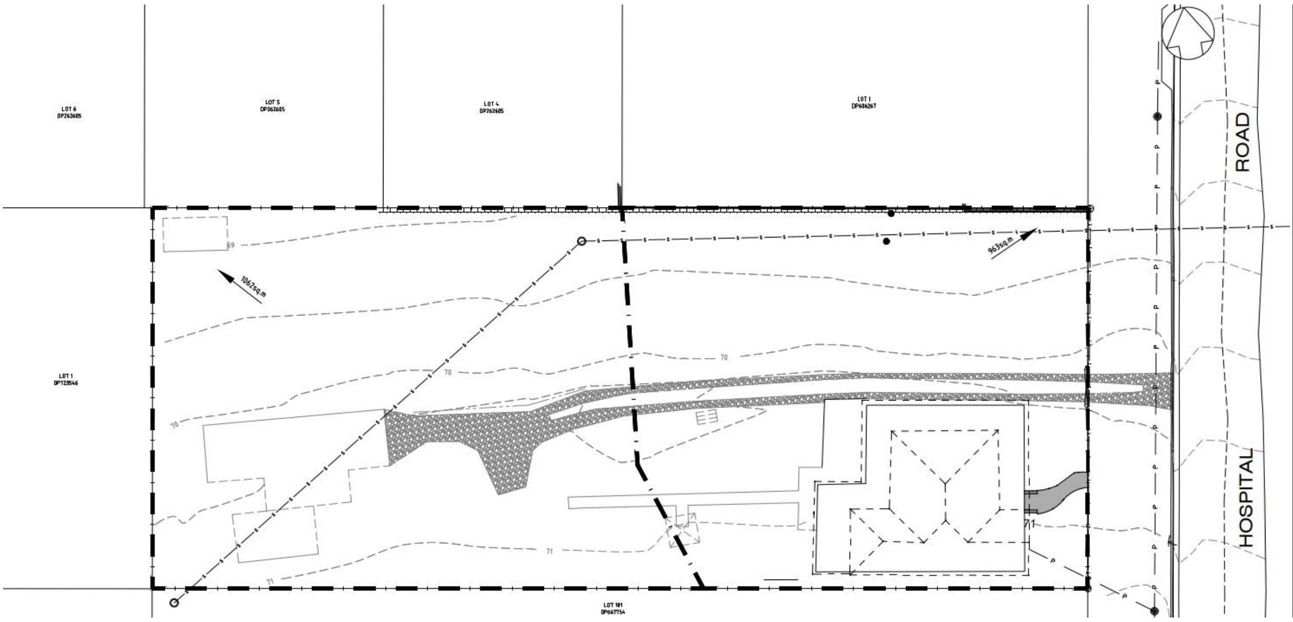


Figure 5: Pre-development Catchments

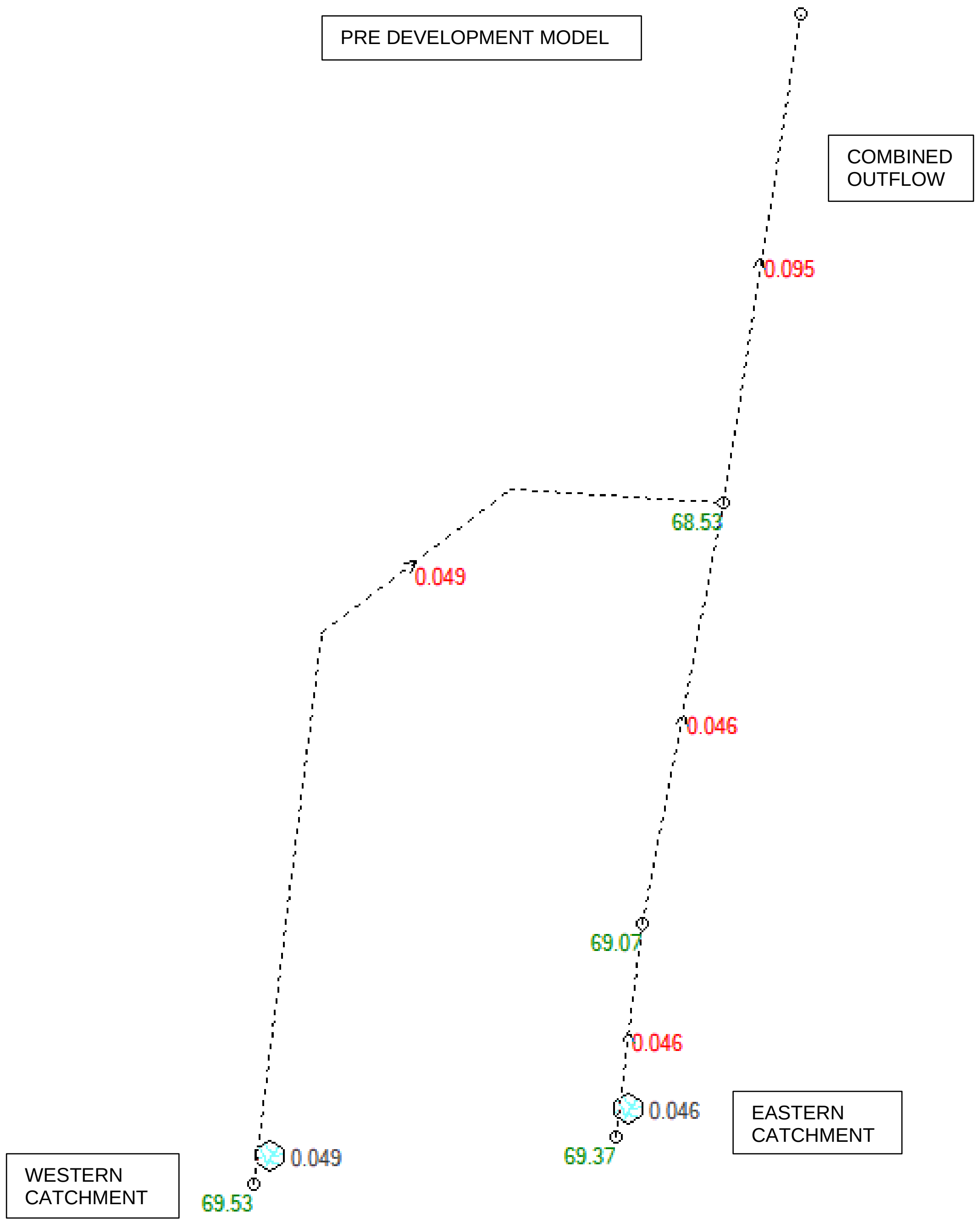


Figure 6: Pre-Development DRAINS Model Showing 1% AEP Results

4.3 DESIGN STATE MODEL

A 1D node and link model was created to reflect the proposed development. The proposed development is to be filled to redirect the developed catchment to hospital road via a surface detention system and biofilter. The high point of the driveway acts as a weir to control 1% AEP discharge from the site. Low flows discharge to the kerb on Hospital Road at the lowest point of the frontage and an intermediate discharge point is proposed to discharge to the kerb adjacent to the biofilter.

The DRAINS model was set up to run a full range of ensemble rainfall events, for the 10%, 5% and 1% AEP's. Peak flow rates were assessed for the peak median events for each AEP.

