

SITE BASED STORMWATER MANAGEMENT PLAN

FOR THE PROPOSED
CHILD CARE CENTRE

LOCATED AT
44-77 OLD PUB LANE,
GREENBANK, 4124

PREPARED FOR
OLD PUB LANE PTY LTD

SEPTEMBER 2019

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2019/1042

Date: 8 January 2020



Bornhorst & Ward Project No. **19097**

If you have any queries regarding this report please contact Carissa Pickering.

Revision	Date	Description	Author	Rev.	App.
A	May 2019	Issued for Approval	MST	CP	NR
B	Sep 2019	Issued in Response to RFI	CP		NR

Nicholas Rozis (RPEQ 7729):



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1. INTRODUCTION

Bornhorst and Ward has been commissioned to investigate and report on the stormwater requirements pertaining to the proposed Development Application for a PDA development permit for Material Change of Use (Child Care Centre) and Reconfiguring a Lot (1 Lot into 3 Lots and creation of access easements) located at 44-77 Old Pub Lane, Greenbank (Lot 1 on RP184067). The proposal consists of constructing a single storey building and associated carpark to serve as a new child care centre. Plans of the proposed development layout can be seen in Appendix A.

This document reports on the existing and proposed civil works and infrastructure required as part of the proposed development. The engineering requirements for this proposal shall be in accordance with Engineering Best Management Practices, Logan City Council Planning Scheme and the State Planning Policy 2017.

This report outlines the preliminary design methodology in support of a Development Application and should be read in conjunction with other documents issued by the consultant team.

A variation request has been lodged previously over the site and is for the PDA Preliminary Approval (pursuant to s94 of the Economic Development Act 2012) for Material Change of Use to vary the effect (Level of Assessment) of the Greater Flagstone PDA Development Scheme in accordance with a Master Plan of Development (Health Care Services, Business [Vet], Warehouse [Self Storage Facility], Shop [Pet supplies shop], Child Care Centre and Indoor Sport and Recreation [Gym, Swim School]). Documents included within the variation request application have been referenced throughout this stormwater management plan and formed the basis of the engineering design for this development application.

2. EXISTING AND PROPOSED SITE CHARACTERISTICS

2.1 LOCATION AND EXISTING FEATURES

The development site, located at 44-77 Old Pub Lane, Greenbank, has the following existing characteristics:

- The site is bound by Pub Lane to the north and east, the interstate railway line to the west, and Old Pub Lane to the south;
- The total area of the site is 2.01ha, with approximately 0.303ha of development area required for the child care centre;
- The site currently comprises of a single lot made up of a swim centre and other small existing buildings, along with an associated carpark and driveways;
- The remaining site area consists of medium density bushland;
- There are no easements located within or adjacent to the development site;
- The existing site access is from Old Pub Lane and there are currently two crossovers along this road that facilitate access to the development site;
- The site is located within the Greater Flagstone Priority Development Area;
- A Department of Transport and Main Roads/Queensland Rail land resumption is required along the western property boundary for future rail corridor realignment works.

Refer to Figure 1 for locality details.



Figure 1: Locality Plan

2.2 PROPOSED DEVELOPMENT

The following points outline information regarding the proposed development:

- A Material Change of Use (Child Care Centre);
- A Reconfiguration of Lot (1 Lot into 3 Lots and creation of access easements). The child care centre site is to be located within lot 3 of the new reconfigured lots;
- Demolition of existing buildings, services and associated infrastructure;
- Construction of a child care centre and associated carparking.

Refer to the development drawings in Appendix A for further details of the proposed development.

2.3 TOPOGRAPHY AND CATCHMENT CHARACTERISTICS

The topography and catchment characteristics of the child care centre site are as follows:

- The site falls in a south-western direction from the high point near Pub Lane (RL 66.5m AHD) to the low point near Old Pub Lane (RL 64.0m AHD) at an approximate grade of 4.9%;
- A roadside swale is located on the northern verge of Old Pub Lane and conveys runoff west to a sag located within the south-western corner of Lot 1 on RP184067;
- During minor and major storm events, runoff from the site discharges as overland flow towards the swale where it is then conveyed west to the sag point. Runoff is then conveyed beneath Old Pub Lane via a culvert before entering into the neighbouring property to the south;
- A series of downstream dams within neighbouring private property are believed to collect runoff from the development site and other upstream catchments;

- There are no external catchments associated with the development site.

See Figure 2 below for contour information.

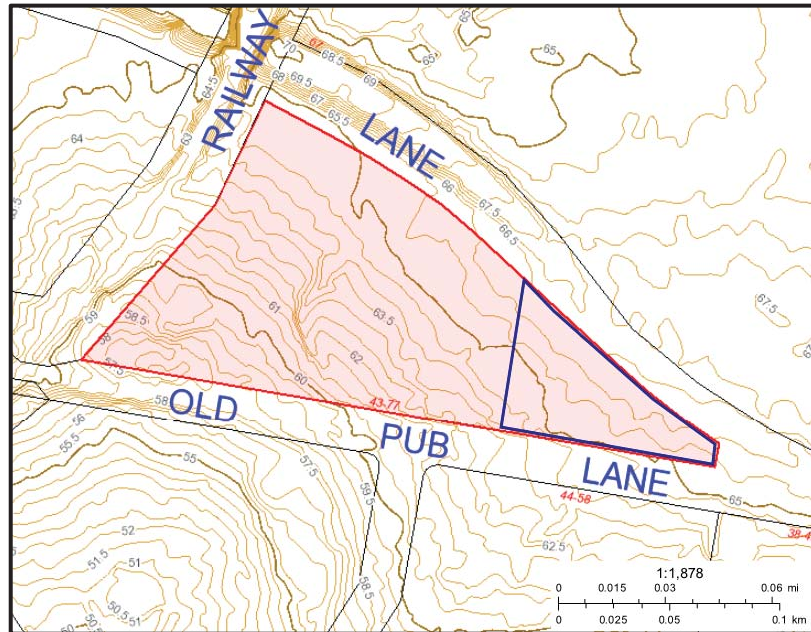


Figure 2: Development Contours provided by the LCC Online Interactive Mapping

2.4 EXISTING FLOODING CONDITIONS

The Logan City Council Interactive Mapping system and Flood Level Report were used to determine the extent of flooding within the development site. The flood impact over the site is as follows:

- No flood levels or flags for building development purposes exist for the development site;
- It is expected that the site is at a low risk of flood inundation.

3. EXISTING AND PROPOSED STORMWATER INFRASTRUCTURE

3.1 EXISTING INFRASTRUCTURE

A Dial Before You Dig Investigation has been completed of the site and its surrounding area. The following stormwater infrastructure was noted:

- The existing swim centre currently provides stormwater quality treatment via a swale alongside the existing carpark, a natural grass buffer and rainwater tanks;
- A swale is also present along the site's frontage with Old Pub Lane;
- A series of gully pits located around the swim centre collect surface flows and roofwater from the site and convey the stormwater to the swale via a 150mm PVC pipe;
- A 750mm dia. culvert is located at the sag point of the swale and conveys stormwater beneath Old Pub Lane into the neighbouring property;
- The crossovers along Old Pub Lane have driveway culverts with headwalls with scour protection within the swale.

3.2 PROPOSED STORMWATER DRAINAGE

The following points outline the stormwater management strategy for the child care centre site as detailed in the Variation Request:

- As the child care centre site has an area greater than 2500m², stormwater quality treatment measures will be required;
- The proposed treatment system will comprise of SPEL filters, a stormsack and utilisation of the existing swale along Old Pub Lane;
- A detention tank will be required for the site and has been sized to over-detain the Q10 storm event;
- Roofwater from the child care centre will be collected and conveyed via an internal drainage system to a combined detention and treatment tank located within the new carpark;
- Surface runoff will be collected via grated inlets and conveyed to the detention tank;
- Flows discharging from the detention tank will be conveyed through a stormwater pipe located along the site's frontage with Old Pub Lane to outlet into the swale;
- Stubs will be provided from this pipe to service the other new lots;
- An easement will be required over this stormwater pipe;
- Any runoff not collected by the piped network will sheet flow to Old Pub Lane where it will be collected and conveyed west by the existing swale as per existing conditions.

Refer to Appendix B for a sketch of the proposed stormwater infrastructure for further details.

4. STORMWATER QUANTITY ANALYSIS

Under the Logan City Council Guidelines, several design elements were identified in relation to stormwater management issues. Logan City Council must be satisfied that:

- The proposed development can be drained;
- The stormwater management system can follow the features and functions of the natural drainage system;
- The volume, timing, velocity and pollutant load of stormwater has no adverse effect on any surrounding properties or receiving waters; and
- Suitable provision is made in the design layout to accommodate for major drainage.

All stormwater discharge will comply with Logan City Council's Stormwater Management Code with quantity calculations completed in accordance with the requirements and methods outlined in the Queensland Urban Drainage Manual (QUDM).

4.1 DETAILED HYDRAULIC MODELLING – XP STORM

A detailed hydrologic and hydraulic analysis using XP Storm software has been undertaken to more accurately model the stormwater flow characteristics of the site.

XP Storm is a hydraulic modelling software tool that utilises detailed hydrograph flow analysis to provide an effective representation of urban stormwater systems. Hydrographs are calculated using the Laurenson Method for runoff routing in conjunction with the Uniform Loss model for determining catchment losses. XP Storm has been used to demonstrate acceptable detention sizing and non-worsening effects on downstream properties through comparison of the results obtained for existing and developed mitigated scenarios.

The modelling took into consideration the entirety of Lot 1 on RP184067 in consideration of future modelling expected to be performed over the site. The child care centre will provide its own detention system but the ultimate development will need to ensure that developed runoff rates from the site match those of the existing scenario. All modelling described below refers to the development of the child care centre only, with the remainder of the site modelled as per existing conditions.

4.1.1 Existing Scenario Model

Initially the existing XP Storm model was built using the catchment parameters outlined in Table 1. The initial and continuing loss properties were assumed from site investigations and recent experience with stormwater modelling in the subject area. The catchments outlined below were modelled to the existing culvert beneath Old Pub Lane.

Table 1: XP Storm Existing Model Parameters

Parameter	Ex Catchment A&B	
	Pervious Data	Impervious Data
Area (ha)	1.156	0.444
Slope (%)	6	3
Mannings 'n'	0.07	0.013
Initial Loss (mm)	25	0
Continuing Loss (mm/hr)	1.1	0
Laurenson 'n'	-0.285	-0.285

4.1.2 Results for Existing Scenario

Table 2 indicates the existing total peak discharge rate for the site at the culvert beneath Old Pub Lane as outputted by XP storm. The peak flow rate indicated is the combined flow of the site and external catchments. The critical storm duration for the existing catchment was determined by simulating all storm events from the 1 to 100 year ARI storm events for 20, 25, 30, 45, 60, 90, 120 and 180 minute durations. The critical storm events can be seen within the table below.

Table 2: XP Storm Existing Peak Flow Results – Ex Catchment A&B (m³/sec)

Storm Duration (min)	ARI (Years)						
	1	2	5	10	20	50	100
20	0.142	0.188	0.238	0.268	0.309	0.399	0.507
25	0.142	0.183	0.258	0.318	0.407	0.462	0.561
30	0.131	0.168	0.238	0.293	0.373	0.432	0.528
45	0.120	0.156	0.206	0.258	0.365	0.464	0.525
60	0.129	0.167	0.270	0.323	0.415	0.513	0.623
90	0.107	0.154	0.257	0.329	0.413	0.497	0.584
120	0.101	0.131	0.241	0.282	0.371	0.436	0.503
180	0.063	0.123	0.257	0.297	0.379	0.419	0.480
Critical	20	20	60	90	60	60	60

Discharge hydrographs for the existing model have been included in Appendix D.

4.1.3 Developed Scenario Model

A developed scenario model was then created with internal catchments and parameters modified from the existing model to suit the proposed development as outline in Table 3.

Table 3: XP Storm Developed Model Parameters

Parameter	Undev Catchment A&B		Dev Catchment C	
	Pervious Data	Impervious Data	Pervious Data	Impervious Data
Area (ha)	1.015	0.3	0.056	0.226
Slope (%)	6	3	1	5
Mannings 'n'	0.07	0.013	0.03	0.013
Initial Loss (mm)	25	0	25	0
Continuing Loss (mm/hr)	1.1	0	1.1	0
Laurenson 'n'	-0.285	-0.285	-0.285	-0.285

4.1.4 Detention Tank Design

For the developed mitigated scenario, a storage node representing the proposed detention tank was included in the model. Flows from Dev Catchment C were routed to the detention tank with flows from Undev Catchment A&B bypassing the tank and discharging directly to the culvert as per existing conditions.

