NORTHROP

CIVIL

Engineering Report

for

559 Anambah Road Residential Subdivision

for Thirdi Anambah Pty Ltd

NL222055 / 28 August 2024 / Revision B

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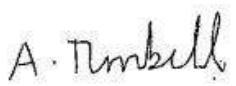

Aidan Turnbull
Civil Engineer

Reviewed:

Lach McRae
Principal | Senior Civil & Environmental Engineer

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Appendices

1. Introduction

1.1 Project Overview

Northrop Consulting Engineers have been engaged by Thirdi Anambah Pty Ltd (The Proponent) to prepare an Engineering Report for the proposed Residential Development located at 559 Anambah Road, Gosforth NSW 2320, being Lot 55 DP 8741070 and part of Lot 177 DP 874171 (the site). The Proponent is seeking approval for a concept development application (DA) consisting of up to 900 low and medium density residential lots and associated roads and open space, and Stage 1 subdivision DA approval for 240 lots.

This report provides an assessment of stormwater quality and quantity, as well as sewer and water servicing.

1.2 Site Description

The subject site is located within the Maitland City Council (MCC) local government area (LGA) and has a total area of approximately 66 hectares, with extents illustrated in Figure 1.

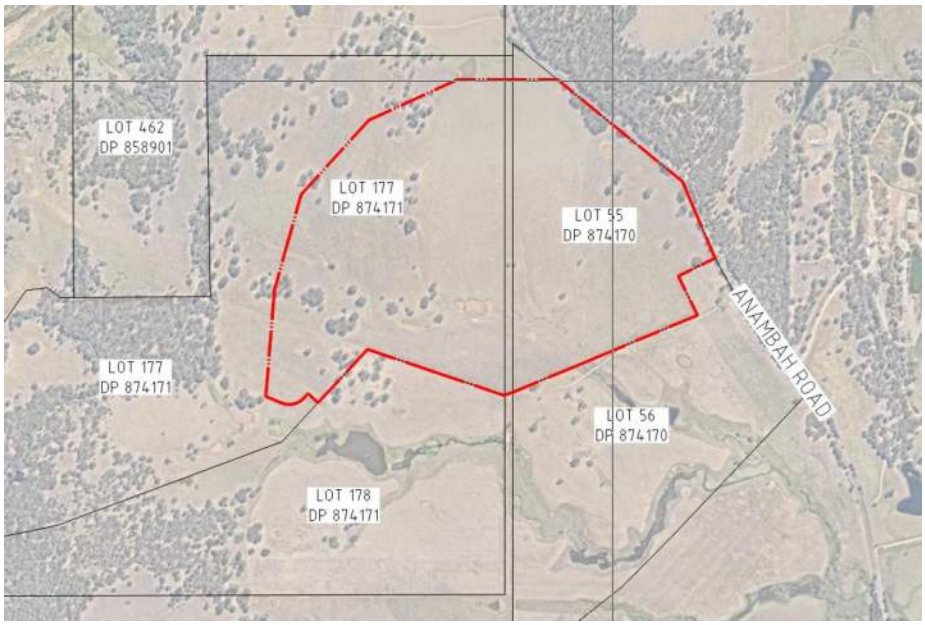


Figure 1 – Subject Site

The development site is within the Anambah Urban Release Area. The current land use zoning of the development site is R1 General Residential, with areas to the west of the proposed development consisting of RU2 Rural Landscape, and areas to the north of the development consisting of RU1 Primary Production (Maitland LEP 2011). The existing River Road reserve exists centrally within the site, extending from south to north. The development site currently comprises predominantly grassland with some scattered tress.

The site has a defined ridge centrally within the site from east to west. The northern section of the site generally falls to the north at approximately 4-8% to an existing farming dam. This dam then discharges to a piped culvert crossing of Anambah Road. The southern section of the site generally falls at approximately 4-8% to an existing first order watercourse which runs to the south-east within the site. A small area in the south-west corner of the site falls to the south to an existing third order watercourse which also runs to the south-east. Both watercourses eventually converge further south before crossing Anambah Road via a piped culvert crossing.

1.3 Proposed Development

The proposed concept masterplan consists of up to 900 low and medium density residential lots, and a local park located centrally within the site. A large lot is proposed in the north-eastern section of the site, which is to be developed as a Build To Rent development. Stage 1 of the development includes areas in the south-eastern and central sections of the site. An access track is proposed as part of Stage 1 of the development along the River Road reserve to provide both a flood egress and a secondary bushfire access for the development.

1.4 Relevant Guidelines

This report and associated drawings have been prepared in accordance with the following standards and guidelines:

- Maitland Development Control Plan (DCP) 2011
- Maitland City Council Manual of Engineering Standards – 6. Stormwater Drainage (MOES)
- NSW Floodplain Development Manual 2005
- NSW MUSIC Modelling Guidelines 2015
- Soils and Construction Volume 1 2004 (‘Blue Book’)
- Australian Rainfall and Runoff 2019

2. Stormwater Management

2.1 Stormwater Management Objectives

The intent of the proposed stormwater management strategy is to ensure the post developed stormwater runoff discharged from site does not exceed the pre-developed flows, while also ensuring post developed stormwater flows meet MCC's water quality objectives. To facilitate this, it is proposed both onsite detention (OSD) and water quality infrastructure be provided as end of line treatment.

A flood impact assessment has also been prepared for the development by Northrop Consulting Engineers (dated August 2024).

2.2 Stormwater Quantity

2.2.1 Methodology

Preliminary one-dimensional hydrological modelling has been undertaken using RAFTS (in DRAINS) to assess catchment runoff in both the pre- and post-developed scenarios. A two-dimensional TUFLOW hydraulic model was then employed to quantify the existing and developed case flood behaviour. For this study, the TUFLOW version 2020-10-AD with HPC GPU solver has been used with a 1.5m grid size. Detention structures were then sized to limit post-development flows to less than or equal to pre-development flows for a range of storm durations for the 1EY, 10% AEP and 1% AEP storm events. This range of storm frequencies is in accordance with MCC's MOES for stormwater drainage. Water quality treatment (WSUD) and retention measures such as rainwater tanks are expected to effectively attenuate the more frequent storm events.

The hydraulic model was developed in the TUFLOW software package utilising a RAFTS hydrological model with NSW-specific ARR2019 rainfall intensities, temporal patterns, pre-burst rainfall and catchment losses. The following model inputs were utilised:

- For the existing scenario, the natural sub-catchments were modelled as 0% impervious bushland catchments. In the developed scenario, a 64% impervious fraction was applied based on average imperviousness within the site. In accordance with MCC's MOES for stormwater drainage, road reserves were assumed to be 70% impervious, and residential lots assumed to be 60% impervious.
- Average catchment slopes were estimated by utilising LIDAR and detailed survey information.
- Initial and continuing loss selection for the pre-developed catchment were obtained from the ARR 2016 data hub.
- Impervious areas were assumed to have no initial or continuing losses.

Catchment modelling parameters are summarised in Table 1.

Table 1 – Adopted Hydrological Parameters used in DRAINS model.

	Predeveloped Scenario Natural Catchment	Developed Scenario Urbanised Catchment	
	Pervious Surfaces	Pervious Surfaces	Impervious Surfaces
Initial loss (mm)	18	18	0
Continuing Loss rate (mm/hr)	2	2	0

It is proposed stormwater detention is achieved through end of line detention basins. Proposed storage volumes for the central drainage corridor are to be achieved through online detention within the existing first order watercourse. Staged outlet configurations, including box culverts and circular pipes with headwalls, have been designed to ensure on site detention is achieved to mimic pre-

developed flows. A stormwater plan, showing proposed stormwater management measures and outlet configurations, are indicatively shown in Exhibit C of Appendix B for the ultimate development.

Stage 1 has also been assessed to meet MCC MOES requirements for stormwater detention independently of other stages. A stormwater plan for Stage 1 of the development, showing proposed stormwater management measures and outlet configurations, have been included in Exhibit A and B of Appendix B. As previously discussed, an access track is proposed along the River Road reserve to provide both a flood egress and a secondary bushfire access for the development. Six creek crossing locations with culverts are proposed as part of Stage 1 to ensure the existing watercourses crossing the River Road reserve do not inundate the proposed access track in the 1% AEP event. As per the Flood Impact Assessment conducted by Northrop Consulting Engineers (August 2024), flood immunity has been provided in the 1% AEP event.

Pre- and post-developed catchment runoff resulting from critical median storm events are summarised in Table 2:

Table 2 – Median Peak Storm Event Site Discharge Flow Rates with Detention.

Outlet Location	Storm Ev2nt	Pre-developed Scenario Peak Discharge Flowrate (m^3/s)	Critical Duration	Post-developed Scenario Peak Discharge Flowrate with Detention (m^3/s)	Critical Duration	Detention Storage Volume (m^3)
CENTRAL DRAINAGE CORRIDOR OUTLET	1 EY	1.8	3hr	1.6	2hr	5020
	10% AEP	7.0	1hr	4.2	1hr	11170
	1% AEP	16.0	2hr	11.4	2hr	17670
NORTH BASIN OUTLET*	1 EY	1.2	2hr	1.2	2hr	1790
	10% AEP	3.6	1hr	2.2	1.5hr	3780
	1% AEP	8.5	2hr	4.2	2hr	6780
SOUTH-WEST BASIN OUTLET**	1 EY	1.6	6hr	1.5	6hr	40
	10% AEP	8.8	2hr	8.8	2hr	115
	1% AEP	22.6	2hr	22.6	2hr	215

* Flow reporting location in creek, approximately 20m downstream Anambah Road

** Flow reporting location in creek at site boundary, approximately 130m downstream south-west basin

Outlet locations are shown in Exhibit C of Appendix B.

Through provision of the storage volumes noted, stormwater runoff can be effectively attenuated in up to the 1% AEP storm events. It is noted that detention modelling has not considered attenuation through the water quality basins and on lot rainwater tanks, which will further reduce post-developed flows.

