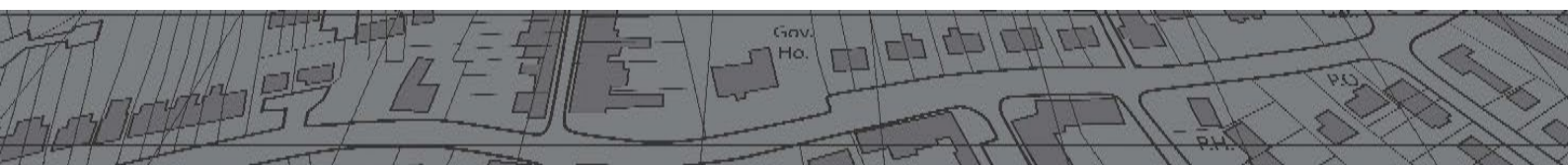
ATTACHMENT 1
Response Letter & Ecological Assessment



Our Ref: BC-16090
Your Ref: COM.2019/82

6 November 2019

Chief Executive Officer
City of Gold Coast
PO Box 5042
GCMC QLD 9749

Attention: Karl Allen

Dear Karl,

RE: DEVELOPMENT APPLICATION COM.2019/82
COMBINED MATERIAL CHANGE OF USE AND RECONFIGURATION OF A LOT
RESPONSE TO ASSESSMENT MANAGER'S INFORMATION REQUEST
79, 89, 91, 97 & 99 COURTNEY DRIVE, UPPER COOMERA

Please find below relevant responses to Further Information Request item raised by Council within the Further Information Request issued on 12 July 2019, including:

- PART A
  - Environmental Assessment – Items 11, 12, 13, 14 and 15; and
  - Hydraulics and Water Quality – Items 28, 29 and 30;
- PART B
  - Environmental Planning – Items A, B and D;

The following amended reports have also been prepared in support of this response:

1. Ecological Assessment Version 2 dated October 2019;
2. Open Space Management Statement Version 2 dated November 2019;
3. Statement of Rehabilitation Intent Version 2 dated November 2019;
4. Stormwater Management Plan Version 2 dated October 2019;

If you would like clarification of any of the information included within this Information Request response, please contact the undersigned.

Yours faithfully

BRAD COMLEY
MSc, BAppSc MEngPrac, NER, RPEQ

INFORMATION REQUEST RESPONSE

DEVELOPMENT APPLICATION COM.2019/82
COMBINED MATERIAL CHANGE OF USE AND RECONFIGURATION OF A LOT
RESPONSE TO ASSESSMENT MANAGER'S INFORMATION REQUEST
79, 89, 91, 97 & 99 COURTNEY DRIVE, UPPER COOMERA

PART A

Request Item – 11

Protection of waterways

Amended plans should be provided which demonstrate that the proposed development will protect all mapped waterways over the site by providing appropriate buffers between the development and the waterway. In particular, the south-eastern waterway should be retained and protected in accordance with recommendations of the ecological assessment provided.

Buffers for all other waterways should be 30m either side of the waterway in accordance with Acceptable outcome 5.5 of the City Plan's Environmental significance overlay code. Any buffers proposed of a lesser width should demonstrate compliance with Performance outcome 5 within an amended ecological assessment.

Response

An amended plan has been prepared which retains and buffers the mapped waterways within the site with existing ecological value. These waterways include:

- Yaun Creek – This waterway is located within the northern portion site. In accordance the provisions of the Emerging Community - Upper Coomera (Courtney Drive) precent outcomes a rehabilitated minimum 60 m wide corridor will be achieved.
- South eastern waterway – This water has been retained with a 30 m buffer provided. A fauna underpass is to be provided to allow fauna movement through the corridor.

It should be noted that the mapped waterway within the central portion of the site has been assessed to be degraded with limited fauna habitat values. It is proposed that the waterway be removed and a new fabricated naturalised watercourse be constructed. This proposal has been discussed with Council officers and provided natural channel design principles are incorporated it has been suggested that this option can be supported. The following figure represents the design outcomes that have been agreed.

Request Item – 12

Protection of assessable vegetation

The Overall outcome 9.4.1.4.2 (2)(a) & (b) and Performance outcome 1 (PO1) of the Vegetation management code include ensuring vegetation of environmental, historical, cultural, visual and character significance is retained. Vegetation should also be retained to provide habitats for threatened flora and fauna, prevent erosion and ensure slope stabilisation. In addition, retention of assessable vegetation throughout the subject site is important in maintaining the intended character of both the Rural and Rural residential zone codes, which is supported within the Overall outcomes of the codes. Amended plans should demonstrate the following:

a. *The seven (7) habitat trees identified within the ecological assessment will be retained; and*
b. *Isolated koala habitat tree species identified within the ecological assessment provided will be retained; and*
c. *Impacts to other assessable vegetation on site will be minimised to the greatest extent possible to maintain the intended character of the Rural and Rural residential zones.*

Response

It is understood that this information request item was prepared in the context of assessing the application against the Rural/Rural Residential Zone Code. Since the IRR was issued City Plan Major Update 2 & 3 has been endorsed by the State and is currently undergoing public consultation. This update to the City Plan includes the development site within the Upper Coomera Investigation Area.

The update recommends the Courtney Drive area to be rezoned from Rural / Rural Residential to Emerging Community as presented within the Upper Coomera (Courtney Drive) Precinct Plan has been established.

The retention of the seven (7) isolated habitat trees referred to by Council, in the context of developing residential land at the densities envisage by Council for an Emerging Community Zone is not practical.

In relation to koala habitat the development layout has been designed to retain all mapped koala habitat. This mapped habitat is present within the southwestern corner of the site. This area has been designed as a conservation area to be dedicated to Council.

Request Item – 13

Vegetation management plan to be provided

In order to satisfy the City Plan's Vegetation management code a vegetation management plan should be prepared. This should demonstrate that impacts to assessable vegetation have been minimised to the greatest extent possible (as requested above). This should include consideration of possible impacts of new lot boundaries, building and effluent envelopes, lot access (i.e. driveways) and bushfire management.

Response

The City Plan's Vegetation Management Code requires that "*a Vegetation Management Plan, prepared by a suitably qualified person, is submitted as part of an Operational Work (Vegetation Clearing) application*.

It is considered reasonable that Council place a condition on the development approval to ensure that this provision is met.

Request Item – 14

Protection of priority vegetation

In order to satisfy Performance outcome 11 of the City Plan's Environmental significance overlay code amended plans should be provided which demonstrate that the proposed development avoids impacts on General priority vegetation across the site, with any damage minimised to the greatest extent

possible. As indicated in the submitted material, the general priority vegetation in the south-western corner of the subject site should be of greatest protection priority as it is also identified as koala habitat.

Response

All areas of general priority vegetation mapped as koala habitat have been retained and will be protected within a proposed conservation area to be dedicated to Council.

Request Item – 15

Rehabilitation management plan

Rehabilitation should be undertaken as per the recommendations of the ecological assessment provided. A Rehabilitation management plan should be prepared in general accordance with SC6.8 City Plan policy – Environmental management plans in order to demonstrate compliance with Performance outcome 26 and Overall outcome 8.2.6.2(2)(b) of the City Plan's Environmental significance overlay code.

Response - 15

A statement of rehabilitation intent was prepared and submitted with the original application material. This plan of intent has been revised to reflect the amended layout and included again for Council's consideration.

Request Item – 28

Updated Stormwater Management Plan

The applicant is requested to update the SMP to address Council's concerns such as environmental or open space, and demonstrate compliance to Council's Healthy waters code and General development provisions code.

Response

An amended Stormwater Management Plan has been prepared and included with the Information Request Response.

Request Item – 29

A. Hydrological Assessment

The applicant is requested to undertake hydrological assessment on the below identified waterway should development encroach within the 30 metre buffer zone.

Figure 1: Waterway within Lot 192 on RP173728

Response

An amended Stormwater Management Plan has been prepared and included with the Information Request Response. This report includes a hydraulic assessment of the fabricated waterway that is proposed within this area.

Request Item – 30

Erosion and Sediment Control Plan

The applicant is requested to provide an erosion and sediment control plan. This is required to be submitted in accordance with Healthy waters code and latest State Planning Policy (SPP). It is particularly advised to adopt control measures to achieve 80% hydraulic efficiency. Please also consider sensitive water environment adjacent to the site to identify the risk and mitigation measures.

Response

It is considered responsible that Council place a condition on the decision notice to require that an Erosion and Sediment Control Plan be prepared and submitted to Council for approval prior to the commencement of any earthworks.

PART B

Environmental Planning Request Item – A

Protection of other waterways

In addition to Yuan Creek, other waterways identified on the City Plan's Environmental significance – wetlands and waterways overlay map should be rehabilitated with appropriate buffers, satisfying the Environmental significance overlay code (i.e. minimum 30m buffer either side). Any buffers proposed of a lesser width should demonstrate compliance with Performance outcome 5 within an ecological assessment. These areas should be protected through either private covenant or public open space.

Response

An amended plan has been prepared which retains and buffers the mapped waterways within the site with existing ecological value. These waterways include:

- Yaun Creek – This waterway is located within the northern portion site. In accordance the provisions of the Emerging Community - Upper Coomera (Courtney Drive) precent outcomes a rehabilitated minimum 60 m wide corridor will be achieved.
- South eastern waterway – This water has been retained with a 30 m buffer provided. A fauna underpass is to be provided to allow fauna movement through the corridor.

It should be noted that the mapped waterway within the central portion of the site has been assessed to be degraded with limited fauna habitat values. It is proposed that the waterway be removed and a new fabricated naturalised watercourse be constructed. This proposal has been discussed with Council officers and provided natural channel design principles are incorporated it has been suggested that this option can be supported.