The tank was modelled as outlined in Table 4 below.

Table 4: XP Storm Developed Model Hydraulic Routing

Elevation (RL)	Area (m ²)	Approximate Volume (m ³)
61.5	45	
62.8	45	59

Outlets to the detention tank were modelled as below:

- Low-flow outlet: 100mm dia. orifice with invert level RL 61.5mAHD.
- Mid-flow outlet: 100mm dia. orifice with invert level RL 62.4mAHD.
- High-flow outlet: 2m long weir with crest invert level 62.6mAHD.

See drawing SK-C001 in Appendix B for more information.

4.1.5 Results for Developed Scenario

Table 5 indicates the developed total peak discharge rate at the culvert beneath Old Pub Lane as outputted by XP storm. The peak flow rate indicated is the combined flow of the Undev Catchment A&B and Dev Catchment C. To determine the critical storm event for the developed mitigated case, the 1 to 100 year ARI storm events for 20, 25, 30, 45, 60, 90, 120 and 180 minute durations were simulated in the model. From these simulations it was determined that the critical duration for the 1 year ARI storm event was the 25 minute storm, the critical duration for the 2 year ARI storm event was the 20 minute storm, the critical duration for the 10 and 50 year ARI storm event was the 90 minute storm and the critical duration for all remaining storm events was the 60 minute storm. The 20, 25, 60 and 90 minute storm duration results will therefore be compared against the existing scenario discharges as identified in Section 4.1.2.

Table 5: XP Storm Developed Mitigated Peak Flow Results (m³/sec)

Storm Duration (min)	ARI (Years)						
	1	2	5	10	20	50	100
20	0.132	0.163	0.196	0.216	0.270	0.396	0.489
25	0.134	0.161	0.223	0.272	0.346	0.430	0.522
30	0.126	0.151	0.208	0.253	0.320	0.415	0.496
45	0.116	0.142	0.212	0.254	0.374	0.471	0.530
60	0.122	0.154	0.254	0.303	0.402	0.500	0.603
90	0.106	0.155	0.251	0.314	0.388	0.502	0.592
120	0.101	0.131	0.241	0.277	0.355	0.440	0.507
180	0.068	0.132	0.249	0.284	0.354	0.387	0.474
Critical Event	25	20	60	90	60	90	60

Further details of the outputs for the critical events have been located within Appendix D.

4.1.6 Hydraulic Impacts on Downstream Waterway Corridor

A comparison of critical peak flows for the existing and developed mitigated scenarios has been included in Table 6. The hydraulic modelling undertaken has demonstrated that the proposed development will not cause a worsening impact downstream of the site in the Q1-Q100 storm events and that the tank has been adequately sized. **Therefore, the required detention volume for the child care centre site in the 1% AEP storm event is 59m³.**

Discharge hydrographs, stage/water elevations for the detention tank and associated XPstorm outputs have been included in Appendix D of this report to demonstrate the performance of the proposed detention system.

Table 6: XP Storm Existing and Developed Mitigated Peak Discharge Comparison (m³/sec)

ARI (Years)	Existing Critical Discharge	Developed Critical Discharge	Discharge Difference
1	0.142	0.134	-0.008
2	0.188	0.163	-0.025
5	0.270	0.254	-0.016
10	0.329	0.314	-0.015
20	0.415	0.402	-0.013
50	0.513	0.502	-0.011
100	0.623	0.603	-0.020

5. STORMWATER QUALITY

5.1 CONSTRUCTION PHASE

As a result of the proposed development, contaminants will be generated during the construction phase. A comprehensive Erosion and Sediment control plan including the construction process will be prepared during the detailed design. This is to be kept on site during the construction phase and will be in accordance with the State Planning Policy 2017 and LCC Planning Scheme.

5.2 OPERATIONAL PHASE

The following is an extract from the Logan Planning Scheme 2015, Schedule 6, PSP 5 – Infrastructure Version 5.1, Section 3.6.1.4 – Stormwater Quality:

Stormwater quality, waterway stability and frequent flow infrastructure is provided to achieve the stormwater management design objectives where the development site is a:

- 1) *A material change of use for urban purposes where:*
 - a) *The size of the premises is greater than 2,500 m²; or*
 - b) *It results in the creation of six or more additional dwellings; or*
 - c) *Located in the Loganholme local plan area; or*
 - d) *Included in the Highway business precinct of the Specialise centre zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area; or*
- 2) *Reconfiguring a lot for urban purposes where:*
 - a) *The size of the subject premises is greater than 2,500m² and results in an increase number of non-residential lots (e.g. industrial, commercial, etc.); or*
 - b) *It results in the creation of six or more residential lots;*
 - c) *Located in the Loganholme local plan area and results in a total of four or more lots; or*
 - d) *Where included in the Highway business precinct of the Specialised Centre Zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area and results in a total of four or more lots.*

As the proposed development is for a material change of use that involves greater than 2,500m² of land the Logan Planning Scheme requirements for water quality are applicable to the proposed development.

5.2.1 Pollutants of Concern

The key pollutants to be targeted and the minimum reductions in mean annual loads described in the State Planning Policy for the South East Queensland Region area outlined in Table 7.

Table 7: South East Queensland Water Quality Objectives

Pollutant	Reduction in Mean Annual Load
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants (GP)	90%

5.2.2 Modelling/Assessment Approach

A quantitative assessment of stormwater runoff quality was considered for the catchments ultimate developed scenario.

The predicted reductions in mean annual loads of key pollutants have been identified using the “Model for Urban Stormwater Improvement Conceptualisation” (MUSIC), Version 6 (6.3.0). MUSIC is a stormwater quality modelling program that provides estimates of stormwater pollution generation and the performance of stormwater management measures used in series or parallel to form a ‘treatment train’.

5.2.3 Meteorological Data

The first step in creating the MUSIC model was to select the appropriate meteorological data set (period and time step) to be used as the basis for the runoff algorithms. Section 3.1 – Meteorological Data and Section 3.2 – Modelling Period and time-step, of the MUSC Modelling Guidelines details the Rainfall Data and Time Step process requirements of the model, respectively.

The time step used for the MUSIC modelling process was: Logan 6 Minutes.

5.2.4 Source Nodes

The second step taken in creating the MUSIC models was to define 'Source Nodes' or Sub-Catchments. The MUSIC model consisted of three source node types based on the proposed development layout; commercial roof area, ground area and road area. Source node input parameters for each node type were adopted in accordance with the MUSIC Modelling Guidelines.

5.2.5 Treatment Methodology

A treatment strategy that included the child care centre site was employed during the Variation Request. This treatment strategy ensured that runoff from the entire lot 1 on RP184067 met the South East Queensland Water Quality Objectives at the lawful point of discharge. As the child care centre is to be developed before the balance of the lot, runoff from the site (located within Catchment 3 of the Variation Request) must be capable of meeting the objectives without reliance on future treatment measures.

5.2.6 Treatment Nodes

The MUSIC model consisted of three types of treatment nodes as detailed in Table 8. Treatment node input parameters were based on the MUSIC Modelling Guidelines. Refer to Appendix B for details on the proposed location of the treatment devices.

Table 8: Selected Stormwater Quality Treatment Devices

Treatment Device	Discussion
SPEL Filters	A SPEL filter is a proprietary device containing cartridge filtration designed to remove nutrients and sediments from stormwater runoff. A SPEL system comprising of 5 filter cartridges is proposed to treat this catchment and will be located within a combined treatment/detention tank.
SPEL Stormsack	A stormsack is a catch pit insert that captures and retains litter, suspended solids and other gross pollutants. A single stormsack has been proposed to pre-treat the ground surface flows.
Swale	A swale is a vegetated channel which promotes the flow of water through a vegetated treatment zone. The existing swale located along Old Pub Lane will be maintained post development. The swale will take discharges from the development at multiple points and therefore has been modelled as three separate swales that each feed into the next segment to ultimately discharge to the same outlet.

	Swale (1) - Swale Length = 95m - Depth = 0.3m Swale (2) - Swale Length = 73m - Depth = 0.3m Swale (3) - Swale Length = 42m - Depth = 0.3m
--	---

Refer to the MUSIC information attached in Appendix E for further details.

5.2.7 Proposed Treatment Train

A 'Treatment Train' was developed to target each of the pollutants of concern to be incorporated into the development site layout. This treatment train for the child care centre site only is illustrated in Figure 3.

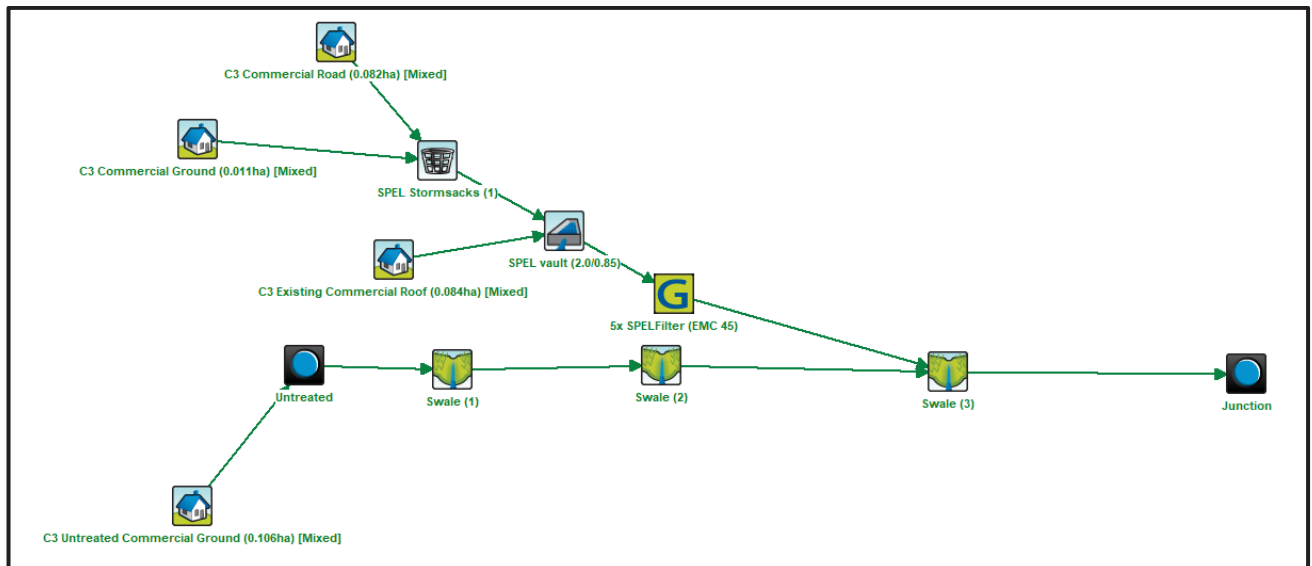


Figure 3: Proposed Treatment Train

The overall treatment train for the site including the balance of the lot is shown below in Figure 4.