2.3 Stormwater Quality

2.3.1 Overview

MCC's MOES for stormwater drainage requires the provision of stormwater quality controls to manage the environmental impact of runoff on receiving waters and provide reduction targets which must be met. These targets have been reproduced in Table 3 below:

Table 3: Adopted Pollutant Reduction Targets.

Pollutant	Treatment Target (When compared to the unmitigated developed scenario)
Total Suspended Solids (TSS)	80% yearly reduction
Total Phosphorus (TP)	45% yearly reduction
Total Nitrogen (TN)	45% yearly reduction
Gross Pollutants (GP)	70% yearly reduction

2.3.2 Music Model Setup

Preliminary water quality modelling of the site has been undertaken using the MUSIC software package (Version 6.3). MUSIC serves as a planning and decision support system used to estimate the efficiency of Stormwater Quality Improvement Devices (SQIDs) at capturing common pollutants from stormwater runoff, namely total suspended solids (TSS), total nitrogen (TN), total phosphorous (TP) and gross pollutants (GP). Modelling involves the use of historical or synthesized long-term rainfall data and algorithms to accurately simulate the performance of treatment measures. Where applicable, model parameters have been adopted from the NSW MUSIC Modelling Guidelines (2015). In the absence of MCC specific MUSIC parameters, the Lake Macquarie City Council Music-Link was adopted. The resulting Music-Link report is shown in Appendix A.

The MUSIC model schematic for the ultimate development is illustrated in Figure 2:

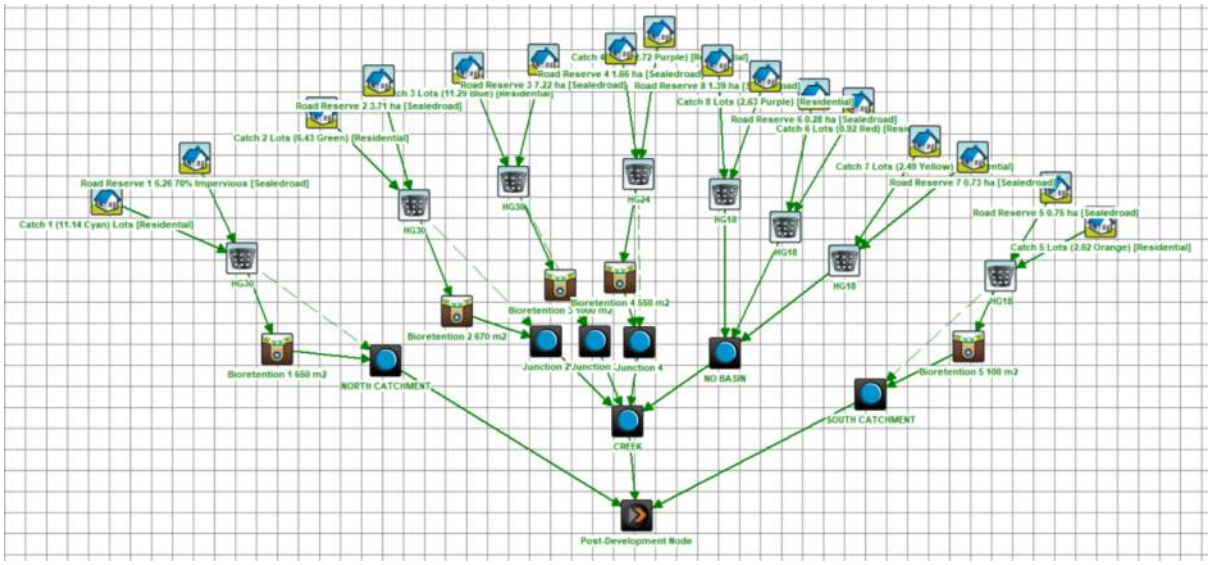


Figure 2 – MUSIC Model Schematic.

The following stormwater treatment measures have been proposed:

- GPTS – Humeguard gross pollutant traps (GPTs) have been proposed to provide primary treatment prior to discharge to secondary and tertiary treatment measures for each catchment. The devices are designed to remove litter, debris and course sediment from runoff to protect downstream treatment measures. Stormwater runoff greater than the median 4 EY (3-month ARI) storm event was modelled to bypass the GPT and downstream treatment measures, reflecting a typical high flow bypass weir or splitter pit arrangement.
- Biofiltration basins – Biofiltration basins have been proposed as end of line tertiary treatment measures. Biofiltration systems are shallow, vegetated water bodies that utilise fine filtration and biological uptake processes to remove pollutants from stormwater. Detailed design of

such measures will be required to show consideration for outlet configuration, plant species selection and nominal detention time.

Exhibit C of Appendix B shows locations of proposed stormwater treatment measures.

Bioretention filter areas for each catchment within the development have been summarised in Table 4 below:

Table 4: Proposed Bioretention Filter Areas

Catchment	Bioretention Filter Area
1	650
2	670
3	1000
4	550
5	100
6	n/a (GPT only)
7	n/a (GPT only)
8	n/a (GPT only)

A catchment plan is shown in Exhibit A of Appendix C.

2.3.3 Results

MUSIC modelling results for the ultimate development have been presented against treatment targets in Table 5 below:

Table 5: MUSIC Model Results for Ultimate Development

Pollutant	Treatment Target	Source Loading (kg/year)	Residual Loading (kg/year)	Percentage Reduction
Total Suspended Solids (TSS)	80% total reduction	83900	16200	80.7%
Total Phosphorus (TP)	45% total reduction	141	48.4	65.7%
Total Nitrogen (TN)	45% total reduction	796	425	46.5%
Gross Pollutants (GP)	70% total reduction	10700	146	98.6%

The results above demonstrate the proposed treatment measures are compliant with MCC's MOES for stormwater drainage.

In addition, Stage 1 has been assessed as a stand-alone development to ensure compliance with MCC's MOES for stormwater drainage. MUSIC modelling results for Stage 1 of the development have been presented against treatment targets in Table 6 below:

Table 6: MUSIC Model Results for Stage 1 of The Development

Pollutant	Treatment Target	Source Loading (kg/year)	Residual Loading (kg/year)	Percentage Reduction
Total Suspended Solids (TSS)	80% total reduction	22600	4100	81.9%
Total Phosphorus (TP)	45% total reduction	38.3	12.3	68%
Total Nitrogen (TN)	45% total reduction	222	108	51.5%
Gross Pollutants (GP)	70% total reduction	2980	76	97.4%

The results presented above demonstrate the reduction requirements for the site are achieved through the implementation of the proposed treatment train for the ultimate development as well as for Stage 1 only. It is noted that the provision of rainwater tanks within each lot as per BASIX requirements have not been included as part of the assessment, which will further improve water quality treatment.

Confirmation of individual device sizes, including identification of additional water quality and retention opportunities will be undertaken at detailed design stage.

A stormwater plan, showing proposed stormwater management measures, are indicatively shown in Exhibit A and B of Appendix B for Stage 1, and Exhibit C of Appendix B for the ultimate development.

2.4 Erosion and Sediment Control

To minimise sediment runoff from the development entering downstream waterways during the construction phase, several treatment devices will be implemented. These include but are not limited to:

- Minimising disturbance areas via temporary fencing and ‘No Go’ zones.
- Sediment Basins.
- Sediment Silt Fencing.
- Clean and Dirty water diversion drains.
- Rock check dams.
- A range of temporary sediment controls (i.e. sand bags, coir logs, mesh and gravel filters).
- Stabilised site entries.
- Progressive Rehabilitation.

A Soil and Water Management Plan has been included in the Civil Engineering Drawing Package prepared for this application. The intent of the plan is to demonstrate how the control of erosion and sediment can be managed to prevent the pollution of downstream waterways. It has been prepared in accordance with Council’s DCP and Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

If required, the plan should be updated prior to construction commencing to ensure the plan suits the proposed construction methodology including any staging proposed by the civil contractor. The plan should then continually be reviewed and updated as required throughout the construction period.

3. Potable Water

3.1 Existing Water Infrastructure

Theres is currently no existing water infrastructure within the vicinity of the site. A network of DN150 and DN100 watermains as well as the Windella 1 Water Pump Station (WPS) exists approximately 3km to the south of the development site. These watermains connect to dual DN375 trunk watermains in the northern verge of the New England Highway. Two water pressure zones exist within the Anambah Urban Release Area, a high-level supply zone for lots located above RL41, and a low-level supply zone for lots below RL41.

3.2 Consultation with Hunter Water

A meeting with Hunter Water was conducted on the 15/07/2024 to discuss the proposed water servicing. Key outcomes are discussed below:

- HWC noted the two pressure zones in the Thirdi land would mean delivery of the proposed WPS will be required.
- To address security of supply and the two pressure zones, it may be possible to run parallel mains within the road reserve between the northern extent of the existing formed section of River Road and the southern extent of the Thirdi development, and cross connect these with a normally closed valve.

Correspondence with Hunter Water to date is included in Appendix D.

3.3 Approved Servicing Strategy

The development site was included in the Anambah Urban Release Water Servicing Strategy prepared by ADW Johnson (Final dated 04/10/2023). The strategy proposes the area be serviced through dual DN375 watermains extending along River Road from the New England Highway and a new WPS replacing the existing Windella 1 WPS to provide a high-level water supply.

3.4 Proposed Addendum to Water Servicing Strategy

As per the approved Anambah Urban Release Water Servicing Strategy, it is proposed Stage 1 of the development be serviced through dual DN375 watermains extending along River Road from New England Highway for approximately 1.5km. Beyond this point, dual DN200 and DN250 watermains are proposed to extend along the River Road reserve to provide a point of connection for the site. A looped low level reticulation network is proposed within the development to provide a connection point for each lot. As per the approved Anambah Urban Release Water Servicing Strategy, security of supply is to be achieved via a cross connection with a normally closed valve. Construction of a new WPS is not required for Stage 1 of the development as Stage 1 is only in the low-level supply zone.

Once development occurs at levels above approximately RL41, the new WPS is to be constructed within the River Road reserve adjacent the future River Road extension. The DN200 watermain along the River Road alignment is to become the high-level supply. As per the Anambah Urban Release Water Servicing Strategy, the new WPS will replace the existing Windella 1 WPS and will also service the existing Windella residential estate. Looped low and high-level reticulation networks are proposed within the development to provide a connection point for each lot.