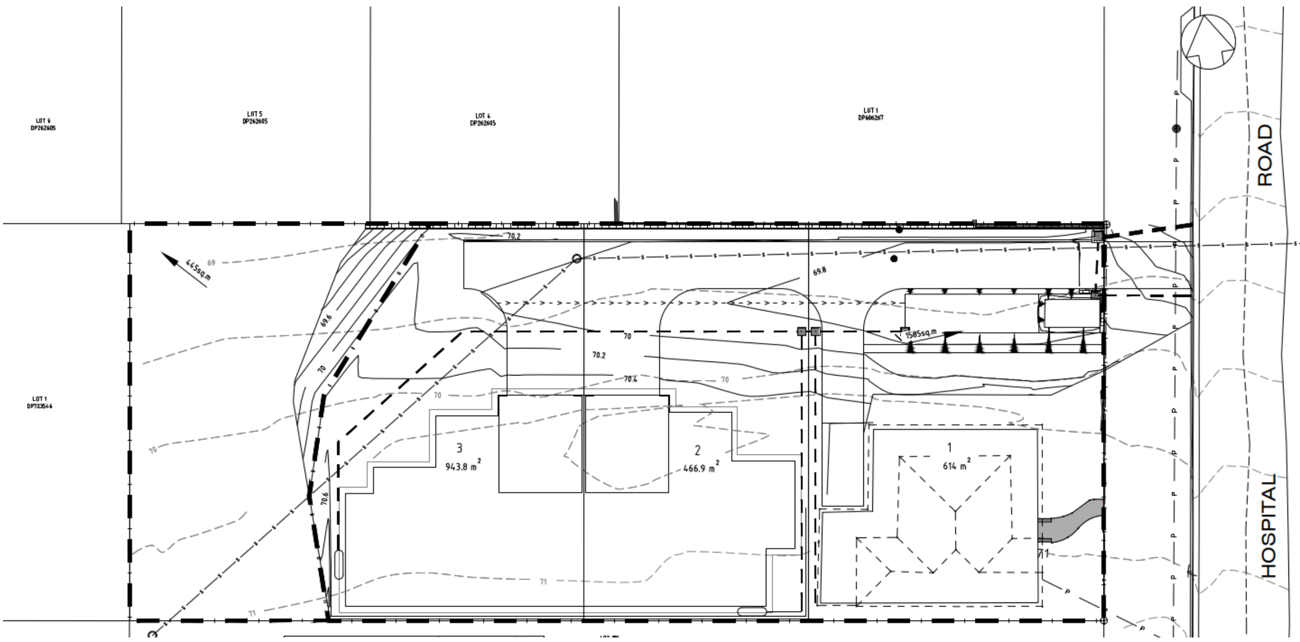


Figure 7: Post-development Catchments

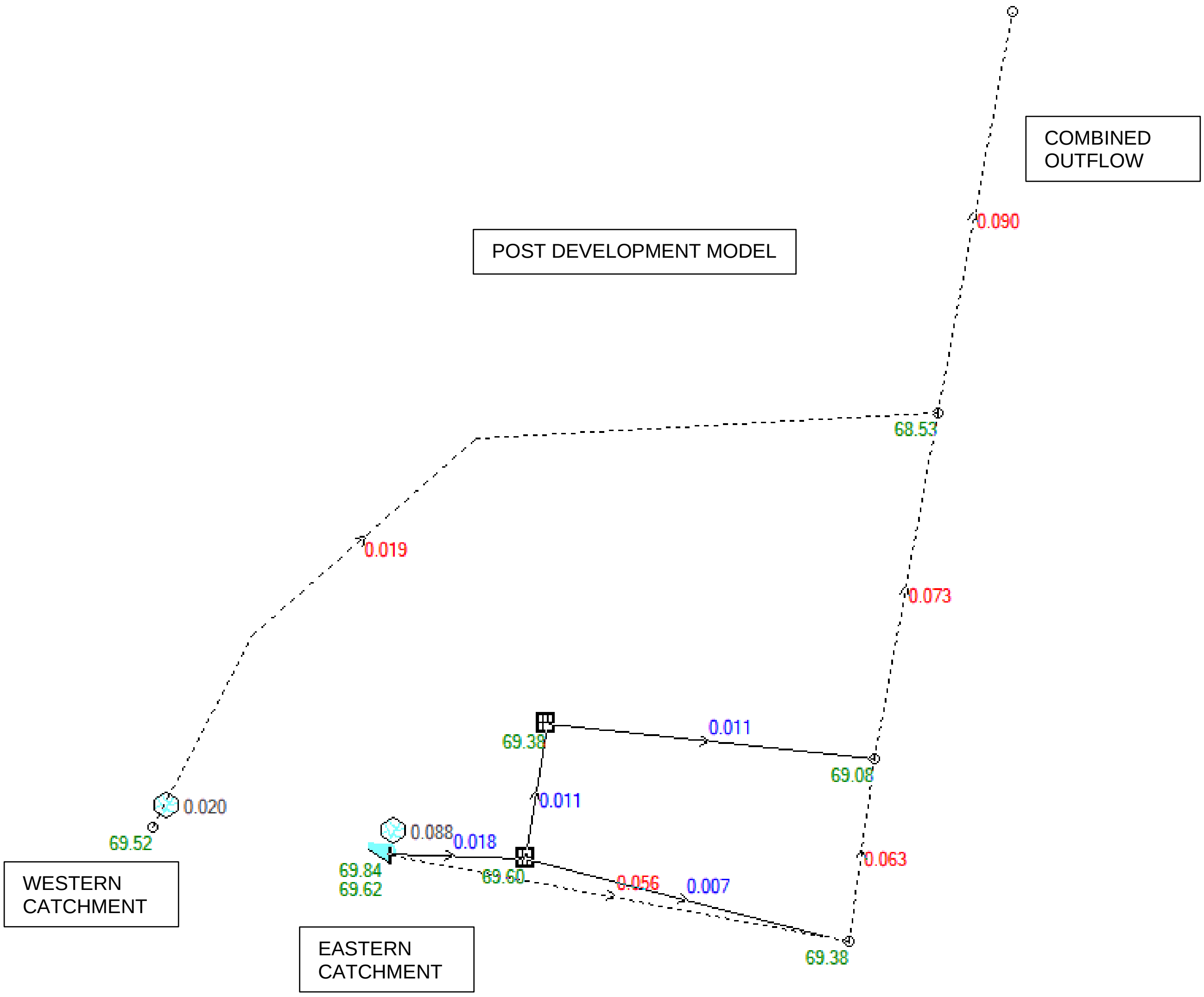


Figure 8: Post Development DRAINS Model Showing 1% AEP Results

Table 4: Site Discharge Rates to Lot 901

	Pre Developed	**Post Developed**
AEP	**(L/s)**	**(L/s)**
20%	24	20
10%	45	25
5%	61	50
1%	95	90

As can be seen from the above figures, the overall post-development peak discharge rates are lower than the existing site conditions.

5.0 CONCLUSION

The results derived from modelling procedures indicate that water quality constraints are appropriately addressed in the proposed development through the inclusion of a rainwater tanks and a biofiltration raingarden in the proposed design, and the proposed development will have an overall beneficial impact on water quality.

Peak flow rates leaving the site have been reduced via the surface detention and the rates flowing through adjoining lands have been reduced by directing the development discharge to Hospital Road as the legal point of discharge.

From a stormwater perspective, it is considered the proposal is acceptable and recommended for approval.

6.0 REFERENCES

NSW MUSIC Modelling Guidelines, 2015, BMT WBM

Music Version 6.0 User Manual, 2011, eWater

Stormwater Flow and Quality, and the Effectiveness of Non-Proprietary Stormwater Treatment Measures, 2004, Fletcher et al

WSUD Engineering Procedures: Stormwater, 2005, Melbourne Water

MUSIC Modelling Guidelines, 2018, Healthy Land and Water Limited & Water By Design

APPENDIX A: PROPOSED LAYOUT & DETAIL PLANS

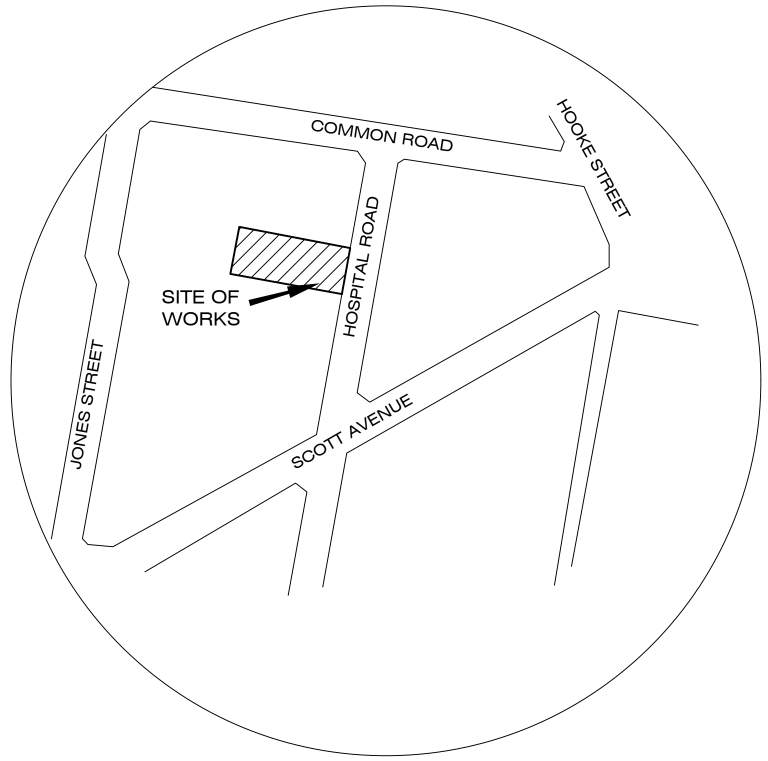
PROPOSED 1 INTO 3 LOT SUBDIVISION

DA DRIVEWAY & DRAINAGE PLANS

84 HOSPITAL ROAD, DUNGOG
LOT 181 DP 661448

Sheet List Table

Sheet Number	File Number	Sheet Description	Revision
1	2230208	COVER SHEET, LOCALITY SKETCH & SCHEDULET OF DRAWINGS	A
2	2230209	SUBDIVISION LAYOUT PLAN	A
3	2230210	DEMOLITION PLAN	A
4	2230211	DETAILED ENGINEERING LAYOUT PLAN	A
5	2230212	DETAILED SITE SECTIONS	A
6	2230213	PRE-DEVELOPED STORMWATER CATCHMENT PLAN	A
7	2230214	POST-DEVELOPED STORMWATER CATCHMENT PLAN	A
8	2230215	TURNING PATH PLAN	A
9	2230216	EROSION & SEDIMENT CONTROL PLAN	A



LOCALITY SKETCH
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SHEET No. : 1 of 9

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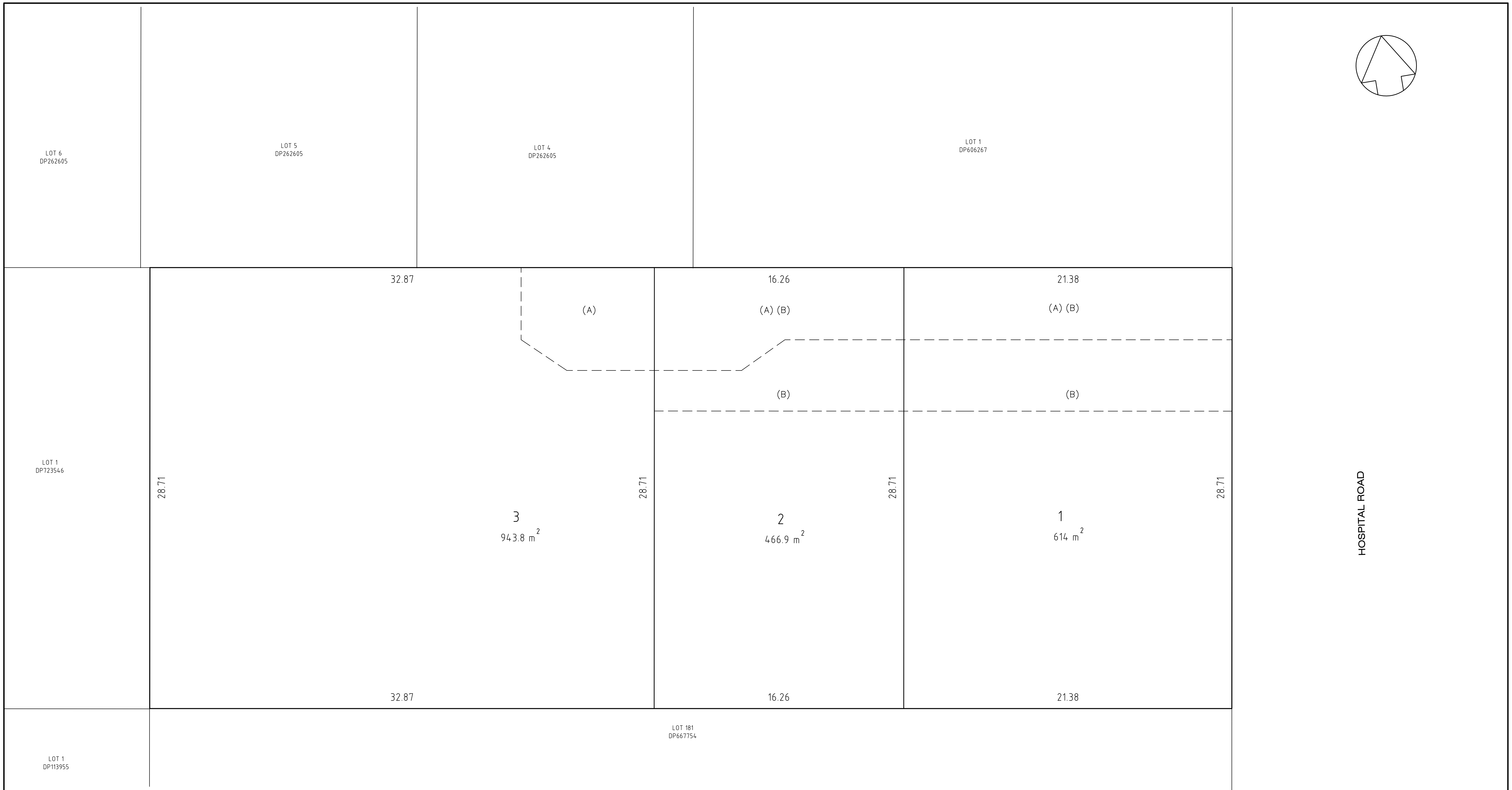