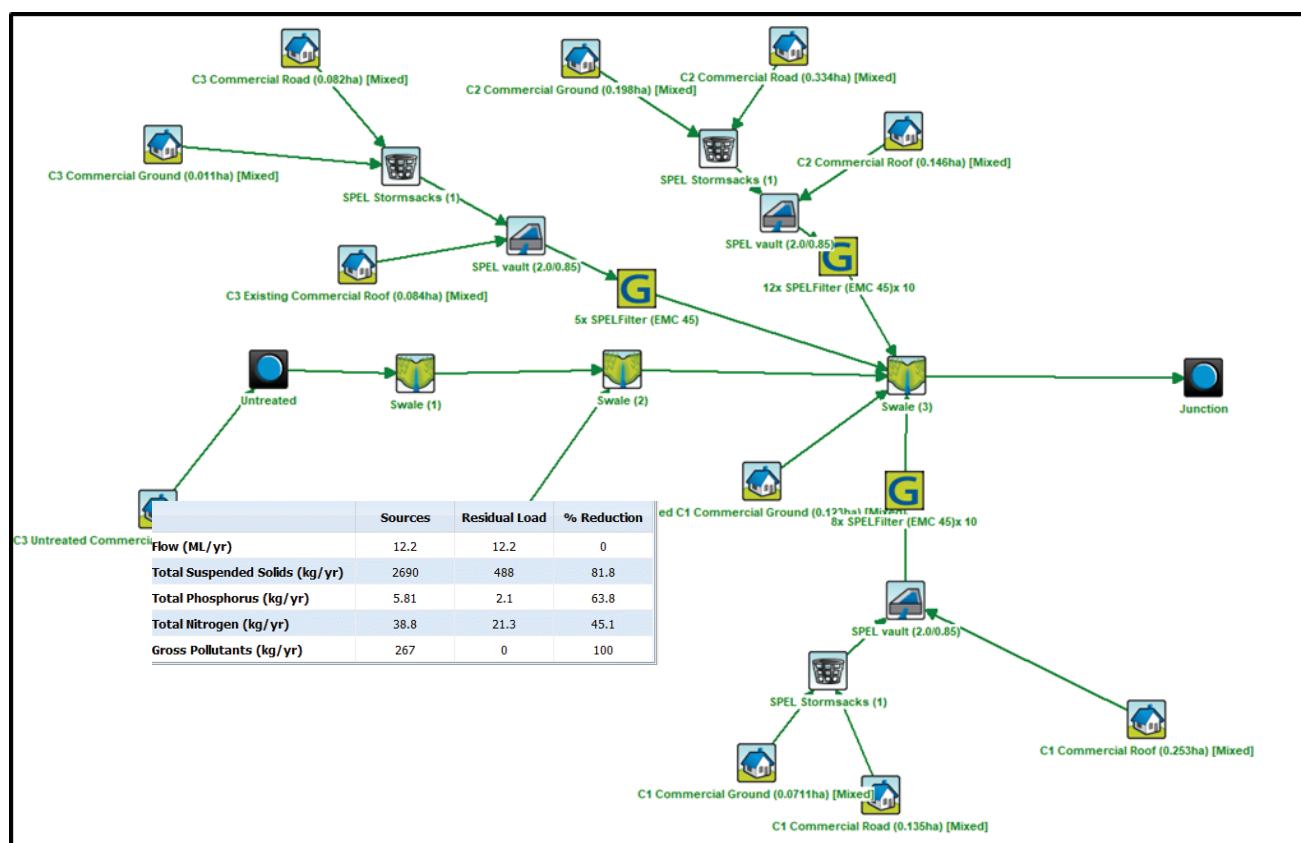


Figure 4: Proposed Fully Developed Lot Treatment Train

5.2.8 Results

The pollutant reductions for the developed phase of the child care centre, with the inclusion of the detailed treatment train shown in Figure 3, as obtained from the MUSIC model and analysis are summarised in Table 9.

Table 9: Pollutant Removal Rates Discharge

Pollutant	TSS (%)	TP (%)	TN (%)	GP (%)
Treatment Train Effectiveness	91.7	71.4	51.8	100.0
WQOs	80.0	60.0	45.0	90.0

As indicated in the table above, the removal rates for the target pollutants; total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutants (GP) are all above the water quality objectives stipulated in the State Planning Policy (2017). Therefore, the proposed treatment train for these areas will yield satisfactory pollutant removal.

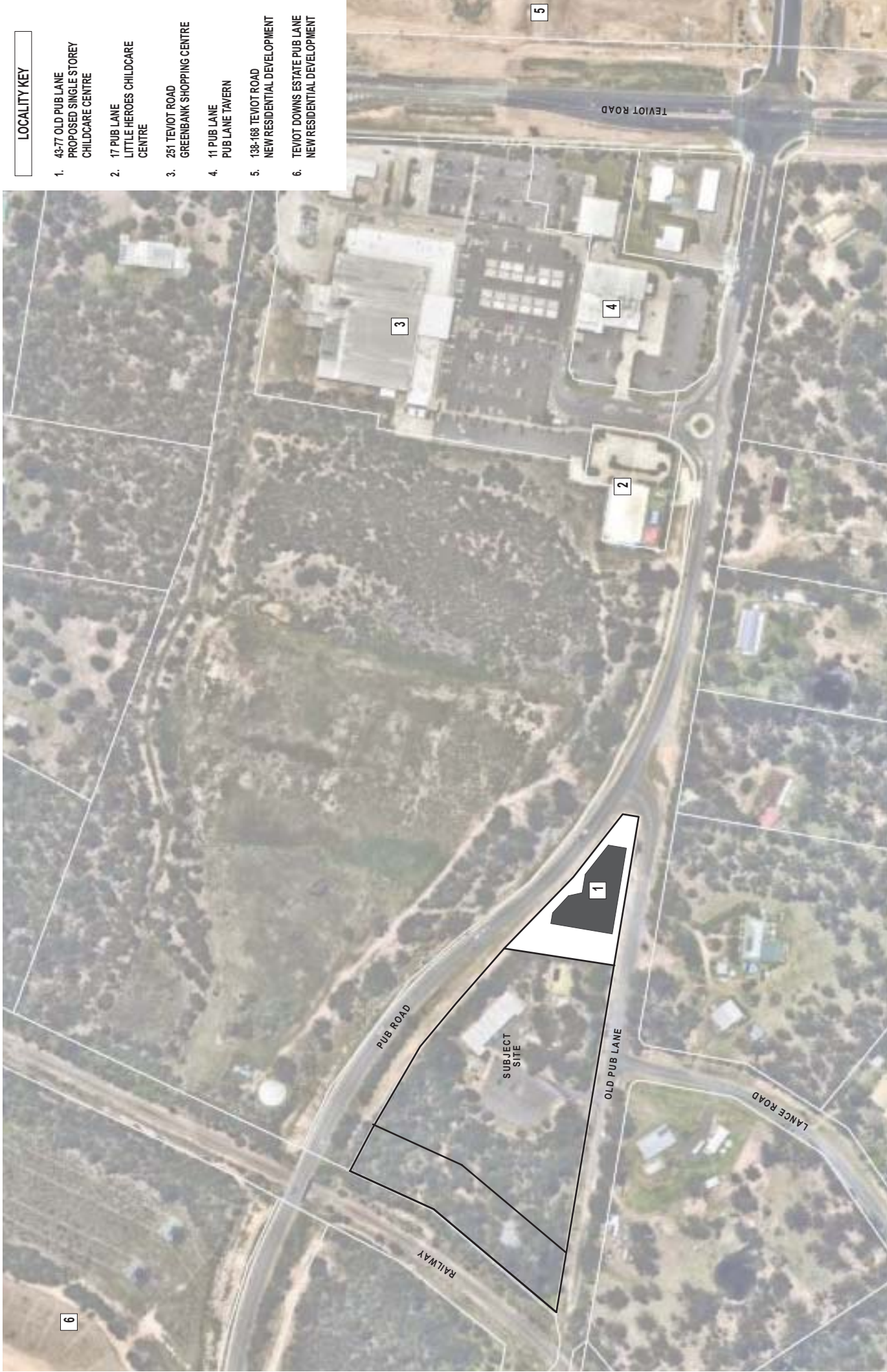
6. SUMMARY

This Engineering Report has demonstrated that the proposed development located at 44-77 Old Pub Lane, Greenbank can be developed in accordance with Engineering Best Management Practice, LCC guidelines and the State Planning Policy 2017. The following points summarise the findings and recommendations:

- The proposed development site has no flood levels or flags for building or development purposes and is expected to be low risk;
- Detention for the site will be provided via the use of a single detention tank;
- Stormwater treatment will be provided by a proprietary treatment device located within the detention tank;
- During minor storm events, runoff from the roof of the child care centre and associated carpark will be collected and conveyed via the internal piped network;
- During major storm events, runoff will be conveyed via the carpark as overland flow to the Old Pub Lane swale where it will continue to flow west as per existing conditions;

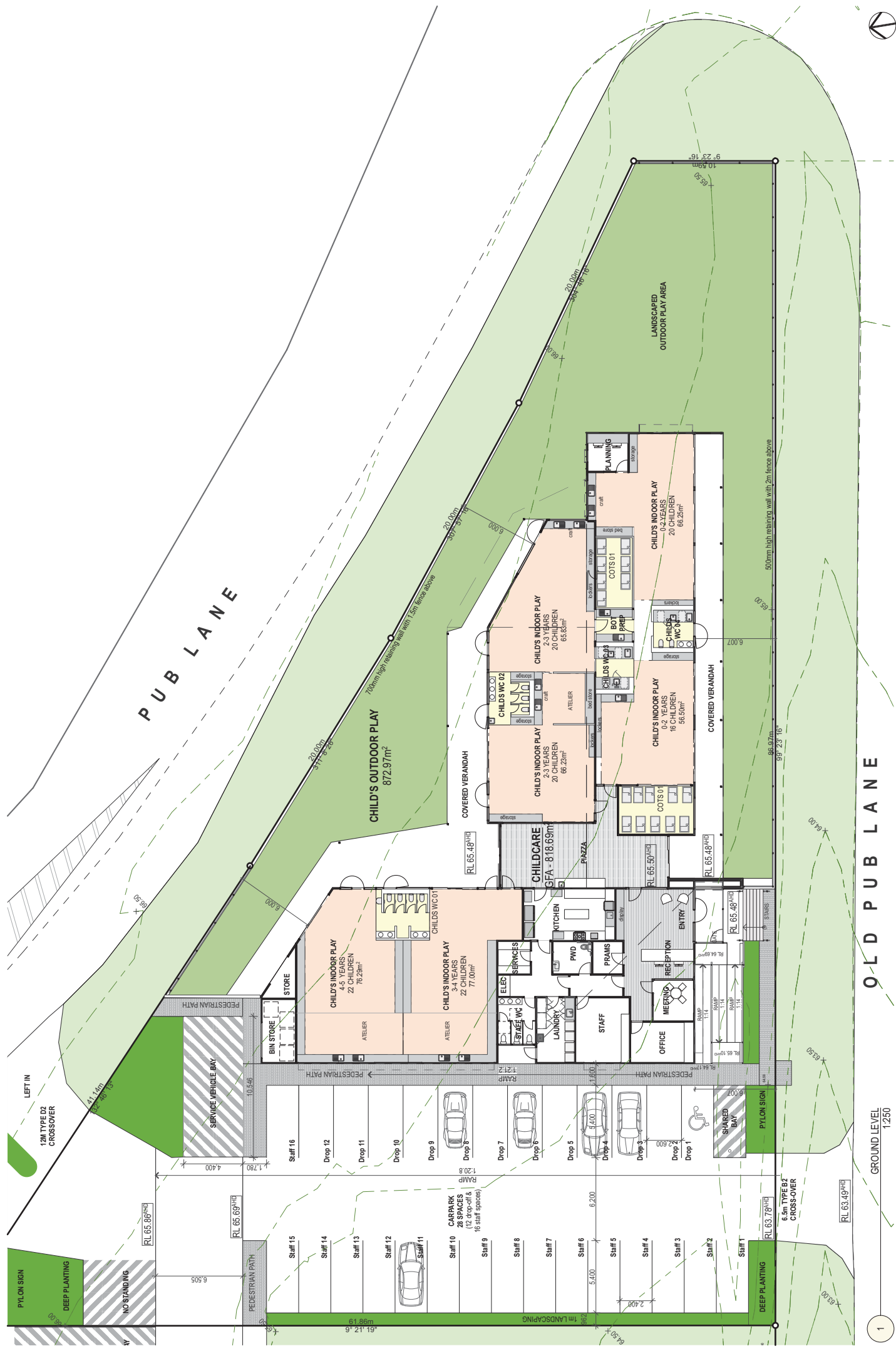
APPENDIX A

DEVELOPMENT DRAWINGS



LOCALITY KEY

1. 43-77 OLD PUB LANE
PROPOSED SINGLE STOREY
CHILDCARE CENTRE
2. 17 PUB LANE
LITTLE HEROES CHILDCARE
CENTRE
3. 251 TEVIOT ROAD
GREENBANK SHOPPING CENTRE
4. 11 PUB LANE
PUB LANE TAVERN
5. 138-168 TEVIOT ROAD
NEW RESIDENTIAL DEVELOPMENT
6. TEVIOT DOWNS ESTATE PUB LANE
NEW RESIDENTIAL DEVELOPMENT



DATE

ISSUE DETAILS

19/02/19

A Preliminary Site Plan

09/04/19

B Preliminary Site Plan

11/04/19

C Preliminary Outdoor Play Plan

28/05/19

D Service vehicle bay added - 35 car spaces

28/05/19

F RCV Bay + 8m Pick Up Point

22/05/19

G RCV Bay + Consultant Issue

PROJECT NAME:

CHILD CARE CENTRE

CLIENT:

CK Group Pty Ltd

DRAWING NO.

DD-200

LAYOUT NAME

Ground Floor Plan

ISSUE NO.