Concept water servicing design plans are included in Exhibit A of Appendix E.

It is concluded that both Stage 1 and the ultimate development can be adequately provided a potable water supply. Ongoing consultation with Hunter Water is being undertaken in preparation of an addendum to the approved Anambah Urban Release Water Servicing Strategy.

4. Sewer

4.1 Existing Sewer Infrastructure

Theres is currently no existing sewer infrastructure within the vicinity of the site. A sewer network and series of Wastewater Pump Stations (WWPS) exist approximately 4km south-east of the development site towards the New England Highway, including a trunk DN1000 sewer gravity main on the southern side of the New England Highway near the intersection of Shipley Drive and the New England Highway. The Anambah Urban Release Area is within the Hunter Water Farley Wastewater Treatment Works Catchment.

4.2 Consultation with Hunter Water

A meeting with Hunter Water was conducted on the 15/07/2024 to discuss the proposed wastewater servicing. Key outcomes are discussed below:

- HWC noted both timing and the locations of proposed WWPS as part of the approved Anambah Urban Release Wastewater Servicing Strategy could be reviewed to provide wastewater servicing to the development site.

Correspondence with Hunter Water to date is included in Appendix D.

4.3 Approved Servicing Strategy

The development site was included in the Anambah Urban Release Wastewater Servicing Strategy prepared by ADW Johnson (Final dated 10/01/2024). The strategy proposes the area be serviced through a series of five Wastewater Pump Stations (WWPS). A rising main along Anambah Road is proposed to convey all sewer flow within the urban release area and discharge into the existing DN1000 trunk sewer main to the south of the New England Highway.

A WWPS is proposed for the northern catchment of the development site, which then gravitates to another WWPS within the Roche development. According to the Urban Release Wastewater Servicing Strategy, this WWPS is not expected to be constructed until 2041.

4.4 Proposed Addendum to Wastewater Servicing

It is proposed the Stage 1 of the development be serviced by an internal sewer gravity network gravitating to a WWPS in the south-eastern corner of the site. Flows will then be pumped via a rising main along the River Road reserve to a proposed gravity main at the high point within River Road. It is proposed WWPS 5 as part of the Anambah Urban Release Wastewater Servicing Strategy be relocated to be within the development site. Relocation of the pump station has been assessed to ensure to ensure the gravity catchment to the south can be serviced. Refer to Exhibit B of Appendix E for further details.

In accordance with the Anambah Urban Release Wastewater Servicing Strategy, an internal sewer reticulation network will gravitate to a second WWPS in the northern catchment. This will discharge flows via a rising main to the southern catchment, which will then gravitate to the proposed WWPS as part of Stage 1.

Concept sewer servicing design plans are included in Exhibit B of Appendix E.

Through this, it is concluded that both Stage 1 and the ultimate development can be adequately provided sewer services. Ongoing consultation with Hunter Water is being undertaken in preparation of an addendum to the approved Anambah Urban Release Wastewater Servicing Strategy.

5. Conclusion

This engineering report has been prepared for the proposed residential subdivision at 559 Anambah Road, Gosforth NSW 2320. The proposed subdivision consists of up to 900 low and medium density residential lots, and a local park located centrally within the site.

Preliminary one-dimensional hydrological modelling has been undertaken using RAFTS (in DRAINS) to assess catchment runoff in both the pre- and post-developed scenarios. A two-dimensional TUFLOW hydraulic model was then employed to quantify the existing and developed case flood behaviour. Through provision of on-site detention, stormwater runoff can be effectively attenuated in up to the 1% AEP storm events for stage 1 of the subdivision as well as the ultimate development. An access track is proposed along the River Road reserve to provide both a flood egress and a secondary bushfire access for the development. Six creek crossing locations with culverts are proposed as part of Stage 1 to ensure the existing watercourses crossing the River Road reserve do not inundate the proposed access track in the 1% AEP event. As per the Flood Impact Assessment conducted by Northrop Consulting Engineers (August 2024), flood immunity has been provided in the 1% AEP event.

Preliminary water quality modelling of the site has been undertaken using the MUSIC software package. The MUSIC modelling has concluded that through the implementation of end of line water quality treatment devices, post developed stormwater flows meet MCC's water quality reduction targets for both Stage 1 and the ultimate development. It is noted that the provision of rainwater tanks within each lot as per BASIX requirements has not been included as part of the assessment, which will further increase water quality treatment.

Potable water servicing will be provided through dual DN375 watermains extending along River Road from the New England Highway for approximately 1.5km and dual DN200 and DN250 watermains extending along the River Road extension to the development. A looped low level and high level reticulation network is proposed within the development to provide a connection point for each lot. Once development occurs above levels of approximately RL41, a new WPS is to be constructed within the River Road reserve at the high point of River Road. The new WPS will replace the existing Windella 1 WPS and will also service the existing Windella residential estate. Security of supply for the development is to be achieved via a cross connection with a normally closed valve.

Stage 1 of the development will consist of an internal sewer gravity network gravitating to a WWPS in the south-eastern corner of the site. Flows will then be pumped via a rising main along the River Road reserve to a proposed gravity main at the high point adjacent the future River Road extension. In accordance with the Anambah Urban Release Wastewater Servicing Strategy, an internal sewer gravity network will gravitate to a second WWPS in the northern catchment. This WWPS will discharge flows via a rising main to the southern catchment, which will then gravitate to the proposed WWPS as part of Stage 1.

Appendix A - MUSIC Link Report

LAKE MACQUARIE CITY COUNCIL

MUSIC-*link* Report

Project Details		Company Details	
Project:	559 Anambah Road Residential Subdivision	**Company:**	Northrop Consulting Engineers
Report Export Date:	27/08/2024	**Contact:**	Aidan Turnbull
Catchment Name:	NL222055-01_559 Anambah Rd_MUSIC Model_AT FULL SITE Humeguard	**Address:**	Level 1, 215 Pacific Highway Charlestown NSW 2290
Catchment Area:	61.55ha	**Phone:**	0249431777
Impervious Area*:	118.5%	**Email:**	aturnbull@northrop.com.au
Rainfall Station:			
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	902mm		
Evapotranspiration:	1408mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.35		
Study Area:	North Region		
Scenario:	North Region		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Post-Development Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	2.16%	Bio Retention Node	5	Urban Source Node	17
TSS	80.7%	GPT Node	8		
TP	65.7%				
TN	46.5%				
GP	98.6%				

Comments

Passing Parameters

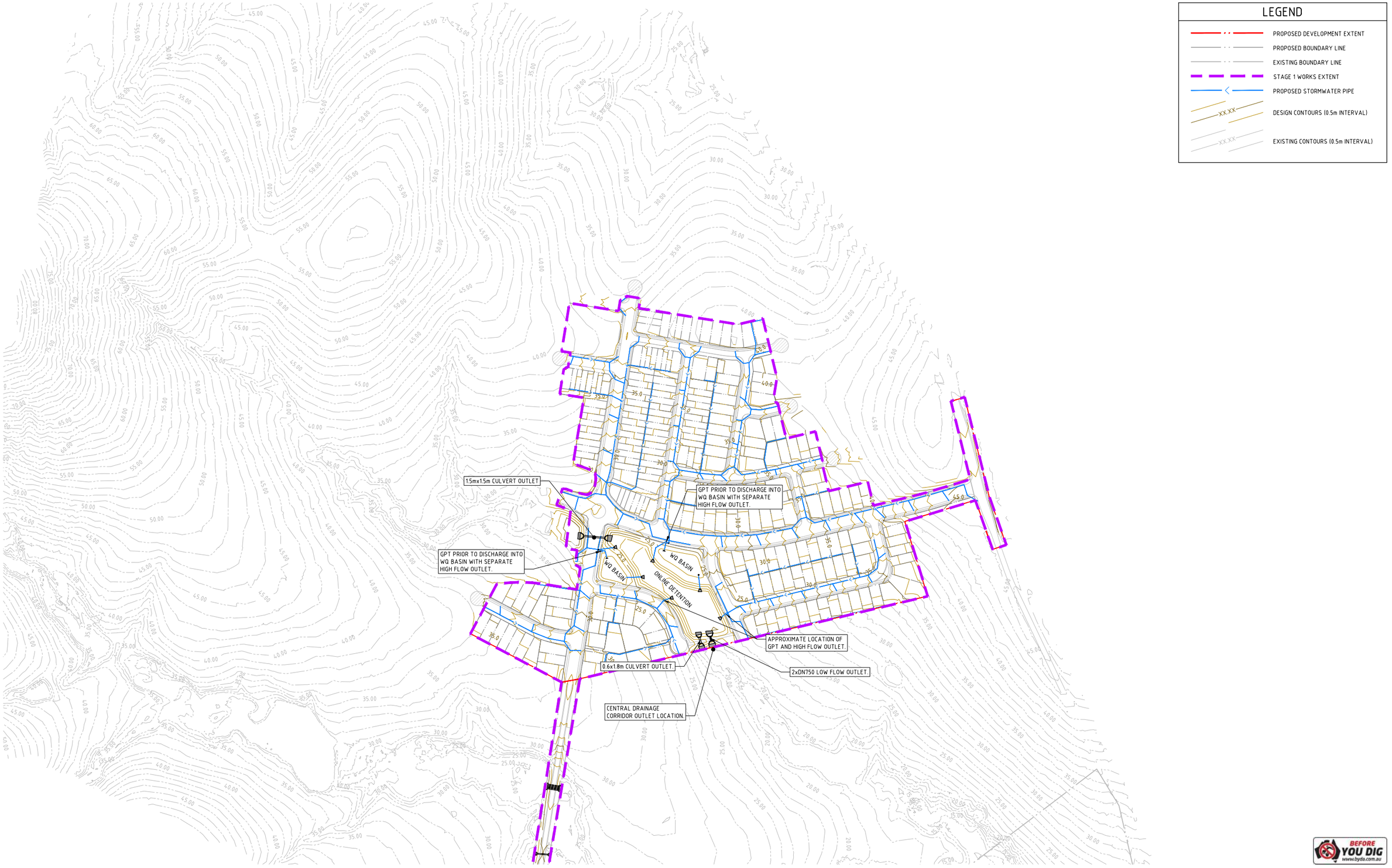
Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention 1 650 m2	Hi-flow bypass rate (cum/sec)	None	None	945
Bio	Bioretention 1 650 m2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention 2 670 m2	Hi-flow bypass rate (cum/sec)	None	None	540
Bio	Bioretention 2 670 m2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention 3 1000 m2	Hi-flow bypass rate (cum/sec)	None	None	945
Bio	Bioretention 3 1000 m2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention 4 550 m2	Hi-flow bypass rate (cum/sec)	None	None	540
Bio	Bioretention 4 550 m2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention 5 100 m2	Hi-flow bypass rate (cum/sec)	None	None	540
Bio	Bioretention 5 100 m2	PET Scaling Factor	2.1	2.1	2.1
GPT	HG18	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	HG18	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	HG18	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	HG18	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	HG24	Hi-flow bypass rate (cum/sec)	None	None	1.05
GPT	HG30	Hi-flow bypass rate (cum/sec)	None	None	1.33
GPT	HG30	Hi-flow bypass rate (cum/sec)	None	None	1.33
GPT	HG30	Hi-flow bypass rate (cum/sec)	None	None	1.33
Post	Post-Development Node	% Load Reduction	None	None	2.16
Post	Post-Development Node	GP % Load Reduction	70	None	98.6
Post	Post-Development Node	TN % Load Reduction	45	None	46.5
Post	Post-Development Node	TP % Load Reduction	45	None	65.7
Post	Post-Development Node	TSS % Load Reduction	80	None	80.7
Pre	Pre-Development Node	% Load Reduction	None	None	0
Pre	Pre-Development Node	GP % Load Reduction	None	None	0
Pre	Pre-Development Node	TN % Load Reduction	None	None	0
Pre	Pre-Development Node	TP % Load Reduction	None	None	0
Pre	Pre-Development Node	TSS % Load Reduction	None	None	0
Urban	Catch 1 (11.14 Cyan) Lots	Area Impervious (ha)	None	None	6.684
Urban	Catch 1 (11.14 Cyan) Lots	Area Pervious (ha)	None	None	4.456
Urban	Catch 1 (11.14 Cyan) Lots	Total Area (ha)	None	None	11.14
Urban	Catch 2 Lots (6.43 Green)	Area Impervious (ha)	None	None	3.858
Urban	Catch 2 Lots (6.43 Green)	Area Pervious (ha)	None	None	2.572
Urban	Catch 2 Lots (6.43 Green)	Total Area (ha)	None	None	6.43
Urban	Catch 3 Lots (11.29 Blue)	Area Impervious (ha)	None	None	6.774
Urban	Catch 3 Lots (11.29 Blue)	Area Pervious (ha)	None	None	4.516
Urban	Catch 3 Lots (11.29 Blue)	Total Area (ha)	None	None	11.29
Urban	Catch 4 Lots (2.72 Purple)	Area Impervious (ha)	None	None	1.632
Urban	Catch 4 Lots (2.72 Purple)	Area Pervious (ha)	None	None	1.088
Urban	Catch 4 Lots (2.72 Purple)	Total Area (ha)	None	None	2.72