Environmental Planning Request Item – B

Protection of ecological significant areas

Ecologically significant areas along the southern site boundary should be protected through the dedication of public open space. This includes the general priority vegetation along the southern boundary identified on the Environmental significance – vegetation management overlay map and the south-eastern waterway corridor. This should also include any required bushfire management zones / setbacks to protect adjacent dwellings.

Response

All areas of general priority vegetation mapped as koala habitat have been retained and will be protected within a proposed conservation area to be dedicated to Council.

Environmental Planning Request Item – D

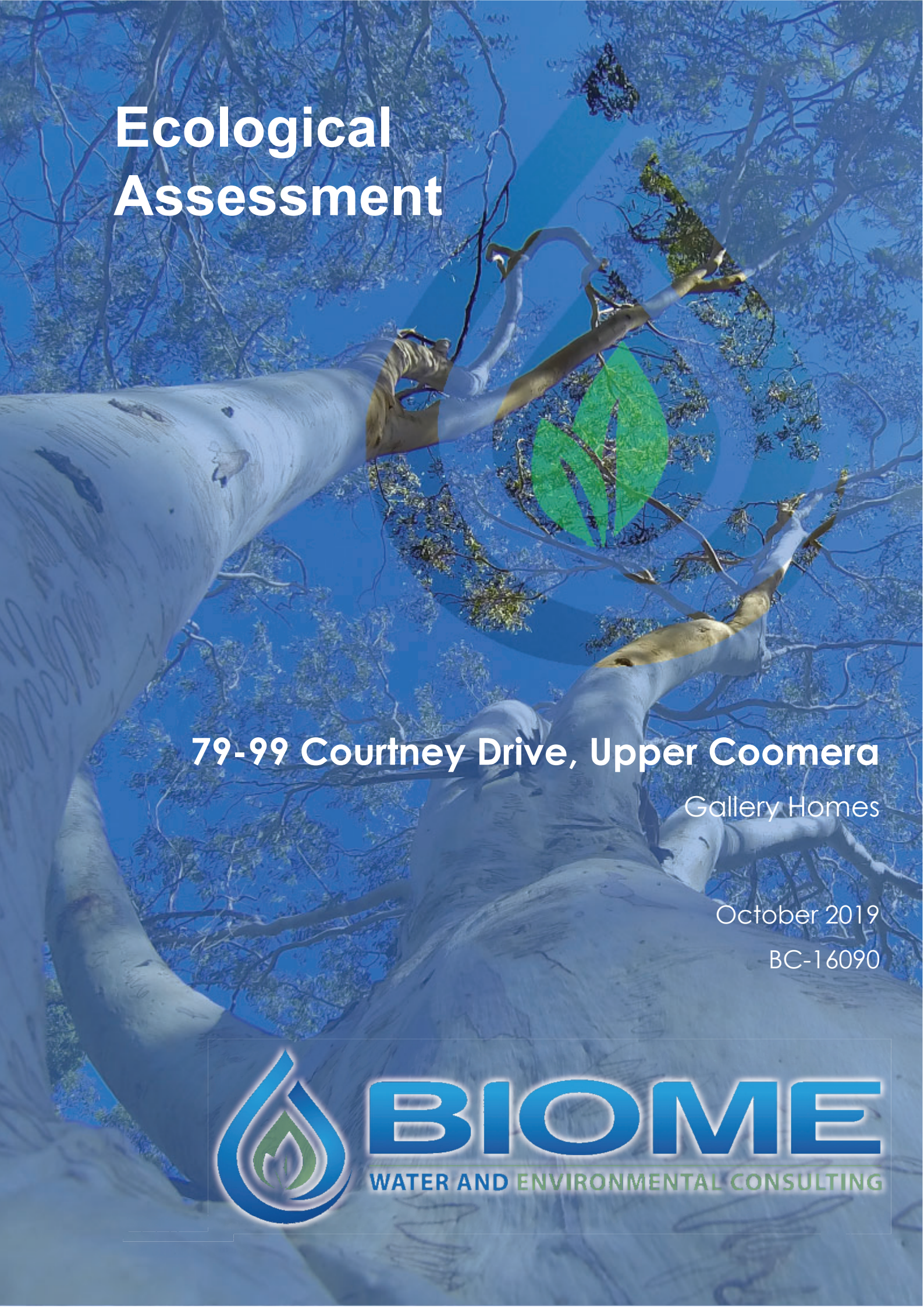
Fauna movement infrastructure

Where road crossings over the green space network are required (i.e. the road which crosses over the southern boundary), fauna movement infrastructure must be provided.

Response

An amended Ecological Assessment has been prepared to reflect the revised plan of development. This report includes recommendations for the installation of an underpass to allow for fauna movement within the site south eastern waterway corridor.

Ecological Assessment



79-99 Courtney Drive, Upper Coomera

Gallery Homes

October 2019

BC-16090

BIOME

WATER AND ENVIRONMENTAL CONSULTING

Document Control

Project Name	79-99 Courtney Drive, Upper Coomera	
Project Number	BC-16090	
Report Title	Ecological Assessment	
Prepared by	Nadya Lees BSc (Hons)	David Conder BAppSc
Reviewed by	Brad Comley	
Approved by	Brad Comley CEnvP MEIANZ, MIEAust, MSc, BAppSc	

Version Number	Date	Distribution
1	March 2019	Gallery Homes
2	23 October 2019	Gallery Homes

Biome Consulting Pty Ltd
ABN: 86 166 087 476

PO Box 3469, Australia Fair SOUTHPORT QLD 4215
Office: 5532 7779
Mobile: 0415 935 222
Email: admin@BIOMEconsulting.com.au
Internet: www.BIOMEconsulting.com.au

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Abbreviations and Definitions

Term	Meaning
CAMBA	China Australia Migratory Bird Agreement
CGC	City of Gold Coast
City Plan	City of Gold Coast Planning Scheme, *City Plan* Version 7
DNRM	Department of Natural Resources and Mines
DoE	Department of the Environment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Endemic species	Species unique to a geographical location
EVNT	Endangered, Vulnerable or Near Threatened
Exotic Species	Refers to all species of both flora and fauna that are introduced to Australia
Fauna	Refers to all animal species
Flora	Refers to all plant species
JAMBA	Japan Australia Migratory Bird Agreement
KSAT	Koala Spot Assessment Technique – used to determine the level of use of an area by Koala
MLES	Matters of Local Environmental Significance
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NCA	*Nature Conservation Act 1992*
Planning Scheme	City of Gold Coast Planning Scheme, *City Plan* Version 7
PMST	Protected Matters Search Tool
QPWS	Queensland National Parks and Wildlife Services
RE	Regional Ecosystem. Defined as a vegetation community that is consistently associated with a particular combination of geology, landform and soil
RL	Reduced level - this is the height or elevation above the point adopted as the site datum for the purpose of establishing levels
RoKAMBA	Republic of Korea Australia Migratory Bird Agreement
RoL	Reconfiguration of a lot
SDAP	State Development Assessment Provisions
SL	Special Least Concern species are listed under the NCA for species on migratory bird agreements, the platypus and echidna
SPP	State Planning Policy
SPRP	State Regulatory Planning Provisions
Threatened species	Species listed under the NCA or EPBC Act as having a conservation status of near threatened, vulnerable, endangered or critically endangered.
VMA	*Vegetation Management Act 1999*

Executive Summary

This report has been prepared to identify the environmental values and constraints of the subject site, located at 79-99 Courtney Drive, Upper Coomera and to accompany a development application for a Reconfiguration of a Lot.

The subject site has been assessed for its development potential and constraints in the Investigation Area Program – Courtney Drive, Upper Coomera Draft Concept Plan, prepared by GHD (2017). The Draft Concept Plan ranked the site as having high marketability and development potential. The plan recommends the amalgamation of allotments to maximise development yields, habitat connectivity and bushfire management.

This ecological assessment investigated the environmental constraints of the subject site. The assessment of the ecological values on the site focused on the vulnerable Koala, which is known to occur in the Upper Coomera area.

Investigations were made to determine the habitat use of the site by Koala using a randomised grid-based spot assessment technique. Koala were determined to be using the site at low use levels (as defined by Phillips and Callaghan, 2011). Areas of Koala habitat have been included in the proposed open space areas of the development. No other threatened species were identified on the site during the survey period.

The site is mapped as containing a small area of regulated vegetation and essential habitat for state regulated species. The regulated vegetation area is reflective of least concern regional ecosystem 12.11.5 (Spotted Gum/Ironbark open forest). This area has been included within designated open space to ensure vegetation is protected and rehabilitated to improve its existing ecological condition.

Four vegetation associations were identified on the site:

- *Acacia* low open forest;
- Spotted Gum/Grey Ironbark open forest;
- *Acacia* low open woodland/mosaic in association with infrastructure; and
- Pasturelands.

No threatened flora species were identified in any of the vegetation communities. Several restricted invasive species were recorded. These species must be controlled by the landholder under the provisions of the *Biosecurity Act 2014.*

Recommendations have been made to rehabilitate and buffer Yaun Creek where it traverses the site in the northern corner, the Koala habitat area within the south-western corner of the site and the drainage channel in the south-eastern corner of the site.

To assist with the on-going management of the site and as stipulated in the City of Gold Coast planning provisions, it is recommended that the following reports be prepared:

- Flora and Fauna Management Plan;
- Open Space Management Plan; and
- Rehabilitation Management Plan.