190306OLD

Scale @

A3 - 1:200

Address:

43-77 Old Pub Lane, Greenbank, QLD 4124

Printed:

22/05/19

1

GROUND LEVEL 1:250

ALTO ARCHITECTS PTY LTD

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DRAFT

ISSUE

ISSUE	DATE	DESCRIPTION	CHECKED BY
A	29.04.2019	Site Plan	---
B	14.05.2019	Site Plan	MS

LEGEND



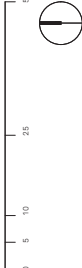
NOTES

Total maximum Gross Floor Area for each use category
Commercial - Health Care Service, Veterinary 2000m²
Clinic
Industry - Warehouse (Self Storage Facility) 4600m²
Retail - Shop (Pet Supplies Store) 400m²
Service, Community and Other Uses - Child Care Centre 820m²
Sport and Recreation - Indoor Sport and Recreation (Gym, Swim School) 1000m²
Total Approved Gross Floor Area 8820m²
Recommended minimum supply of car parks 130

Development Specifications:

1. Minimum 30m setback is required to the western boundary of the site adjoining the railway corridor.
2. Maximum building height of 8.0m for all uses (except industry).
3. Industry (Warehouse) may comprise a building height up to 15m.
4. Pub Lane and Old Pub Lane must be setback a minimum of 6m from the site boundary.
5. Landscaping is to be provided along all street boundaries, around buildings and within car parking areas.

SCALE 1:1000



DRAWING

MASTERPLAN

DRAWING NO.	ISSUE	JOB	DRAWN BY
01	A	7190332	TB

PROJECT

MASTERPLAN

43 - 77 Old Pub Lane, Greenbank QLD 4124
LGA: City of Brisbane
Prepared for: Warren WTT, BW Advisory

Ethos Urban Pty Ltd
ABN 13 615 097 931
1/356 St Pauls Terrace Brisbane
QLD 4000
www.ethosurban.com

ETHOS
URBAN



APPENDIX B

ENGINEERING DRAWINGS

EXISTING INFRASTRUCTURE
PROPOSED INFRASTRUCTURE



Not part of this
application

PROPOSED STUBS
FOR FUTURE
CONNECTION

EXISTING 750mm DIA
CULVERT. IL 56.5

PROPOSED
EASEMENT

GRADED INLET PITS

59m³ DETENTION
TANK WITH 5 SPEL
FILTERS

IL 58.1

Swale 3.42m

Swale 2.73m

Swale 1.95m

Level 4, 67 Astor Terrace
Spring Hill, QLD 4000, Australia
P. +61 (7) 3013 4699
mail@bornhorstward.com.au
www.bornhorstward.com.au

BORNHORST + WARD
CONSULTING ENGINEERS
CIVIL AND STRUCTURAL

PROJECT
Child Care Centre 44-77 Old Pub
Lane, Greenbank

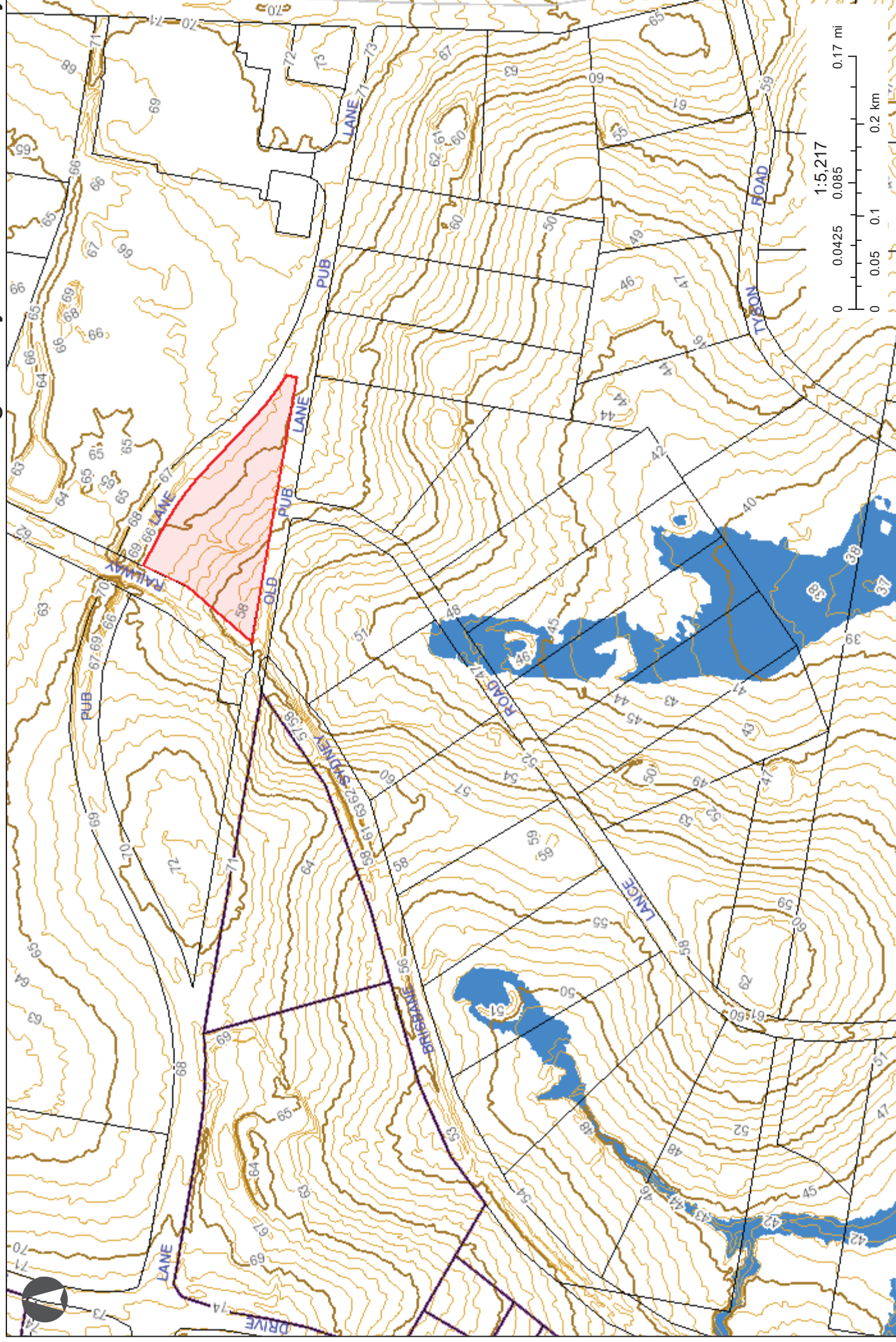
SUBJECT
Proposed Stormwater Drainage

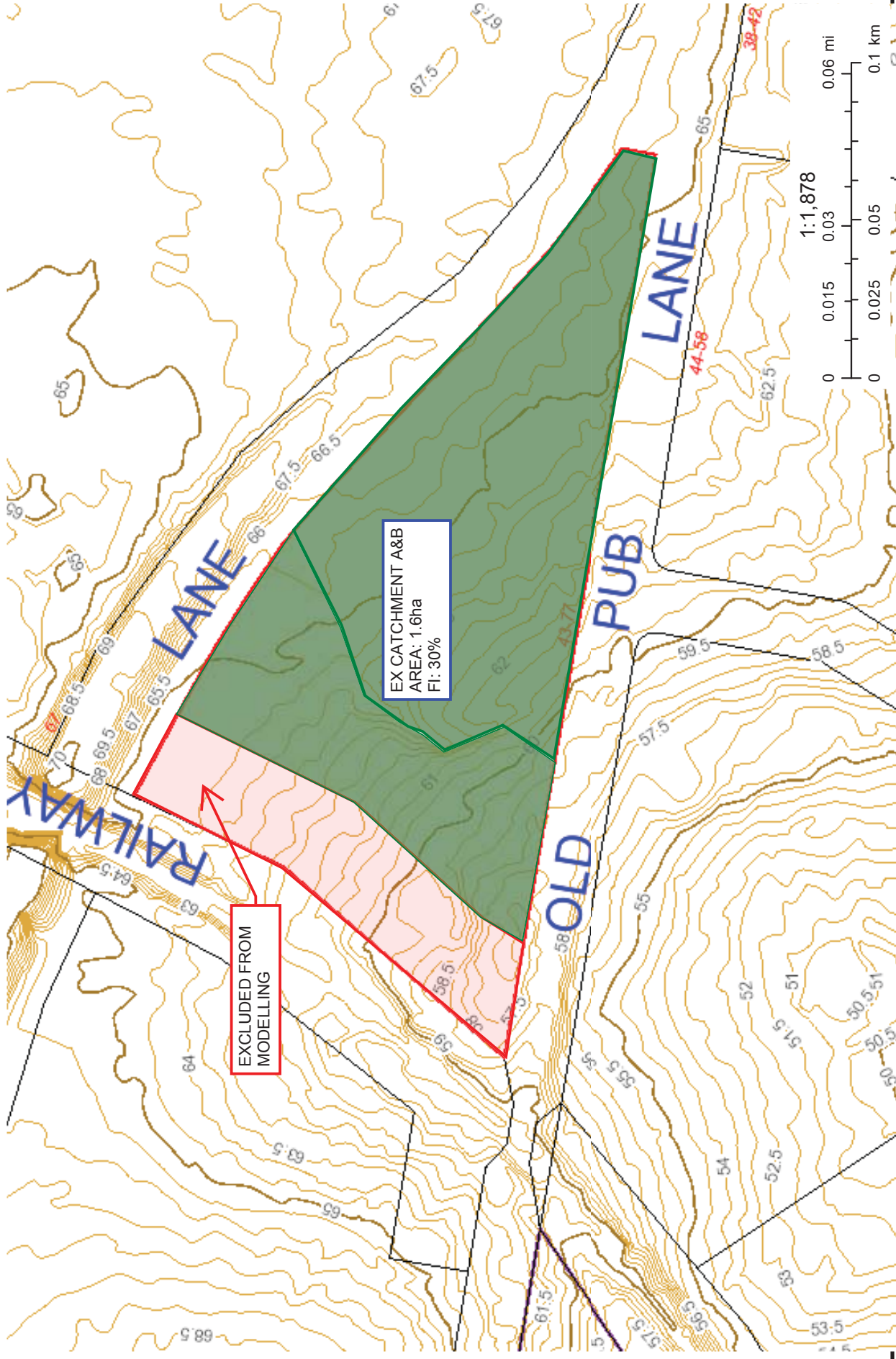
PROJECT No.
19097A
DRAWING No.
SK-C001
REVISION
A

ORIGINAL SIZE A3

APPENDIX C

CONTOUR AND SERVICE INFORMATION





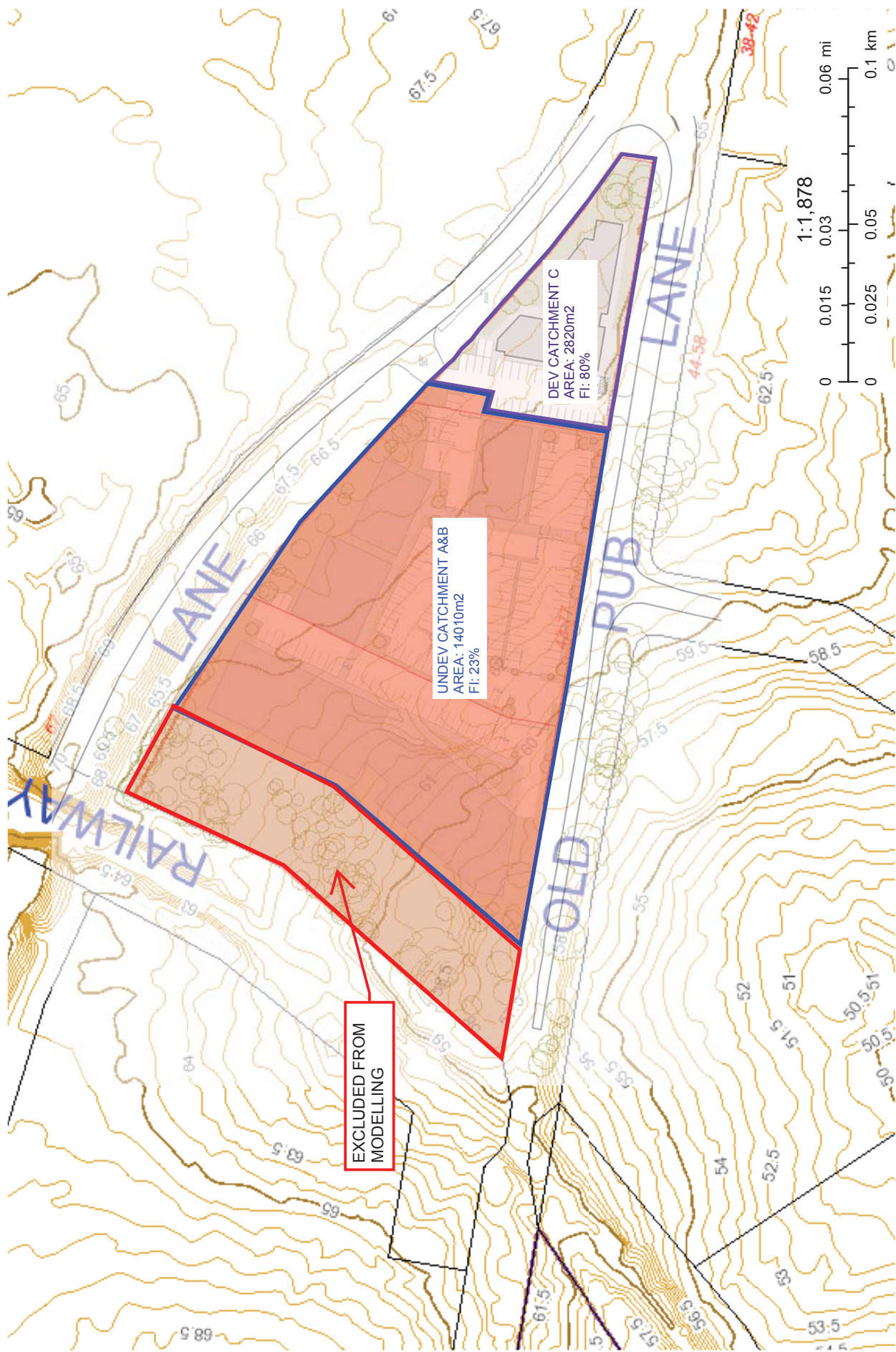
Level 4, 67 Astor Terrace
Spring Hill, QLD 4000, Australia
P. +61 (7) 3013 4699
mail@bornhorstward.com.au
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BORNHORST + WARD
CONSULTING ENGINEERS
CIVIL AND STRUCTURAL

