NORTHROP

Stormwater Servicing Report

Marsfield Common

PREPARED FOR
Winston Langley

Ref: 212044
Rev: G
Date: 10.05.2022

Stormwater Servicing Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
03.08.2021	A	DRAFT	M Brown	D Liganaris
30.09.2021	B		J Kane	D Liganaris
08.10.2021	C		J Kane	D Liganaris
24.11.2021	D		J Kane	D Liganaris
11.03.2022	E		J Kane	D Liganaris
14.03.2022	F		J Kane	D Liganaris
10.05.2022	G	FINAL	J Kane	D Liganaris

Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

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Introduction

Winston Langley engaged Northrop to undertake a stormwater and flooding assessment to determine appropriate responses for the redevelopment of the TG Millner site at 146 Vimiera Road, Marsfield, known as Marsfield Common.

The existing site incorporates TG Millner Field and associated rugby uses as the current home ground of Eastwood Rugby Club. North Ryde RSL operate the licensed club that fronts the main field. A childcare centre occupies a building in the north of the site.

The existing site layout is shown in **Figure 1**:

Figure 1: Existing Site Layout

Proposed Development

Figure 2 shows the proposed site layout upon redevelopment. Key features of the proposal are listed as follows:

- Internal road network which is proposed to be dedicated to Council,
- Street connections on Vimiera Road,
- Drainage easement in northwest of site retained,
- Retention of trees on the site perimeter in combination with 570 trees planted,
- Detached/attached dwellings throughout, and
- Public domain, including 10,000m^2 of land for public open space.

Figure 2: Proposed site layout (DKO Architecture)

Site characteristics

Topography and flow paths

As depicted in **Figure 3**, the site's topography is a combination of a large gently sloping area that dominates the east of the site; a steep transition to the western part of the site which houses the club house and northern car park; and from the club, the site slopes down to TG Millner Field – which is relatively flat.

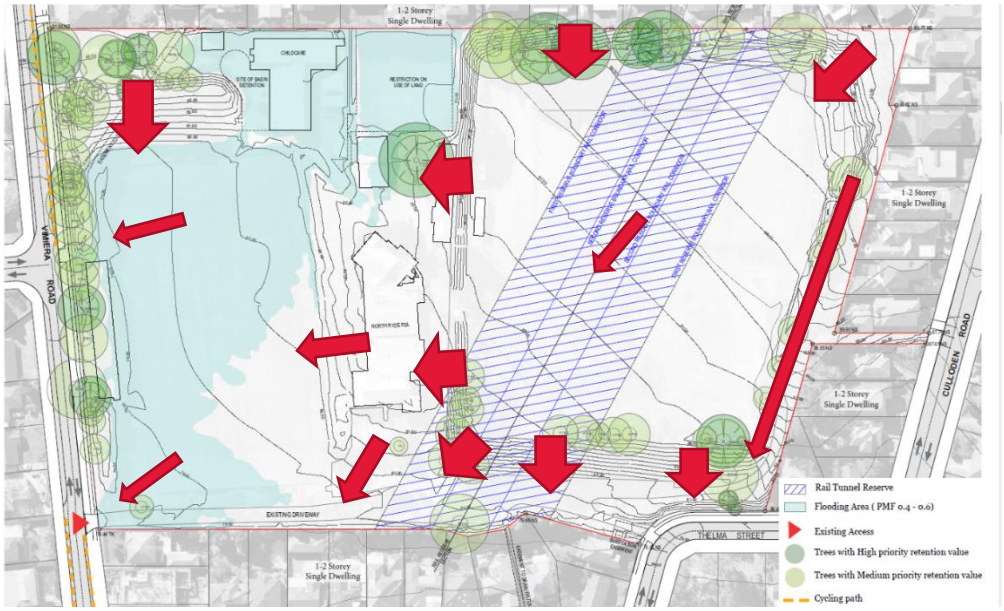


Figure 3: Site topography - slopes and flow pathways. The fatter the arrow, the steeper the slope.

Existing stormwater network

Figure 4 identifies critical locations for local stormwater and Figures 6-9 show the stormwater network at these locations.

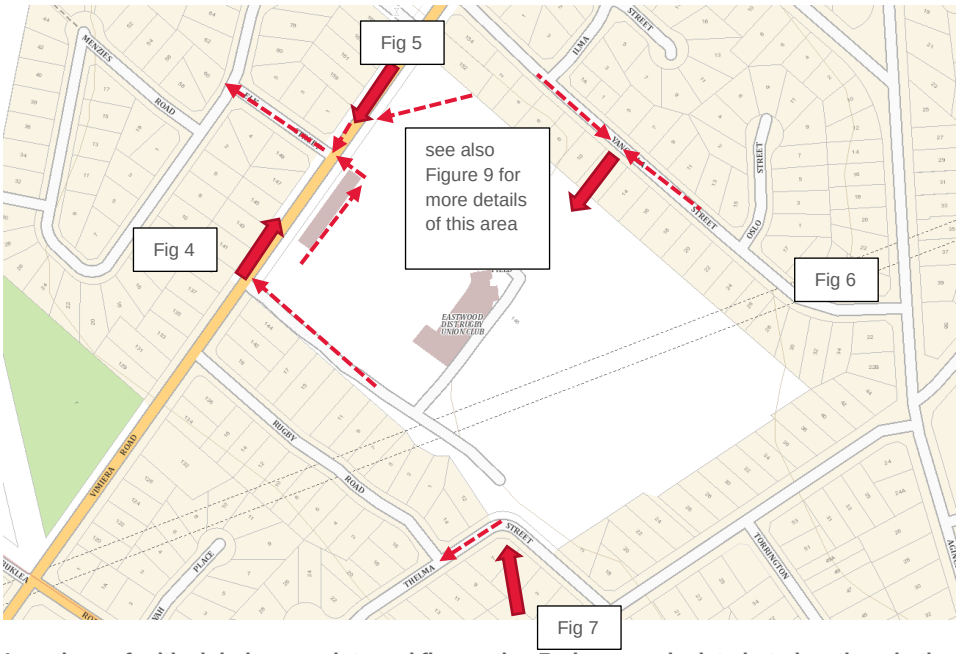


Figure 4: Locations of critical drainage points and flow paths. Red arrows depict photo locations in the following Figures. Dashed lines indicate stormwater network.

Figure 5: Vimiera Road at the current main entrance – no drainage network is present. Drainage from the site is to the gutter.

Figure 6: Vimiera Road near Elk Street – showing drainage pits on both sides

Figure 7: Yangalla Street (north of site). Showing stormwater pits both sides of street. This is an area of modelled overtopping into the three properties on the LHS of the image. It is a permanent sag point in the street and so when its capacity is exceeded, overland flow moves through the adjoining properties on the RHS

Figure 8: Thelma Street – showing stormwater pit near the entrance to the site

In preparing our report to accompany the planning proposal, we have engaged with Council officers and have been provided with data from council in relation to their stormwater network in the north of the site and upstream to Yangalla Street (**Figure 9**).

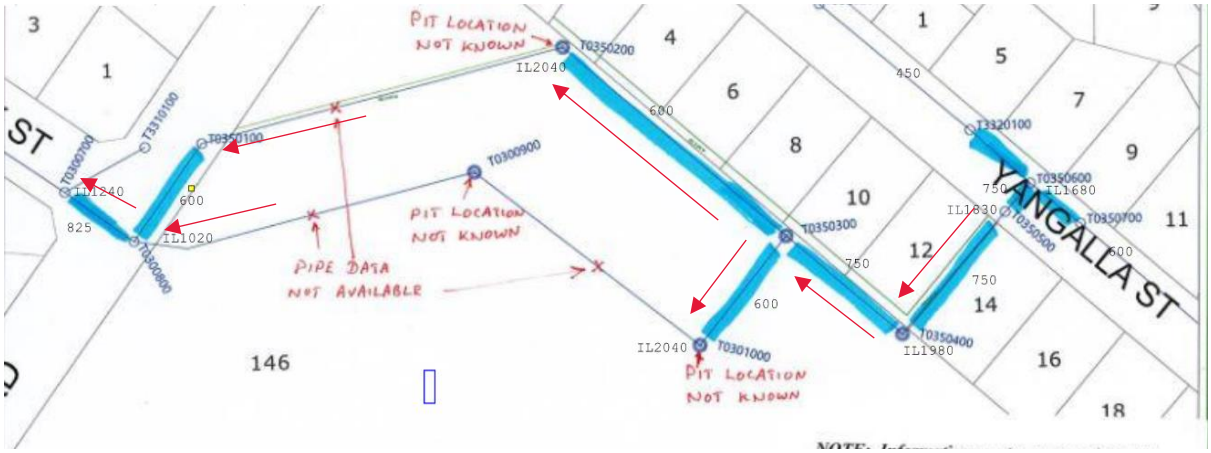


Figure 9: Council stormwater network draining upstream catchment through the site

Overland flow path

In the northwest of the site, an existing drainage easement is to be retained to allow pipe flows from the upstream catchment to continue to Vimiera Road (**Figure 10**). Within the site, there is a stormwater pipe contained within this easement.

As indicated in Figures 7 and 9, another overland flow path is present. When the capacity of the drainage network in Yangalla Street is exceeded, flow moves through the yards at 10, 12 and 14 Yangalla Street. The amount of flow running overland may be able to be reduced with the augmentation of the stormwater network in the street, however, overland flow will always need to be accommodated through the properties (Nos. 10, 12 and 14) and through the Marsfield Common site. This is described further in the next section – Flooding.

A

Figure 10: Drainage easement to be retained

Flooding

Council has undertaken a flood study of the Terrys Creek catchment, which includes the site. **Figure 11** shows the mapped flood risk for the site and surrounds. Flood risk on the site varies between low (light blue) to medium (dark blue) in the northern and western portions. Flood risk is determined by a combination of depth and velocity of flow.