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1 Introduction

Gallery Homes is proposing a new residential sub-division to be located within the rapidly developing northern Gold Coast region. Gallery Homes has commissioned Biome Consulting to undertake an assessment of the ecological constraints related to the proposal. This Ecological Assessment report accompanies a planning application to be assessed by the City of Gold Coast (CGC) for a development permit for Reconfiguration of Lots to accommodate the sub-division components.

The location of the sub-division is described as Lots 188-192 on RP173728, at 79-99 Courtney Drive, Upper Coomera (hereafter referred to as 'the site').

The intent of this assessment is to detail the ecological features and functions of the subject site and identify any potential impacts to these values as a result of the proposed development. The report includes a desktop assessment and field investigation. This report has been updated so that impacts to the revised plan of development could be assessed.

1.1 Scope and Objectives

This Ecological Assessment aims to provide the following information:

- Desk top review of existing databases and local, state and federal environmental policy documents;
- Flora survey to identify:
  - terrestrial and aquatic flora species;
  - the presence of any significant flora species;
  - dominant vegetation associations and their level of integrity;
  - the presence of any regional ecosystems; and
  - areas of weed infestation and disturbance.
- Map of vegetation communities and significant species;
- Targeted fauna survey to identify:
  - terrestrial fauna species;
  - the presence of any significant fauna species; and
  - the presence of any significant fauna habitat.
- A map which identifies any important trees i.e. trees with active den and nest sites or the presence of hollows;
- An assessment of the ecological features, their function and significance;
- An assessment of impacts upon any matters of environmental significance;
- Recommendations to mitigate environmental impacts; and
- Required specialist reports.

2 Site Specifics

The following sections describe the site and current conditions.

2.1 Site Location

The subject site is located at 79-99 Courtney Drive, Upper Coomera on Lots 188-192 on RP173728 and is located within the City of Gold Coast Local Government Area. The site comprises of five allotments with a total land area of 18.849 ha (Table 2.1).

Table 2.1 Allotment Details

Street Number	Lot Plan Number	Lot Size (ha)
79	188 RP173728	3.079
89	189 RP173728	3.034
91	190 RP173728	3.095
97	191 RP173728	3.739
99	192 RP173728	5.902

Figure 2.1 Site Location (Google Earth, image date 2016)

2.2 Current Land Use

The site is used for residential/rural purposes. Residential dwellings and associated out buildings are present on the site and it is grazed by livestock. Several dams are present on the site. Yaun Creek and/or its tributaries pass through Lots 188, 191 and 192.

The immediate surrounding land use pattern is characterised by rural residential allotments to the immediate west, south and north. These allotments range in size from 3 – 157 ha. Small lot residential developments are present to the east.

The site is accessed via Courtney Drive. The unformed Reserve Road runs along the southern site boundary.

2.2.1 Land Use Zones

Under the City of Gold Coast Planning Scheme *City Plan* Version 7, the site is designated as Rural and Rural Residential (Figure 2.2). Some areas of the site are designated Rural Landscape and Environment Precinct.

The site falls within an Investigation Area for Future Development. The Draft Concept Plan (GHD, 2017) identifies much of the the site as *Suburban Neighbouhood.*

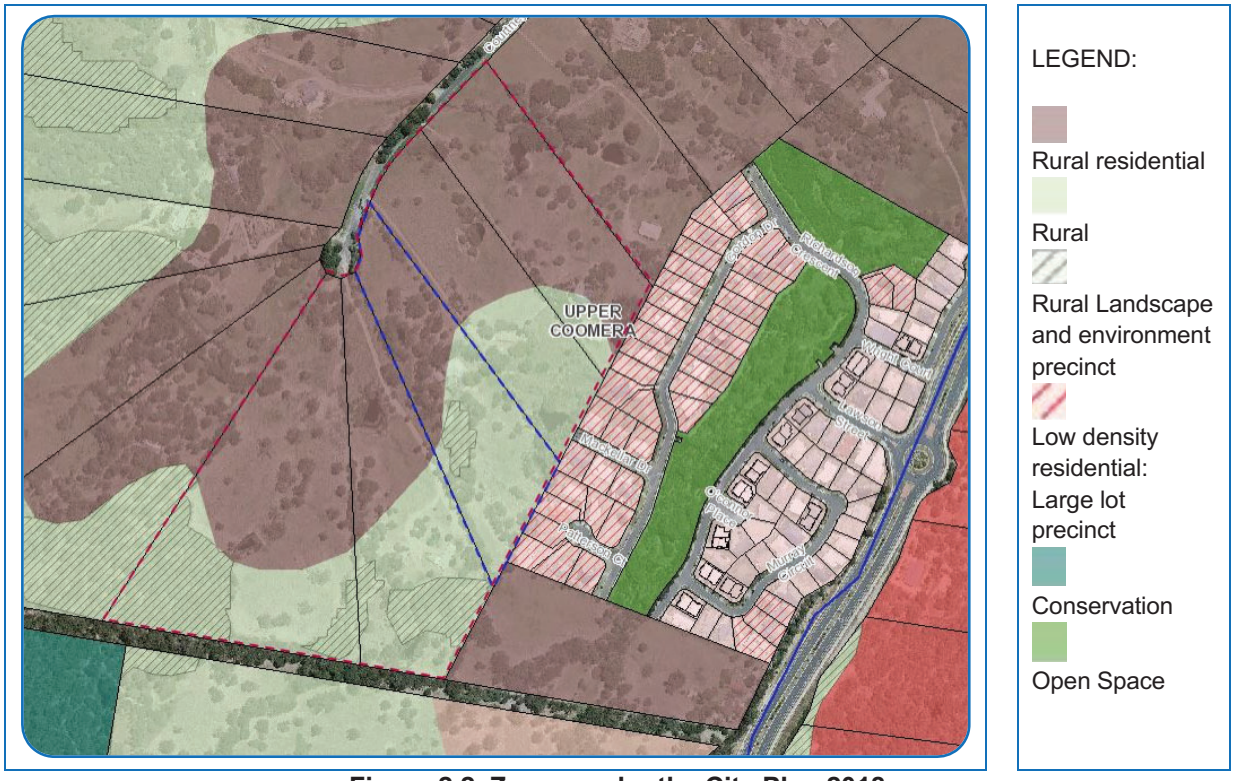

Figure 2.2 Zones under the City Plan 2018

2.3 Draft Concept Plan

Under the City Plan, 13 non-urban areas within the urban footprint of the *South East Queensland Regional Plan 2009-2031*, were identified for investigation into land use opportunities and constraints. Courtney Drive was given the highest ranking in terms of marketability and development suitability (GHD, 2017).

The subject site falls within the Courtney South East and Courtney West Precincts of the investigation area (Figure 2.3). Three potential land use categories have been identified on the subject site – suburban neighbourhood, suburban neighbourhood (constrained) and green space. Constrained suburban neighbourhood areas require special design considerations as the land is above Reduced Level (RL) 60.

The draft concept plan recommends the amalgamation of allotments to maximise the development potential, connectivity and bushfire management.

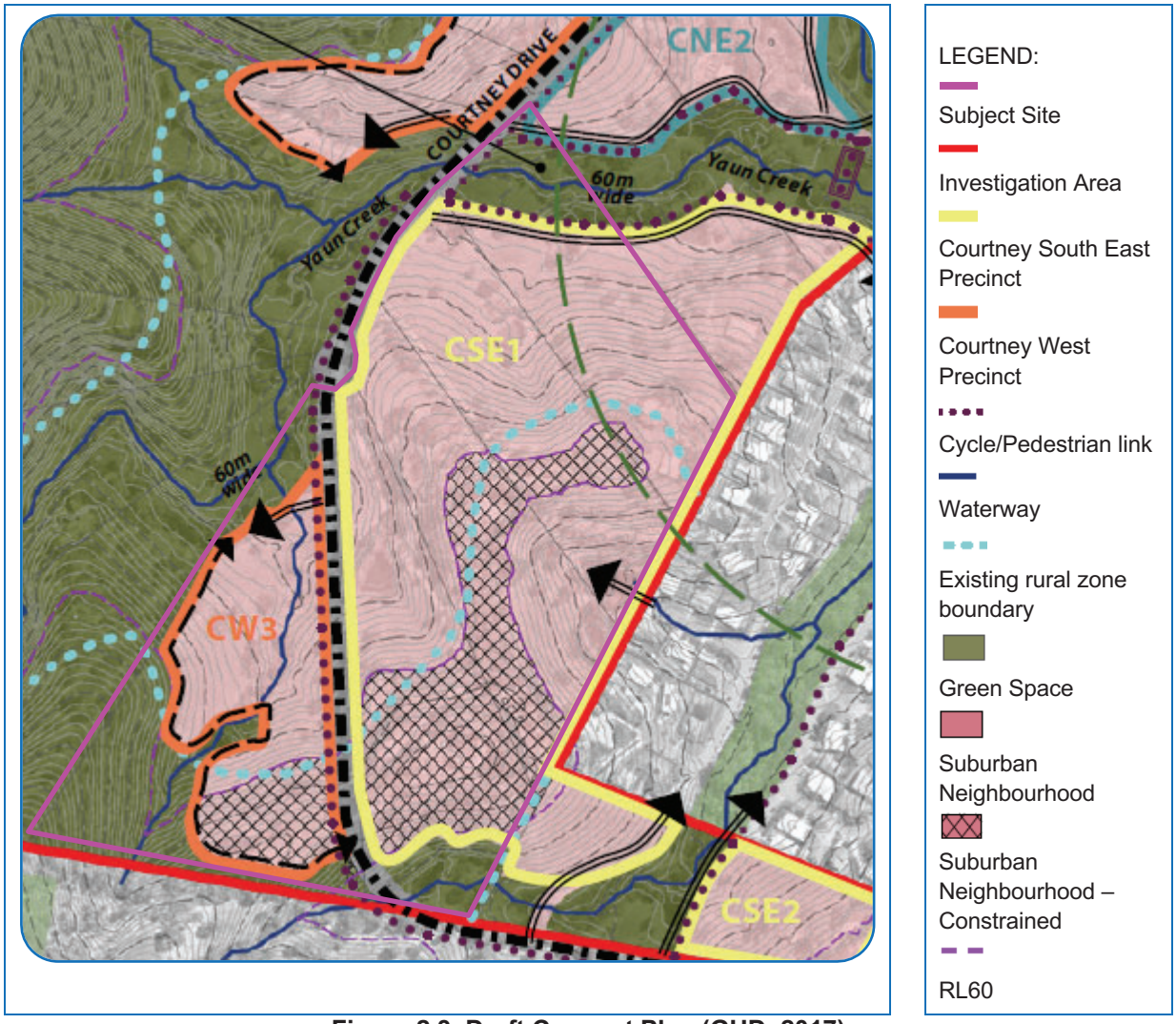

Figure 2.3 Draft Concept Plan (GHD, 2017)

2.3.1 Courtney South East Precinct

The Courtney South East Precinct includes the extension of Courtney Drive to connect with Reserve Road and the Yaun Creek Corridor at its northern edge.