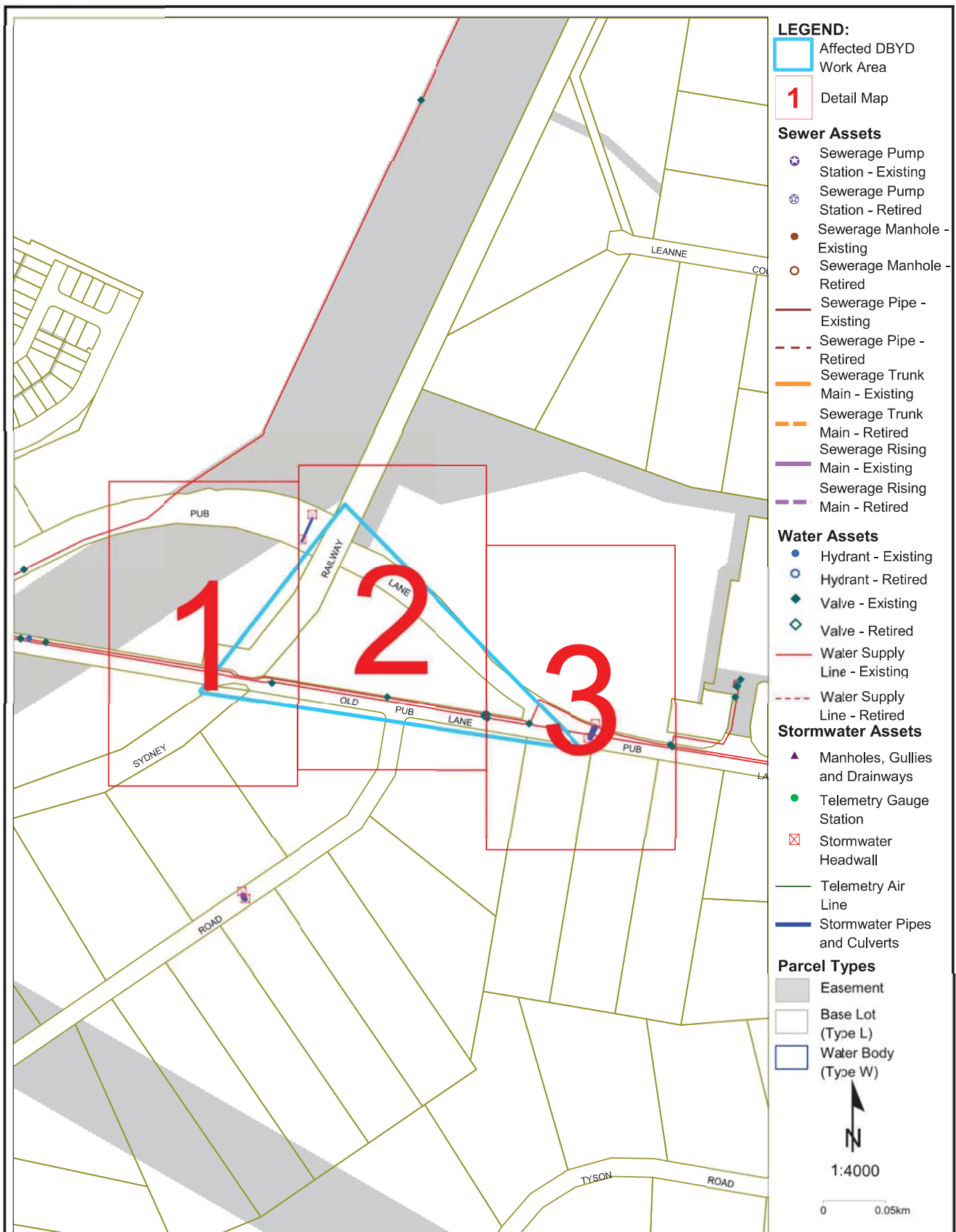
PROJECT
44-77 Old Pub lane, Greenbank

SUBJECT
Existing Internal Catchment Plan

PROJECT No.	19097
DRAWING No.	SK-C004
REVISION	A

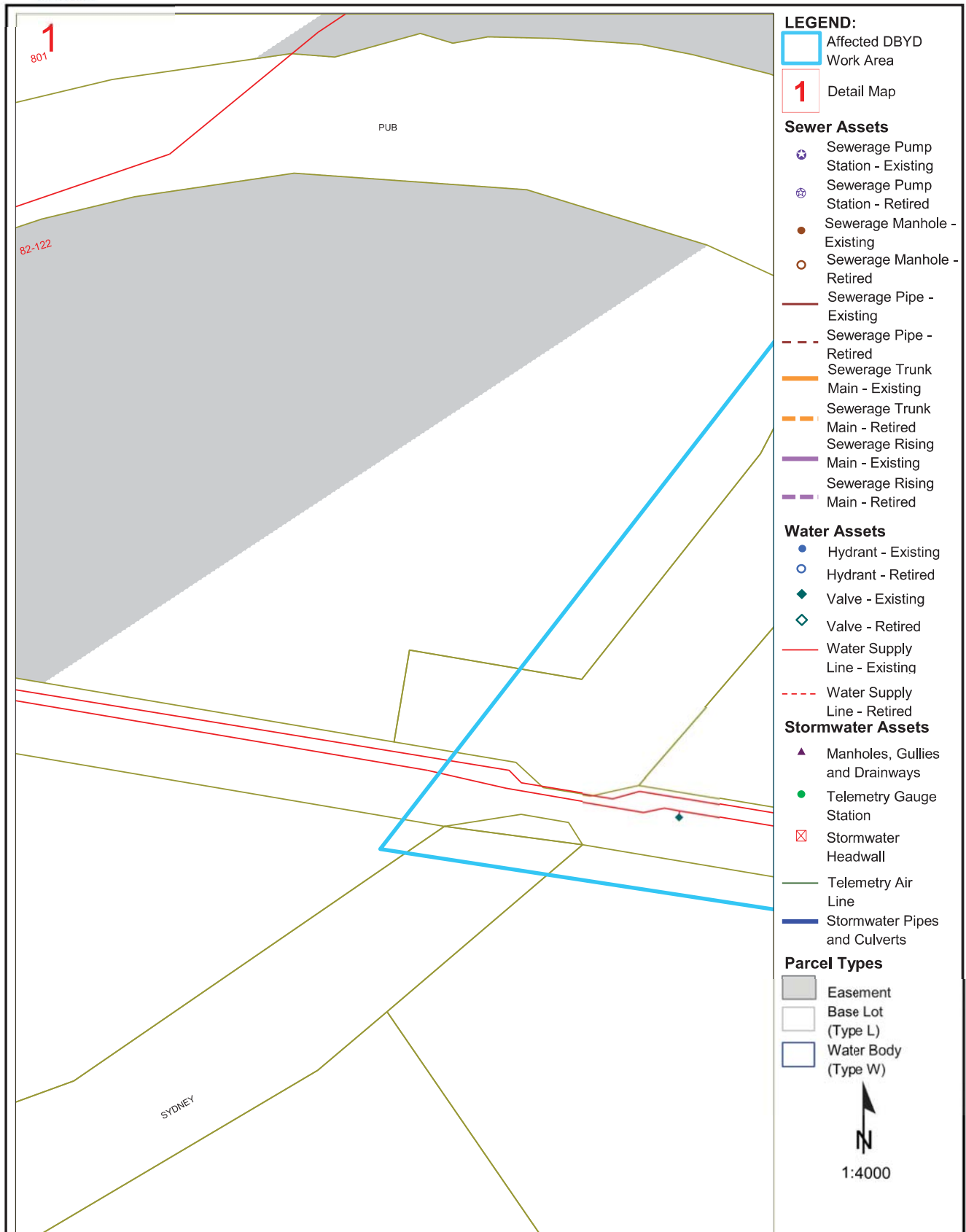


BORNHORST + WARD CONSULTING ENGINEERS CIVIL AND STRUCTURAL	PROJECT 44-77 Old Pub lane, Greenbank	SUBJECT Developed Internal Catchment Plan	PROJECT No. 19097	
			DRAWING No. SK-C00	REVISION A
			0 10 20 30 40 50	
			ORIGINAL SIZE A3	



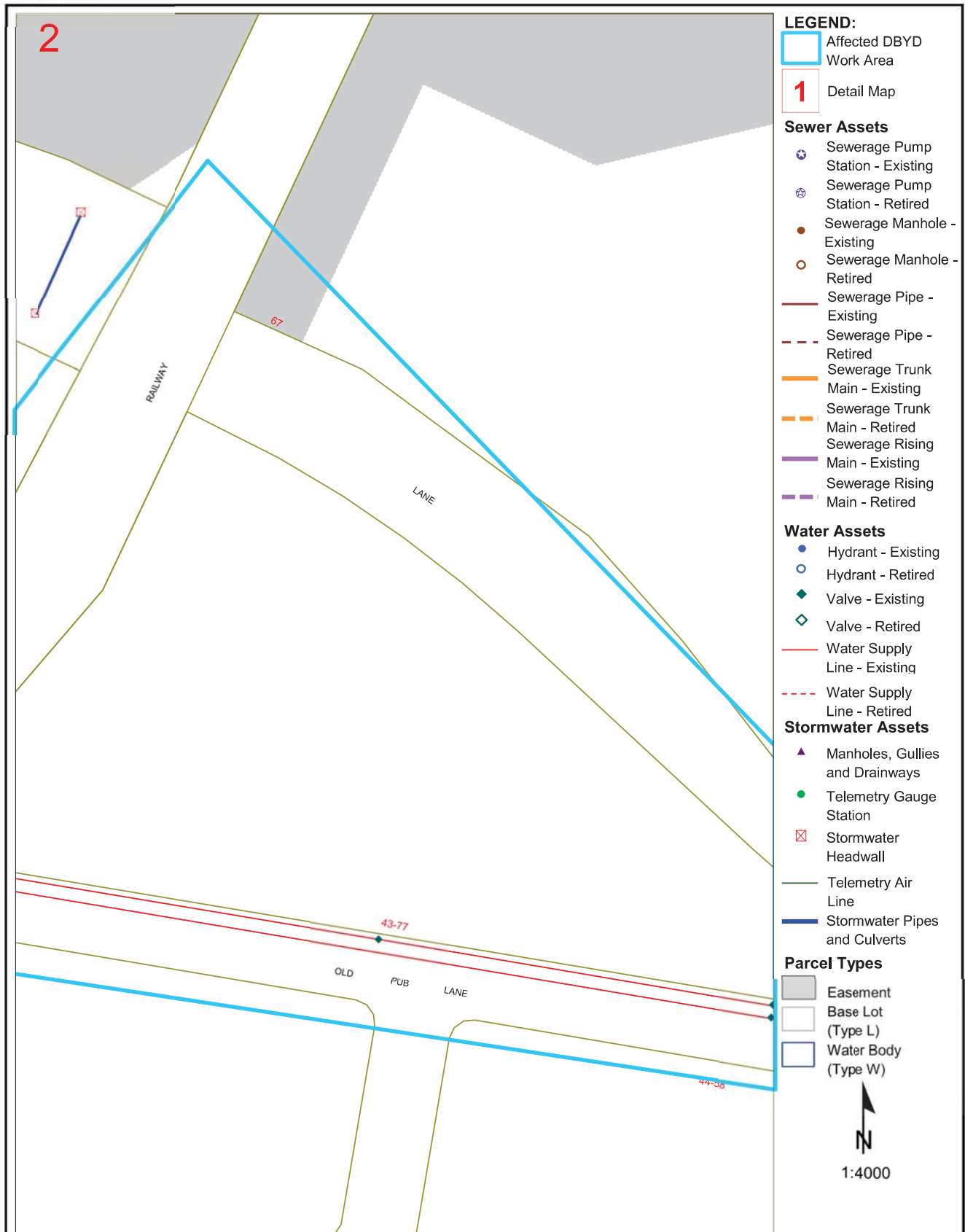
Disclaimer: The plans are indicative only and while all reasonable care has been taken in producing this information, Logan City Council does not warrant the accuracy, completeness or currency of this information and accepts no responsibility for, or in connection with any loss or damage suffered as a result of any inaccuracies, errors or omissions or your reliance on this information. Base material reproduced with permission of the Director-General, Department of Natural Resources and Mines, The State of Queensland (Department of Natural Resources and Mines).