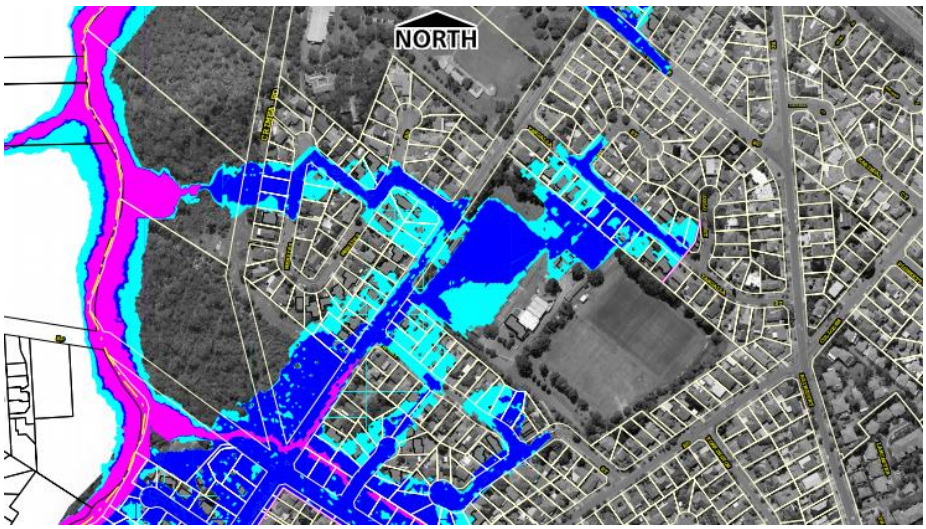


Figure 11: Flood risk as mapped by Council for the site and surrounds (Bewsher Consulting)

The 1% AEP (formerly referred to as 1in100) flood depths are shown in **Figure 12**.

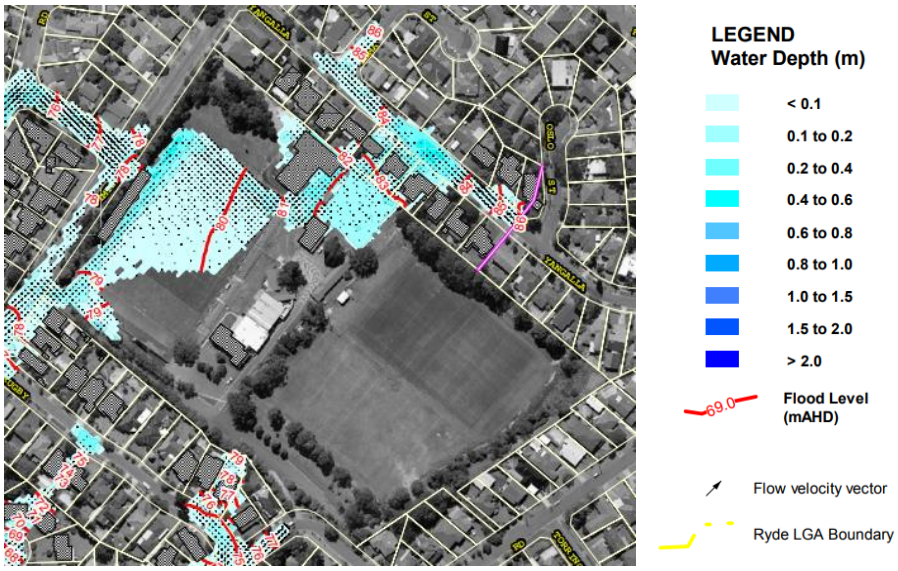
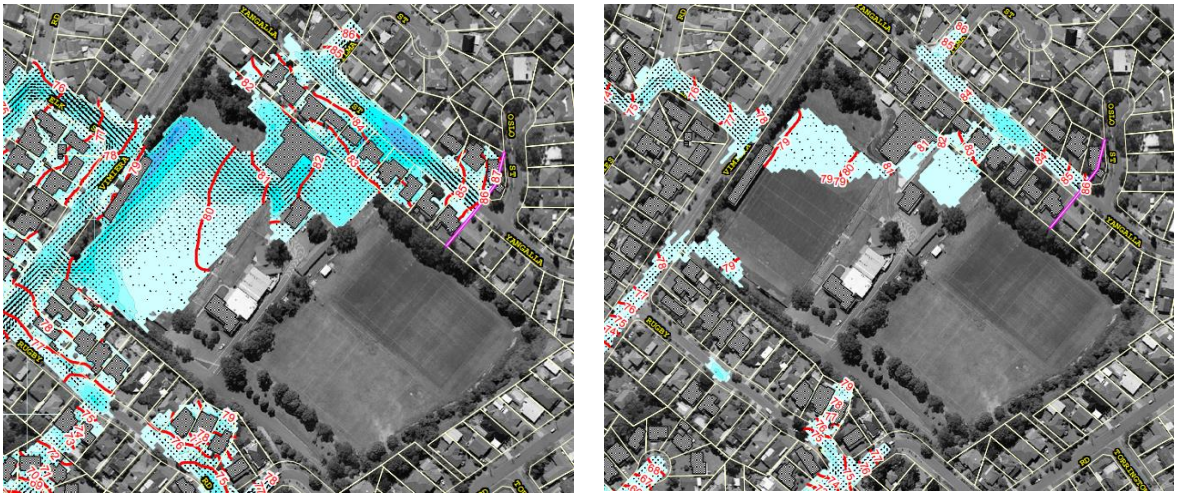


Figure 12: 1% AEP Flood depths on the site and surrounds (Bewsher Consulting)



Probable Maximum Flood **20% AEP**

Figure 13: PMF and 20% AEP flooding on the site and surrounds (Bewsher Consulting).

The various flood images show that site flooding is confined to the western portion in the flood model. The flow which causes this flooding emanates from Yangalla Street and contributing subcatchment to the north. Despite there being drainage in this street, flood modelling demonstrates that the drainage system has insufficient capacity for at least the 20% AEP, and it overtops mainly through Nos. 10-14 Yangalla Street. This overtopping makes its way through the yards of these houses and flows out through the rear fences where it enters the site. From there, it makes its way onto the main TG Millner Field. In smaller floods (20% AEP), stormwater flows west onto Vimiera Road. With larger storm events, the extent and depth of flooding increases in the model.

Note that for each of the potential points of discharge in all the reported flood events, the flood model shows that the street drainage system is inadequate to cater for the flows, with flooding of local streets and properties occurring. It may be possible to augment the stormwater network in Yangalla Street (e.g. more pits/larger pipes, etc), however, the overland flow path will remain a feature of the drainage system.

Stormwater Strategy

Council compliance framework

Council's DCP 2014 contains provisions pertaining to stormwater and drainage, with a summary of matters specifically applicable to the site and development, as follows:

- **Property Drainage Objective** - To ensure the collection and conveyance of stormwater runoff on property is undertaken in a manner to preserve the amenity of the land, prevent damage to property and without jeopardizing public safety.
    - Drainage connection direct to Council stormwater network,
    - Management of flows from upstream properties – fail-safe protection of buildings and people,
    - Accommodate new drainage easements, benefitting upstream properties,
    - Design to be visually unobtrusive and integrated with landscaping,
    - Extend public drainage infrastructure to site, if not already – for direct connection,
    - On-site detention is required,
    - Water quality targets:
        - Gross Pollutants 90%,
        - TSS 85%,
        - TP 60%,
        - TN 45%.
    - Rain/Stormwater harvesting:
        - Rainwater tanks required to meet >50% non-potable demand,
        - Irrigation water to be non-potable and to meet 80% of demand.
- **Flooding provisions**

Medium Flood Risk	Areas whereby there would be potential flood damage or public safety is a concern but could be addressed by the application using appropriate measures.
Low Flood Risk	Land within the floodplain (i.e. within the extent of the probable maximum flood) but not identified as either High Flood Risk, Medium Flood Risk Precinct or as an Overland Flow Precinct.
Overland Flow Precinct	Areas identified as Overland Flow Precincts are distant from watercourses where shallow inundation (relative to major flooding) occurs following heavy rain. Typically the depth of inundation will be less than 0.3 m to 0.5 m but more than 0.1 m to 0.2 m in a 100 year ARI event.

    - Localised overland flows attributed to stormwater runoff on the site itself must be taken into consideration. Minor overland flow depths may typically be around 50mm to 100mm and, whilst they do not present great risk to development, must meet the minimum development control requirements to ensure there is adequate protection from any stormwater inundation.
    - Finished surface levels:
        - Alterations to landform – must not exacerbate flood risk,
        - Fences permeable, to permit the flow of 1% AEP flows 200mm above ground level.
    - Residential controls:

- Not typically permitted on high flood risk land,
- Floor levels set with freeboard,
- Structures in overland flow path to withstand flood forces, and
- Overland flow diversion only if property and life protected.