GHD concluded that based primarily on slope, lot sizes similar to the adjoining residential area are the most appropriate response for the majority of housing in this precinct. Where properties can be amalgamated, increased density may be suitable. A density estimate of future dwellings for this precinct was determined to be 9.7-13.3 (GHD, 2017).

A large area of this precinct is greater than RL 60. These areas are considered suitable for significant earthworks to reduce the amount of land above RL 60 and achieve an extension of Courtney Drive that improves the development potential and connectivity.

Yaun Creek is considered a key character element.

2.3.2 Courtney West Precinct

The Courtney West Precinct is characterised by its proximity to conservation open space, its higher elevation and several overland flow paths. The extent of development in this precinct relies on the amalgamation of the site to address bushfire management.

The density estimate of future dwellings was determined to be 8.4-10.9 (GHD, 2017).

2.3.3 Green Space

Green Space areas have been proposed in the concept plan. Green Space is land suitable for a conservation or open space.

This land is considered not suitable for development based on the following constraints (GHD, 2017):

- High value and medium value ecological constraints;
- Extreme slopes 1:3 (33.33 %) or steeper;
- Land above RL 60 (where servicing issues, bushfire risk/ fire-fighting capabilities and scenic amenity values are anticipated to affect development potential); or
- Within 30 m from the outer bank of watercourse.

3 Legislation and Planning Considerations

Several acts, policies and guidelines apply to the assessment, planning and management of biodiversity values within the study site. The following sections provide an overview of their relevance to this report and identifies the stages when applicable. Table 3.1 provides a summary of this information.

Table 3.1 Summary of Legislative Considerations

Legislation	Applicable to Development
Environment Protection and Biodiversity Conservation Act 1999	Referral under the EPBC Act only required if impacts to a threatened species is deemed to be significant. No referral is considered necessary for this development.
Nature Conservation Act 1992	Parts of the site falls within the protected plants trigger area. A survey for threatened flora will need to be conducted prior to any vegetation clearing. Essential habitat is mapped on the site and is excluded from the building envelopes.
Vegetation Management Act 1999	Regulated vegetation present on the site: • Least Concern RE 12.11.5/12.11.24; • Regulated vegetation intersecting a watercourse; and • Essential habitat.
Water Act 2000	Drainage features as defined under the Water Act are present on the site. No permits are required for placing fill or excavating drainage features.
Biosecurity Act 2014	Restricted and invasive weeds must be controlled on the site.
Environmental Offsets Act 2014	No significant residual impacts to matters of state environmental significance will result due to the development. Therefore, the provisions of the Environmental Offsets Act do not apply.
City of Gold Coast Planning Scheme *City Plan, Version 7*	The following are required under the planning scheme provisions: • Basic Ecological Assessment; • Compliance with the Environmental Significance Overlay Code.

3.1 Federal Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is federal legislation that provides a framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the Act as Matters of National Environmental Significance (MNES).

There are eight MNES identified under the EPBC Act including:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of National Importance (listed under the Ramsar Convention);
- Listed Threatened Species and Ecological Communities;
- Migratory Species (protected under international agreements);
- Commonwealth Marine Areas;
- The Great Barrier Reef Marine Park; and

- Nuclear Actions (including uranium mines).

Under the EPBC Act, actions that are likely to have a significant impact on either Commonwealth land or MNES are deemed 'controlled actions'. A controlled action is also any action which is likely to have a significant impact on the environment.

A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

If a proposed action is likely to have a significant impact on a MNES, it must be referred to the Australian Government Minister for the Environment for assessment against the EPBC Act.

To identify the MNES that are known or likely to occur on site, a review of EPBC Act Protected Matters database was undertaken. Results of this investigation are discussed in Section 4.

3.2 State of Queensland Legislation

State ordinances applicable to the study area are discussed below.

3.2.1 Planning Act 2016

The *Planning Act 2016* (Planning Act) and the underlying *State Planning Policy July 2017* (SPP) form Queensland's primary planning and development assessment legislation. The Planning Act seeks to achieve sustainable planning outcomes through managing the development process; managing the effects or impacts of development on the environment; and coordinating development assessment at local, regional and state planning level through the Integrated Development Assessment System (IDAS).

The SPP is supported by two interactive mapping systems the State Planning Interactive Mapping System (SP IMS) and the Development Assessment Mapping System (DAMS). These mapping systems provide links to registers or external mapping systems maintained by relevant state or federal agencies and are used to identify matters of state or national interest when assessing development applications.

A review of the SP IMS mapping indicates that the site is constrained by the following state environmental interests:

- Biodiversity:
  - Matters of State Environmental Significance (MSES) – Wildlife habitat;
  - MSES – Regulated vegetation (essential habitat); and
  - MSES – Regulated vegetation (intersecting a watercourse).

A review of the DAMS indicates that the site is constrained by:

- SEQ Regional Plan Triggers:
  - SEQ Regional Plan land use categories (Urban Footprint);
- Native Vegetation Clearing:
  - Regulated vegetation (category A and B extract);

The implications of the environmental constraints listed above are discussed in the following sections.

3.2.2 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NCA) protects areas that have been dedicated for conservation as well as individual specimens of native plants and animals that are prescribed as extinct, endangered, vulnerable, near threatened, special least concern and least concern under the schedules of the Act's regulation, the *Nature Conservation (Wildlife) Regulation 2006*.

The NCA endeavours to ensure that protected plants are not illegally removed from the wild or illegally traded. Some areas fall within a high-risk area for protected plants. For properties in a high-risk area, a flora survey must be undertaken on and within a 100 m buffer of the mapped high-risk area. If an endangered, vulnerable or near threatened plant (EVNT plant) is recorded in the survey area, a clearing permit is required. If a flora survey identifies that EVNT plants are not present or can be avoided by 100 m, the clearing activity is exempt and an exempt clearing notification application is required. In an area, other than a high-risk area, a clearing permit is only required where EVNT plants are present.

The protected plants map shows areas where provisions of the NCA apply to the clearing of protected plants. Parts of the site falls inside a high-risk area; therefore, a protected plants flora survey is required before clearing to identify the presence of EVNT flora on the site and within the 100 m survey buffer.

The Wildlife Online Database was queried to identify any threatened species recorded within a 2 km radius of the site. The results of this database search informed the targeted searches for threatened species during the field assessment. Results of this database search are discussed in Section 4.

3.2.3 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VMA) regulates the clearing of remnant vegetation, high value regrowth vegetation, and high value vegetation near regrowth watercourses across Queensland. The purpose of the VMA is mainly achieved through the classification of vegetation units and defining permissible clearing for each unit in accordance with its level of significance.

The VMA regulates the clearing of vegetation in a way that:

- Conserves remnant vegetation that is:
    - An endangered regional ecosystem; or
    - An of concern regional ecosystem; or
    - A least concern regional ecosystem.
- Conserves vegetation in declared areas;
- Ensures the clearing does not cause land degradation;
- Prevents the loss of biodiversity;
- Maintains ecological processes;
- Manages the environmental effects of the clearing; and
- Reduces greenhouse gas emissions.

The VMA defines regional ecosystems (RE) as a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil.

Vegetation mapping indicates the subject area is constrained by:

- Least concern regional ecosystems; and

- Essential habitat.

Results of the vegetation mapping are discussed in Section 4.

Clearing of least concern regional ecosystems is governed by the VMA and as such, development is required to address the provisions of *State Code 16 – Native Vegetation Clearing* of the SDAP should this area not be avoidable.

The purpose of this code is to regulate the clearing of native vegetation within Queensland to conserve remnant vegetation, prevent the loss of biodiversity and maintain ecological processes.

In planning the proposed development, consideration should be given to the preservation of essential habitat and regulated vegetation.

3.2.4 Water Act 2000

The *Water Act 2000* seeks the sustainable management of Queensland's water resources. Amongst other regulatory provisions, the *Water Act 2000* protects vegetation within watercourses, whereby a permit is required for destroying vegetation, excavating or placing fill in a watercourse, lake or spring.

The waterways on the site are mapped as a drainage feature under the Water Act and therefore, the Act's provisions are not applicable.

3.2.5 Biosecurity Act 2014

The *Biosecurity Act 2014* provides comprehensive biosecurity measures to safeguard our economy, agricultural and tourism industries, environment and way of life, from:

- Pests (e.g. Wild dogs and weeds);
- Diseases (e.g. Foot-and-mouth disease); and
- Contaminants (e.g. lead on grazing land).