Logan City Council's infrastructure dates back over many years and may include manufactured materials containing asbestos. You are solely responsible for ensuring that appropriate care is taken at all times and that you comply with all mandatory requirements relating to such matters, including but not limited to "workplace health and safety".



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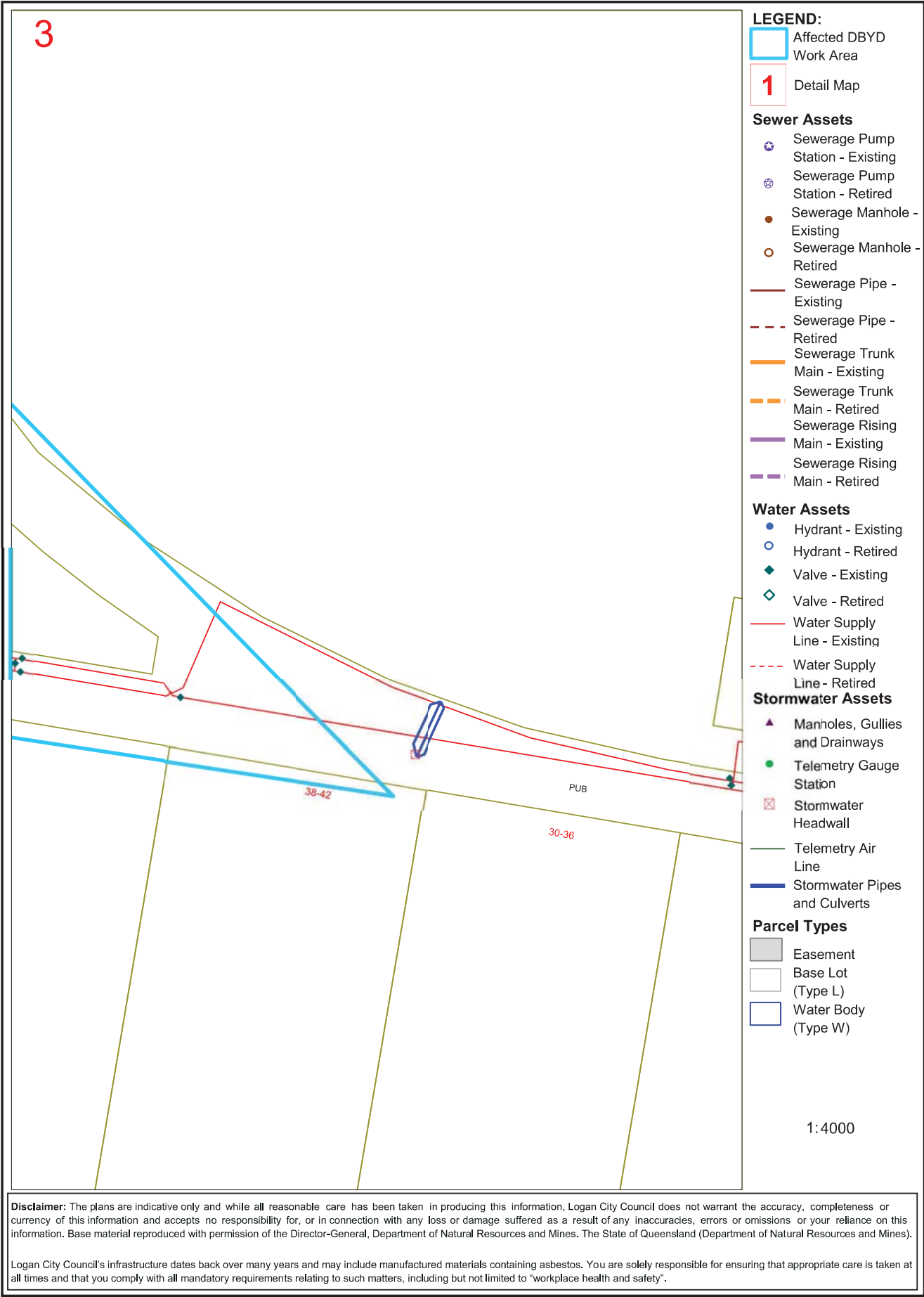


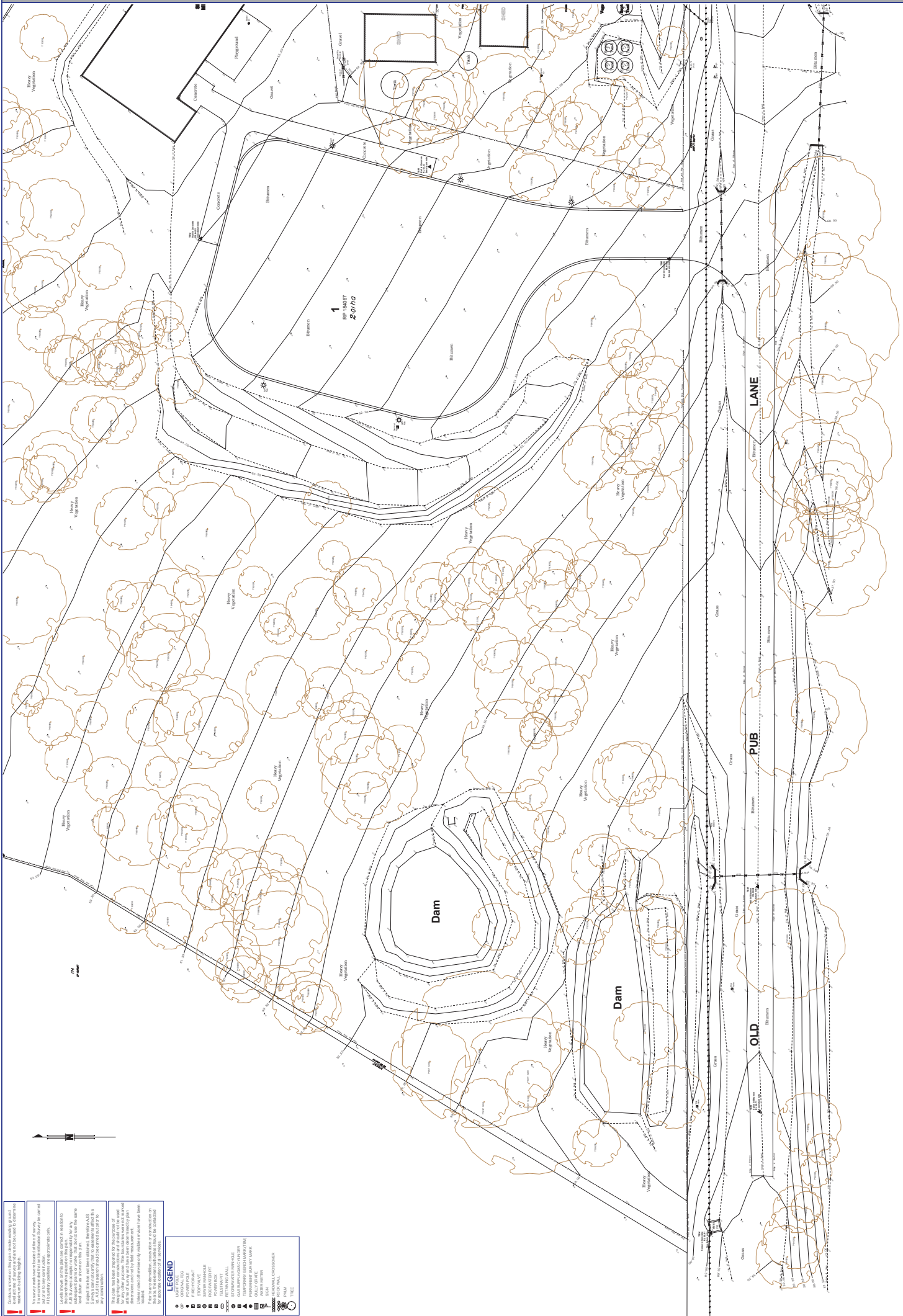
Disclaimer: The plans are indicative only and while all reasonable care has been taken in producing this information, Logan City Council does not warrant the accuracy, completeness or currency of this information and accepts no responsibility for, or in connection with any loss or damage suffered as a result of any inaccuracies, errors or omissions or your reliance on this information. Base material reproduced with permission of the Director-General, Department of Natural Resources and Mines. The State of Queensland (Department of Natural Resources and Mines).

Logan City Council's infrastructure dates back over many years and may include manufactured materials containing asbestos. You are solely responsible for ensuring that appropriate care is taken at all times and that you comply with all mandatory requirements relating to such matters, including but not limited to "workplace health and safety".

Map 3

Sequence No: 81711480
44 Old Pub Ln New Beith

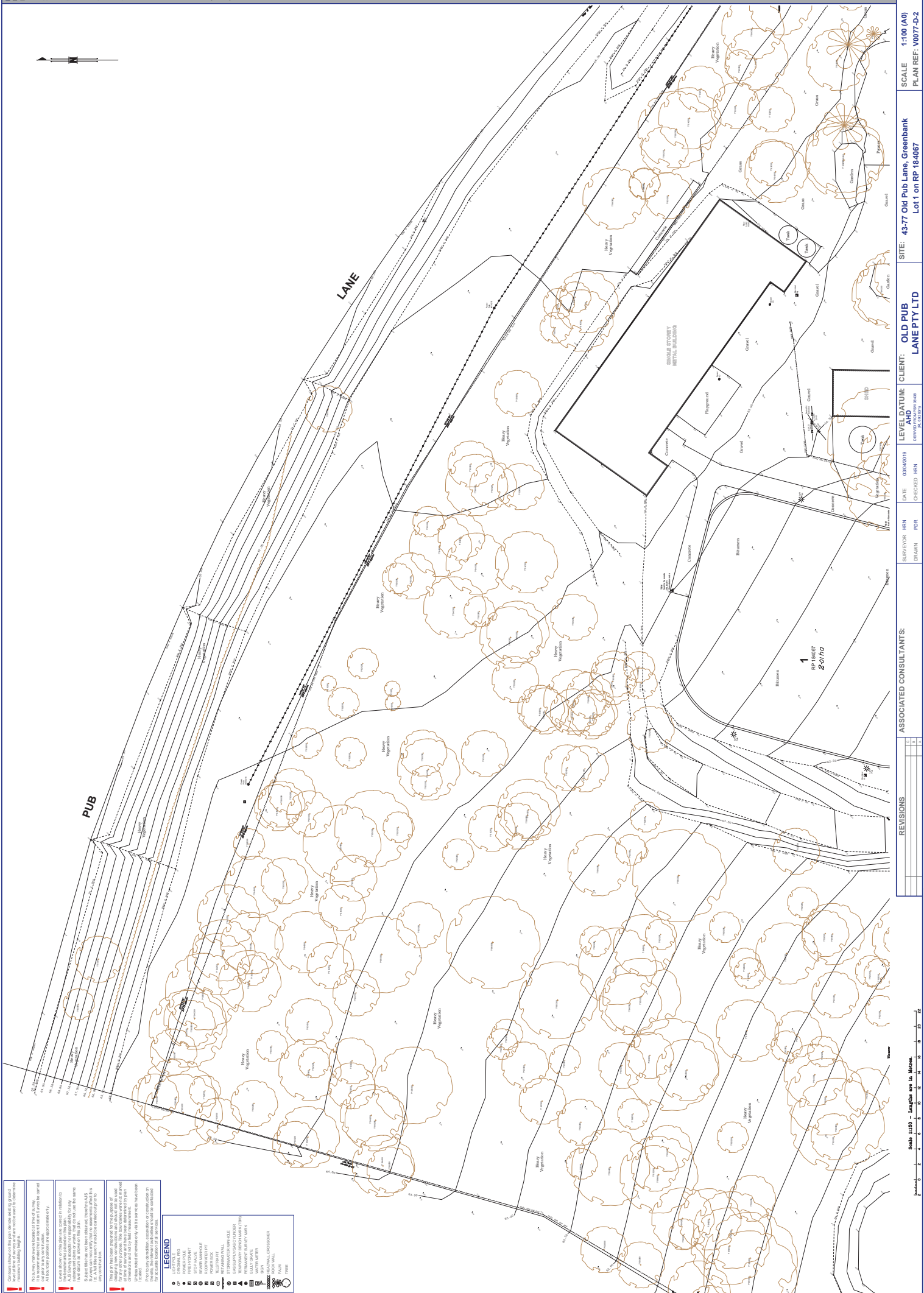




REVISIONS	
	C
	B
	A

ASSOCIATED CONSULTANTS:	DATE 03/04/2019 SURVEYOR HRN DRAWN FOR CHECKED HRN DATE 03/04/2019 DESIGNED HRN	LEVEL DATUM: AUD CLIENT: OLD PUB LANE PTY LTD SITE: 43-77 Old Pub Lane, Greenbank Lot 1 on RP 194067	SCALE 1:100 PLAN REF: V0077-D-1
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Scale 1:150 - Lengths are in Metres.