- **Stormwater Management Technical Manual**
  - No obstruction of runoff from upstream properties,
  - Inlet to wetland/bioretention – rock aprons,
  - On-site Detention (OSD):
    - Restrict post development flows to pre-development levels for a 20% AEP event,
    - The site falls under zone 1 of site OSD catchment zones,
    - At lowest point/s of site,
    - Maximum OSD bypass area is 25%,
    - Positive covenant to address ongoing maintenance (applicable to non-public areas),
    - Rainwater tank offsets – to be justified,
    - Full hydraulic analysis required,
  - Freeboard provisions:

Drainage System/ Overland Flow	Residential			Industrial/ Commercial	
	Land Level [b]	Habitable Floor Level	Non-Habitable Level [c]	Land Level [b]	Floor Level
Surface Drainage/ adjoining ground level [a]	-	.15m	-	-	.15m
Public drainage infrastructure, creeks and open channels	0.5m	0.5m	0.1m	0.3m	0.3m
Flooding and Overland Flow (Overland Flow Precincts and Low Risk)	N/A	0.3m	0.15m	N/A	0.3m
Flooding and Overland Flow (Medium Risk and greater)	N/A	0.5m	0.3m	N/A	-
Onsite Detention [d]	N/A	0.2m	0.1m	N/A	0.2m
Road Drainage Minor Systems (Gutter and pipe flow)		0.15m below top of grate			
Road Drainage		Refer to Figure 2-1.			
Detention Basins [4]		The top water level shall be designed to be 0.5m below top of embankment (100yr ARI)			

- **WSUD Guidelines**
    - WSUD Strategy required with DA Demonstrate targets are met:
        - Contents- (site) constraints and opportunities; WSUD Objectives (water quality, water conservation, waterway stability,
        - Integration with urban design,
        - Costs and maintenance included.

Strategy response

The key drivers of the stormwater strategy for the redeveloped site are listed as follows:

- Compliance with Council DCP – direct connection to Council drainage, On-site Detention, Water Quality Treatment, WSUD, Harvesting and Reuse.
- Managing local flooding and overland flow – providing flow paths through the site for upstream properties.
- Mitigating downstream flooding – matching or (preferably) lowering pre-development flows to alleviate the overloading of the stormwater systems in adjoining streets.
- Taking advantage of the opportunity afforded by having a large green-space area in the west of the development – integrating with urban design.
- Take advantage of a precinct-scale re-development with completely new infrastructure.

Key features of the strategy are described as follows:

Strategy Element	**Description/function**
One Discharge Point	Channelling flows via a series of pit and pipes along the proposed internal roads to maximise site area draining to proposed underground OSD tank and to maximise the area draining to a single on-site detention/underground OSD tank.
Upstream Catchment Flow Management	Retention of stormwater easement/s in north-west corner of site. A trapezoidal grassed open channel will be constructed to help divert flows from the upstream catchment area to avoid build-up and flooding within the site. This collected flow is proposed to be channelled through house lots where it will either be collected in the site drainage pits, or onto the road carriageway as overland flow. This water will by-pass the site underground OSD tank. Sloping of adjoining yards to sheet flow into the overland flow path is proposed to occur.
Gross Pollutant Traps	To **pre-treat stormwater flows**, i.e., primary treatment at one location
Bioretention basin	**WSUD water quality improvement** in one basin which will be designed to integrate with the landscaped open space.
On-site detention	Underground OSD tank at the western edge of the site. Overflow to existing stormwater pit and pipe located on Vimiera Road.
Rainwater tanks	**Harvesting and reuse of rainwater** for each dwelling – not shown on the plan. Used for toilet flushing and/or irrigation (subject to BASIX and Water Quality Modelling).

A resulting stormwater strategy is depicted in **Figure 14** (also Refer Appendix A).

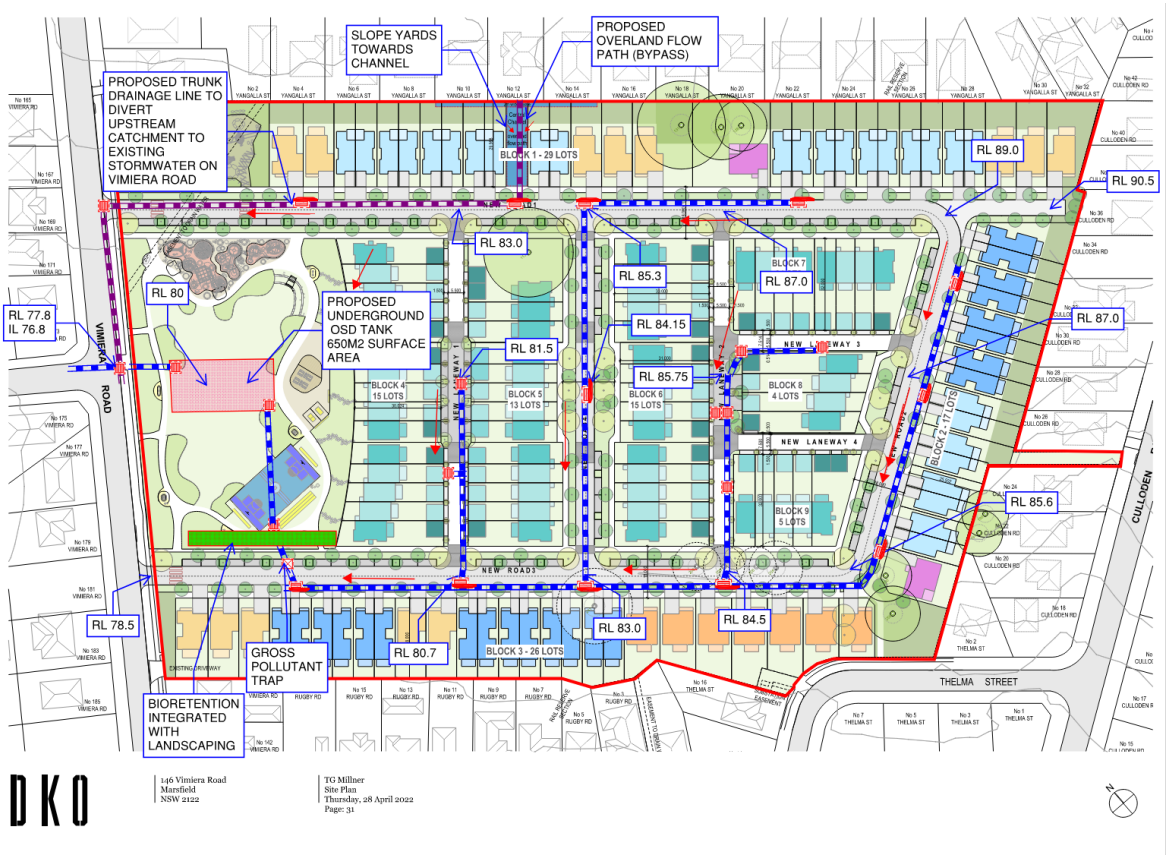


Figure 14: Stormwater/Grading Strategy for Marsfield Commons

Water quality Guidelines

As per the requirements of City of Ryde Council DCP, an effective treatment train is to be implemented per future MUSIC modelling which seeks to reduce the environmental impact of drainage systems and incorporate effective stormwater cycle management. Figure 15 displays the pollutant target controls that the proposed system must satisfy.

Gross Pollutants	90%
Total Suspended Solids	85%
Total Phosphorus	60%
Total Nitrogen	45%

Figure 15: WSUD Pollutant Targets

As illustrated in the proposed stormwater management plan, the option to incorporate Rainwater Harvesting, Bio-retention and Gross pollutant traps are a few ways to implement and maintain water sensitive urban design. Water quality provisions are indicative only and subject to MUSIC modelling and detailed design.

Proposed Treatment Train

Rainwater harvesting within each lot is generally a requirement of development and an effective mechanism in reducing pollution loads from a development. Water discharging from rainwater tanks will pass into the stormwater system within the roads to a splitter pit which will direct flows from the 3-

month storm to a gross pollutant trap. Outflow from the GPT would then discharge to one a bioretention area before ultimately ending up at the on-site detention tank.

Upstream Catchment

There is a present upstream catchment area that guide flows towards the boundary of the site. Sizing of the catchment was achieved by obtaining Lidar data of the northern section of the site and determining the extent of flows that drain towards the site boundary, as indicated in **Figure 16**. The blue hatching indicates roughly the area of the site for development, with the red hatching indicating the 6.1 Ha total extent in which stormwater will grade in a southerly direction.

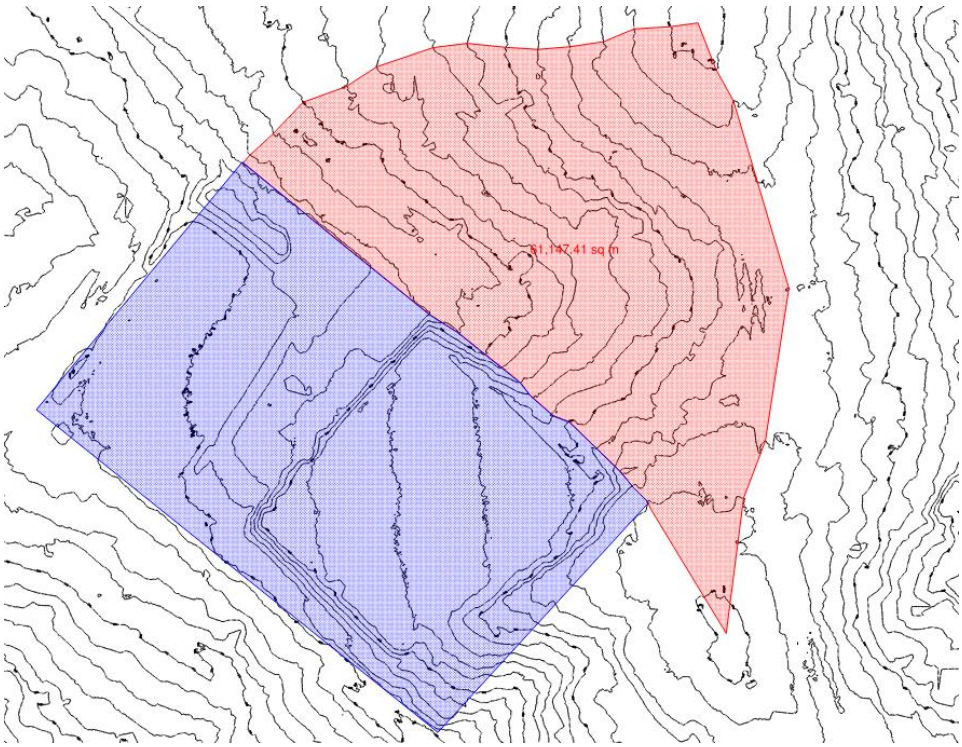


Figure 16: Lidar Data of Upstream and Site Catchments

Catchments were modelled in DRAINS resulting in an upstream flowrate of of 2.7m^3/s in the 1% AEP storm.