(A) EASEMENT FOR ACCESS AND SERVICES

(B) EASEMENT FOR DRAINAGE

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(1:250 for A3 Size Plot)

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A	Original Issue	DS	DS	AV	BL	5/10/23

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SUBDIVISION LAYOUT PLAN
RESIDENTIAL DEVELOPMENT 1-INTO-3 TORRENS SUBDIVISION
LOT 181 DP 661448
85 HOSPITAL ROAD, DUNGOG

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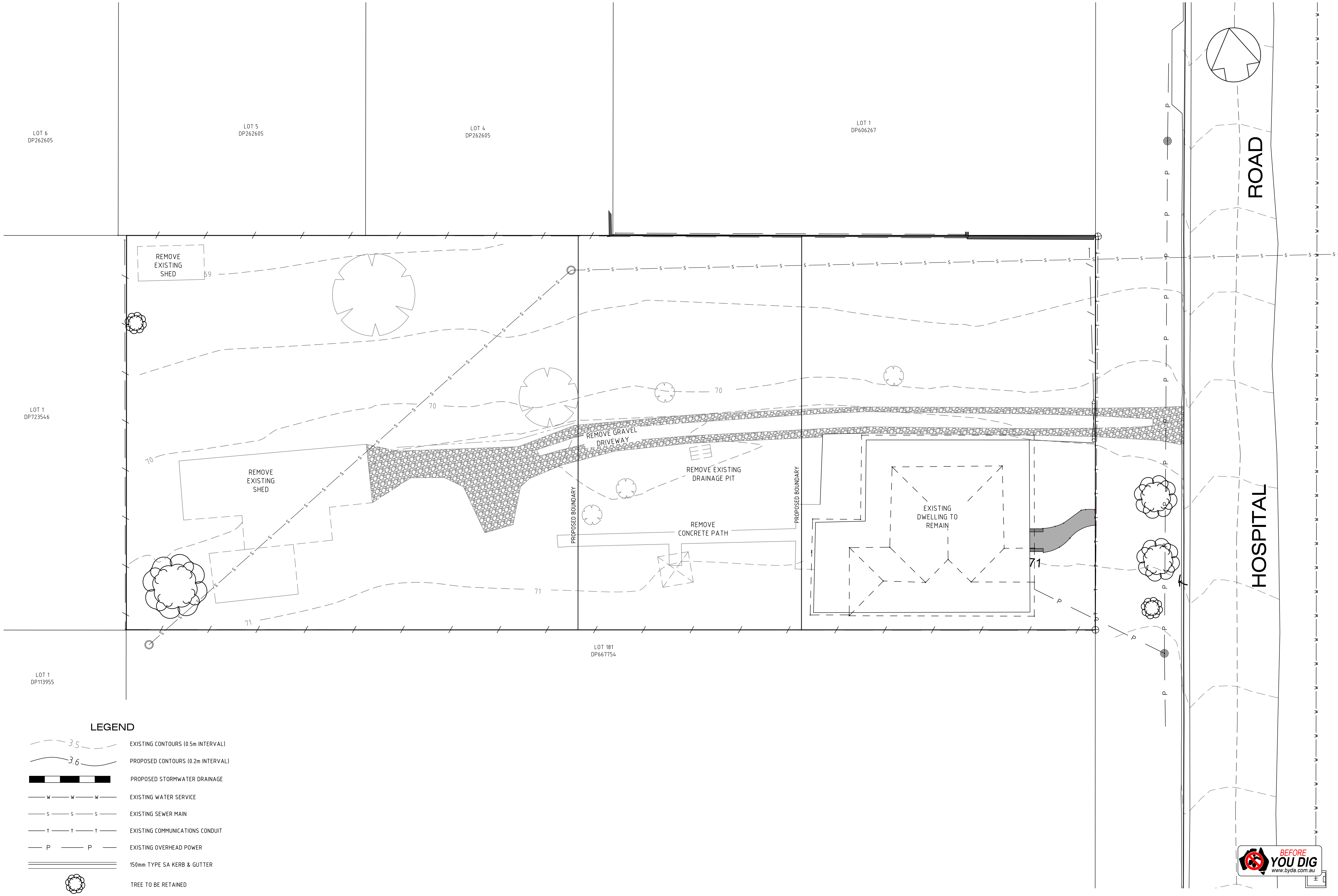

LEGEND

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3.6	PROPOSED CONTOURS (0.2m INTERVAL)
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—S—S—S—	EXISTING SEWER MAIN
—T—T—T—	EXISTING COMMUNICATIONS CONDUIT
—P—P—	EXISTING OVERHEAD POWER
	150mm TYPE SA KERB & GUTTER
	TREE TO BE RETAINED
	TREE TO BE REMOVED

DEMOLITION PLAN

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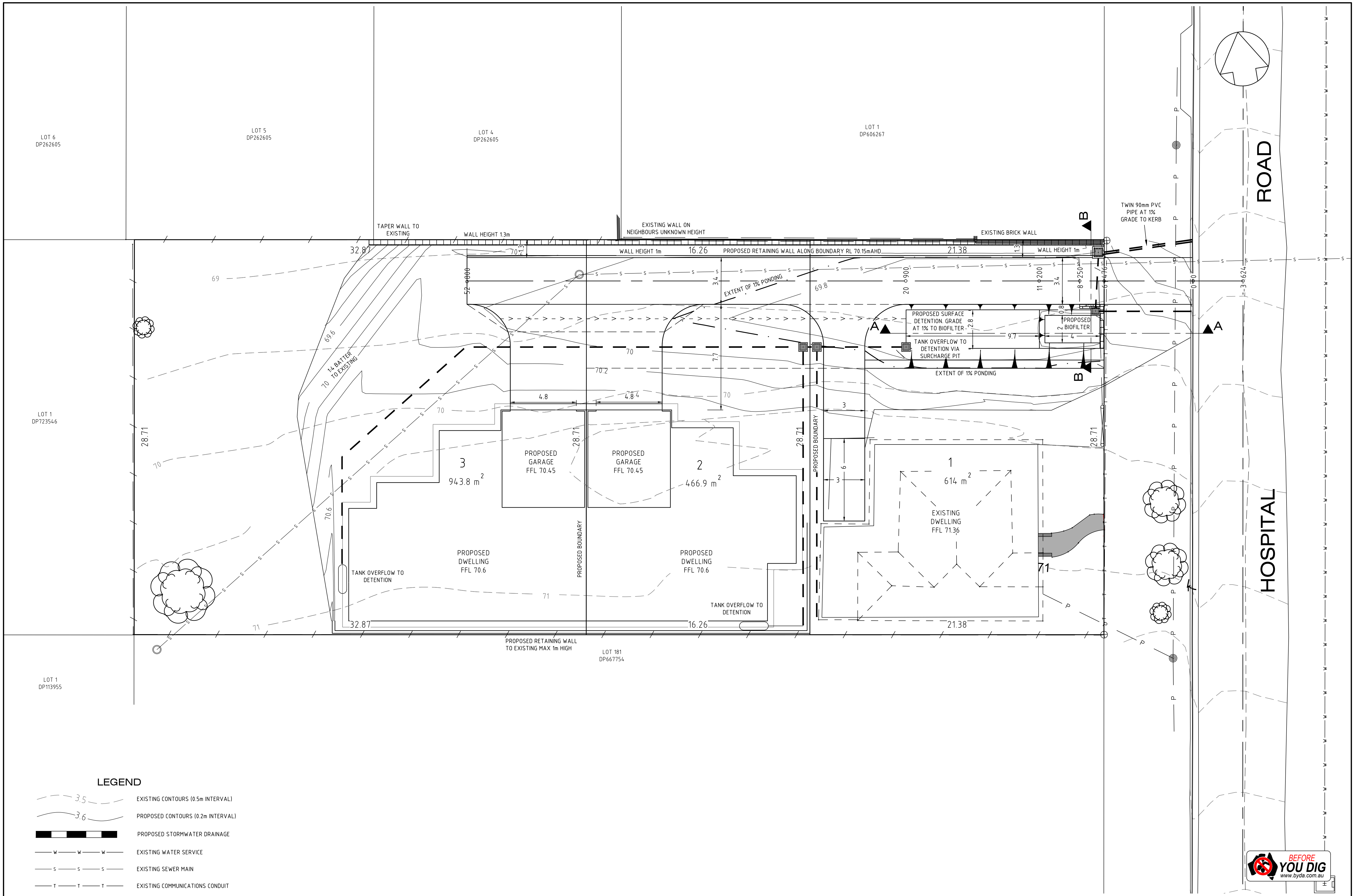

LEGEND

- EXISTING CONTOURS (0.5m INTERVAL)
- PROPOSED CONTOURS (0.2m INTERVAL)
- PROPOSED STORMWATER DRAINAGE
- EXISTING WATER SERVICE
- EXISTING SEWER MAIN
- EXISTING COMMUNICATIONS CONDUIT
- EXISTING OVERHEAD POWER
- 150mm TYPE SA KERB & GUTTER
- TREE TO BE RETAINED

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DETAILED ENGINEERING LAYOUT PLAN

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS	AV	BL	5/10/23

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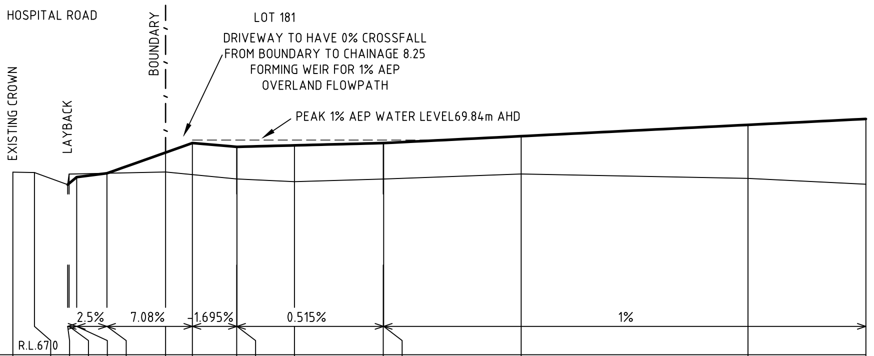