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Catch 5 Lots (2.02 Orange)	Area Impervious (ha)	None	None	1.212
Urban	Catch 5 Lots (2.02 Orange)	Area Pervious (ha)	None	None	0.808
Urban	Catch 5 Lots (2.02 Orange)	Total Area (ha)	None	None	2.02
Urban	Catch 6 Lots (0.92 Red)	Area Impervious (ha)	None	None	0.552
Urban	Catch 6 Lots (0.92 Red)	Area Pervious (ha)	None	None	0.368
Urban	Catch 6 Lots (0.92 Red)	Total Area (ha)	None	None	0.92
Urban	Catch 7 Lots (2.49 Yellow)	Area Impervious (ha)	None	None	1.494
Urban	Catch 7 Lots (2.49 Yellow)	Area Pervious (ha)	None	None	0.996
Urban	Catch 7 Lots (2.49 Yellow)	Total Area (ha)	None	None	2.49
Urban	Catch 8 Lots (2.63 Purple)	Area Impervious (ha)	None	None	1.578
Urban	Catch 8 Lots (2.63 Purple)	Area Pervious (ha)	None	None	1.052
Urban	Catch 8 Lots (2.63 Purple)	Total Area (ha)	None	None	2.63
Urban	Road Reserve 1 6.26 70% Impervious	Area Impervious (ha)	None	None	4.382
Urban	Road Reserve 1 6.26 70% Impervious	Area Pervious (ha)	None	None	1.878
Urban	Road Reserve 1 6.26 70% Impervious	Total Area (ha)	None	None	6.26
Urban	Road Reserve 2 3.71 ha	Area Impervious (ha)	None	None	2.534
Urban	Road Reserve 2 3.71 ha	Area Pervious (ha)	None	None	1.086
Urban	Road Reserve 2 3.71 ha	Total Area (ha)	None	None	3.62
Urban	Road Reserve 3 7.22 ha	Area Impervious (ha)	None	None	5.054
Urban	Road Reserve 3 7.22 ha	Area Pervious (ha)	None	None	2.166
Urban	Road Reserve 3 7.22 ha	Total Area (ha)	None	None	7.22
Urban	Road Reserve 4 1.66 ha	Area Impervious (ha)	None	None	1.162
Urban	Road Reserve 4 1.66 ha	Area Pervious (ha)	None	None	0.498
Urban	Road Reserve 4 1.66 ha	Total Area (ha)	None	None	1.66
Urban	Road Reserve 5 0.75 ha	Area Impervious (ha)	None	None	0.525
Urban	Road Reserve 5 0.75 ha	Area Pervious (ha)	None	None	0.225
Urban	Road Reserve 5 0.75 ha	Total Area (ha)	None	None	0.75
Urban	Road Reserve 6 0.28 ha	Area Impervious (ha)	None	None	0.196
Urban	Road Reserve 6 0.28 ha	Area Pervious (ha)	None	None	0.084
Urban	Road Reserve 6 0.28 ha	Total Area (ha)	None	None	0.28
Urban	Road Reserve 7 0.73 ha	Area Impervious (ha)	None	None	0.511
Urban	Road Reserve 7 0.73 ha	Area Pervious (ha)	None	None	0.219
Urban	Road Reserve 7 0.73 ha	Total Area (ha)	None	None	0.73
Urban	Road Reserve 8 1.39 ha	Area Impervious (ha)	None	None	0.973
Urban	Road Reserve 8 1.39 ha	Area Pervious (ha)	None	None	0.417
Urban	Road Reserve 8 1.39 ha	Total Area (ha)	None	None	1.39
Urban	Total Site Area (61.223 Rural)	Area Impervious (ha)	None	None	61.27
Urban	Total Site Area (61.223 Rural)	Area Pervious (ha)	None	None	0
Urban	Total Site Area (61.223 Rural)	Total Area (ha)	None	None	61.27

Only certain parameters are reported when they pass validation

Appendix B – Stormwater Management Plan



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ABN 81 094 433 100

PROJECT: **ANAMBAH SUBDIVISION GOSFORTH 2320**

DRAWING TITLE: **ENGINEERING REPORT**

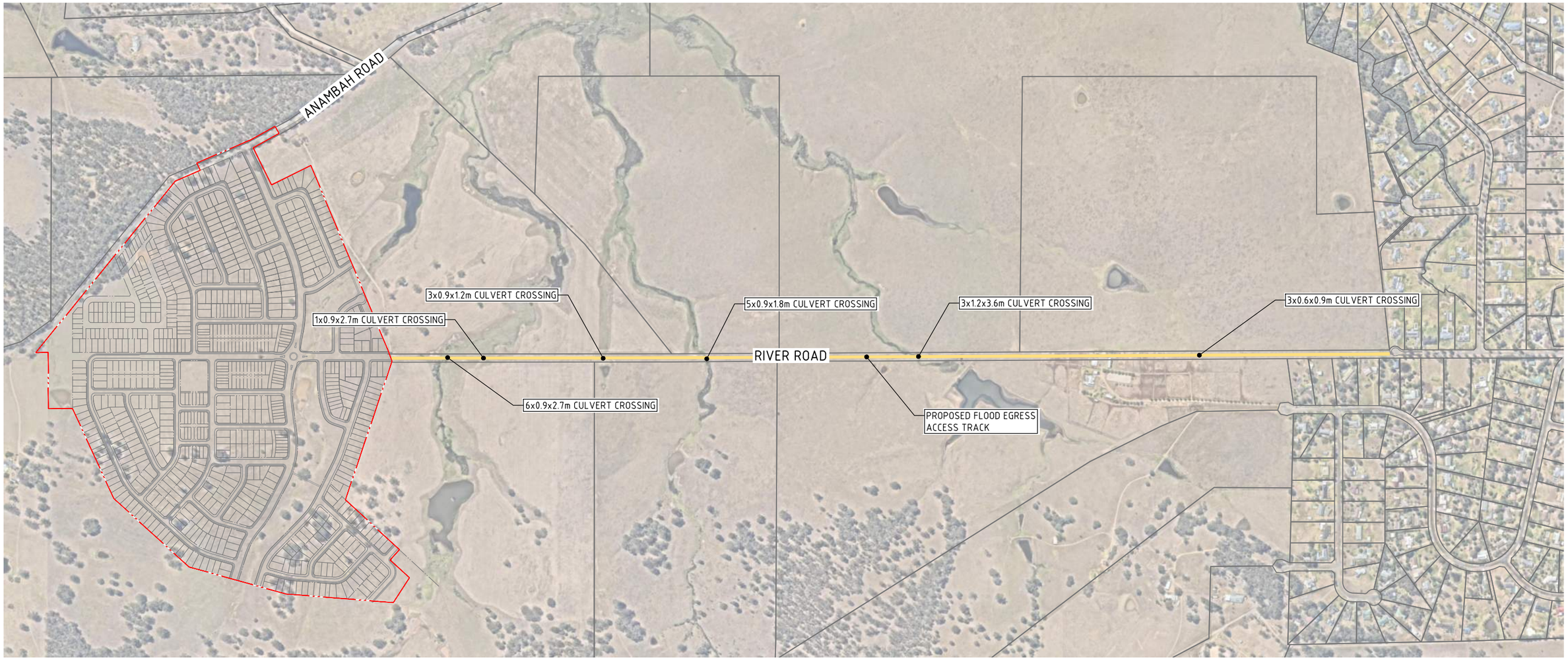
APPENDIX B EXHIBIT A - STAGE 1 STORMWATER MANAGEMENT PLAN

JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK09.02**

REVISION: **B**

Date: 28.08.2024 10:55 AM Plotted By: AIDAN TURNBULL Found: O:\S Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\O - Drawings\CIVIL\02-SKETCH\CSK09.01-STORMWATER CATCHMENT\NL222055-01-CSK09.02-SW STAGE 1.dwg



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PROJECT: **ANAMBAH SUBDIVISION GOSFORTH 2320**

DRAWING TITLE: **ENGINEERING REPORT**

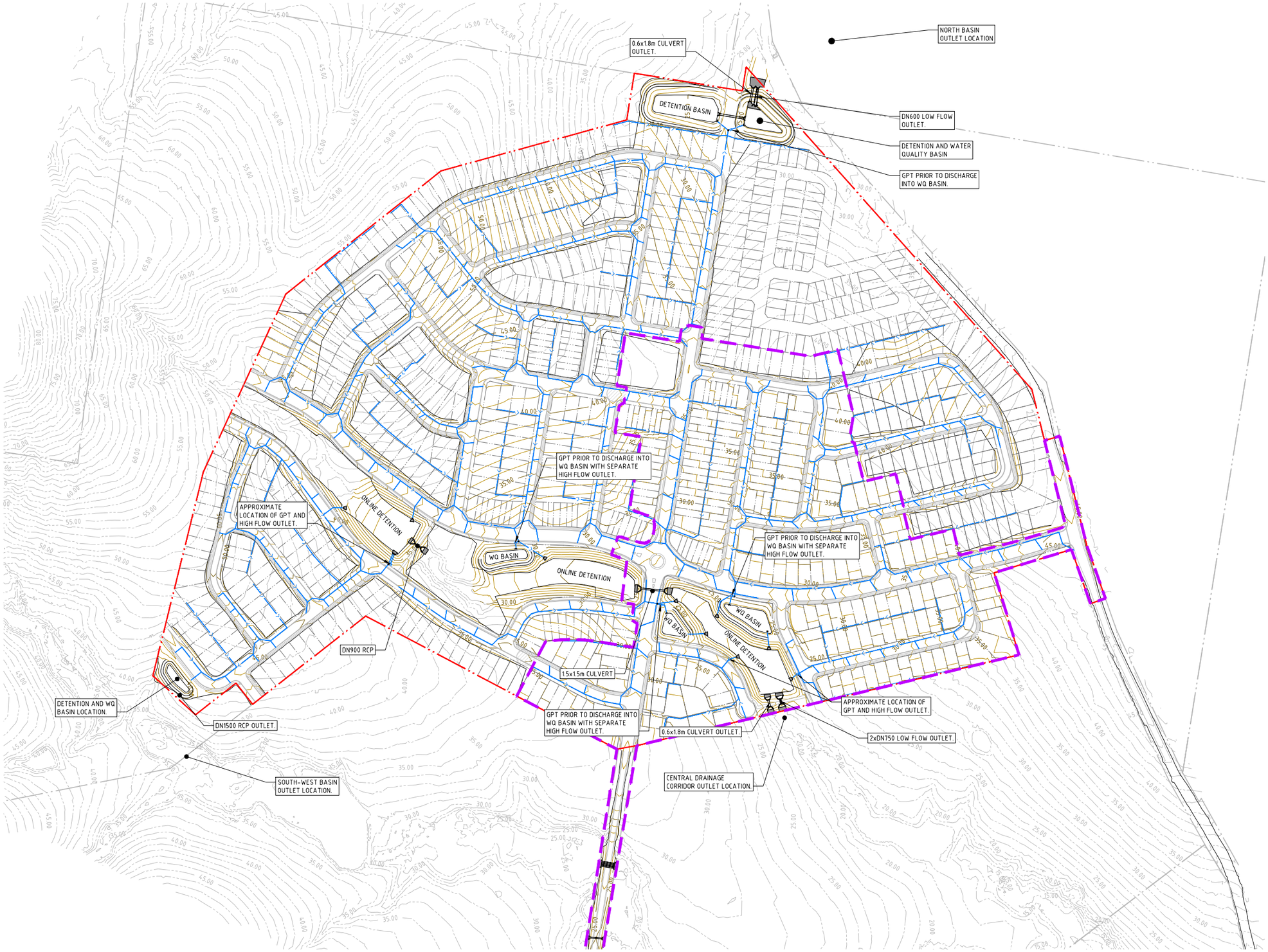
APPENDIX B EXHIBIT B - STAGE 1 STORMWATER ARRANGEMENT PLAN ALONG RIVER ROAD

JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK09.03**

REVISION: **C**

Date: 28.08.2024 10:55 AM Plotted By: AIDAN TURNBULL Found: O:\5 Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\O - Drawings\CIVIL\02-SKETCH\CSK09.01-STORMWATER CATCHMENTS\NL222055-01-CSK09.03-SW RIVER RD.dwg



LEGEND

- PROPOSED DEVELOPMENT EXTENT
- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- STAGE 1 WORKS EXTENT
- PROPOSED STORMWATER PIPE
- DESIGN CONTOURS (0.5m INTERVAL) — XX.XX
- EXISTING CONTOURS (0.5m INTERVAL) — XX.XX

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PROJECT: **ANAMBAH SUBDIVISION GOSFORTH 2320**

DRAWING TITLE: **ENGINEERING REPORT**

APPENDIX B EXHIBIT C - MASTERPLAN STORMWATER MANAGEMENT PLAN

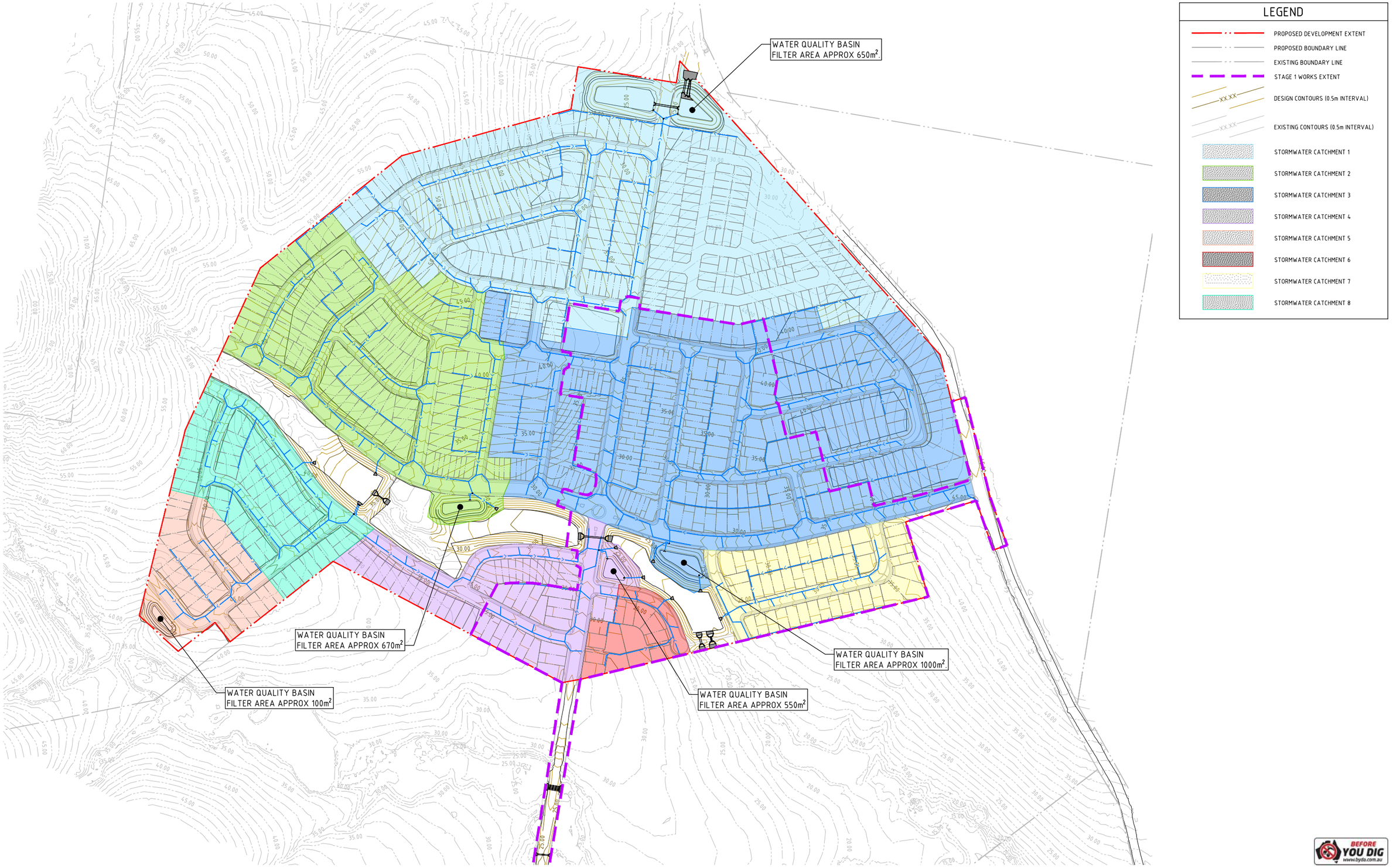
JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK09.04**