Channel for Upstream Catchment Flows

To manage the upstream catchment flows, a trapezoidal drainage channel is proposed at the low point of the catchment as depicted in **Figure 17**. The existing pipework from Yangalla Street is proposed to be retained to cater for low flows. Northrop explored the option to pipe stormwater flows from the current sag pit in Yangalla Street all the way to Vimiera Road to ease overland flow through the site; however this option requires running pipe against the natural grade of the site which is not to standard and will lead to extremely deep pits (Refer Appendix C for a visual representation of this option). The level difference between the sag pit and the highest point along the proposed pipe is approx. 2m.

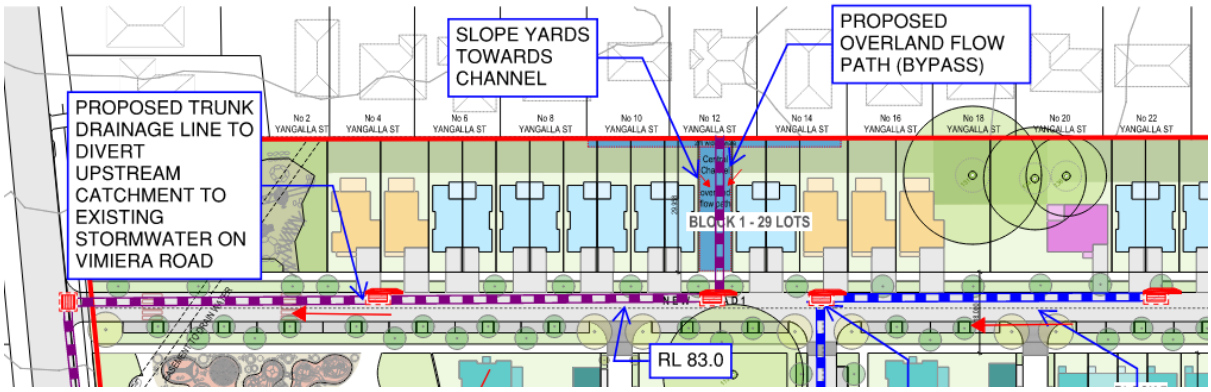


Figure 17: Channel to divert upstream catchment

To cater for existing upstream catchment flows which currently run overland through Nos. 10-14 Yangalla Street, a fenced off channel is proposed. We note that the low flows will be piped and the channel is only for flows in excess of the existing pipe system that runs through the back of 12 Yangalla Street.

Figure 17 depicts this visually and an output of the DRAINS modelling is provided in **Figure 18**.

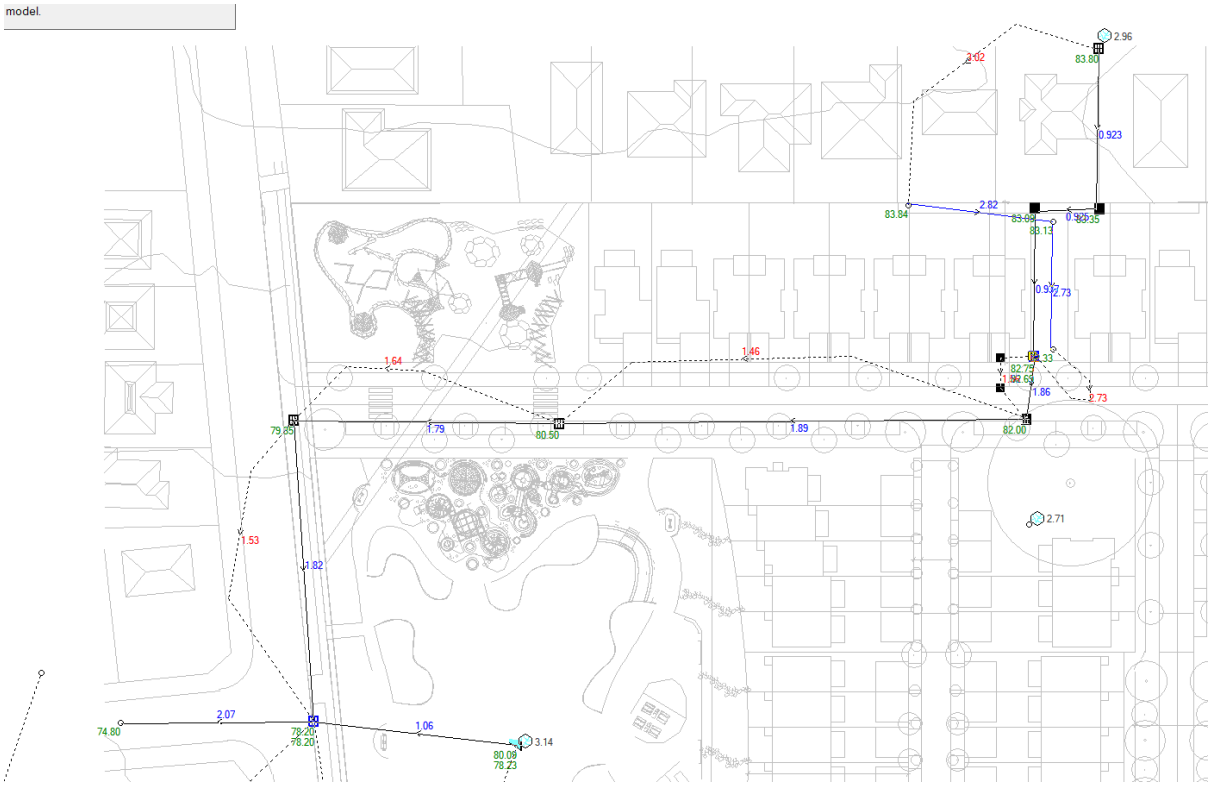


Figure 18: Upstream Catchment Modelling 100yr Storm

Northrop have modelled the existing 675mm pipe that runs through existing properties from Yangalla Street and into an upsized drainage system through the proposed road network (black pit and pipes in **Figure 18** above). The channel has also been designed to capture the 100 year flow from the upstream catchment and direct it to a large sag pit within the channel. Excess flows from channel will

top the footpath and run down the proposed road network. Refer to Appendix B for DRAINS results including flow information for the proposed channels and pipes.

In response to Annexure 3 dot point 1 of Council's letter dated 31 March 2022, we note the following:

- The channel proposed at the rear of proposed properties is necessary due to the existing flow from the upstream catchment; the existing flow is between houses of multiple upstream properties and hence requires an extensive point of capture within the site.
- The channel will be completely fenced off a with locked gate.
- Flow is completely contained within the channel and will have sufficient freeboard to adjacent properties.
- During detailed design, flood modelling will be undertaken to confirm this channel has no adverse impacts to upstream properties.
- Flow from the channel over the proposed footpath is managed at safe velocity-depth ratios.
- Flow through the proposed road network is managed at safe velocity-depth ratios.

On-Site Detention (OSD) Tank

In the western portion of the site, and within the parkland open space is an on-site detention tank. It will discharge via pipe and overflow channel to Vimiera Road (**Figure 20**).

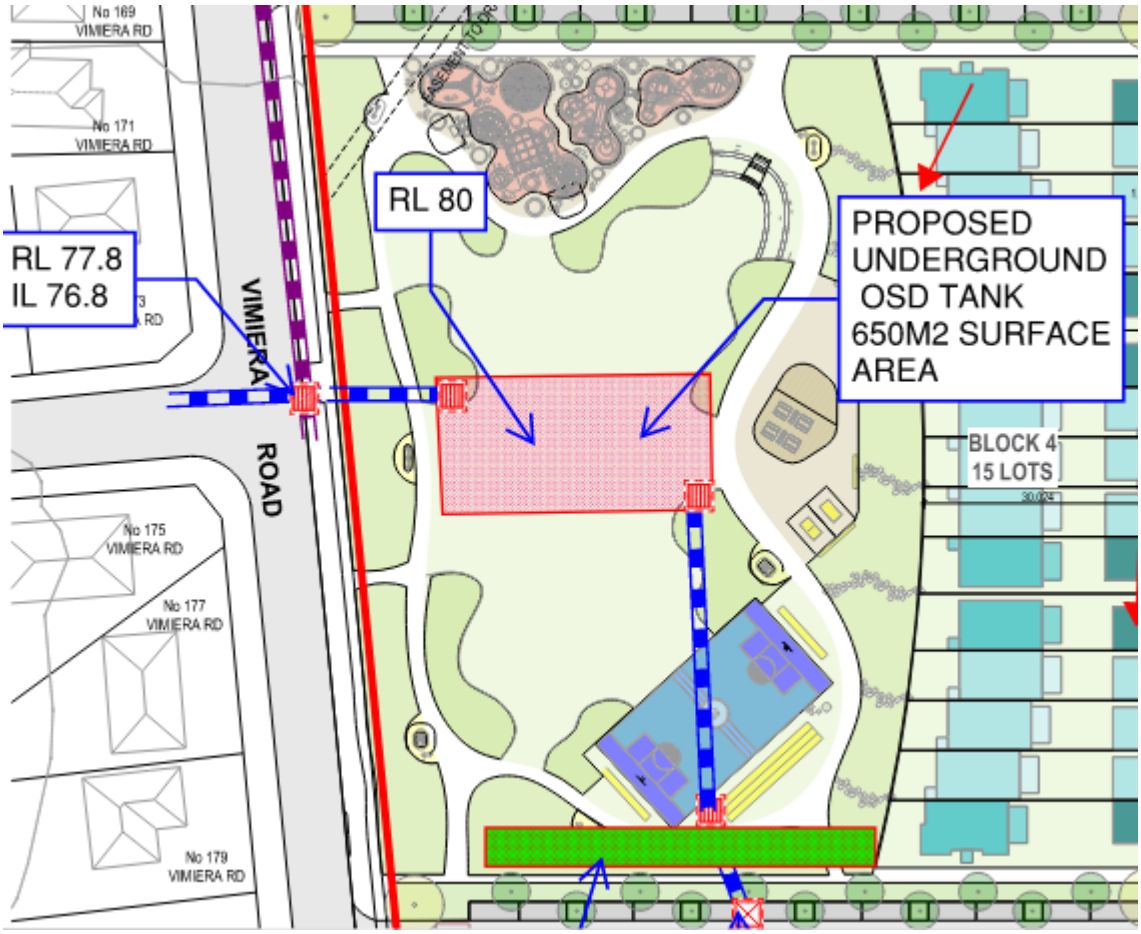


Figure 20: OSD Tank Plan (Site Only)

Table 1 demonstrates existing and proposed peak discharge rates in various storm events.