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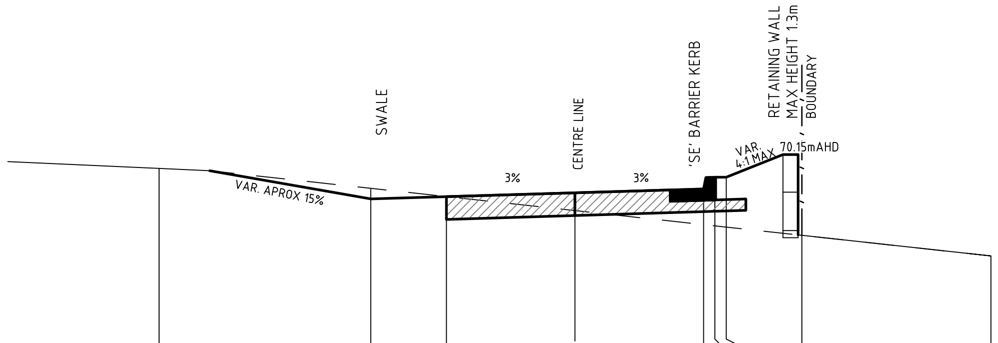

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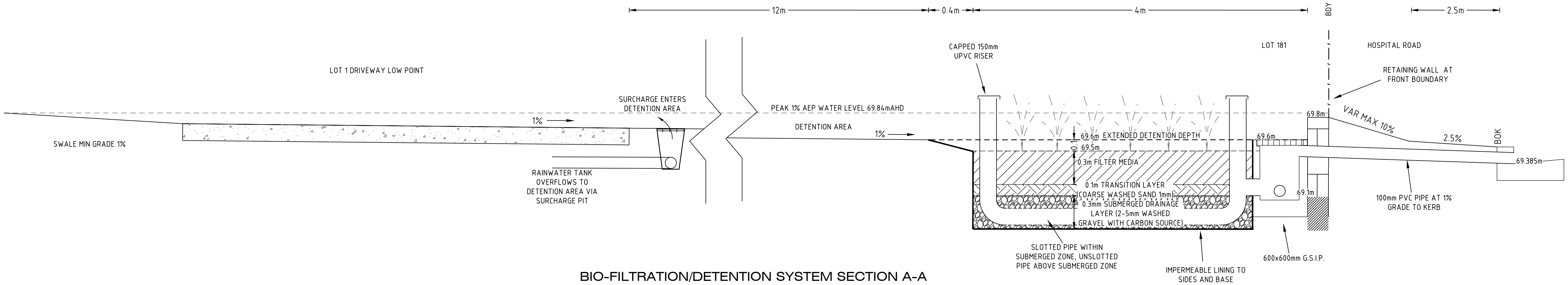

BIO-FILTRATION/DETENTION SYSTEM SECTION A-A

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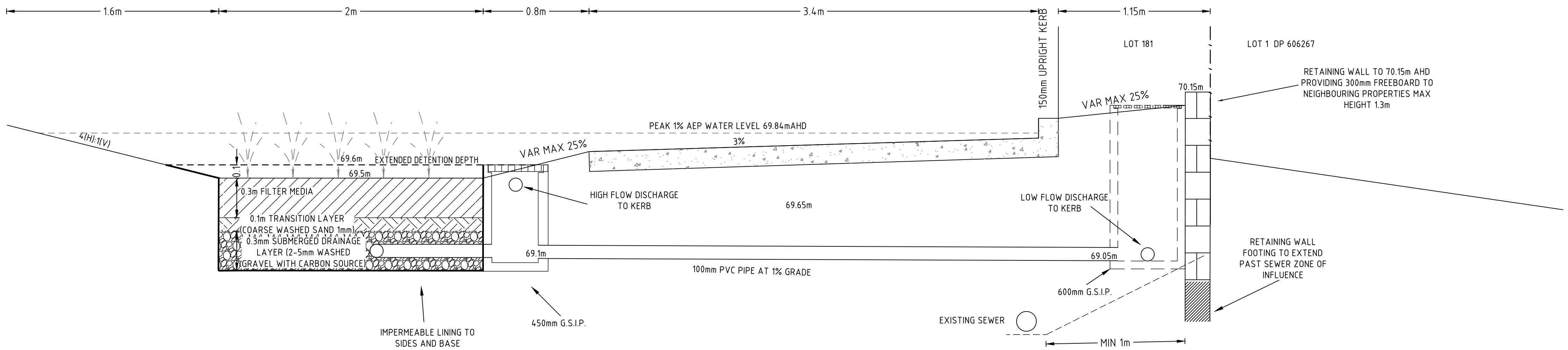

BIO-FILTRATION SYSTEM - SECTION B-B

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DETAILED SITE SECTIONS

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COMPUTER FILE : S:\Clients\2023\223017\Dwg\223017 DA Design.dwg			

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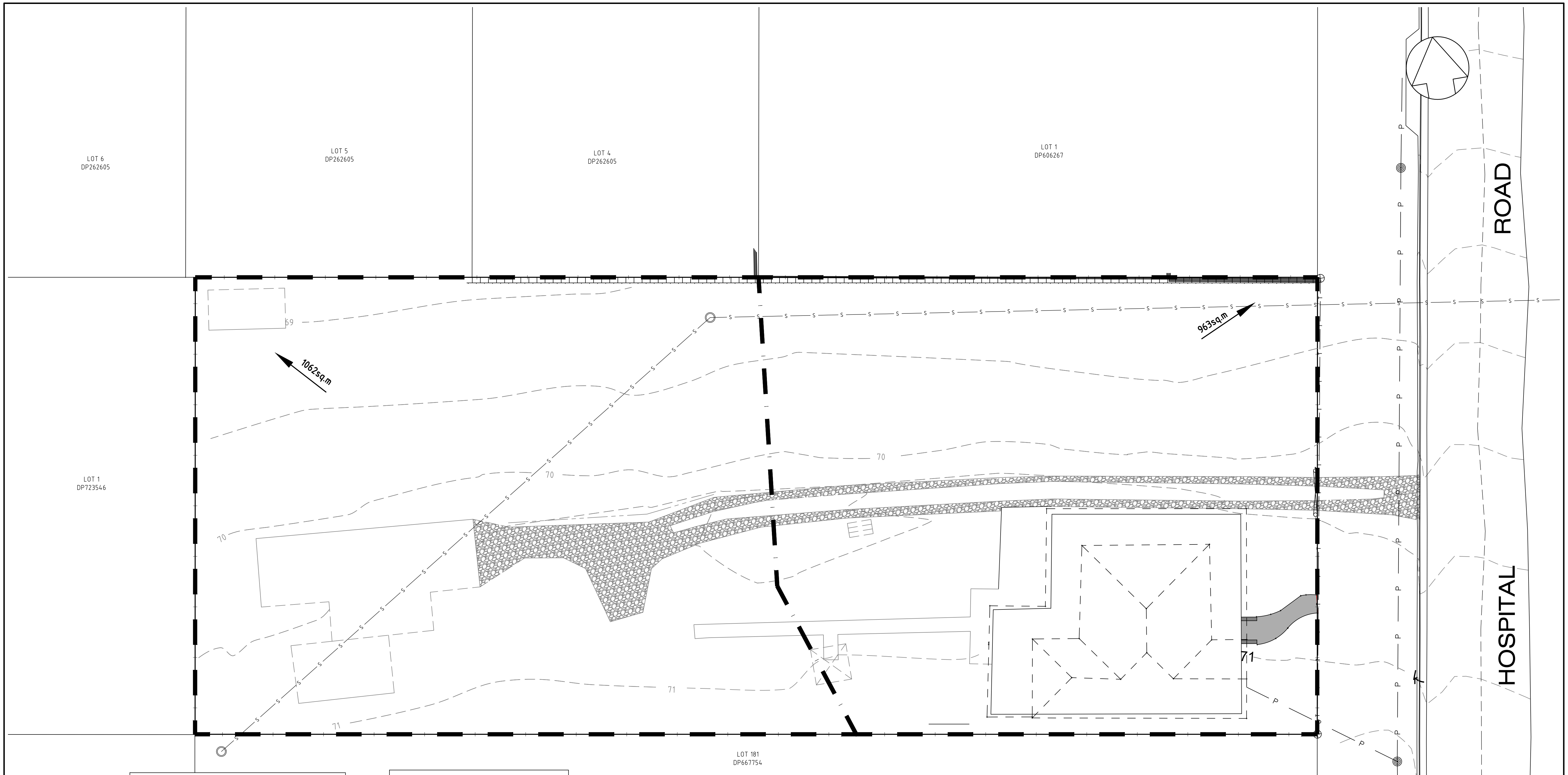
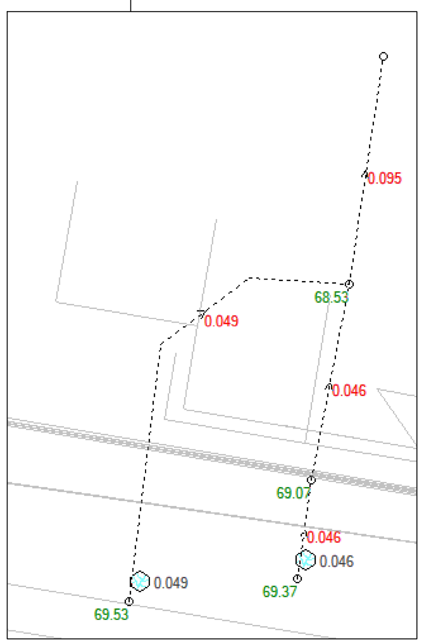
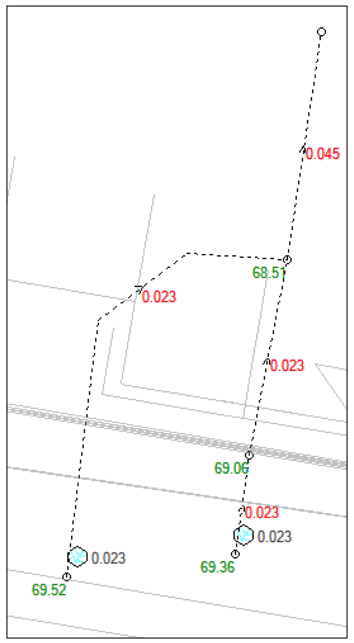




1% AEP Pre-Developed DRAINS Model



10% AEP Pre-Developed DRAINS Model

DETENTION ASSESSMENT:

STORMWATER DETENTION ASSESSMENT COMPLETED USING **'DRAINS'** SOFTWARE, UTILISING CURRENT ARR19 DATA FROM THE ARR DATA HUB AND BUREAU OF METEOROLOGY - FULL MODEL TO BE PROVIDED TO COUNCIL, AND A SUMMARY OF CALCULATIONS IS PRESENTED IN A SEPARATE STORMWATER REPORT.