Every landholder has a general biosecurity obligation. This means activities on the land do not spread a pest, disease or contaminant.

Under the Biosecurity Act, weeds are categorised into prohibited, restricted, and other invasive plants. Prohibited weeds are not usually found in Queensland and must be reported immediately if found. Action should be taken to limit the impact of restricted plants by reducing, controlling or containing them.

Several restricted weed species were recorded on the site. The landholder is responsible for the control and containment of these species.

3.2.6 Environmental Offsets Act 2014

Under the *Environmental Offsets Act 2014* (EOA), there is a requirement in the first instance, of avoiding impacts on prescribed environmental matters and if avoidance cannot be achieved, demonstrating that impacts have been carefully managed and minimized. If after avoidance and mitigation, there is still a significant residual impact on prescribed environmental matters, an offset may be required.

The requirement to provide environmental offsets does not mean that development with unacceptable impacts will be approved. Offsets simply provide an additional tool that can be used in the application and assessment process.

Prescribed environmental matters include development in or impacting on:

- Regulated vegetation;
- Connectivity areas;
- Wetlands and watercourses;
- Protected wildlife habitat; and
- Koala habitat in south-east Queensland.

A significant residual impact for prescribed environmental matters is described in the following:

3.2.6.1 Regulated Vegetation

Regulated vegetation is a 'prescribed regional ecosystem' that:

- Is an endangered or of concern regional ecosystem, as defined under the VMA; or
- Intersects with an area shown on the vegetation management wetlands map, as defined under the VMA, to remove doubt this refers to that component of a regional ecosystem that lies within a mapped wetland; or
- Is located within the defined distance from the defining banks of a watercourse identified on the vegetation management watercourse map, as defined under the VMA.

Clearing in regulated vegetation is restricted by size and/or distance from the watercourse or wetland. For example, buffers of at least 10 m along minor watercourses are required to avoid triggering the EOA.

The provisions of the EOA are not triggered in this instance as no regulated vegetation is mapped outside of the south-western corner of the site.

3.2.6.2 Connectivity Areas

Development that will cause a change in core remnant ecosystem extent at the local scale or result in loss or fragmentation of core remnant ecosystem at the site scale is subject to offset.

A development impact on connectivity areas is determined to be significant if either of the following are true:

1. The change in the core remnant ecosystem extent at the local scale (post impact) is greater than a threshold determined by the level of fragmentation at the regional scale; or
2. Any core area that is greater than or equal to 1 hectare is lost or reduced to patch fragments (core to noncore).

The proposed development will not change the extent of core remnant ecosystems at a local scale.

3.2.6.3 Wetlands and Watercourses

An offset may be required for the following wetlands:

- Wetland in a wetland protection area;
- Wetlands of high ecological significance; and

- Wetland or watercourse in a high ecological value waters.

An action is likely to have a significant residual impact on prescribed wetlands or watercourses if it is likely that the action will result in environmental values being affected in any of the following ways:

- Areas of the wetland or watercourse being destroyed or artificially modified;
- A measurable change in water quality of the wetland or watercourse—for example a change in the level of the physical and/or chemical characteristics of the water, including salinity, pollutants, or nutrients in the wetland or watercourse, to a level that exceeds the water quality guidelines for the waters; or
- The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected; or
- A substantial and measurable change in the hydrological regime or recharge zones of the wetland, e.g. a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland; or
- An invasive species that is harmful to the environmental values of the wetland being established (or an existing invasive species being spread) in the wetland.

No wetlands have been identified on the site. While there are mapped watercourses on the site, they are not defined as high value ecological waters identified under Schedule 2 of the *Environmental Protection (Water) Policy 2009*.

3.2.6.4 Protected Wildlife Habitat

Protected wildlife habitat applies to endangered and vulnerable and special least concern species habitat.

Protected wildlife habitat also includes non-juvenile Koala habitat trees located in an area shown as bushland habitat, high value rehabilitation habitat or medium value rehabilitation habitat on the 'Map of Assessable Development Area Koala Habitat Values' that applies under the repealed *South East Queensland Koala Conservation State Planning Regulatory Provisions*.

A non-juvenile Koala habitat tree is a Matter of State Environmental Significance (MSES) if it is in:

a) A bushland habitat area under the *Planning Regulation 2017*; or
b) A high value rehabilitation habitat area under the *Planning Regulation 2017*; or
c) A medium value rehabilitation habitat area under the *Planning Regulation 2017*.

Koala habitat tree means:

- A food tree of the *Corymbia, Melaleuca,* or *Lophostemon* or *Eucalyptus* genera; or
- A preferred shelter species such as *Angophora*.

Non-juvenile Koala habitat tree means a Koala habitat tree that:

- Is more than 4 m high; or
- Has a trunk with a circumference of more than 31.5 cm at 1.3 m above the ground.

Habitat areas under the *Planning Regulations 2017* are those that fall within the Koala Assessable Development Areas.

Offsets apply when an action is considered likely to have a significant residual impact. Significant residual impacts are those that are likely to:

- Lead to a long-term decrease in the size of a local population; or
- Reduce the extent of occurrence of the species; or
- Fragment an existing population; or
- Result in genetically distinct populations forming as a result of habitat isolation; or
- Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat; or
- Introduce disease that may cause the population to decline, or
- Interfere with the recovery of the species; or
- Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.

The Koala offset policy objective is that development which must impact on important Koala habitat requires a net benefit large enough to ensure that is contributes significantly to the recovery of Koalas in SEQ Region. The policy objective can be met by requiring an offset to contribute the equivalent of five new Koala habitat trees for every non-juvenile Koala habitat tree removed. This is a net benefit ratio of 5:1.

The site is not within a Koala Assessable Development Area under the *Planning Regulations 2017*. In addition, while Koalas have been identified as using the site, it is considered, based on assessment of the species' ecology and habitat requirements and the proposed development design, that no residual significant impact to this species will occur.

The provisions of the EOA therefore, do not apply.

3.3 City of Gold Coast Planning Scheme

In accordance with the CGC *Guidelines for Ecological Site Assessments*, ecological assessments submitted as part of a development application must be undertaken where impacts to mapped vegetation and buffers to wetlands and waterways will occur.

The following section details the biodiversity overlays applicable to the site. Measures to avoid, mitigate or manage impacts to biodiversity values are provided in Section 10.

Code responses are included at Appendix D.

4 Desktop Assessment

A desk top assessment was conducted to inform the flora and fauna values within and proximal to the site. The outcomes of this investigation are presented in the following sections.

4.1 Aerial Photography

Aerial photographs indicate the site is mostly cleared of vegetation except for a relatively small area within the site's south-western corner. This vegetation is directly connected to vegetation located within allotments to the south and a council reserve located further west of the site (refer to Figure 1.1).

Given the extent of connectivity to surrounding bushland, vegetation on-site may provide ecological resources for a variety of native species, especially those adapted to disturbed environments.

4.2 Database Searches

To identify the threatened species and ecosystems present on or near to the site, database searches were undertaken.

4.2.1 Protected Matters Database Search

The EPBC Act protected matters search tool enables searches for MNES in a specified area (Appendix A). Results of this database search (using a 1 km buffer to a central coordinate: Latitude -27.869688; Longitude 153.278631) identified the site to be within 10 km of a Ramsar wetland (Moreton Bay).

A total of 19 threated species or species' habitat, *known* or considered *likely to occur*, are recorded within 1 km of the site (Table 4.1).

Table 4.1 Protected Matters Search Results

Scientific Name	Common Name	Status
Flora		
Baloghia marmorata	Marbled Balogia	V
Bosistoa transversa	Three-leaved Bosistoa	V
Corchorus cunninghamii	Native Jute	E
Endiandra floydii	Floyd's Walnut	E
Macadamia integrifolia	Macadamia Nut	V
Samadera bidwillii	Quassia	V
Thesium australe	Austral Toadflax	V
Fauna		
Anthochaera phrygia	Regent Honeyeater	CE
Botaurus poiciloptilus	Australasian Bittern	E
Erythrotriorchis radiatus	Red Goshawk	V
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	V

Scientific Name	Common Name	Status
Turnix melanogaster	Black-breasted Button-quail	V
Chalinolobus dwyeri	Large-eared Pied Bat	V
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E
Petauroides Volans	Greater Glider	V
Phascolarctos cinereus	Koala	V
Potorous tridactylus tridatylus	Long Nosed Potaroo	V
Pseudomys novaehollandiae	New Holland Mouse	V
Pteropus poliocephalus	Grey-headed Flying-fox	V

Status

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: CE= Critically Endangered, E= Endangered, V= Vulnerable, CD= Conservation Dependent, I = Introduced Species.

4.2.2 Wildlife Online

A search of the Queensland Government Wildlife Online database was undertaken to identify flora and fauna recorded in the local area and consequently species that may occur on-site that are listed as threatened under the Queensland *Nature Conservation (Wildlife) Regulation 2006* (Appendix B). A 2 km buffer was applied to a central coordinate in the site (Latitude -27.8697; Longitude 153.2786) to obtain a representative indication of potential species occurrences.

Seven species recorded in the search area are listed as threatened under State or Commonwealth legislation (Table 4.2). A further six species are listed under the NCA as special least concern. Special least concern species are defined under the NCA as those species listed on a migratory bird agreement (such as JAMBA, CAMBA or RoKAMBA), the Echidna and Platypus.