Table 1: Peak Flow Comparison

Criteria	Site Catchment	Upstream Catchment
Existing Peak Flow (1% AEP)	2.71 cu.m/s	2.96 cu.m/s
Existing Peak Flow (20% AEP)	1.24 cu.m/s	1.58 cu.m/s
Proposed Flow (1% AEP)	3.14 cu.m/s	2.96 cu.m/s
% Change (Existing vs Proposed Site)	16% Increase	
Flow From OSD (1% AEP)	1.13 cu.m/s	N/A
Flow From OSD (1% AEP) - Existing Peak Flow (20% AEP) % Change	9% Decrease	

The effect of the OSD is to reduce post-developed 1% AEP peak discharge to less than the existing 20% AEP peak discharge. The upstream catchment will not be detained, however, it is evident that upstream flows can pass safely through the site *via* the proposed inground pit and pipe network and road network for overland flow.

Conclusions

This stormwater strategy has been prepared for the redevelopment of Marsfield Common. It has considered matters raised by Council officers in the pre-lodgement discussions. It responds to the local flooding and drainage context, and it takes advantage of the site layout to implement flooding and Water Sensitive Urban Design solutions integrated with an urban design.

Key elements of the strategy include:

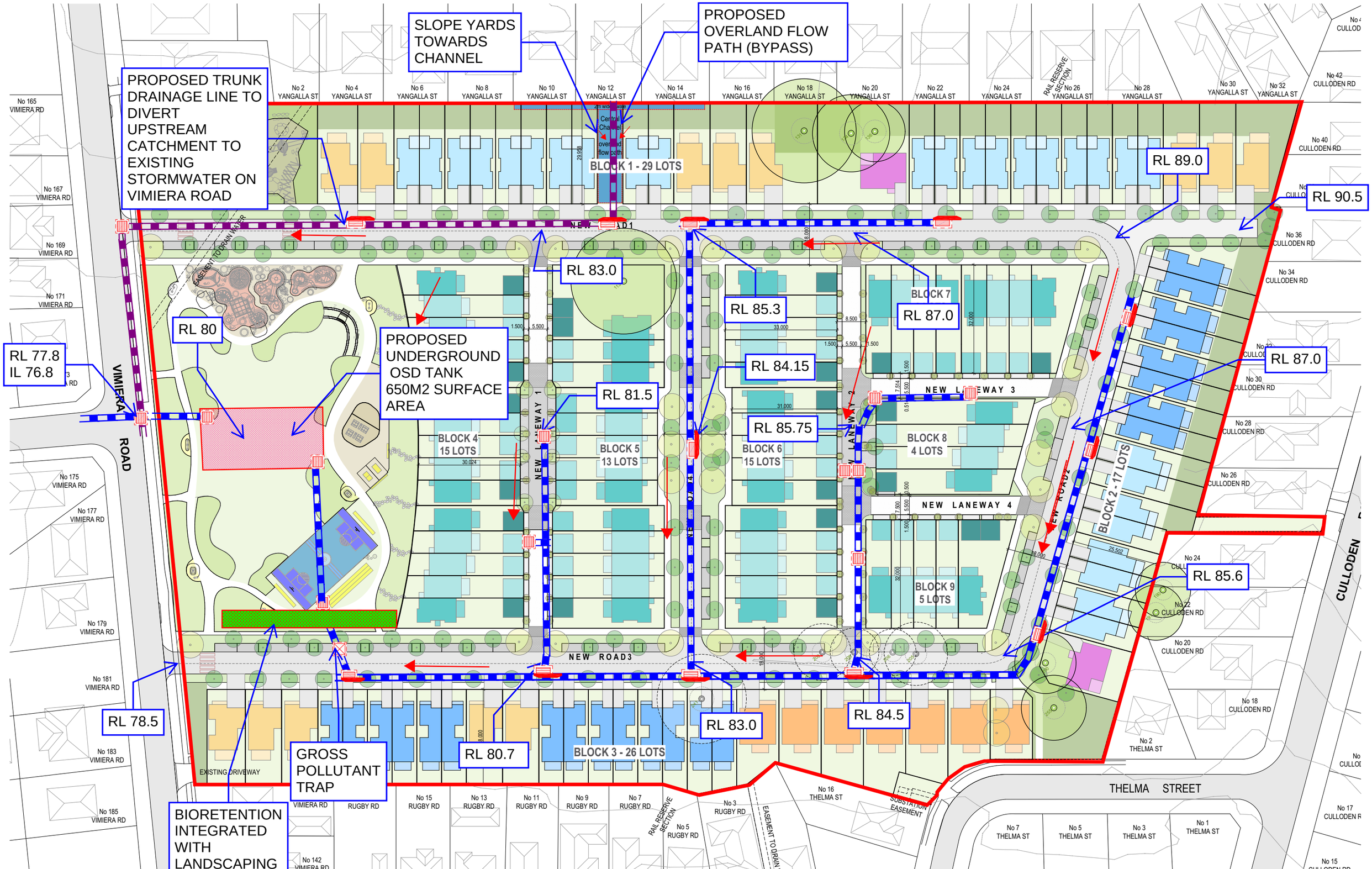
- Rain tanks for non-potable reuse on lots,
- On-site detention tank – below open space,
- Piped stormwater network,
- Single Gross Pollutant Trap,
- Single Bioretention basin integrated with landscaping and open space,
- Overland flow paths / easements and proposed drainage infrastructure to convey upstream catchment.

The strategy is adaptable to different site layouts, as long as an overland flow path is maintained, and open space is provided in the western portion of the site. In future assessment, DRAINS and MUSIC modelling will confirm the drainage network and treatment train complies with Council's DCP requirements.

Options were explored to ease upstream catchment flow through the site and avoid 'channelling of water'. This resulted in running pipe against the natural grade of the road. The proposal includes a small section of fenced off channel to allow for capture of upstream flows and direct them to a piped network and to the road network for overland flow.

This strategy represents a sound and contemporary response that complies with Council's DCP, noting that this report accompanies a planning proposal for the TG Millner Site and that ample opportunity will exist at future stages of the development process to address these issues in more detail.

Appendix A - Concept Stormwater & Grading Plan



DKO

146 Vimiera Road
Marsfield
NSW 2122

TG Millner
Site Plan
Thursday, 28 April 2022
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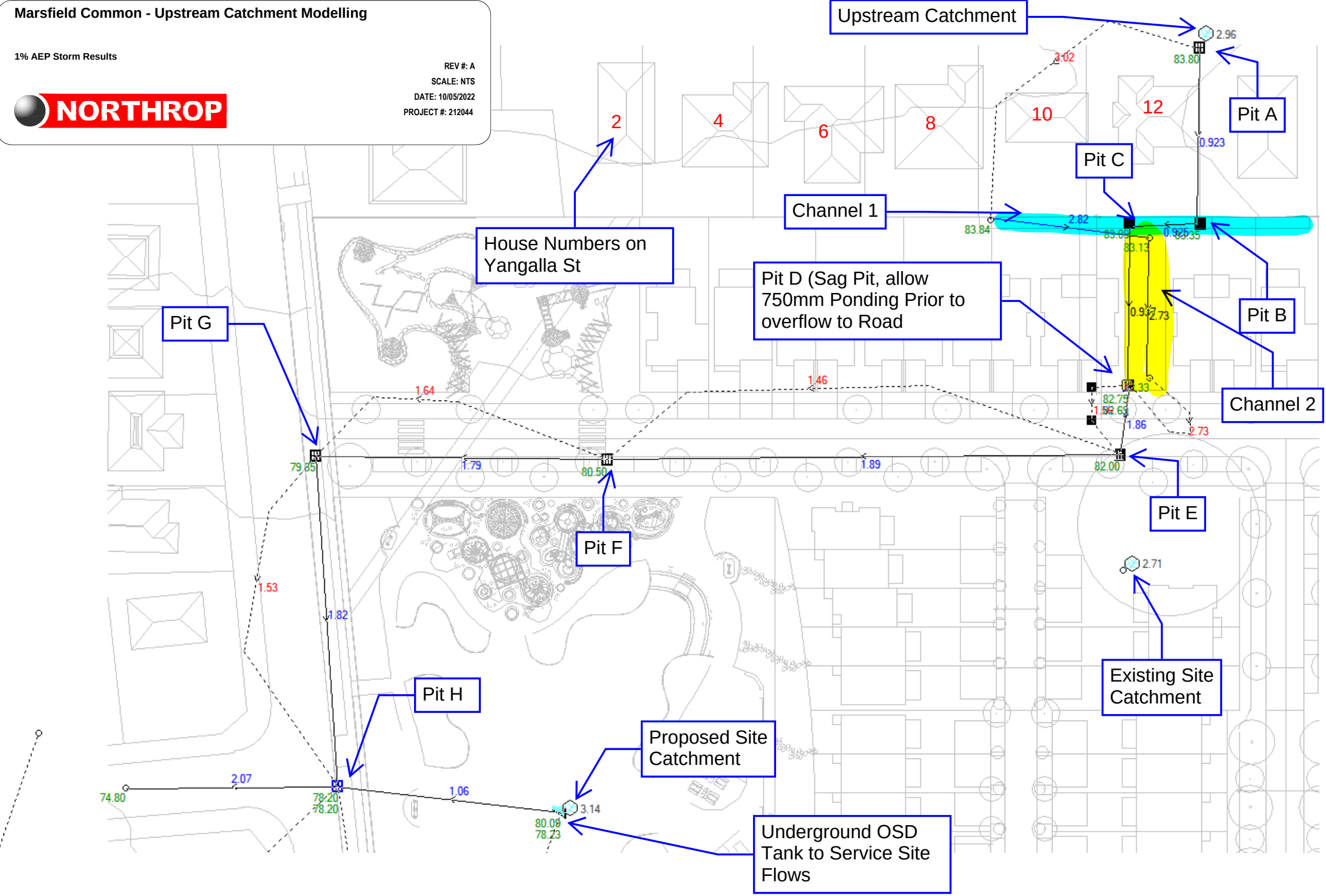
Appendix B- Upstream DRAINS Modelling