PRE-DEVELOPED STORMWATER CATCHMENT PLAN

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS	AV	BL	5/10/23

TATTERSALL LANDER Pty Ltd
DEVELOPMENT CONSULTANTS

SCALE : 0 2.5 5m (1:500 for A3 Size Plot)
SHEET No. : 6
JOB No.: 223017
FILE : 2230213
DATE: Plotted 6/10/23 8:52AM
SHEET SIZE A3
COMPUTER FILE : S:\Clients\2023\223017\Dwg\223017 DA Design.dwg

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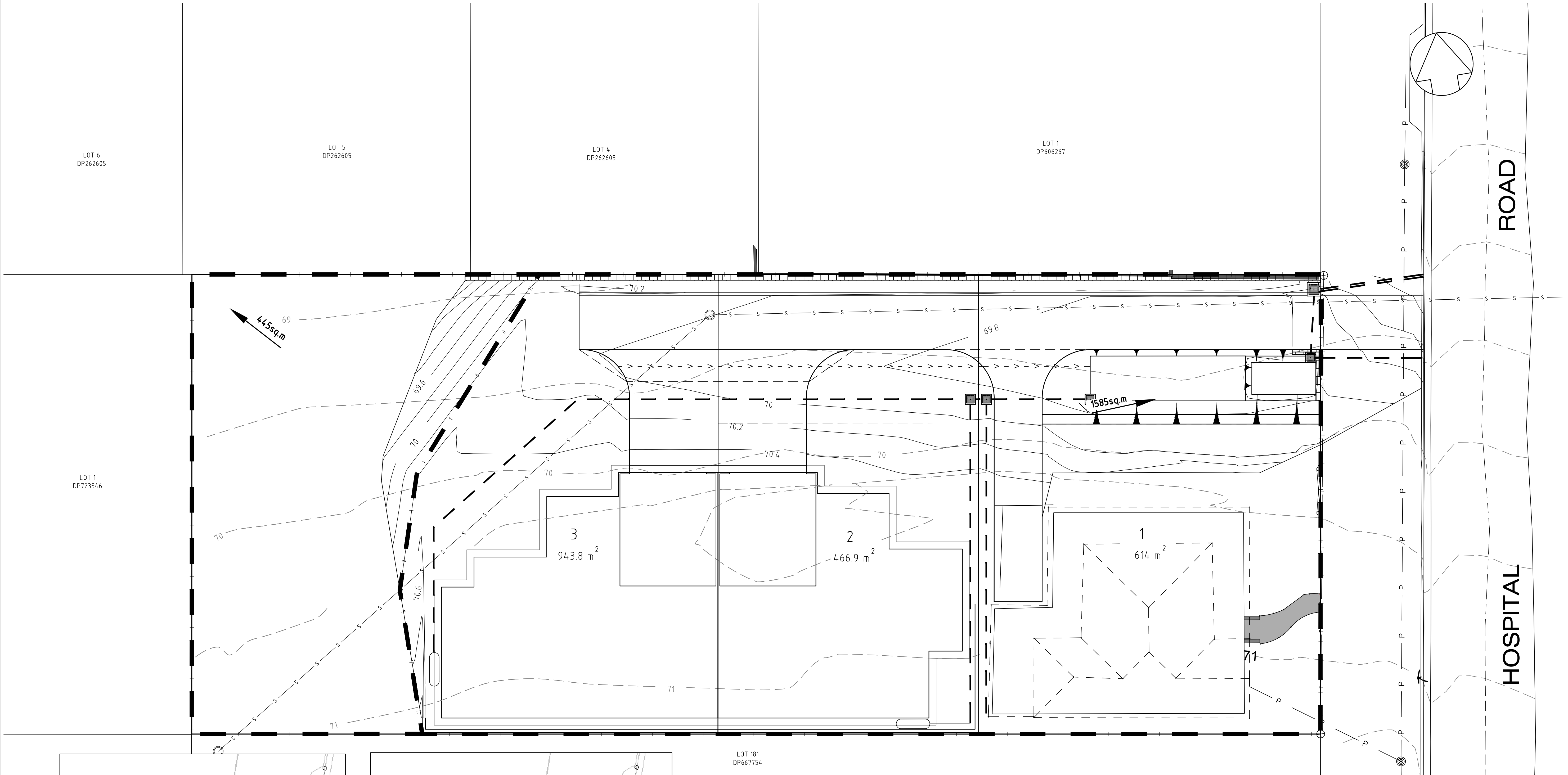

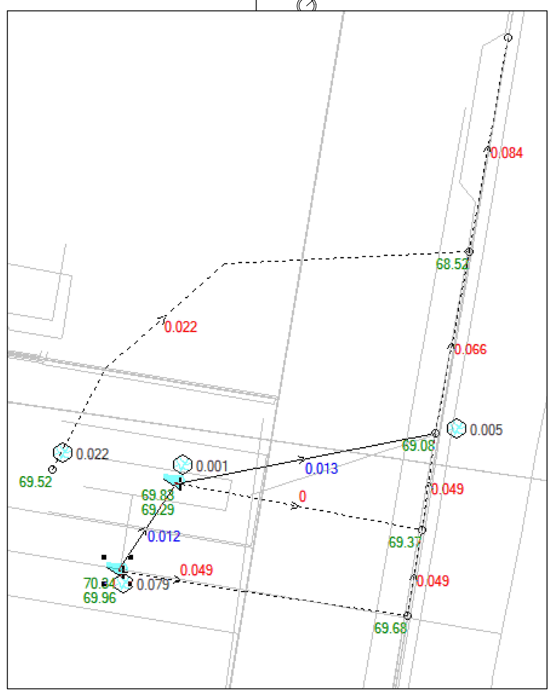

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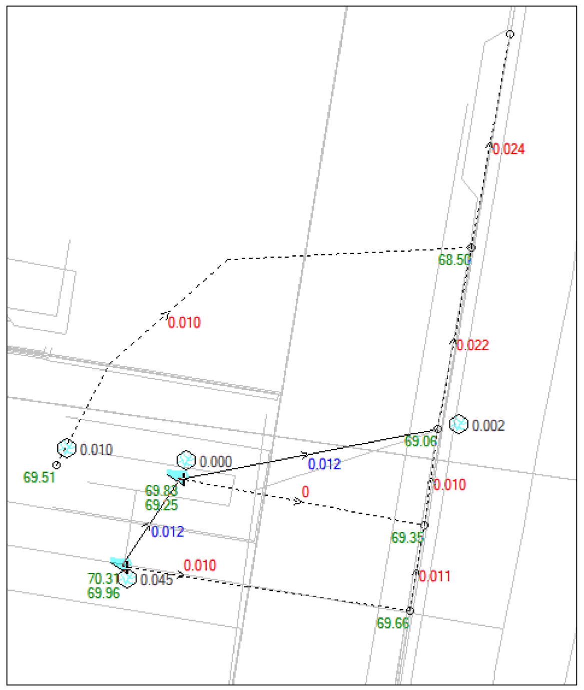

10% AEP Post-Developed DRAINS Model

DETENTION ASSESSMENT:

STORMWATER DETENTION ASSESSMENT COMPLETED USING **'DRAINS'** SOFTWARE, UTILISING CURRENT ARR19 DATA FROM THE ARR DATA HUB AND BUREAU OF METEOROLOGY - FULL MODEL TO BE PROVIDED TO COUNCIL, AND A SUMMARY OF CALCULATIONS IS PRESENTED IN A SEPARATE STORMWATER REPORT.

POST-DEVELOPED STORMWATER CATCHMENT PLAN

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS	AV	BL	5/10/23

TATTERSALL LANDER Pty Ltd
DEVELOPMENT CONSULTANTS

SCALE : 0 1.25 2.5m (1:250 for A3 Size Plot)	SHEET No. : 7	FILE : 2230214	SHEET SIZE
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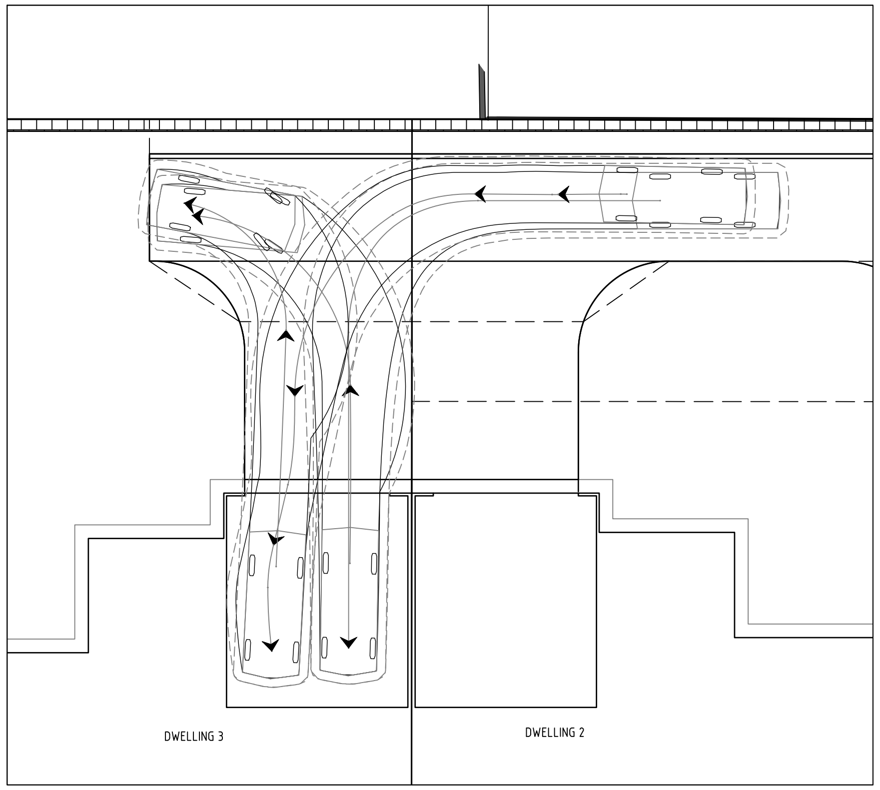