Table 4.2 Conservation Significant Species Potentially Occurring On-Site

Scientific Name	Common Name	Status*
Fauna		
Calyptorhynchus lathami lathami	Glossy Black-cockatoo (Eastern)	V
Numenius madagascariensis	Eastern Curlew	V, CE#
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	SL, V#
Phascolarctos cinereus	Koala	V, V#
Flora		
Eucalyptus curtisii	Plunkett Mallee	NT
Cupaniopsis newmanii	Long-leaved Tuckeroo	NT
Endiandra floydii	Floyd's Walnut	E, E#

*Status

Queensland *Nature Conservation (Wildlife) Regulation 2006* (*Nature Conservation Act 1992*): E = Endangered, V = Vulnerable, NT = Near Threatened, SL = Special Least Concern.

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: CE#= Critically Endangered, E#= Endangered, V#= Vulnerable, CD#= Conservation Dependent, I# = Introduced Species.

4.3 Vegetation Mapping

Several State government maps were analysed as part of the desktop survey to identify vegetation constraints present on-site, including:

- Queensland Government Regulated Vegetation Map;
- Vegetation Management Regional Ecosystem and Remnant Map;
- Watercourses and Drainage Features; and
- Essential Habitat Map.

The results are discussed in the following sections.

4.3.1 Regulated Vegetation

The management and clearing of native vegetation in Queensland are regulated by the *Vegetation Management Act 1999* (VMA) and the *Planning Act 2016* in conjunction with associated regulations, policies and codes. The requirements for a permit depend on the type of vegetation, the land tenure, the location, and the extent and purpose of the proposed clearing. In urban areas, vegetation may be regulated by local government provisions even if it is not regulated vegetation under the VMA.

The regulated vegetation management map shows vegetation categories to determine clearing requirements. A small area within the south-western corner of the site and along the southern boundary is mapped as containing regulated vegetation (blue area in Figure 4.1). The balance of the site is mapped as Category X which is not regulated under the VMA.

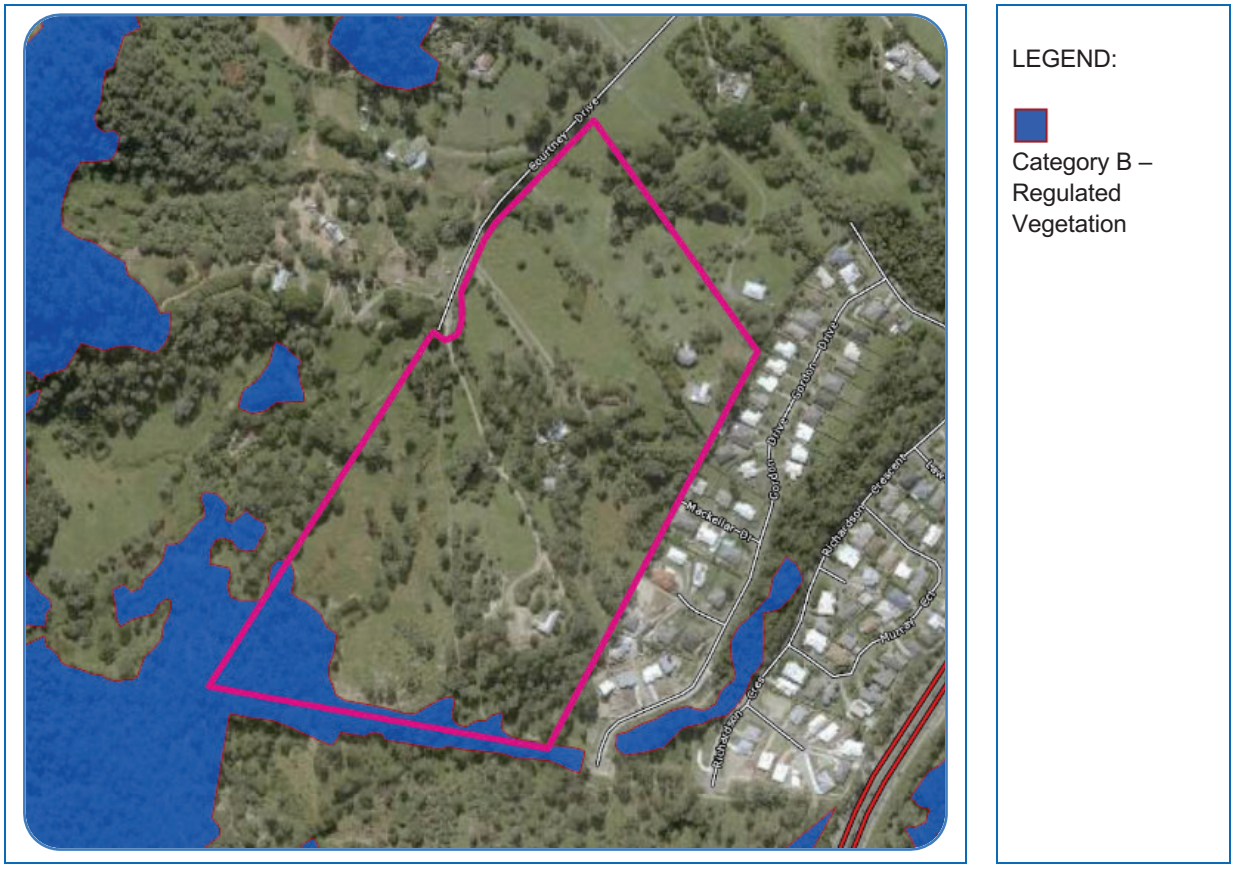

Figure 4.1 Regulated Vegetation Map (Qld Globe)

4.3.2 Vegetation Management Regional Ecosystem and Remnant Map

The vegetation management supporting maps provide information on regional ecosystems, wetlands, watercourses and essential habitat. The regulated vegetation shown in Figure 4.1 is mapped as a least concern regional Ecosystem 12.11.5/12.11.24 (70/30); 70% is RE12.11.5 and 30% is 12.11.24. A full description of RE 12.11.5 and 12.11.24 is provided in Table 4.3.

Figure 4.2 Vegetation Management Support Map (Qld Globe)

Table 4.3 Description of Regional Ecosystems Mapped On-site

Regional Ecosystem	Characteristics	VMA Status
RE12.11.5 *Corymbia citriodora* subsp. *variegata*, *Eucalyptus siderophloia*, *E. major* open forest on metamorphics +/- interbedded volcanics	*Corymbia citriodora* subsp. *variegata* open forest to woodland, usually including *Eucalyptus siderophloia*/*E. crebra* (sub coastal ranges), *E. propinqua* and *E. acmenoides* or *E. carnea*. Other species that may be present and abundant locally include *Corymbia intermedia*, *C. trachyphloia* subsp. *trachyphloia*, *Eucalyptus tereticornis*, *E. microcorys*, *E. portuensis*, *E. helidonica*, *E. major*, *E. longirostrata*, *E. biturbinata*, *E. moluccana* and *Angophora leiocarpa*. *Lophostemon confertus* often present in gullies and as a sub-canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Occurs on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	Least concern

Regional Ecosystem	Characteristics	VMA Status
RE12.11.24 *Eucalyptus carnea, E. tindaliae, Corymbia intermedia* +/- *E. siderophloia* or *E. crebra* woodland on metamorphics +/- interbedded volcanics	*Eucalyptus carnea, E. tindaliae, Corymbia intermedia* woodland +/- *E. crebra* or *E. siderophloia, Eucalyptus resinifera, Eucalyptus major, E. helidonica, Angophora woodsiana, C. trachyphloia, E. microcorys, Corymbia citriodora* subsp. *variegata, C. henryi*. Occurs on Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics usually at altitudes <300 metres.	Least Concern

4.3.3 Watercourses and Drainage Features

Several watercourses are mapped on the site (Figure 4.3). Vegetation along a mapped watercourse is regulated under the VMA where it intersects with a regional ecosystem. If the ecological values of the waterway and riparian vegetation are found to be high, then appropriate buffers should be incorporated into the development design.

Under the *Water Act 2000*, all these waterways are mapped as drainage features (Figure 4.4) and therefore, no Riverine Protection Permit is required to fill or excavate.