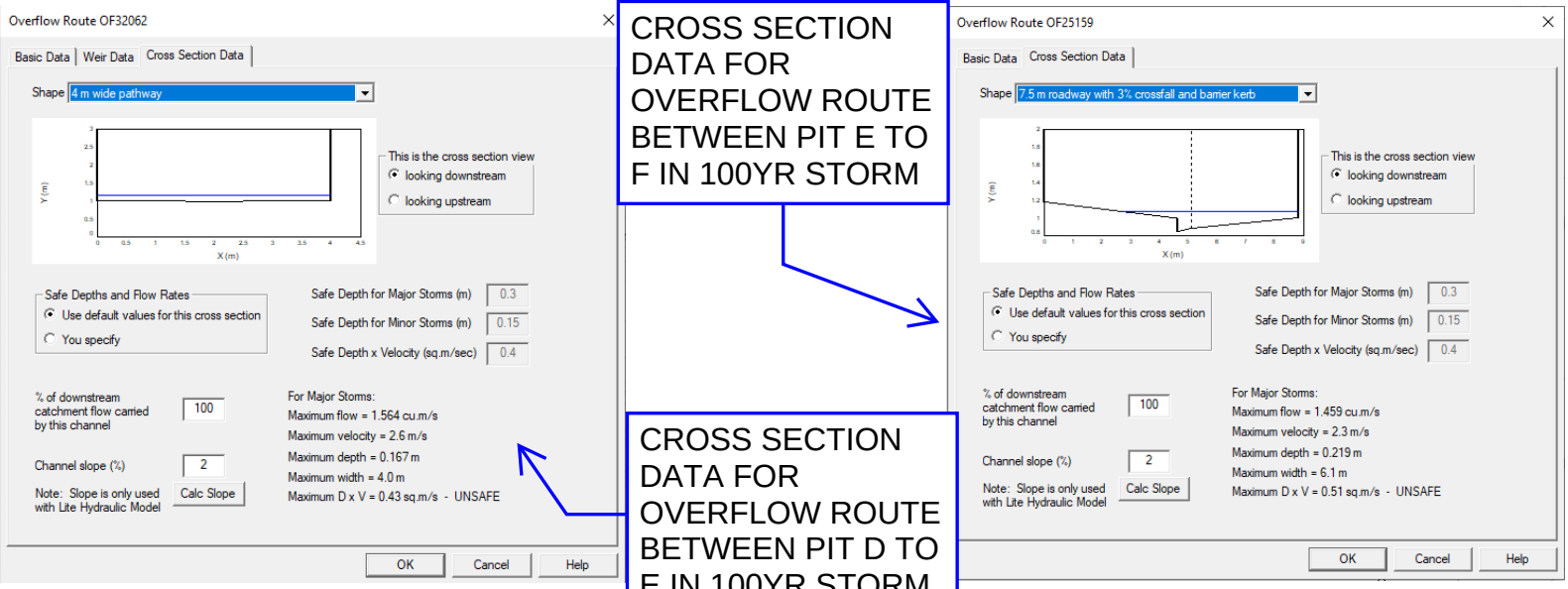
Marsfield Common - Upstream Catchment Modelling

1% AEP Storm Results

REV #: A
SCALE: NTS
DATE: 10/05/2022
PROJECT #: 212044

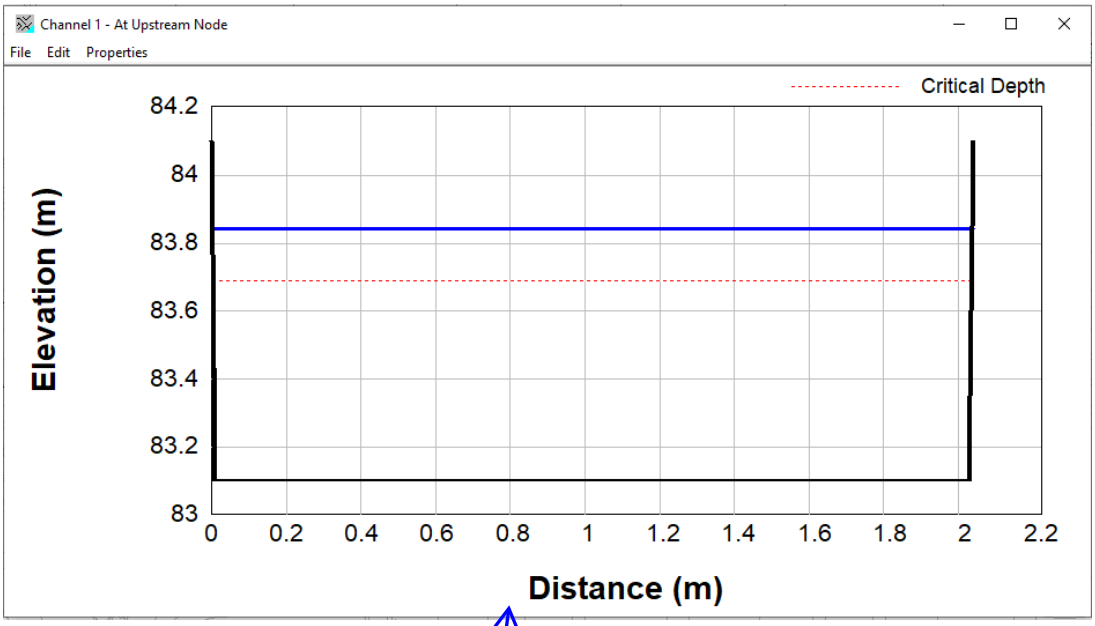
NORTHROP





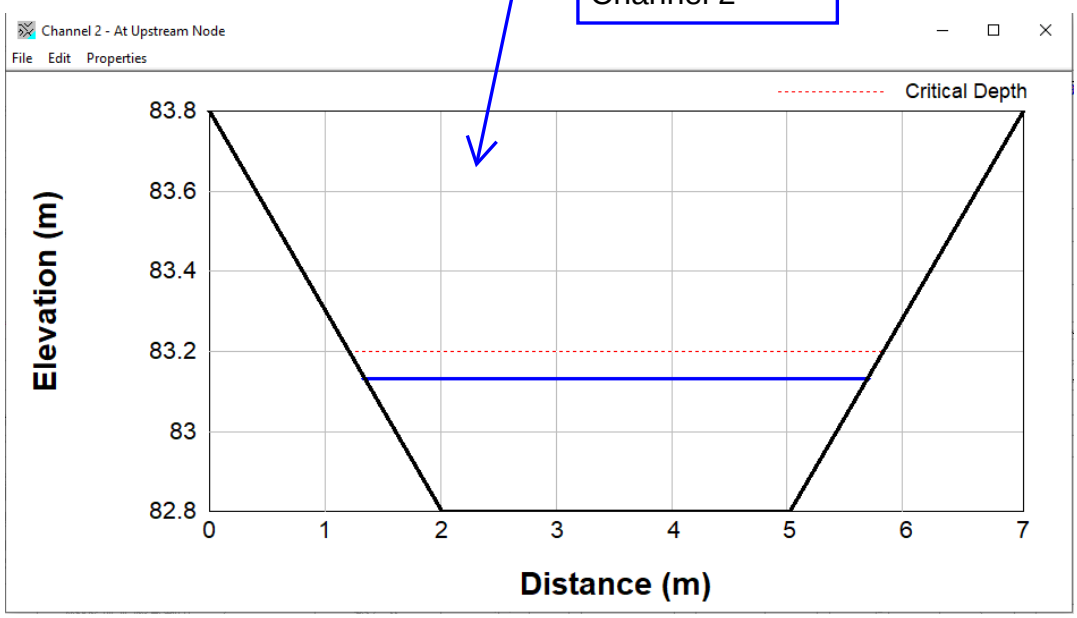
CROSS SECTION DATA FOR OVERFLOW ROUTE BETWEEN PIT E TO F IN 100YR STORM