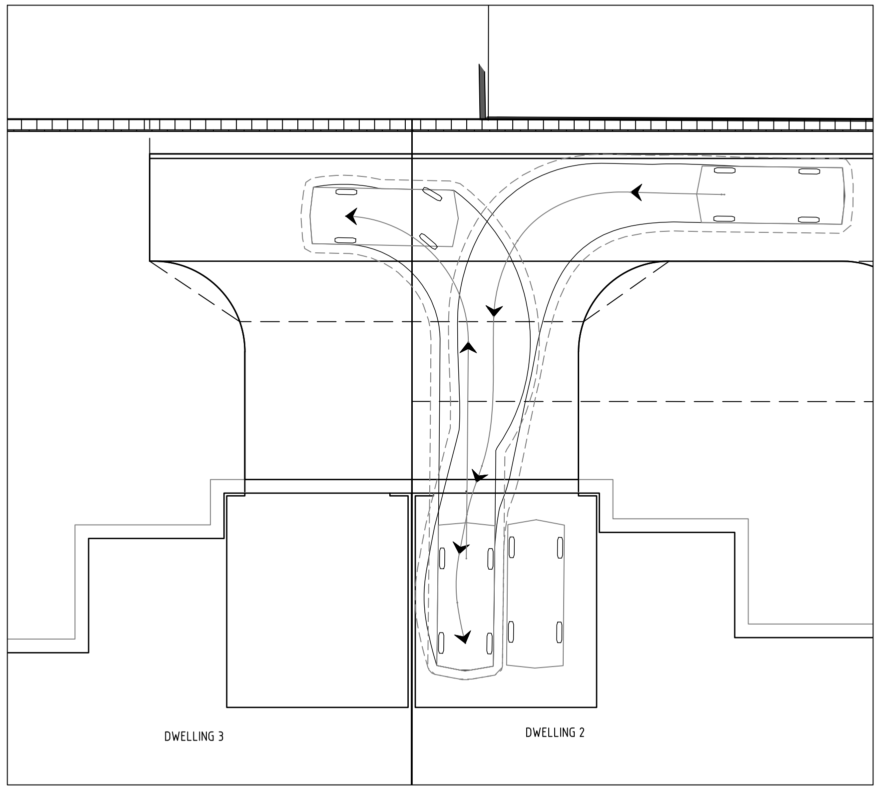

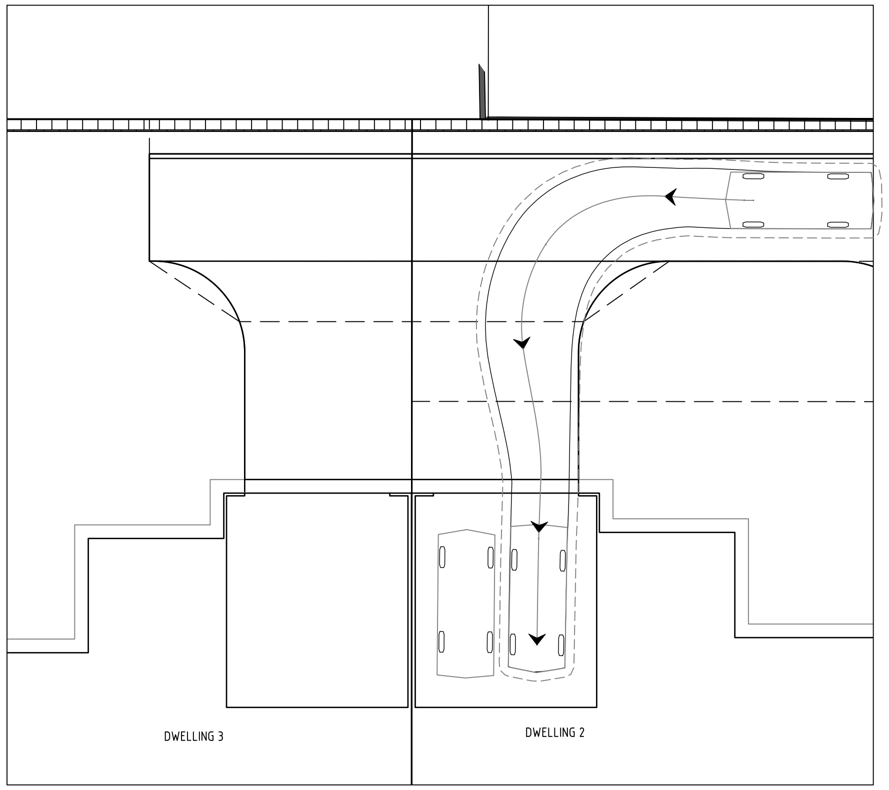

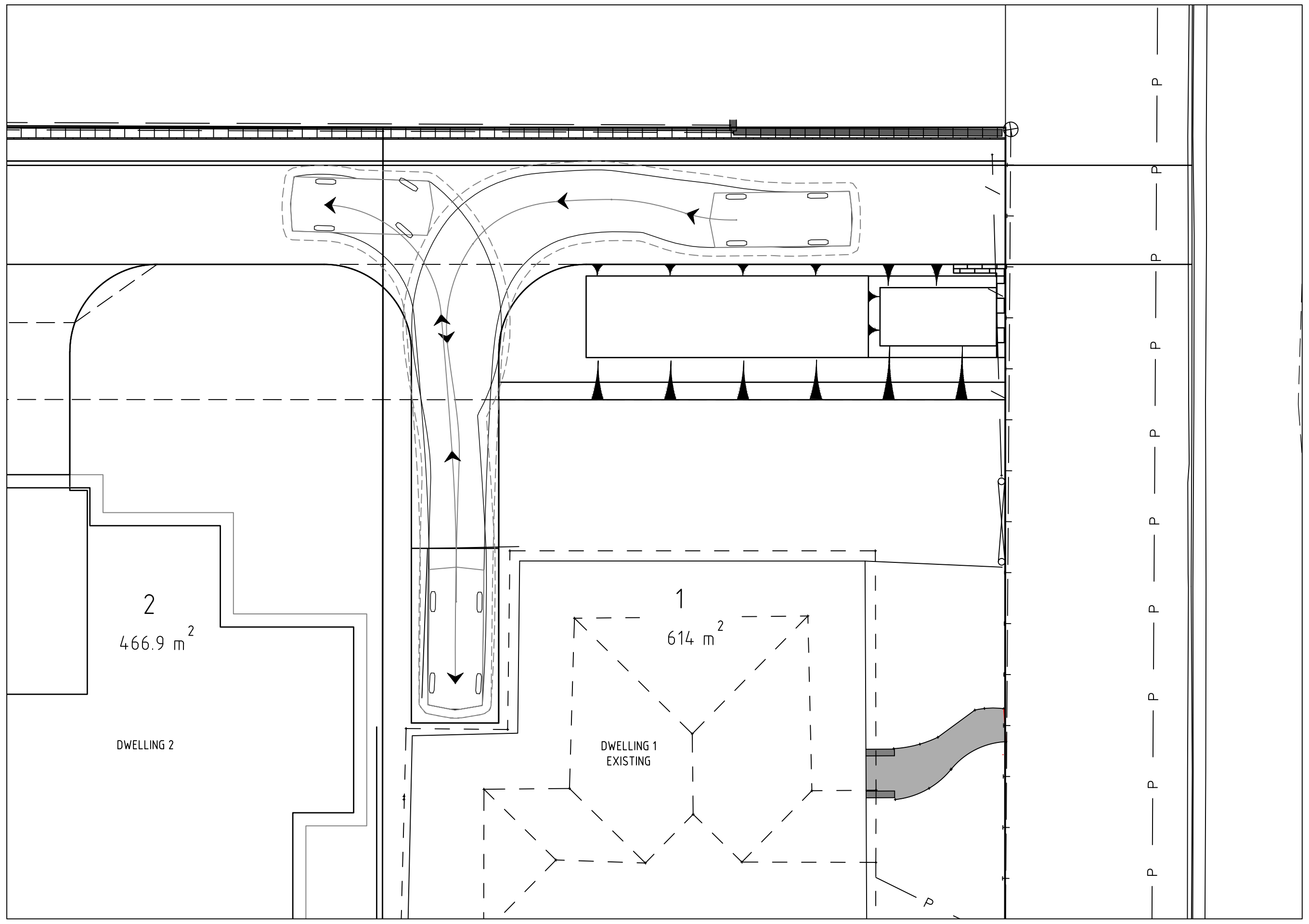

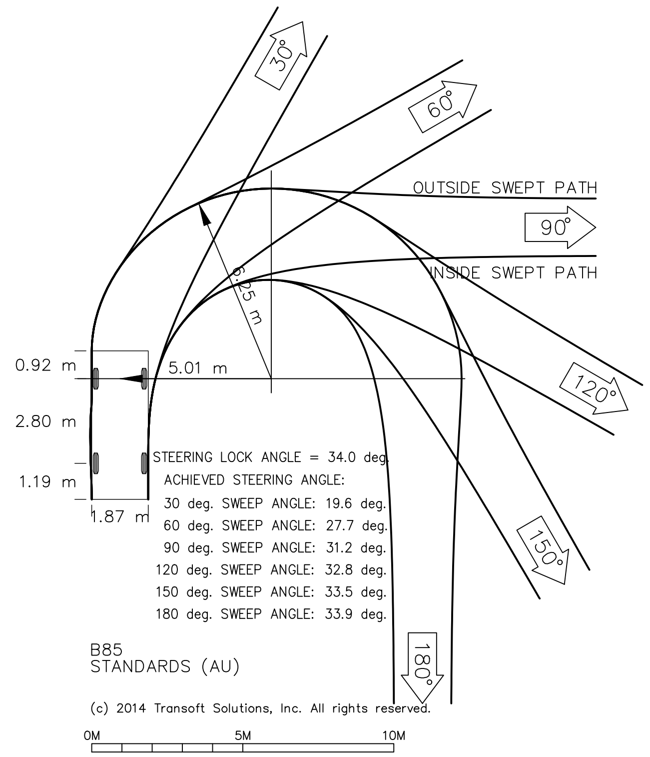

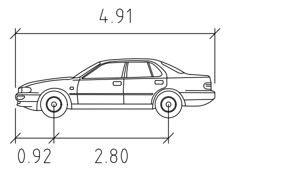

B85	meters
Width	: 1.87
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

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TURNING PATH PLAN

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS	AV	BL	5/10/23

TATTERSALL LANDER Pty Ltd
DEVELOPMENT CONSULTANTS

SCALE : 0 1.25 2.5m (1:250 for A3 Size Plot)
SHEET No. : 8
JOB No.: 223017
FILE : 2230215
DATE: Plotted 6/10/23 8:52AM
SHEET SIZE A3
COMPUTER FILE : S:\Clients\2023\223017\Dwg\223017 DA Design.dwg