REVISION: **B**

Date: 28.08.2024 10:55 AM Plotted By: AIDAN.TURNBULL Found: O:\5 Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\O - Drawings\CIVIL\02-SKETCH\CSK09.01-STORMWATER CATCHMENTS\NL222055-01-CSK09.04-SW MASTERPLAN.dwg

Appendix C – Water Quality Catchment Plan



LEGEND

- PROPOSED DEVELOPMENT EXTENT
- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- STAGE 1 WORKS EXTENT
- DESIGN CONTOURS (0.5m INTERVAL)
- EXISTING CONTOURS (0.5m INTERVAL)
- STORMWATER CATCHMENT 1
- STORMWATER CATCHMENT 2
- STORMWATER CATCHMENT 3
- STORMWATER CATCHMENT 4
- STORMWATER CATCHMENT 5
- STORMWATER CATCHMENT 6
- STORMWATER CATCHMENT 7
- STORMWATER CATCHMENT 8

DRAWN: JSTAUB
DESIGNED: A.TURNBULL
JOB MANAGER: LMCRAE
VERIFIER: X. XXXX

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PROJECT: **ANAMBAH SUBDIVISION GOSFORTH 2320**

DRAWING TITLE: **ENGINEERING REPORT**

APPENDIX C EXHIBIT A - WATER QUALITY CATCHMENT PLAN

JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK09.01**

REVISION: **B**

Date: 28.08.2024 10:56 AM Plotted By: AIDAN TURNBULL Found: O:\5 Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\D - Drawings\CIVIL\02-SKETCHCSK09.01-STORMWATER CATCHMENTS\NL222055-01-CSK09.01-SW CATCHMENTS.dwg

Appendix D – Hunter Water Consultation

Lach McRae

From: Lach McRae
Sent: Tuesday, 16 July 2024 4:51 PM
To: Barry Calderwood (barry.calderwood@hunterwater.com.au)
Cc: Brian Swaine; Jason McIntosh
Subject: 559 Anambah Road - wastewater servicing HWC inception meeting

Hi Barry, thanks for organising our meeting yesterday to review wastewater servicing at the proposed subdivision of 559 Anambah Road. Please find below minutes from our meeting.

Meeting held online. 11.30am 15 July 2024

Attendees:
HWC Barry Calderwood
HWC Wes Jones
HWC Nigel Chenery
HWC Orod Zarrin
HWC Nathan Hays
HWC Subhan Das
Thirdi Brian Swaine
Vara Jason McIntosh
Northrop Lach McRae

Minutes:

- HWC noted under the approved strategy three WWPS's (1A, 3B and 5) would need to be delivered to enable development of the Thirdi lot.
- Thirdi would need to prepare an addendum if it seeks to deviate from the approved strategy.
- HWC noted that an addendum to the approved strategy had been requested to consider rezoning in Lochinvar "fringe" (west of URA) including a gravity catchment that would be pumped over the hill and into the Anambah URA.
- HWC confirmed that a barometric loop on the twin 400 rising mains was proceeding as the alternative for an underbore along Anambah Road was cost prohibitive.
- HWC noted that GCA is currently reviewing the rising main and gravity main alignments from WWPS 1A and were expecting a 15% detailed design that addressed this.
- Northrop requested HWC provide advice on the extent and timing for lead in assets being delivered for Stage 1 of Roche development so that this could be considered in the addendum.
- Northrop noted that the development within gravity catchments WWPS 5 and 6 as presented in Table 5 of the strategy was not until after 2040 and this does not reflect Thirdi's development program.
- HWC noted additional pump stations had been reviewed in preparation of the approved strategy however found increasing the depth of gravity sewers and minimise pump stations was favoured.
- HWC noted both timing and the locations of proposed pump stations could be reviewed in the Northrop addendum. HWC requested that any option be reviewed in terms of technical viability, cost and community benefit.
- Northrop noted one option being considered was pumping from Thirdi land up to the crest on Anambah Road and then gravitating down Anambah Road to WWPS1A. Both options would need further review however it may be possible to relocate WWPS 5 onto Thirdi land. Alternatively, the addition of a new pump station on the north eastern side of creek D may mean the large area of non drainable land shown in the strategy (or part of) could be sewered.
- Northrop noted that WWPS #1A seemed to be at a higher elevation than expected and may be better shifted towards Anambah Road. HWC noted the pump station location could be reviewed however it would need to be above the 1% AEP flood level.
- HWC noted that CAF would likely be available to WWPS 1A as well as 3B and 5. Ie any asset that needed to be upsized.
- HWC noted a possible temporary rising main along the River Road extension could be considered however it would likely be costly and would not attract CAF. Northrop noted this option would need to be reviewed further both in terms of cost and technical feasibility.
- HWC advised that there is no issue with plan stamping for a Concept masterplan and Stage 1 DA. Will need an application for stamping.

Please let me know if you would like to add to / amend the above. Thanks again for your time.

Kind regards,
Lach McRae
Principal | Civil & Environmental Engineer

Northrop Consulting Engineers
Level 1, 215 Pacific Highway Charlestown NSW 2290
T 02 4943 1777
D 02 4074 6842
M 0448 831 345

Lach McRae

From: Lach McRae
Sent: Tuesday, 16 July 2024 4:51 PM
To: Barry Calderwood (barry.calderwood@hunterwater.com.au)
Cc: Brian Swaine; Jason McIntosh
Subject: 559 Anambah Road - water servicing HWC inception meeting

Hi Barry, thanks for organising our meeting yesterday to review the water servicing at the proposed subdivision of 559 Anambah Road. Please find below minutes from our meeting.

Meeting held online. 11.00am 15 July 2024

Attendees:
HWC Barry Calderwood
HWC Wes Jones
HWC Orod Zarrin
HWC Archie Tuffour
HWC Stephanie Hayes
Thirdi Brian Swaine
Vara Jason McIntosh
Northrop Lach McRae

Minutes:

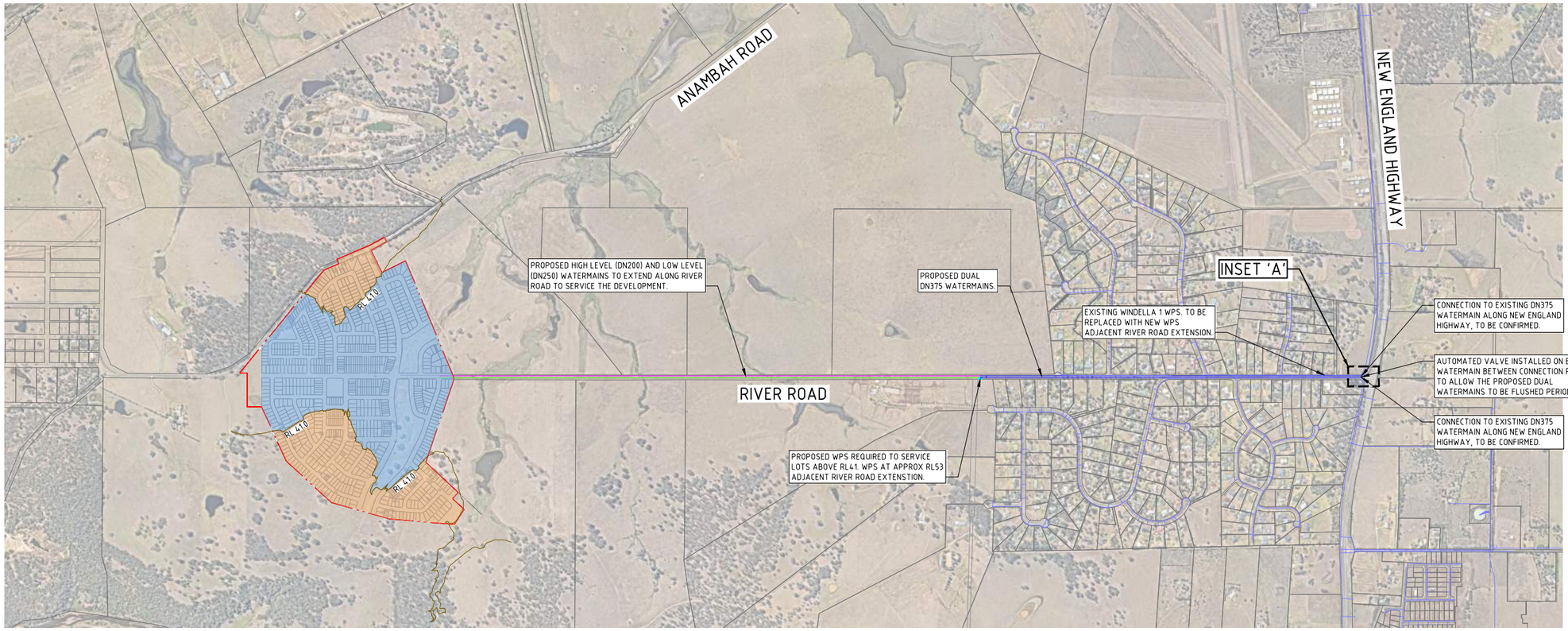
- HWC noted expectation is the lead in twin 375mm watermains proposed along existing formed section of River Road would be delivered together and interconnected so that water could be flushed through the mains periodically. HWC noted that ADW was requested to provide modelling on this.
- HWC noted the proposed water booster would replace the existing Windella 1 WPS.
- HWC noted the two pressure zones in the Thirdi land would mean delivery of the proposed water booster would be required if development in both pressure zones is proposed in Stage 1.
- HWC were not able to provide advice regarding Roche staging however noted that the location of WWPS1A would dictate Roche's staging location and it is possible that the water booster will not be delivered by Roche early in the development.
- Vara noted that the proposed Thirdi development may be ahead of the delivery of assets within the Roche land and on this basis an addendum would be prepared on this basis with watermain/s following the River Road road reserve between existing the northern end of formed section (proposed 2 x 375's) River Road and the Thirdi development.
- HWC advised a CAF application had been made and included the 2 x 375's. **HWC to review and advise whether the water booster is included.** HWC noted funding would be available for booster even if not in the existing application.
- Northrop noted HWC had advised in the prelim servicing advice that detailed design was underway. HWC noted ADWJ were managing the Roche development and GCA are designing the CAF works.
- **Northrop requested HWC provide advice on design and timing for delivery of the lead in assets / extent of trunk assets being delivered for Stage 1 of Roche development so this could be considered in the addendum.**
- In order to address security of supply and the two pressure zones it may be possible to run parallel mains within the road reserve between existing River Road and the Thirdi development and cross connect these with a normally closed valve.
- As part of the addendum Northrop will review the split between high and low pressure zones out of the initial 200-240 lots and the ultimate circa 900 lots.
- HWC noted a DRL would be needed with the addendum.