CROSS SECTION DATA FOR OVERFLOW ROUTE BETWEEN PIT D TO E IN 100YR STORM



100 Year Storm Cross Section at Channel 1

100 Year Storm Cross Section at Channel 2

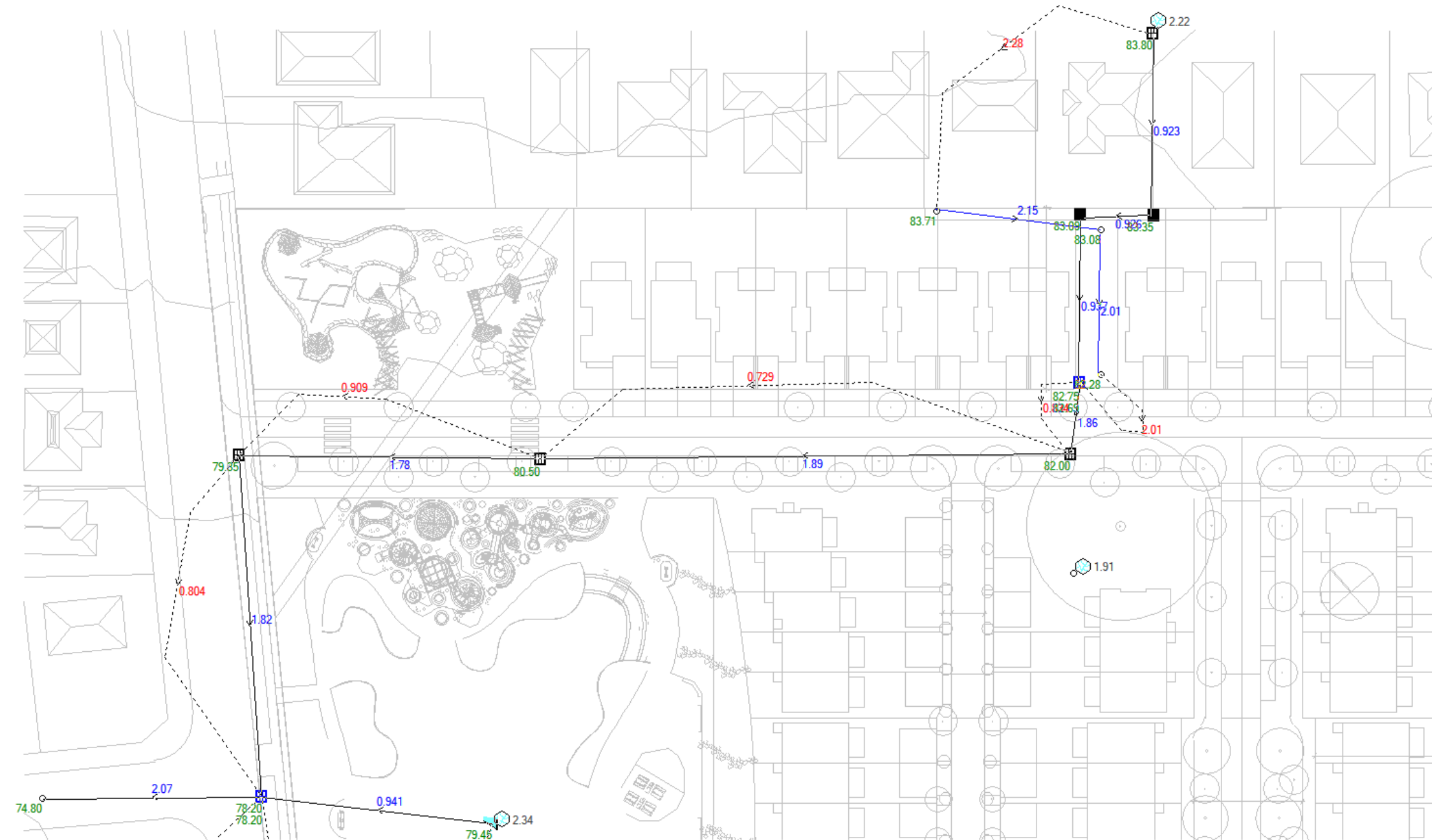


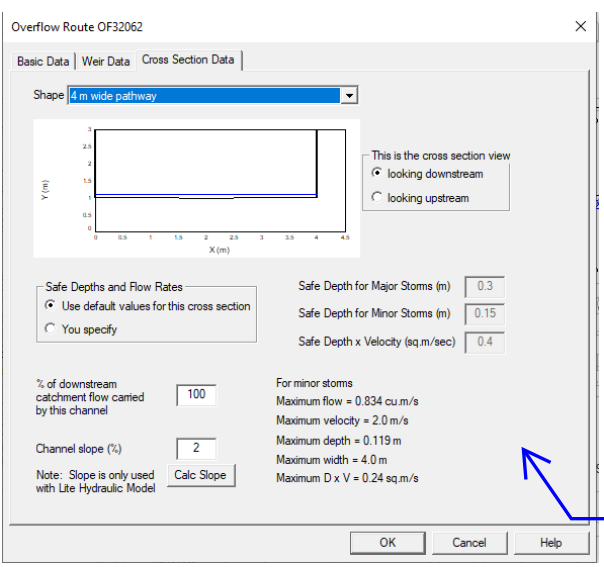
Marsfield Common - Upstream Catchment Modelling

5% AEP Storm Results

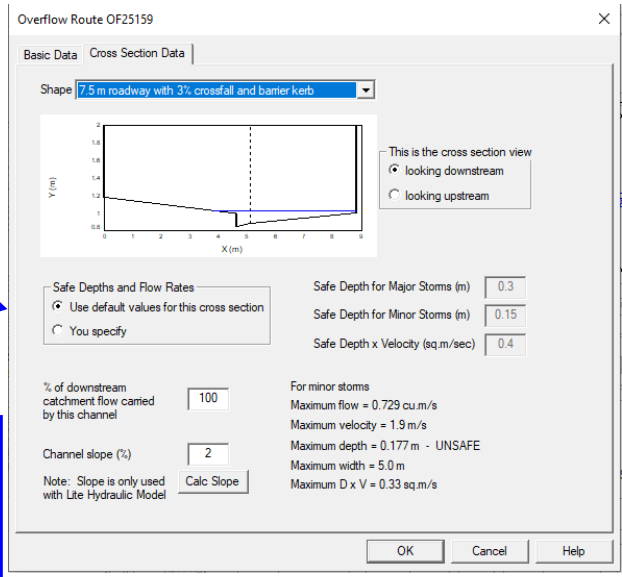
REV #: A
SCALE: NTS
DATE: 10/05/2022
PROJECT #: 212044