Scale 1:100 - Lengths are in Meters.

ASSOCIATED CONSULTANTS:

REVISIONS			

DATE: 03/04/2019

SURVEYOR: HRN

DRAWN: FOR

CHECKED: HRN

(R. 13/1/2019)

LEVEL DATUM: **AN**

CLIENT: **OLD PUB LANE PTV LTD**

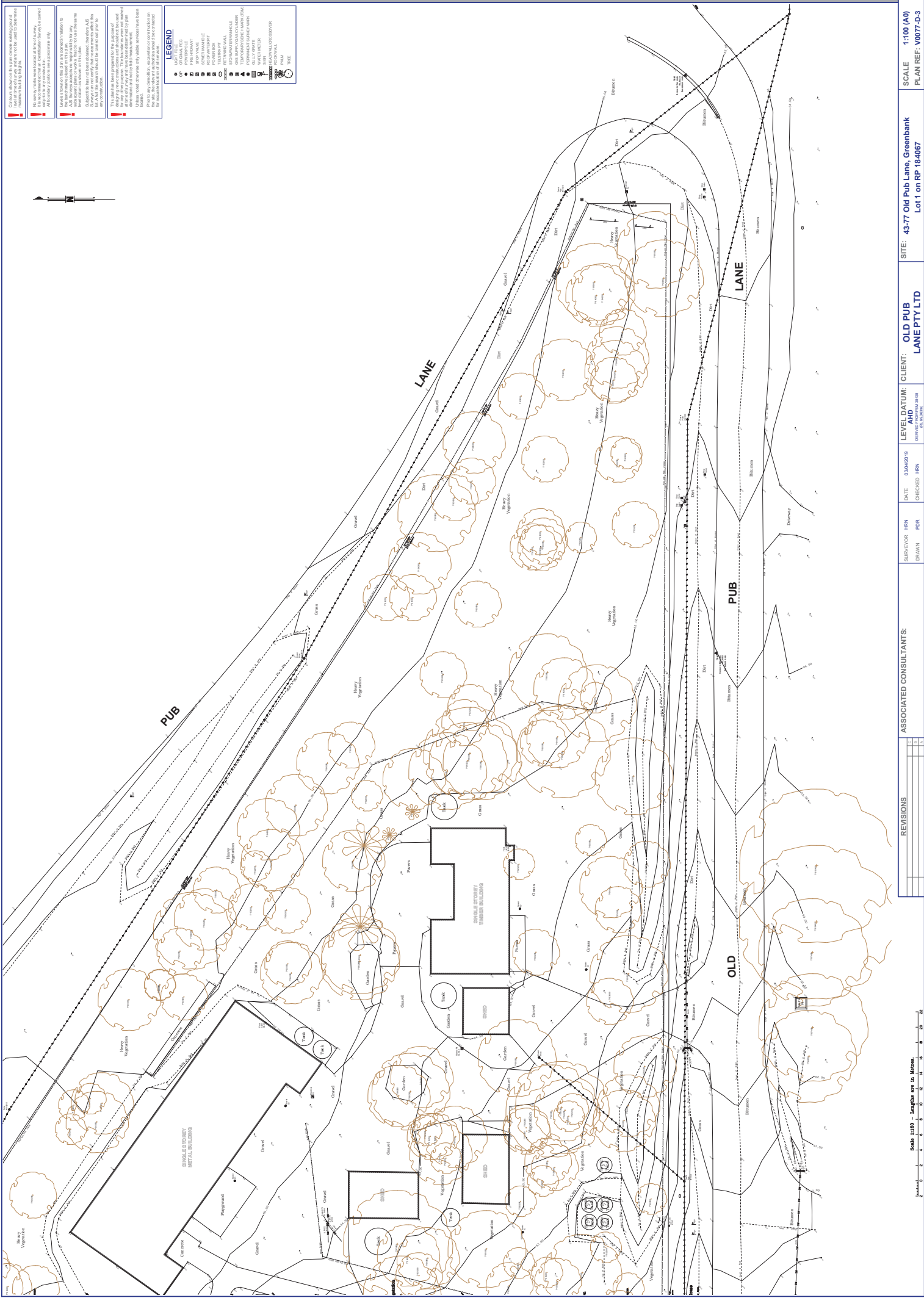
SITE: **43-77 Old Pub Lane, Greenbank Lot 1 on RP 18/067**

SCALE: 1:100 (A0)

PLAN REF: V007-D-2

SCALE: 1:100 (A0)

PLAN REF: V007-D-2

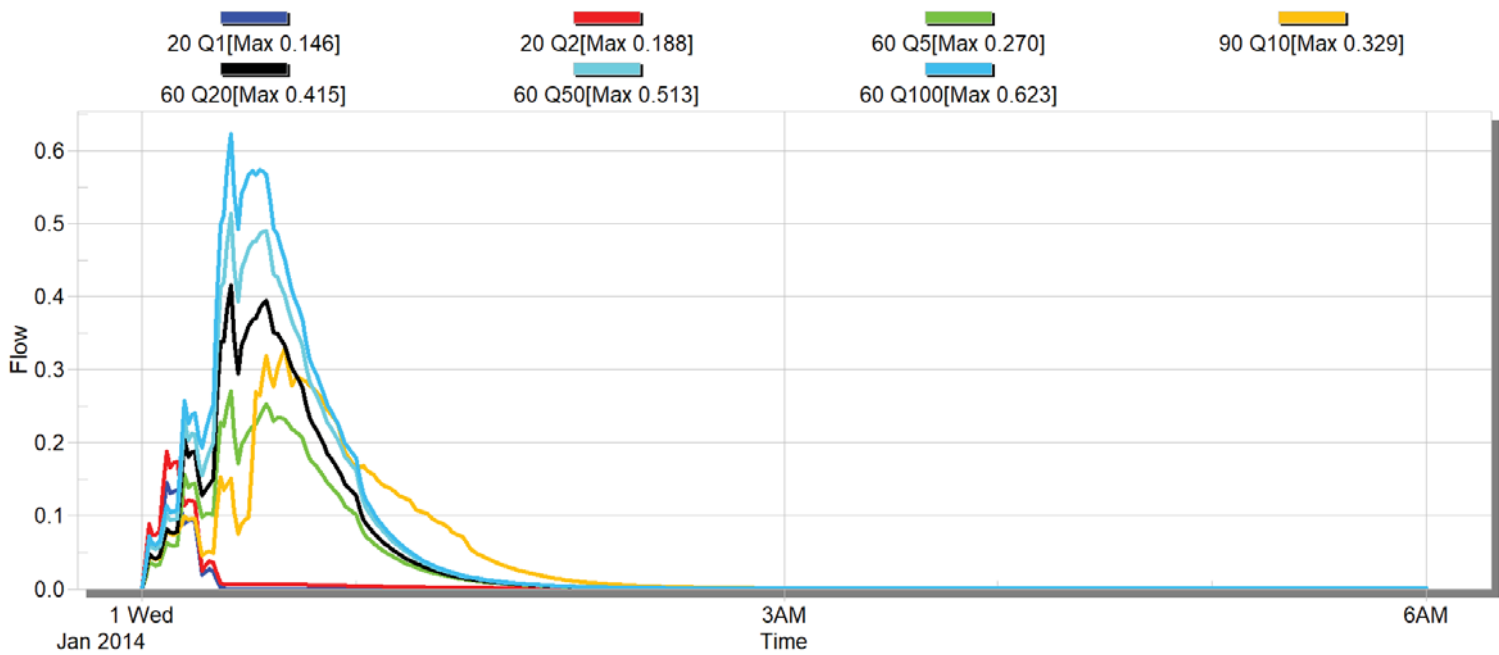


APPENDIX D

XPSTORM HYDROGRAPHS

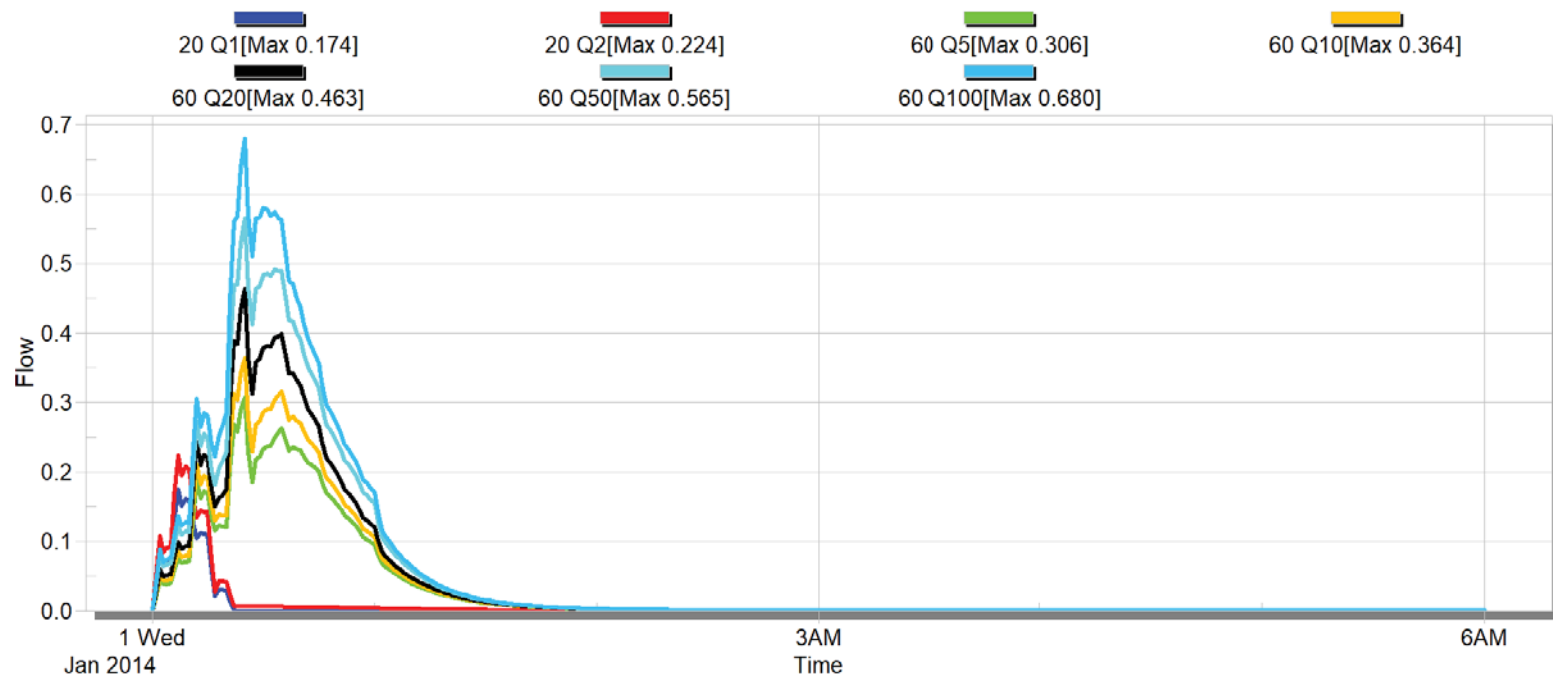
EXISTING SCENARIO

Node - Existing Catchment (Full Site)