Please let me know if you would like to add to / amend the above. Thanks again for your time.

Kind regards,
Lach McRae
Principal | Civil & Environmental Engineer

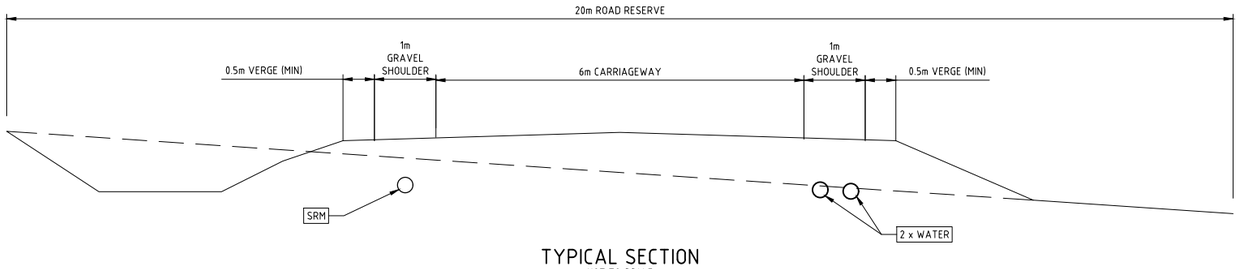
Northrop Consulting Engineers
Level 1, 215 Pacific Highway Charlestown NSW 2290
T 02 4943 1777
D 02 4074 6842
M 0448 831 345

Appendix E – Concept Water and Sewer Servicing



LEGEND

- PROPOSED DEVELOPMENT EXTENT
- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- PROPOSED DN200 WATERMAIN
- PROPOSED DN250 WATERMAIN
- PROPOSED DN375 WATERMAIN
- EXISTING WATERMAIN
- LOW LEVEL SUPPLY ZONE
- HIGH LEVEL SUPPLY ZONE



TYPICAL SECTION
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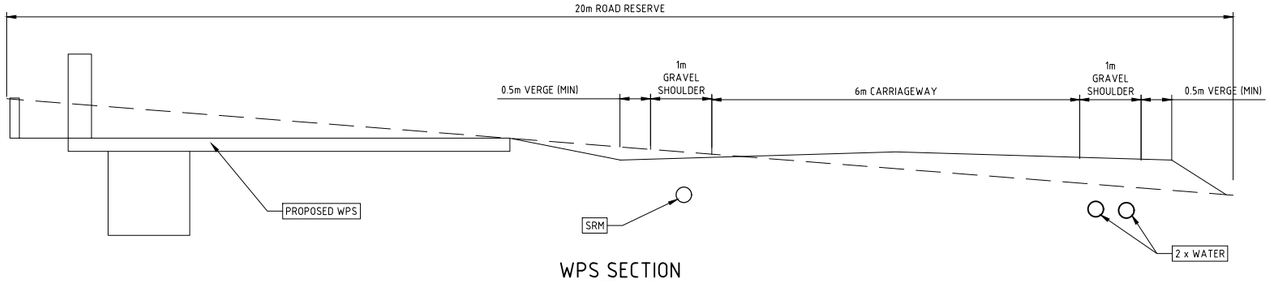

WPS SECTION
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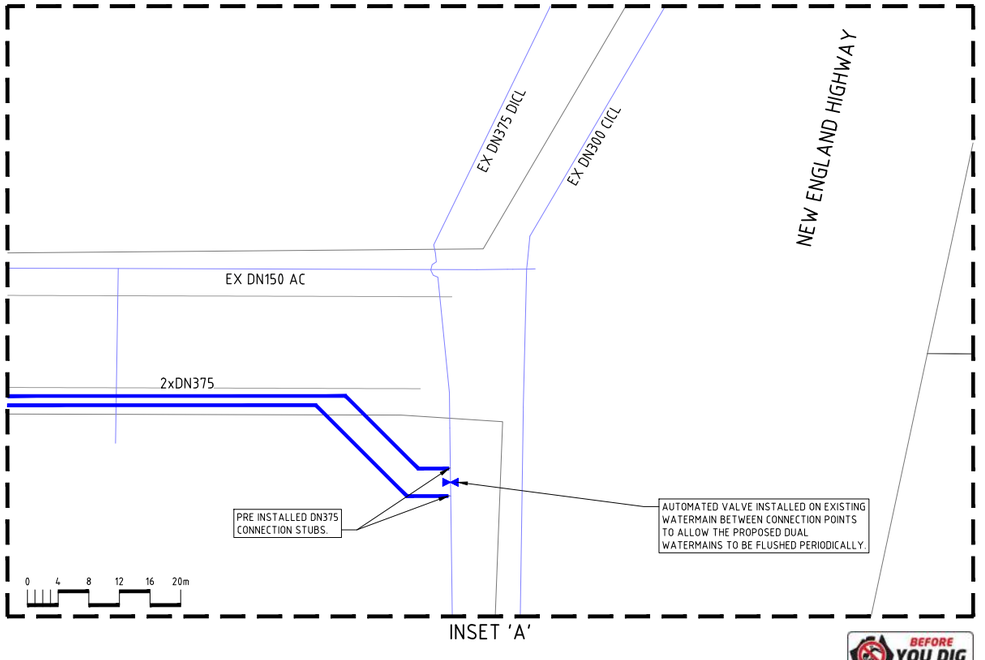

INSET 'A'

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ABN 81 094 433 100

PROJECT: **PROPOSED SUBDIVISION**

559 ANAMBAH ROAD, GOSFORTH NSW 2320

DRAWING TITLE: **WATER SERVICING**

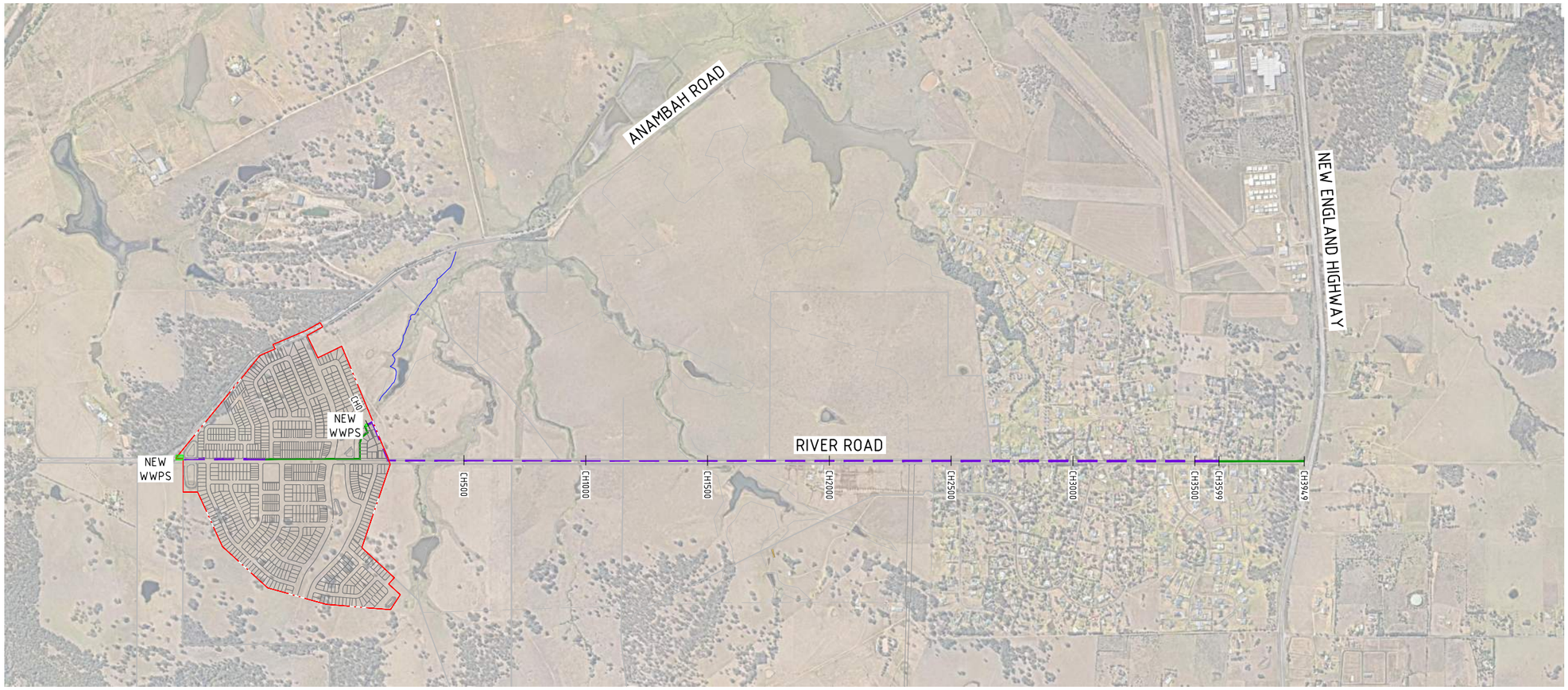
APPENDIX E EXHIBIT A - PRELIMINARY PROPOSED WATER SERVICING

JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK07.01**

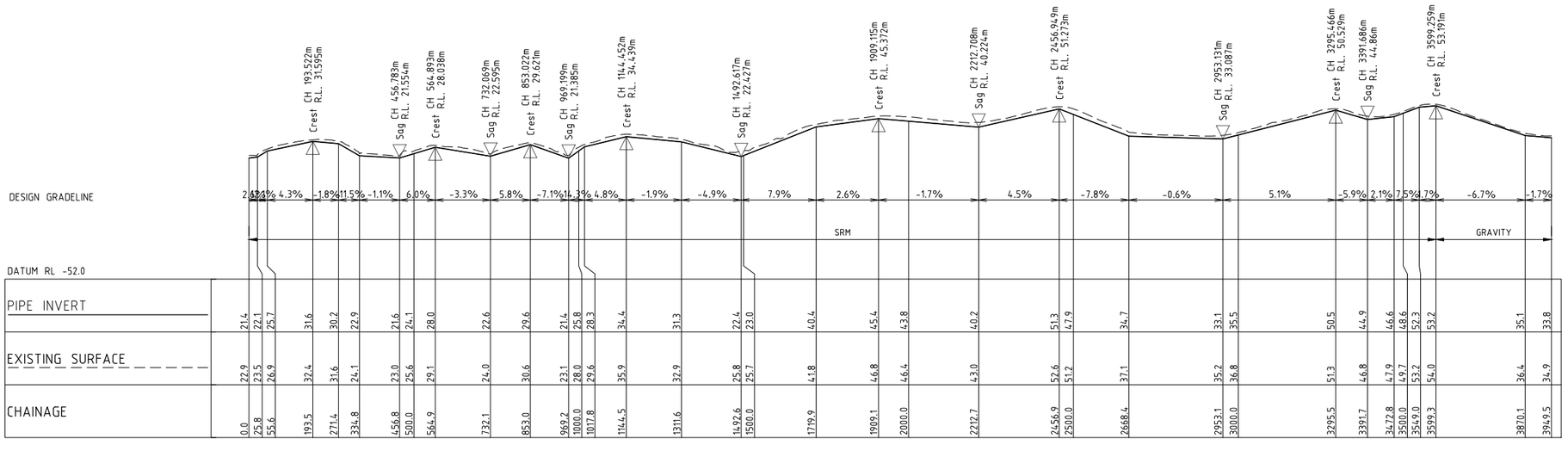
REVISION: **B**

Date: 28.08.2024 12:54 PM Plotted By: AIDAN TURNBULL Found: O:\S Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\O - Drawings\CIVIL\02-SKETCH\CSK07.01-WATER ENGINEERING REPORT\NL222055-01-CSK07.01-WATER SERVICING.dwg



LEGEND

- PROPOSED DEVELOPMENT EXTENT
- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- PROPOSED GRAVITY MAIN
- PROPOSED RISING MAIN
- PROPOSED WASTEWATER PUMP STATION (WWPS)



LONGITUDINAL SECTION ALONG SEWER MAIN

HORIZONTAL SCALE 1:8000@A1
VERTICAL SCALE 1:1600@A1

VERIFIER: X.XXXX
JOB MANAGER: L.MCRAE
DESIGNED: CDAO
DRAWN: JSTAUB

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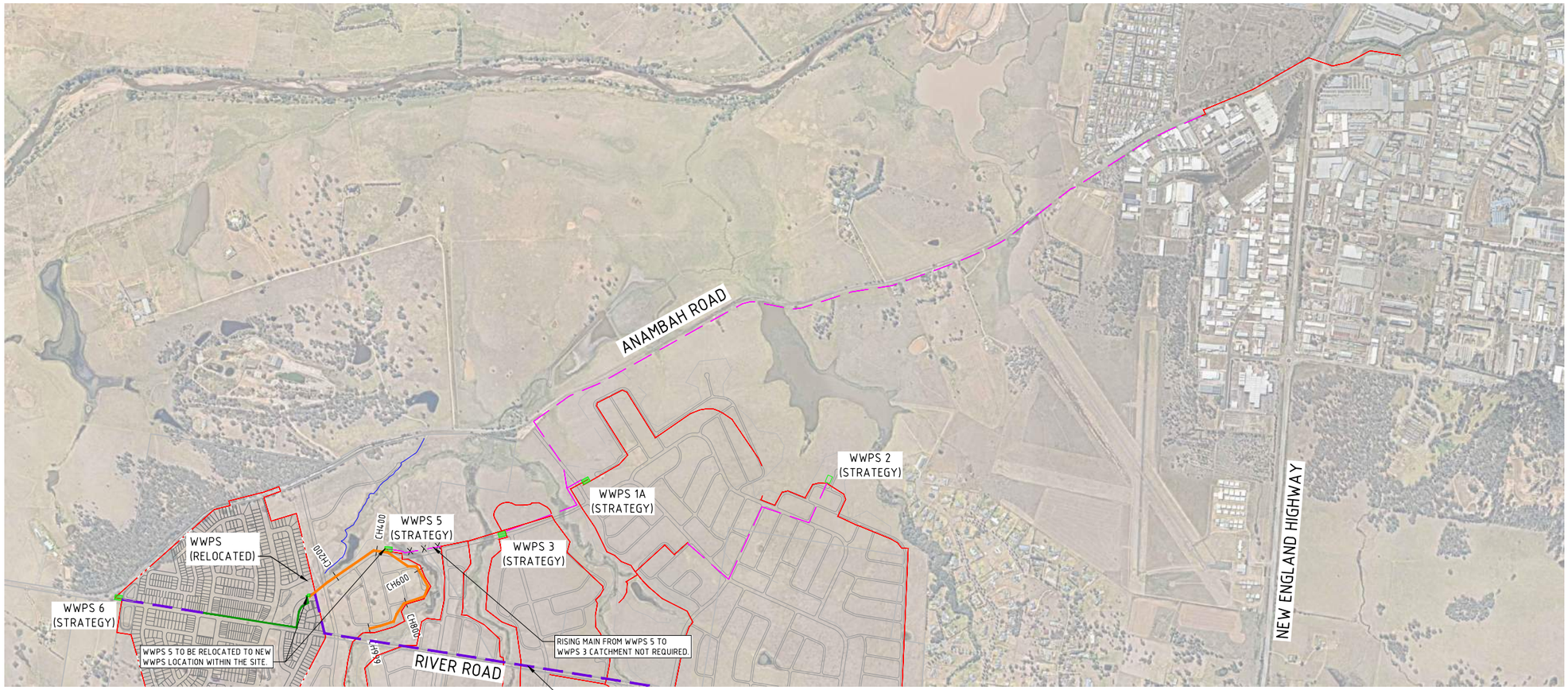
ABN 81 094 433 100

PROJECT: **PROPOSED SUBDIVISION**
559 ANAMBAH ROAD, GOSFORTH NSW 2320

DRAWING TITLE: **ENGINEERING REPORT**
APPENDIX E EXHIBIT B - PRELIMINARY PROPOSED SEWER SERVICING

JOB NUMBER: **NL222055-01**
DRAWING NUMBER: **CSK06.01**
REVISION: **B**

Date: 28.08.2024 10:48 AM Plotted By: AIDAN TURNBULL Found: C:\S Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\O - Drawings\CIVIL\02-SHEETS\CIVCSK06.01-SEWER ENGINEERING REPORT\NL222055-01-CSK06.01-SEWER SERVICING.dwg



LEGEND

- PROPOSED DEVELOPMENT EXTENT
- PROPOSED BOUNDARY LINE
- EXISTING BOUNDARY LINE
- PROPOSED GRAVITY MAIN
- PROPOSED RISING MAIN
- ROCHE - GRAVITY MAIN FROM APPROVED HWC STRATEGY
- ROCHE - RISING MAIN FROM APPROVED HWC STRATEGY
- SEWER PUMPING STATION
- FLOOD EXTENT - 1 IN 100 YEAR 20m

PROPOSED SEWER ALIGNMENT WITHIN ROCHE LAND BASED ON ROCHE ESTATE LAYOUT. SEWER TO BE LOCATED WITHIN ROAD RESERVE FILL BATTER AS PART OF ROCHE ESTATE DEVELOPMENT.

PROPOSED SEWER ALIGNMENT WITHIN ROCHE LAND BASED ON ROCHE ESTATE LAYOUT. SEWER TO BE LOCATED WITHIN ROAD RESERVE FILL BATTER AS PART OF ROCHE ESTATE DEVELOPMENT.

DESIGN GRADELINE		0.7%		0.5%		2.5%	
		GRAVITY					
DATUM RL -1.0							
PIPE INVERT	17.9	18.4	19.0	20.0	21.0	22.0	22.2	26.6
EXISTING SURFACE	23.1	23.3	21.2	22.4	21.5	23.4	24.1	27.7
CHAINAGE	0.0	71.6	200.0	400.0	600.0	800.0	821.6	999.4

LONGITUDINAL SECTION GRAVITY ALIGNMENT TO ASSESS NEIGHBOURS DRAINABILITY

HORIZONTAL SCALE 1:2000@A1
VERTICAL SCALE 1:400@A1

BEFORE YOU DIG www.byda.com.au

NOT FOR CONSTRUCTION

VERIFIER: X.XXXX
JOB MANAGER: L.MCRAE
DESIGNED: C.DAO
DRAWN: J.STAUB

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR INFORMATION	CD		LM	14.08.24
B	ISSUED FOR INFORMATION	JS		AT	27.08.24

CLIENT: Third.i COMMUNITIES

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ARCHITECT

ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE COMMENCING WORK.
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0 100 200 300 400 500m

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ABN 81 094 433 100

PROJECT: **PROPOSED SUBDIVISION**

559 ANAMBAH ROAD, GOSFORTH NSW 2320

DRAWING TITLE: **ENGINEERING REPORT**

APPENDIX E EXHIBIT C - SEWER NEIGHBOR CONSULTATION

JOB NUMBER: **NL222055-01**

DRAWING NUMBER: **CSK06.11**

REVISION: **B**

Date: 28.08.2024 10:46 AM Plotted By: AIDAN TURNBULL Found: O:\5 Pre-July 24 Projects\Newcastle\YEAR 2022 Jobs\NL222055-01 - 559 Anambah Road, Gosforth\0 - Drawings\CIVIL\02-SKETCH\CSK06.01-SEWER ENGINEERING REPORT\NL222055-01-CSK06.11-NEIGHBOUR CONSULTATION.dwg