NORTHROP

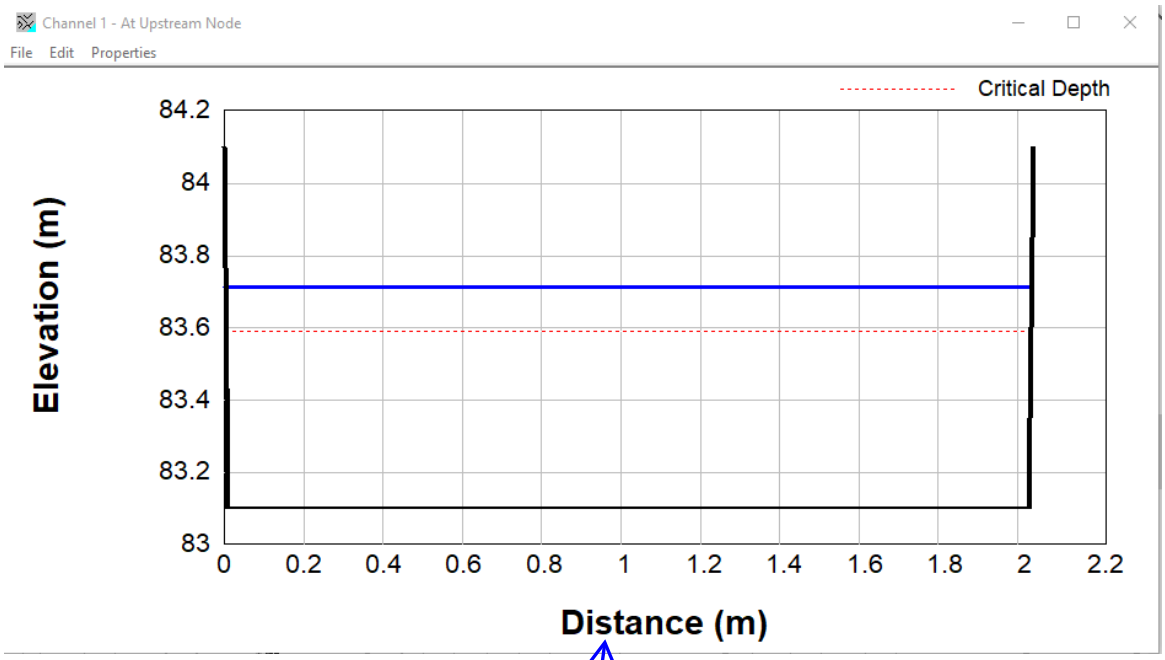




CROSS SECTION DATA FOR OVERFLOW ROUTE BETWEEN PIT E TO F IN 20YR STORM

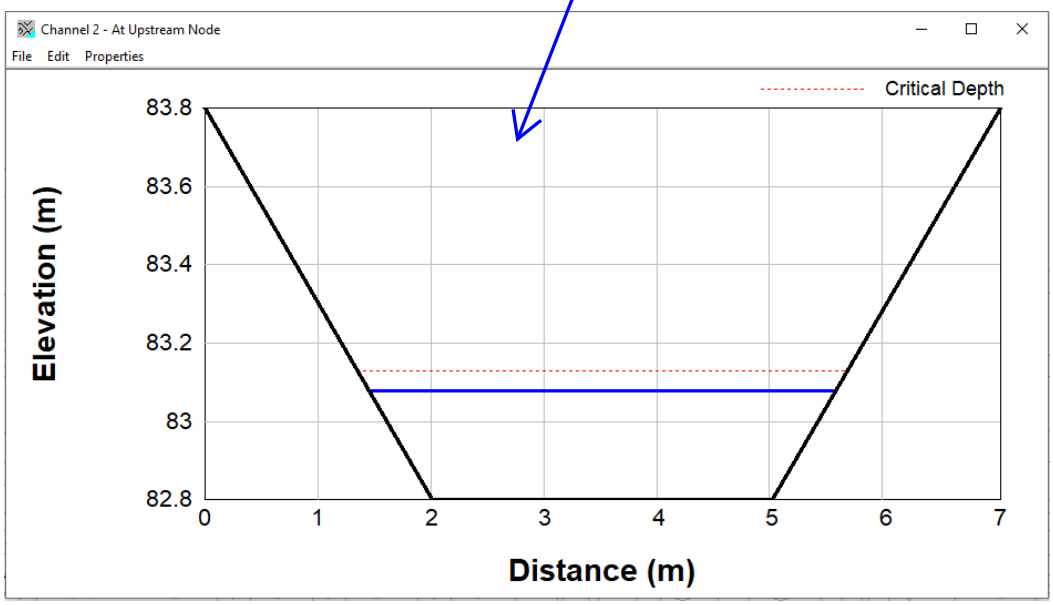


CROSS SECTION DATA FOR OVERFLOW ROUTE BETWEEN PIT D TO E IN 20YR STORM



20 Year Storm Cross Section at Channel 1

20 Year Storm Cross Section at Channel 2



Marsfield Common - Upstream Catchment Modelling

Pipe Long Section - Yangalla st To Vimiera Road

NORTHROP

REV #: A
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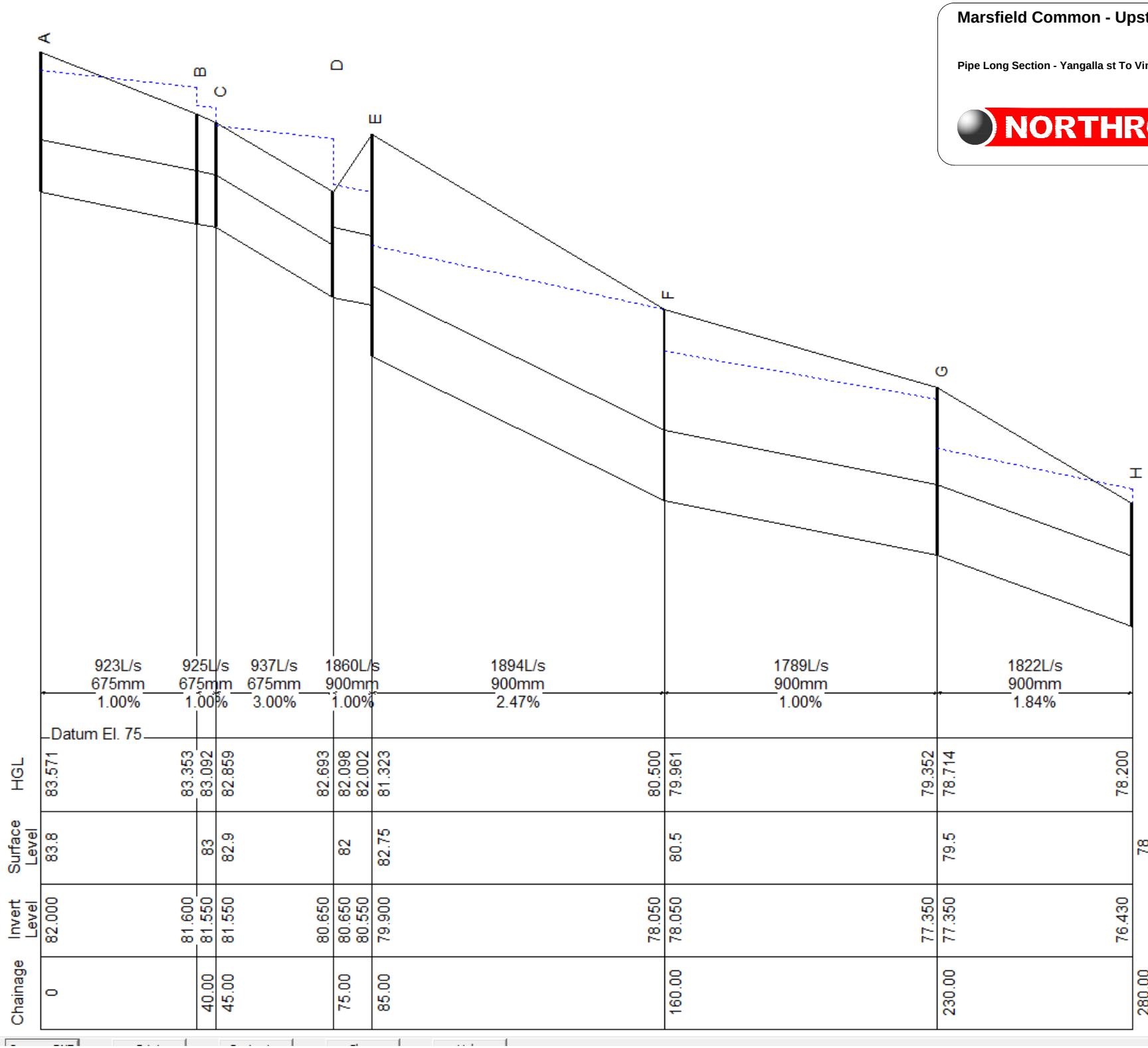
DATE: 10/05/2022
PROJECT #: 212044



Appendix C – Yangalla St Pipe Option

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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NORTHROP
Sydney
Level 11 345 George Street, Sydney NSW 2000
Ph (02) 9241 4188 Fax (02) 9241 4324
Email sydney@northrop.com.au ABN 81 094 433 100

PROJECT
146 VIMIERA ROAD, MARSFIELD

DRAWING TITLE
CIVIL DESIGN
Yangalla Diversion v1

JOB NUMBER 212044
DRAWING NUMBER SK01.01
REVISION 1
DRAWING SHEET SIZE = A1

DRAWN: -
DESIGNED: -
JOB MANAGER: -
VERIFIER:

Found : T:\2021 Jobs\212044 - 146 Vimiera Road, Marsfield\0-Drawings\C-Civil\XXXXXX-CAD\03-SKETCH\XXXXXX_SKC01SK01.01.dwg
Date : 05-4-22 9:38am Plotted By: AFallins

Appendix D – Response to Council Comments

RESPONSE TO CITY OF RYDE LETTER DATED 31 MARCH 2022

Following an initial review of the draft planning proposal and meetings with the applicant, Council wrote to the applicant on 31 March 2022 requesting additional information in relation to various aspects of the planning proposal.

Northrop have sought to address Council's comments in this updated report and address the specific questions/comments made by Council as follows:.

Council comment:

The site is affected by an overland flow path. The proposed concentration of overland flows using concrete walls at the north-eastern side is not supported due to the potential adverse effect on the Yangalla Street properties and safety concerns. Options should be considered to address this concentration such as:

- *Explore the construction of a stormwater pipe (with enough KIPs to collect all runoff) in Yangalla Street to collect the overland flows to ensure it does not reach the development site.*

- *If overland flows are proposed through the site, every dwelling affected by overland flow may have to be built on piers, to allow free pass of the overland flows (no concentration of flows will be supported).*

Northrop response:

See section title "Channel for Upstream Catchment Flows" on Page 15 under Stormwater Strategy for full response and explanation. Northrop has explored the potential, through modelling, of different options to mitigate the usage of a channel through the proposed lots, such as installation of pipe in Yangalla Street. This resulted in running pipes against grade and through the crest of a road and was deemed not feasible. It was determined that the most effective solution in dealing with upstream catchment flows was to install a fenced off channel.

Council comment:

The proposed OSD basin is not a supported solution due to safety concerns (depth, highly variable size/area of detention and frequency of inundation) and its proximity to the end of the catchment (see DCP Section 8.2, 1.4.1 d). Due to size and location of the development, consideration should be given to the upgrade of the stormwater drainage network, to allow direct discharge into the natural waterways without causing any nuisance to any neighbouring properties.

Northrop response:

See Section "On-site Detention Tank" on Page 17 of this report. Northrop has changed the design from a 'basin' to a 'tank' to adhere to councils comments. The tank has a surface area of approximately 650m2 and is proposed to service the majority of site flows and connect into the existing drainage line along Vimiera Road. The tank has been designed to limit the post 1% AEP storm event to the existing 5% AEP.

Council comment:

Cartridges as a WSUD quality devices shall stay under a Strata management system or the like, including all maintenance/replacement costs. If Strata is not proposed, a low-cost maintenance solution must be explored.

Northrop response:

A bioretention basin has been proposed as opposed to cartridges.

Council comment:

Small GPTs should be replaced by one larger GPT able to treat the entire development, located in a zone with easy truck access from a public road.

Northrop response:

As evident in Appendix A drawings, the stormwater network has been redesigned to ensure there is a singular GPT servicing a majority of the site catchment, with a small section of bypass.

Council comment:

A flood study will need to be provided with any future development application, including the effect of the new pipes in the post development scenario. The flood study will have to include all properties potentially affected by the changes in the network and pervious-impervious ratios. The preliminary work for this flood study should be considered at the planning proposal stage to provide early information to any amendments that may be required to the proposal.

Northrop response:

Noted, DRAINS modelling has been undertaken as part of early works, as per Appendix B.

Council comment:

All stormwater drainage infrastructure shall be designed following Australian Standards and Council Design Standards.

Northrop response:

Noted. See Section “Council Compliant Framework” on page 11. Further, all modelling and stormwater design has been proposed in accordance with relevant Australian standards and council guidelines