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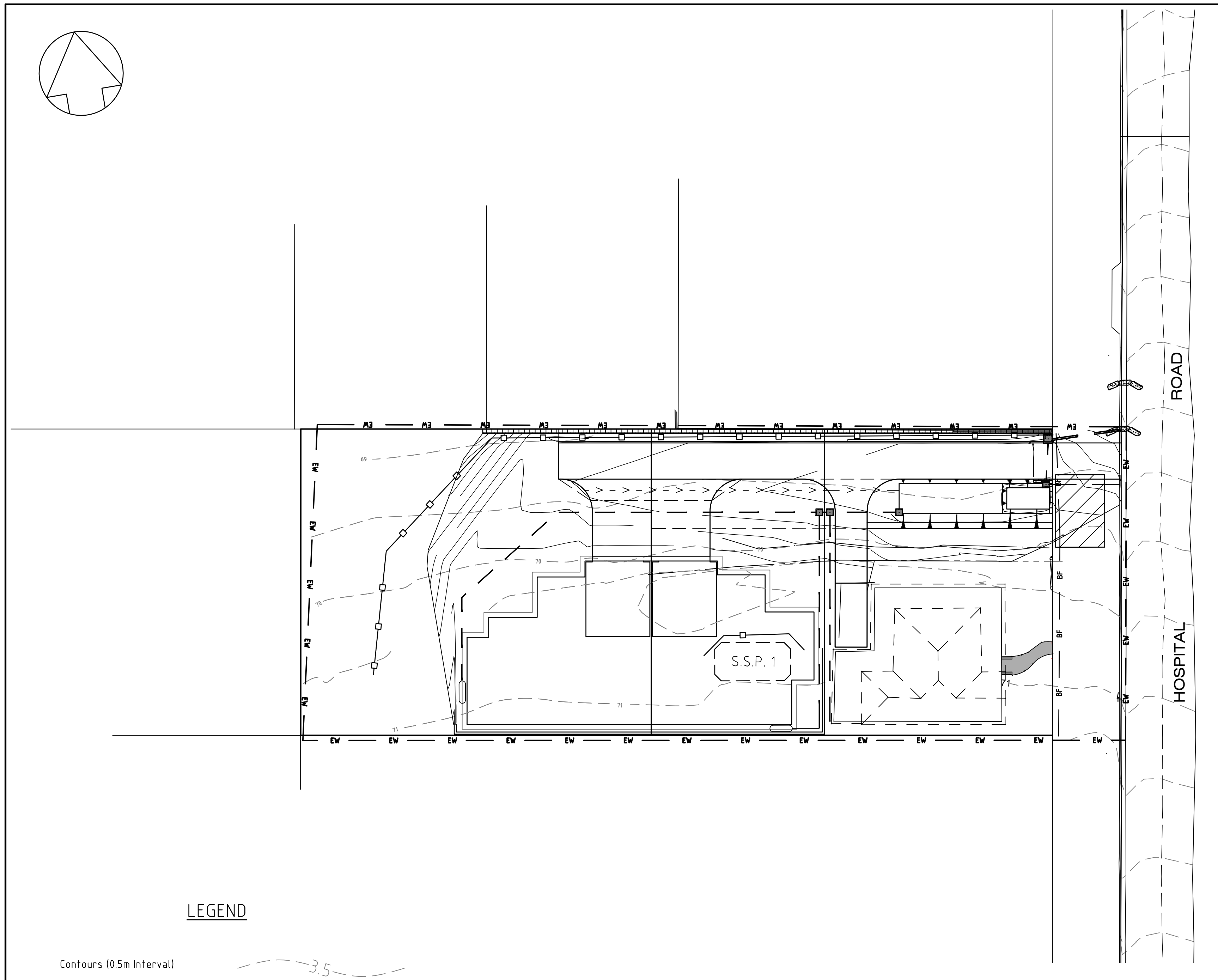
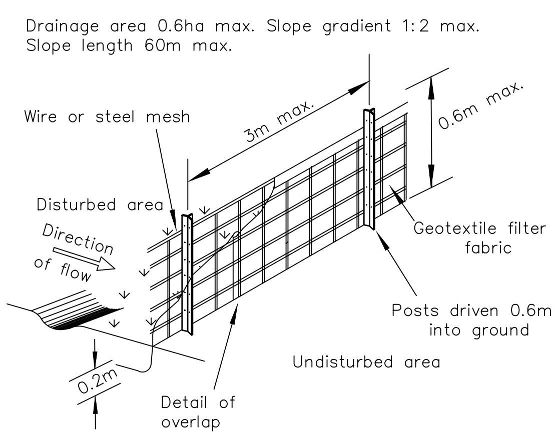


EROSION & SEDIMENT CONTROL NOTES

1. This plan is to be read in conjunction with other engineering plans and any written instructions that may be issued.
2. Conformity with this plan shall in no way reduce the responsibility of the Contractor to protect against water damage during the course of the contract.
3. The contractor shall implement all soil erosion and sediment control measures prior to disturbance of the related catchment area and to the satisfaction of the Superintendent.
4. The location of "silt" fences, barrier fences, sediment traps, basins and other devices are indicative only and final locations are to be decided on site. Variations will be permitted to best suit the circumstances.
5. Cleared vegetation must be disposed of by :-
   i) chipping or mulching for future landscaping and usage, or
   ii) transport to an approved landfill facility.
6. Temporary crossbanks (bunds constructed with earth, straw bales or sandbags), shall be constructed during earthworks to limit slope length, where possible, to 80 metres. These shall be constructed immediately prior to forecast rain and during temporary closure of the site, including weekends.
7. Temporary rehabilitation should be undertaken on disturbed areas where works have stopped and soils are expected to remain exposed for two months.
8. Sediment barriers (e.g. sandbags or straw bales) should be located upstream of stormwater inlet pits prior to the road surface being paved and lands upslope being rehabilitated.
9. The contractor will inspect all erosion and pollution control works at least weekly and before and after every rainfall event greater than 5mm, providing particular attention to the following matters:
   (a) Ensure drains operate effectively and initiate repair as required.
   (b) Remove spilled sand (or other materials) from hazard areas, including lands closer than 5 metres from likely areas of concentrated or high velocity flows such as waterways and paved areas.
   (c) Ensure rehabilitated lands have effectively reduced the erosion hazard and initiate upgrading or repair as appropriate.
   (d) Construct additional erosion and/or sediment control works as might become necessary to ensure the desired protection is given to downslope lands and waterways, i.e., make ongoing changes to the plan.
   (e) Maintain erosion and sediment control measures in a functioning condition until all earthwork activities are completed and the site is rehabilitated.
   (f) Remove temporary soil conservation structures as a last activity in the rehabilitation program.
10. Utilise a single access only to the stock pile sites.
11. Drop inlets which do not outlet to silt traps shall be blocked until all works are completed.
12. Do not taint clean catchment water with silt from the works.
13. Rehabilitate the site as soon as possible after the completion of construction activities and within 10 working days. Lands where works are not to continue for more than 20 working days must be rehabilitated. Such rehabilitation shall involve the spraying of a straw- bitumen mulch to the disturbed lands or equivalent.
14. Access areas limited to a maximum width of 10 (preferably 5) metres.
15. Topsoil and spoil shall be stockpiled in non-hazard areas and protected from surface run-off by diversion drains or similar. Stockpiles shall be surrounded on downstream sides by silt fencing. Stockpiles shall be suitably compacted to inhibit erosion. Where the stockpiling period exceeds four (4) weeks, the stockpile shall be seeded to encourage vegetation growth.
16. Topsoil shall be re-spread and stabilised as soon as possible. Disturbed areas shall be left with a scarified surface to encourage water infiltration and assist keying in topsoil.
17. The contractor shall maintain grass cover until all works have been completed including the maintenance period, by frequent watering and mowing where required.
18. All drainage works shall be constructed and stabilised as quickly as possible to minimise risk of erosion.
19. Site access shall be restricted to a nominated point, which is appropriately stablised, and includes the installation of a shake-down area if site conditions require.
20. Facilities and/or equipment must be provided for the application of water to disturbed areas to minimise the generation of airborne dust from any area disturbed by construction activities.
21. Material removed from sediment control structures must be disposed of in a way that does not pollute waters or bushland.
22. Waste disposal containers must be provided on site for the collection and disposal of all industrial and domestic type wastes generated on site.
23. Concrete wastes or washings from any concrete mixture or deliveries must not be deposited in any location where they can flow or be washed into waters.
24. Runoff from vehicle, construction plant or mobile plant maintenance and cleaning areas must be contained, collected and disposed of in a manner to prevent entry into any waters, including sediment retention ponds.
25. Fuelling of vehicles and construction plant must be carried out with an operator or driver present, and in a way that prevents any spillage occurring.
26. Prior to the controlled discharge (e.g. de-watering activities from excavations and sediment basins) of any water (groundwater or sediment laden water) from the site during construction, the following water quality objectives shall be achieved:
   * not exceed Total Suspended Solids of 50mg/L
   * have no odour or visible petro-chemical sheen
   * have no visible litter or waste matter
   * not contain any other contaminant, chemical or biological condition which causes any measurable adverse effect

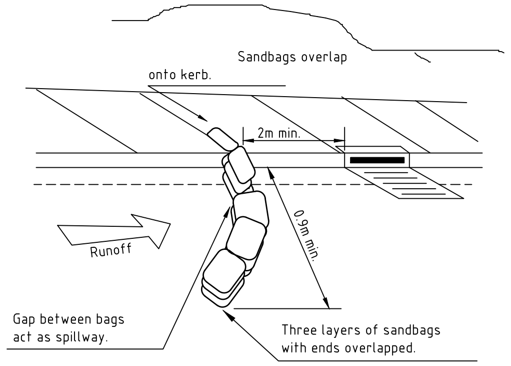
LEGEND

Contours (0.5m Interval)	3.5
Extent Of Works	EW EW
Construction Barrier Fencing	BF BF
Sheet Flowpath	
Concentrated Flowpath	
Sediment Fence - see SD6-8	
Straw Bale Sediment Filter (Or Equivalent Coir Log to Manufacturers specifications)	
Sand Bag Sediment Filter - see ES02	
Diversion Bank / Drain - see SD5-5	
Soil Stock Pile - see SD4-1	S.S.P. 1
Stabilised Site Access - see SD6-14	



GEOFABRIC SEDIMENT FENCE

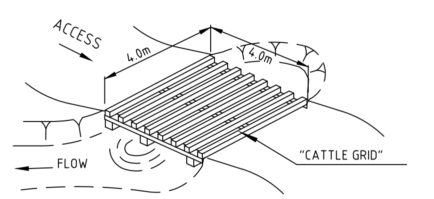
NOT TO SCALE



SANDBAG KERB INLET SEDIMENT TRAP

NOT TO SCALE

TO BE USED AT STORMWATER PITS ON GRADE



TEMPORARY CONSTRUCTION EXIT SHAKE–DOWN FACILITY DETAIL (CATTLE GRID)

NOT TO SCALE

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EROSION & SEDIMENT CONTROL PLAN

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS	AV	BL	5/10/23

TATTERSALL LANDER Pty Ltd DEVELOPMENT CONSULTANTS

SCALE : 0 2.5 5m (1:500 for A3 Size Plot)	SHEET No. : 9	FILE : 2230216	SHEET SIZE
	JOB No.: 223017	DATE:Plotted 6/10/23 8:53AM	A3
COMPUTER FILE : S:\Clients\2023\223017\Dwg\223017 DA Design.dwg			