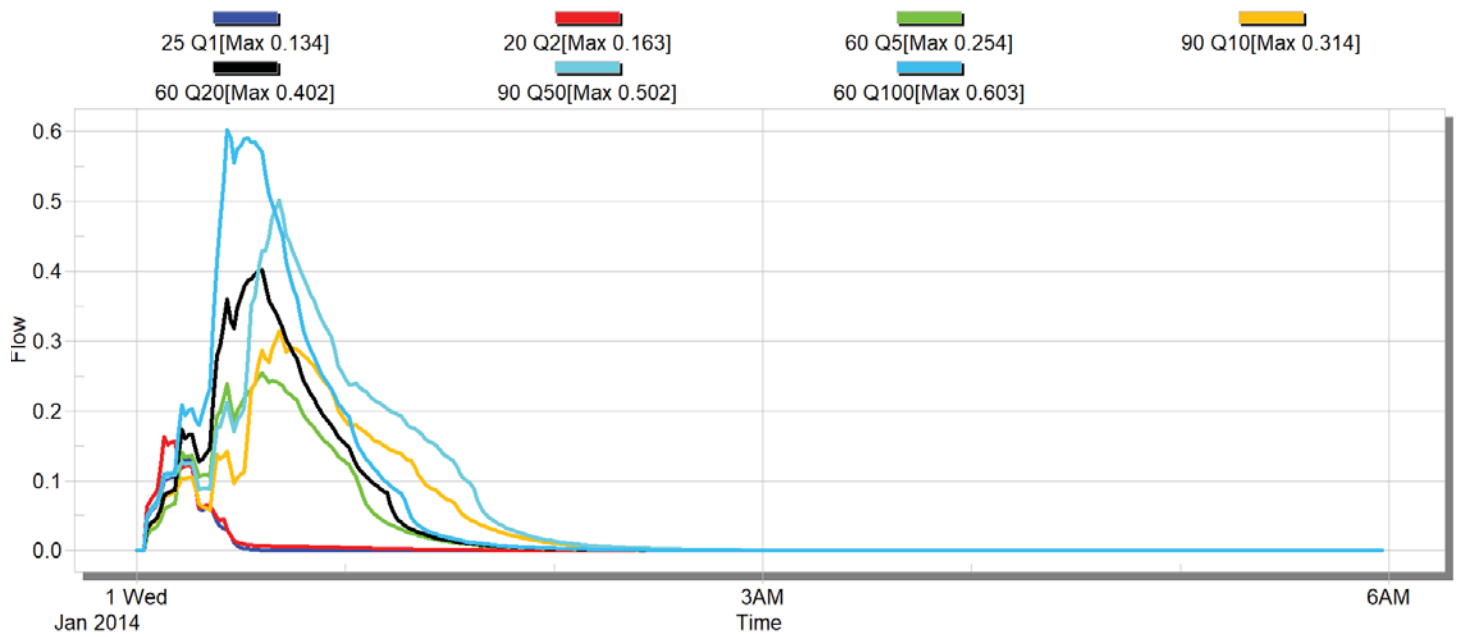
DEVELOPED SCENARIO (UNMITIGATED)

Node - Developed Catchment (Full Site)



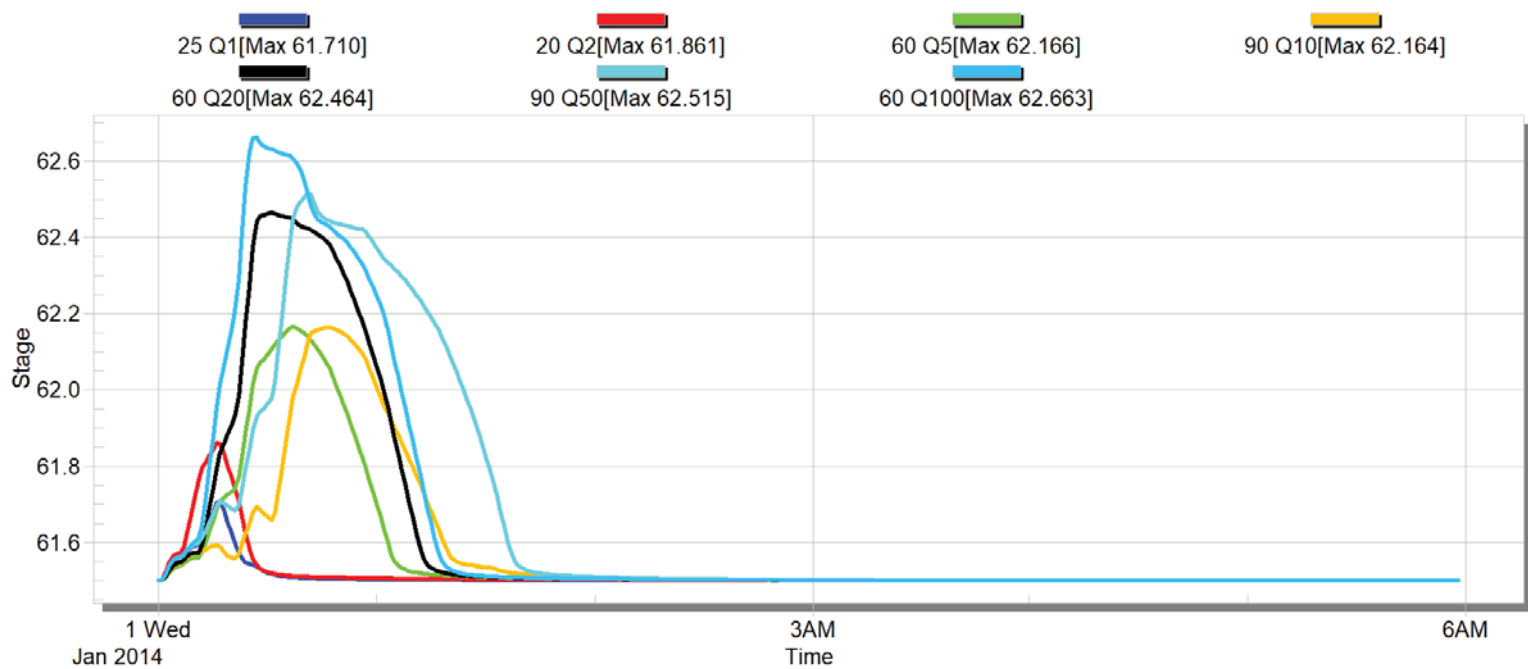
MITIGATED SCENARIO

Conduit Link5 from C1 and C2 and C3 Link to Outlet



DETENTION TANK STAGING

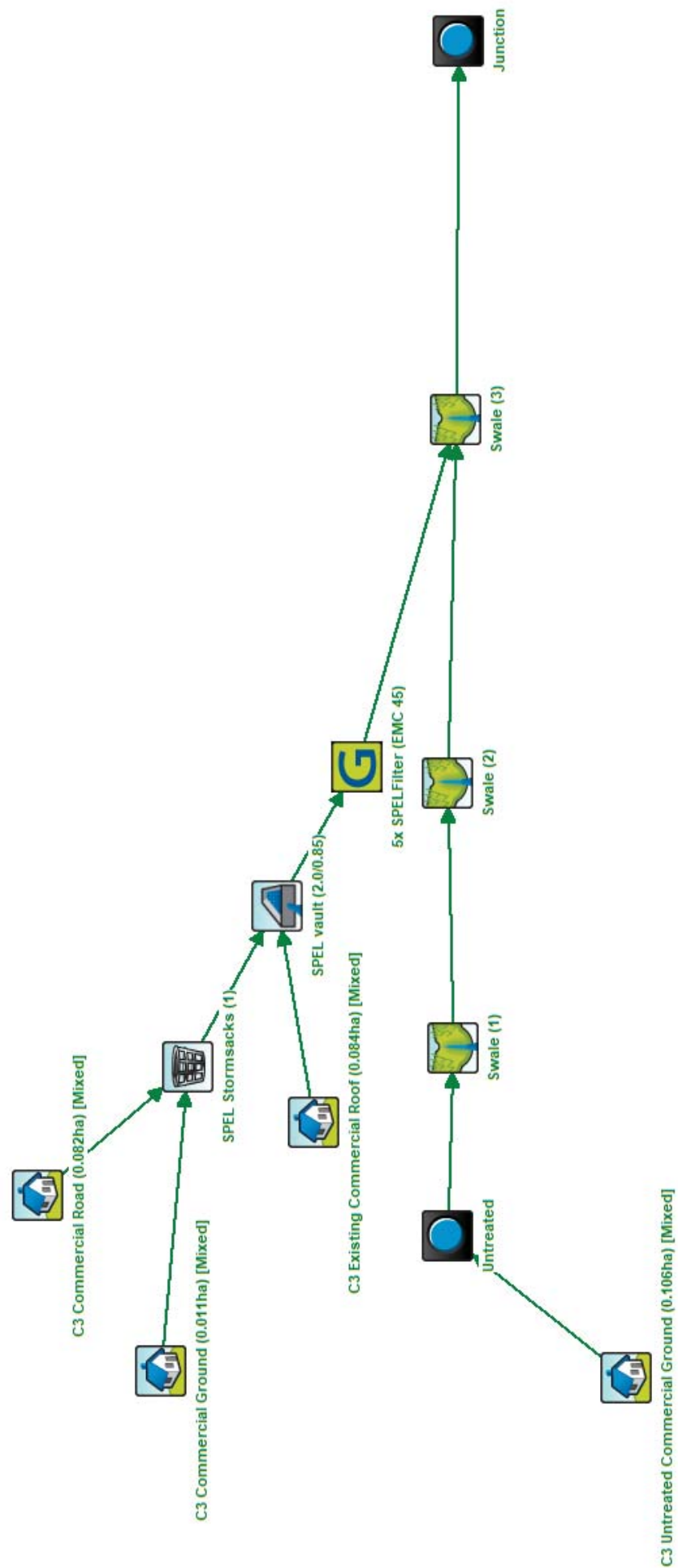
Node - Mitigated Catchment 3



APPENDIX E

MUSIC DATA

PROPOSED TREATMENT TRAIN



TREATMENT TRAIN EFFECTIVENESS

	Sources	Residual Load	% Reduction
Flow (ML/yr)	2.17	2.17	0
Total Suspended Solids (kg/yr)	468	38.7	91.7
Total Phosphorus (kg/yr)	1	0.287	71.4
Total Nitrogen (kg/yr)	6.92	3.34	51.8
Gross Pollutants (kg/yr)	47.1	0	100

SWALE 1 PARAMETERS

Properties of Swale (1)

Location: Swale (1)

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000

Storage Properties

Length (metres)	95.0
Bed Slope (%)	3.30
Base Width (metres)	0.6
Top Width (metres)	3.0
Depth (metres)	0.30
Vegetation Height (metres)	0.250
Exfiltration Rate (mm/hr)	0.00

Calculated Swale Properties

Mannings N	0.144
Batter Slope	1:4
Velocity (m/s)	0.395
Hazard	0.118
Cross sectional Area (m ²)	0.54
Swale Capacity (cubic metres per sec)	0.213

Fluxes... Notes... More

SWALE 2 PARAMETERS

Properties of Swale (2)

Location: Swale (2)

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000

Storage Properties

Length (metres)	73.0
Bed Slope (%)	3.30
Base Width (metres)	0.6
Top Width (metres)	3.0
Depth (metres)	0.30
Vegetation Height (metres)	0.250
Exfiltration Rate (mm/hr)	0.00

Calculated Swale Properties

Mannings N	0.144
Batter Slope	1:4
Velocity (m/s)	0.395
Hazard	0.118
Cross sectional Area (m ²)	0.54
Swale Capacity (cubic metres per sec)	0.213

Fluxes... Notes... More

SWALE 3 PARAMETERS

Properties of Swale (3)

Location: Swale (3)

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000

Storage Properties

Length (metres)	42.0
Bed Slope (%)	3.30
Base Width (metres)	0.6
Top Width (metres)	3.0
Depth (metres)	0.30
Vegetation Height (metres)	0.250
Exfiltration Rate (mm/hr)	0.00

Calculated Swale Properties

Mannings N	0.144
Batter Slope	1:4
Velocity (m/s)	0.395
Hazard	0.118
Cross sectional Area (m ²)	0.54
Swale Capacity (cubic metres per sec)	0.213

Fluxes... Notes... More