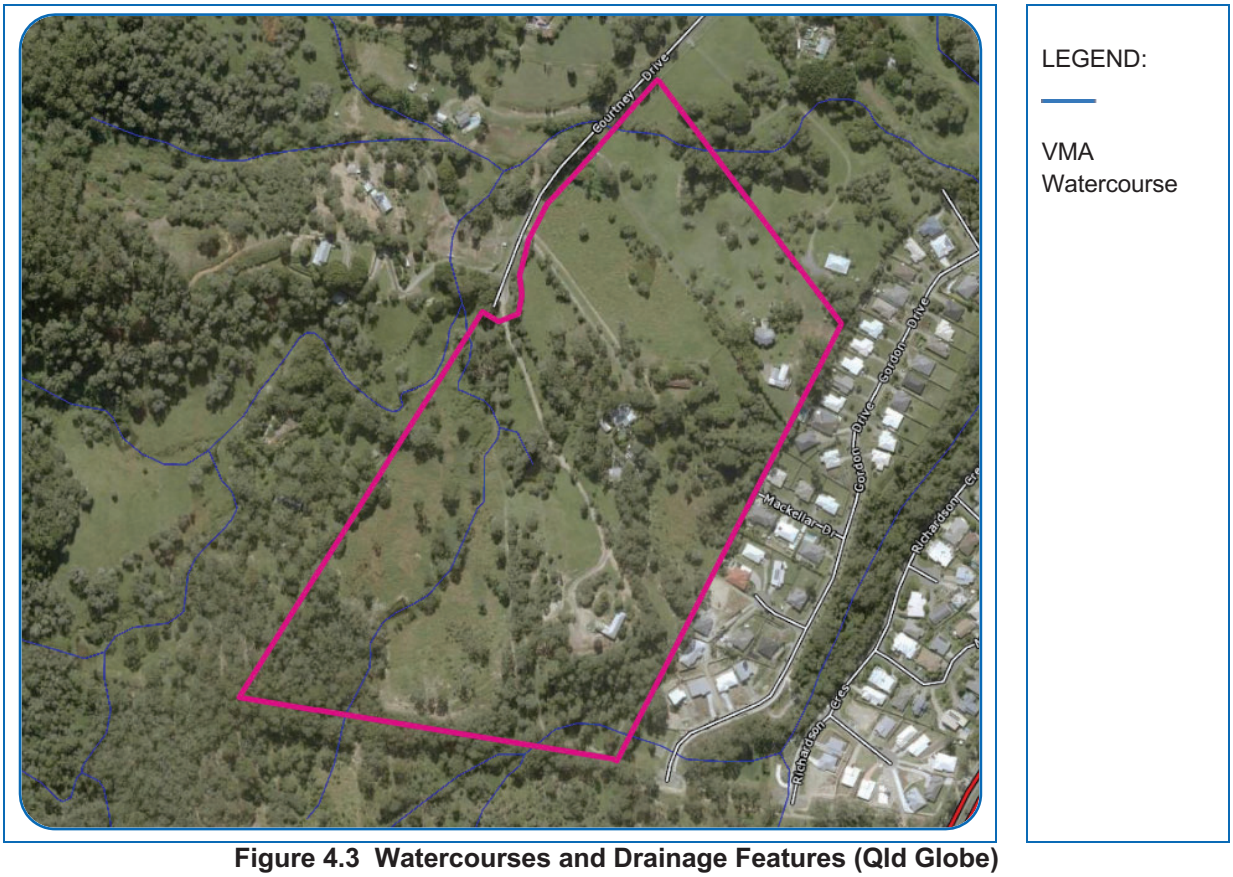

Figure 4.3 Watercourses and Drainage Features (Qld Globe)

LEGEND:

Drainage feature

Figure 4.4 Drainage feature defined by Water Act 2000 (Qld Globe)

4.3.4 Essential Habitat Map

Potential presence of significant fauna habitat is indicated by 'Essential habitat' mapping. Essential habitat mapping identifies areas of potential habitat for species listed as near threatened, vulnerable or endangered under the *Nature Conservation Act 1992*.

Essential habitat for Koala has been mapped over a very small area along the southern boundary of the site (Figure 4.5).

LEGEND:

Essential habitat

Figure 4.5 Essential Habitat Mapping (Qld Globe)

4.4 Planning Scheme Overlays

The proposed development will be assessed under the CGC Planning Scheme *City Plan* Version 7. Several Environmental Significance overlay codes have been identified as being applicable to the site. The purpose of the Environmental Significance Overlay Code and associated mapping is to identify and protect matters of environmental significance and ensure that development is consistent with, and contributes to, the achievement of the objectives of the *Gold Coast Nature Conservation Strategy 2009-2019*.

4.4.1 Environmental Significance – Priority Species

The Environmental Significance Priority Species code seeks to protect significant species and ensure their habitat is enhanced and maintained. Under this overlay code, assessable Koala feed and shelter trees are protected when they are located in Koala habitat areas.

The south-western corner of the site is mapped as containing Koala habitat area and state significant species (Figure 4.6). The overlay code does not identify which species are significant. It is assumed, based on essential habitat mapping, the species is Koala.

Therefore, development is to avoid or minimise impacts on assessable Koala feed and shelter trees to the greatest extent possible. Development design should incorporate safe Koala movement opportunities by incorporating measures to maintain connectivity between areas of Koala habitat on and adjacent to the site.

Where development impacts on state and local significant species and their habitat, it is a requirement that flora species are propagated and used in rehabilitation and landscaping on site and fauna species are safely relocated by a qualified fauna spotter catcher.

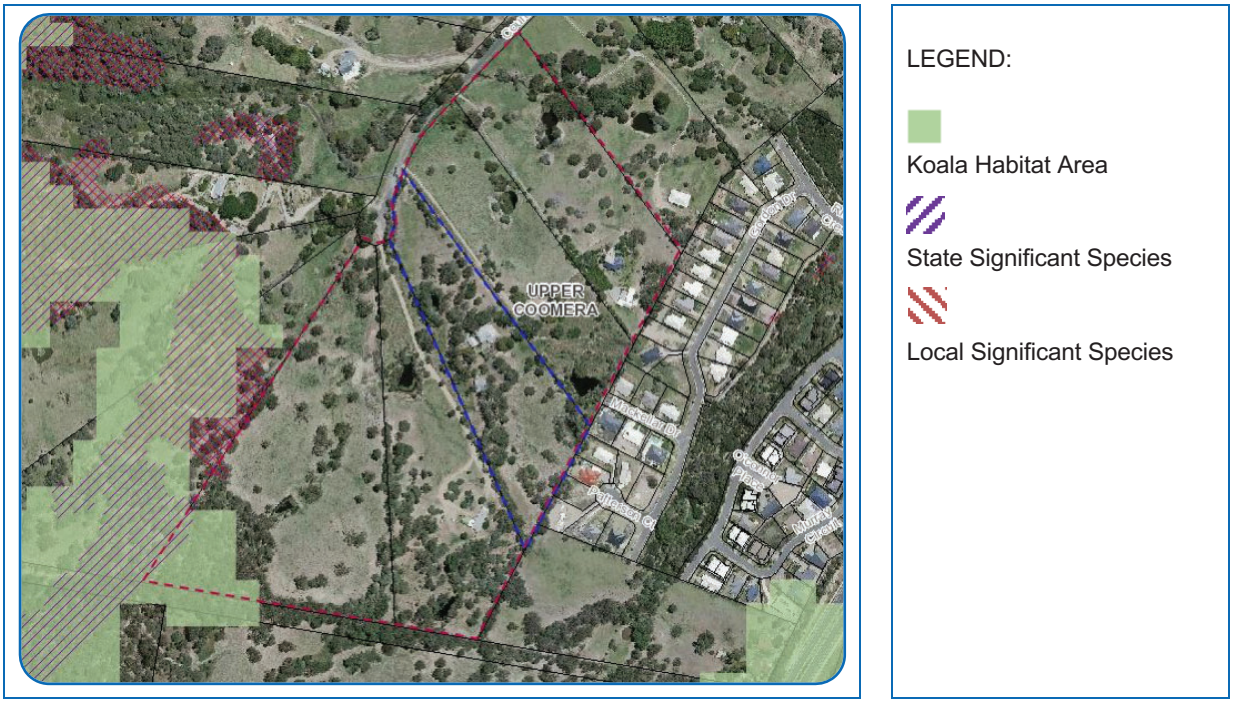

Figure 4.6 Priority Species Overlay (City Plan Interactive Mapping)

4.4.2 Environmental Significance – Vegetation Management

The purpose of the Vegetation Management code is to ensure that development does not impact on high, medium or general priority vegetation. Overlay code mapping indicates that medium and general priority vegetation is present on the site (Figure 4.7).

Damage to medium priority vegetation should be avoided or if damage is unavoidable, offset under the provisions of the *Environmental Offsets Act 2014* at an area ratio of 3:1 in accordance with SC6.8 City Plan policy – Environmental offsets. Damage to general priority vegetation should be minimised where it cannot be avoided.

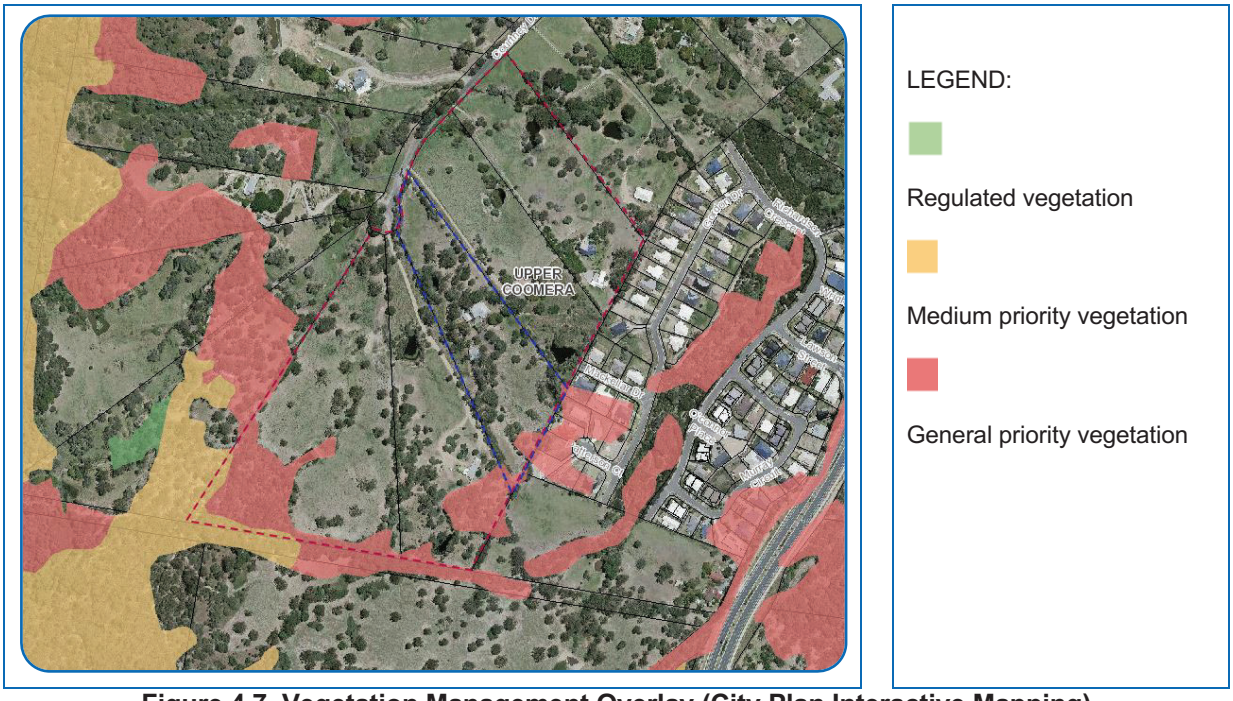

Figure 4.7 Vegetation Management Overlay (City Plan Interactive Mapping)

4.4.3 Environmental Significance – Wetlands and Watercourses

The purpose of this overlay is to ensure that wetlands and watercourses are protected and enhanced. Mapping indicates that there are locally significant minor watercourses on the site (Figure 4.7).