APPENDIX B: SITE DETAIL SURVEY

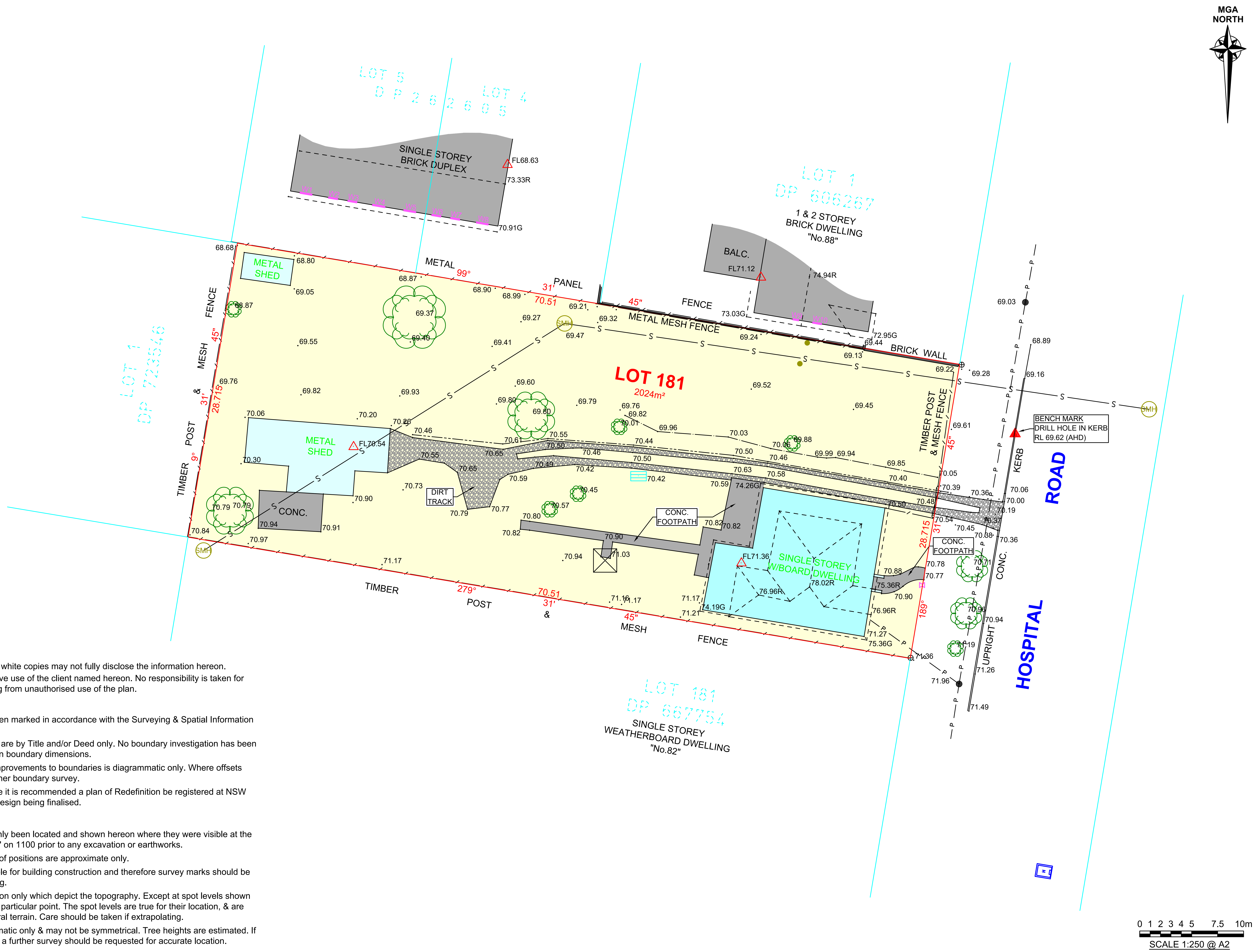
DIAL 1100 BEFORE YOU DIG
www.dialbeforeyoudig.com.au

LEGEND

TREE CANOPY (APPROXIMATE)

- TREE / R.L AT BASE OF TREE
- CLOTHES LINE
- POWER POLE
- TELSTRA POST
- SEWER MANHOLE (SMH)
- SEWER VENT
- LETTER BOX
- FLOOR LEVEL
- BENCH MARK
- GATE
- OVERHEAD POWER LINE (— P —)
- 19.75 G GUTTER HEIGHT
- 21.90 R RIDGE HEIGHT
- TOP OF BATTER
- TOE OF BATTER
- FENCE
- W1 WINDOW
- SEWER MAIN (APPROX.) (— S —)
- WATER HYDRANT

WINDOW & DOOR R.L'S		
No.	TOP	BOTTOM
W1	70.57	68.84
W2	70.62	70.18
W3	70.62	70.19
W4	70.62	68.84
W5	70.61	68.84
W6	70.60	70.20
W7	70.59	70.20
W8	70.60	68.84
W9	72.85	72.26
W10	72.84	71.82



NOTES - GENERAL

1. This plan may be colour coded and black & white copies may not fully disclose the information hereon.
2. This plan has been prepared for the exclusive use of the client named hereon. No responsibility is taken for any loss incurred by any third party resulting from unauthorised use of the plan.

NOTES - BOUNDARY

1. The boundaries of the subject land have been marked in accordance with the Surveying & Spatial Information Regulation 2017.
2. Bearings, distances & areas of subject land are by Title and/or Deed only. No boundary investigation has been carried out in the determination of the shown boundary dimensions.
3. Do not scale off this plan. Relationship of improvements to boundaries is diagrammatic only. Where offsets are critical they should be confirmed by further boundary survey.
4. If it is intended to design to full site coverage it is recommended a plan of Redefinition be registered at NSW Land Registry Services (LRS), prior to the design being finalised.

NOTES - TOPOGRAPHICAL

1. Service lines and service structures have only been located and shown hereon where they were visible at the time of survey. Phone "Dial Before You Dig" on 1100 prior to any excavation or earthworks.
2. Neighbouring houses, ridges, windows & roof positions are approximate only.
3. The accuracy of this data may not be suitable for building construction and therefore survey marks should be placed prior to any construction commencing.
4. Contours shown are a computer interpretation only which depict the topography. Except at spot levels shown they do not represent the exact level at any particular point. The spot levels are true for their location, & are intended to be useful to represent the general terrain. Care should be taken if extrapolating.
5. Tree spread diameters shown are diagrammatic only & may not be symmetrical. Tree heights are estimated. If any of these elements are critical to design, a further survey should be requested for accurate location.

LE MOTTEE GROUP
SURVEYING | CIVIL ENGINEERING | TOWN PLANNING | PROJECT MANAGEMENT
STRATA CERTIFICATION | ECOLOGY | BUSHFIRE ASSESSMENT

4/199 ADELAIDE STREET
PO BOX 363
RAYMOND TERRACE, 2324
P: 4987 1748
reception@lemottee.com
ABN 38 136 535 156

Technical Details:			
Azimuth -	MGA	Datum -	AHD
Origin -	SSM 132865	Origin -	SSM 136447
Easting -	382 216.965	R.L. -	57.269 (AHD)
Northing -	6 414 806.338	Contour Int. -	0.5 METRE

Surveyed MB 11/05/2022
Drafted MB 12/05/2022
Checked AJM 13/05/2022

Title: CONTOUR & DETAIL
Client: INVEST 01 PTY LTD & HUNNIT PROPERTY GROUP PTY LTD
Site: LOT 181 DP 661448 - No.84 HOSPITAL ROAD
Locality: DUNGOG LGA: DUNGOG

Our Ref: 8814 DET-V1
Original Size: A2
Sheet No. 1 of 1

APPENDIX C: BIOFILTER MAINTENANCE TASKS

A. Filter Media Tasks

Sediment Deposition	Remove sediment build up from the surface of bioretention areas (minor manual removal without damaging plants). Frequency – 3 monthly after rain
Holes or scour	Infill any holes in the filter media. Check for erosion or scour and repair, provide energy dissipation (rocks & pebbles etc) if necessary. Frequency – 3 monthly after rain
Filter media surface porosity	Inspect for the accumulation of an impermeable layer (such as oily or clayey sediment) that may have formed on the surface of the filter media. A symptom may be that water remains ponded in the swale for more than a few hours after a rain event. Repair minor accumulations by raking away any mulch on the surface and scarifying the surface of the filter media between plants. Frequency – 3 monthly after rain
Litter Control	Check for litter (including organic litter) in and around bioretention areas. Remove both organic and anthropogenic litter to ensure flow paths and infiltration through the filter media are not hindered. Frequency – 3 monthly after rain

B. Horticultural Tasks

Pests and Diseases	Assess plants for disease, pest infection, stunted growth or senescent plants. Treat or replace as necessary. Reduced plant density reduces pollutant removal and infiltration performance. Frequency – 3 monthly after rain
Maintain original plant densities	Inspect condition of all plants. Replace and dead plants immediately to maintain a minimum density of 4 plants per square metre. Frequency – 3 monthly after rain
Drought / Extreme Heat	In periods of prolonged drought or extreme heat, the condition of plantings and site lawn coverage should to be monitored for signs of stress. Watering may be required to ensure plant survival. Frequency – As required

Weeds	It is important to identify the presence of any rapidly spreading weeds as they occur. The presence of such weeds can reduce dominate species distributions and diminish aesthetics. Weed species can also compromise the systems long term performance. Inspect for and manually remove weed species. Application of herbicide should be limited to a wand or restrictive spot spraying due to the fact that the swales are directly connected to the stormwater system. Frequency – 3 monthly after rain
Swales	Grassed swales treat runoff as it flows off the roads, before it enters the raingarden. Maintaining a healthy grass cover is important, but the use of fertilisers should be kept to a minimum given their proximity to the drainage network.
Lawn Fertiliser	Healthy site grass coverage is important for pollutant treatment, topsoil erosion control and aesthetics. However, if not correctly used, fertilisers can damage the downstream environment. A low Phosphorus fertiliser with restricted leaching properties such as a Fused Calcium Magnesium Phosphate or TNN Industries 'Formula 1', or equivalent is ideal. The application of fertiliser should be restricted to a maximum of twice a year

C. Drainage Tasks

Perforated Pipe	Ensure that perforated pipes are not blocked, to prevent filter media and plants from becoming water logged. Check raingarden low-flow outlet headwall is clear and free-flowing - A small steady clear flow of water may be observed discharging from the raingarden outlet some hours after rainfall. Note that smaller rainfall events after dry weather may be completely absorbed by the filter material and submerged zone and not result in flow, but if the raingarden appears to be holding water for some time after inflows have stopped, and minimal outflow is observed, flushing of the underdrain from the provided flushing points should be performed. When flushing the lines; - Do not undertake maintenance work if rain is likely - Set up sediment fence / sand bag bund around outlet to capture flushed sediment

	- Use a pressurised water hose (or similar means) at the provided flushing points to flush sediment to the outlet, - Remove collected sediment from the discharge point manually, & dispose offsite, - Re-seal the flushing points. Frequency – 6 monthly after rain
Inlet point, high flow weir & low-flow filter outlet	Ensure inflow areas and high flow weir are clear of litter and debris and in good and safe condition. Inspect for sediment, settlement etc and ensure general structural integrity. Frequency – quarterly and occasionally after rain