In accordance with the Planning Scheme, buffers of at least 30 m are to be provided from the outer bank of the minor watercourse, unless an alternative distance is determined through the ecological assessment.

LEGEND:

Watercourse

Figure 4.8 Wetlands and Watercourses Overlay (City Plan Interactive Mapping, 2018)

4.5 Likelihood of Occurrence

Table 4.4 identifies the threatened fauna returned from the Protected Matters and Wildlife Online database searches (as described in Section 4.2) together with a likelihood of occurrence for each species.

Each species' likely occurrence was based on a desktop assessment, habitat availability based on site investigations, knowledge of the species' ecology and professional judgement.

Four terms for the likelihood of occurrence of species are used in this report. The terms for likelihood of occurrence are defined below:

- Known or Recorded = the species has been observed on the site.
- Potential = suitable habitat for a species occurs on the site.
- Unlikely = a very low to low probability that a species uses the site.
- No = habitat on site and in the vicinity, is unsuitable for the species.

Table 4.4 Threatened Fauna – Assessment of Likelihood of Occurrence

Scientific Name	Common Name	Status*	Ecology	Likelihood of Occurrence
Anthochaera phrygia	Regent Honeyeater	E, CE[#]	The Regent Honeyeater is endemic to south-east Australia, where it is widespread but with an extremely patchy distribution (Garnett *et al*. 2011). Its range extends from south-east Queensland to central Victoria. In Queensland, the regent honeyeater has been recorded from 15 sites, primarily south of a line between Chinchilla and the Sunshine Coast (Environment Australia, 2016). Regent Honeyeaters mostly occur in dry box-ironbark eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, especially along creek flats, or in broad river valleys and foothills (Environment Australia, 2016). Regent Honeyeaters usually nest in the canopy of forests or woodlands. The diet of this species consists mainly of nectar, supplemented with some invertebrates (mostly insects) and their exudates (e.g. lerp, honeydew). Nectar is taken mainly from a variety of eucalypt species (Environment Australia, 2016).	**UNLIKELY** Marginal habitat for this species exists on the site but were not observed. Known breeding sites for this species are restricted to west of Warwick.
Calyptorhynchus lathami lathami	Glossy Black-cockatoo (Eastern)	V	Glossy Black-cockatoos inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur. They feed almost exclusively on the seeds of several species of She-oak (*Casuarina* and *Allocasuarina* species). They are dependent on large hollow-bearing eucalypts for breeding (Office of Environment & Heritage, 2015).	**UNLIKELY** While a She-oak stand is present on the subject site, no evidence of feeding by this species was recorded during the survey period.

Scientific Name	Common Name	Status*	Ecology	Likelihood of Occurrence
Botaurus poiciloptilus	Australasian Bittern	E	The Australasian Bittern occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia (Marchant & Higgins 1990). The species is rarely recorded in Queensland, and possibly survives only in protected areas such as the Cooloola and Fraser regions (Department of Environment (DE), 2016). The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant & Higgins 1990). The Australasian Bittern has been recorded feeding on freshwater crayfish, fish (including goldfish), beetles, snakes, leaves and fruit (Marchant & Higgins 1990).	**NO** Suitable habitat for this species does not occur on the subject site
Erythrotriorchis radiatus	Red Goshawk	E, V#	The Red Goshawk is endemic to Australia. It is very sparsely dispersed coastal and sub-coastal Australia, from the western Kimberley Division (north of 19°S) to north-eastern NSW (north of 33°) (Marchant & Higgins, 1993). The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands (Marchant & Higgins, 1993). Riverine forests are also used frequently (Debus, 1991, 1993). Such habitats typically support high bird numbers and biodiversity, especially medium to large bird species which the goshawk requires for prey. The Red Goshawk nests in large trees within one km of permanent water (Debus & Czechura, 1988b).	**UNLIKELY** The low diversity of suitable prey for this species make the subject site an area unlikely to support Red Goshawk.

Scientific Name	Common Name	Status*	Ecology	Likelihood of Occurrence
Turnix melanogaster	Black-breasted Button-quail	V	The present-day known distribution in Queensland extends from near Byfield in the north, south to the New South Wales border and westwards to Palm Grove National Park and Barakula State Forest (Marchant & Higgins, 1993). The most significant populations appear to be in the Yarraman-Nanango, Jimna-Conondale and Great Sandy regions. The Black-breasted Button-quail is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum (Marchant & Higgins, 1993). They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest (Marchant & Higgins, 1993). They may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes (Smith & Mathieson, 2004).	**NO** No suitable habitat exists on the site for this species.
Chalinolobus dwyeri	Large-eared Pied Bat	V	This species prefers roosting habitat of sandstone cliffs and fertile woodland valley. Records from south-east Queensland suggest rainforest and moist eucalypt forest habitats on other geological substrates at high elevation are of importance to the species. Species distribution is poorly known (DE, 2016).	**NO** No suitable habitat exists on the site.
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E	The Spotted-tailed Quoll prefers mature wet forest habitat. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This predominantly nocturnal species rests during the day in dens. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (DE, 2016). Individuals require an abundance of food such as birds and small mammals, and large areas of relatively intact vegetation through which to forage (DE, 2016).	**NO** Suitable habitat in the form of intact mature wet forest was not observed on the subject site. While some hollows were recorded on-site, they were in low abundance, and no rocky outcrops or caves were recorded.

Scientific Name	Common Name	Status*	Ecology	Likelihood of Occurrence
Petauroides volans	Greater Glider	V[#]	The Greater Glider is an arboreal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers (Kehl & Borsboom, 1984; Kavanagh & Lambert, 1990; van der Ree *et al*., 2004). The Greater Glider is restricted to eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevational range from sea level to 1200m ASL (Vanderduys *et al*., 2012). It is found in highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows (van der Ree et al., 2004; Vanderduys *et al*., 2012). The distribution may be patchy even in suitable habitat. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species (Kavanagh, 1984). During the day, it shelters in tree hollows, with a preference for large hollows in large, old trees (Kehl & Borsboom, 1984; Smith *et al*., 2007). In southern Queensland, greater gliders require at least 2-4 live den trees for every 2 ha of suitable forest habitat (Eyre, 2002). Home ranges vary from 1-4 ha in high productivity forests (Kavanagh & Wheeler, 2004) to 16 ha in open woodlands (Eyre, 2002; Smith *et al*., 2007).	**NO** Suitable habitat and denning sites were not observed on the site.
Phascolarctos cinereus	Koala	V, V[#]	Koalas inhabit dry open sclerophyll forests and woodlands occurring on fertile soils (Van Dyck, 1995; Menkhorst and Knight, 2001; Environmental Protection Agency, 2006). Communities containing denser vegetation and larger trees are generally preferred; however, Koalas can also inhabit less optimal habitat such as young forests, highly fragmented vegetation communities, and small remnants (Environmental Protection Agency, 2006). They mainly feed on *Eucalyptus* species, along with some *Corymbia*, *Angophora*, *Lophostemon*, *Melaleuca*, and *Leptospermum* species (Environmental Protection Agency, 2006).	**KNOWN** This species was not directly recorded during surveys. Indirect evidence (scratch marks and scats) were found of Koala during the KSAT survey.

Scientific Name	Common Name	Status*	Ecology	Likelihood of Occurrence
Pteropus poliocephalus	Grey-headed Flying-fox	V#	The Grey-headed Flying-fox occurs in the coastal belt from Rockhampton to Melbourne. The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands (Eby, 1998). None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year, so the species selectively forages where food is available. Consequently, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly (Eby & Lunney, 2002). The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. They most frequently travel around 15 km from a roost site to feed (Tidemann, 1998), although can travel up to 50 km as food resources change (Eby, 1991).	**POTENTIAL** The site would provide seasonal foraging resources. No flying-fox camps are present on the site.
Pseudomys novaehollandiae	New Holland Mouse	V	The New Holland mouse is patchily distributed in coastal areas of south eastern Australia from southern Queensland in the north, to Flinders Island and Tasmania in the south, extending inland to around 100 km in NE NSW (Australian Museum, 2016). The species is now largely restricted to the coast of central and northern NSW (DE, 2016).	**NO** Suitable heath habitat does not exist on the subject site.
Potorus tridactylus tridatylus	Long Nosed Potaroo	V	This species generally prefers rainforest and adjacent to wet sclerophyll forest, coastal heathlands and similar habitats with a dense understorey. Like all Potoroos, fungi are the major component of the diet and is also known to feed on invertebrates (DE, 2016).	**NO** Suitable habitat for this species does not occur on the subject site.

5 Development Proposal

The development involves reconfiguring the existing site into 310 lots (Figure 5.1). The development will include:

- An internal road network with pedestrian footpath;
- Environmental Reserves to protect existing ecologically significant areas;
- Recreation areas;
- Drainage areas; and
- Rehabilitated waterways incorporated into public open space areas.

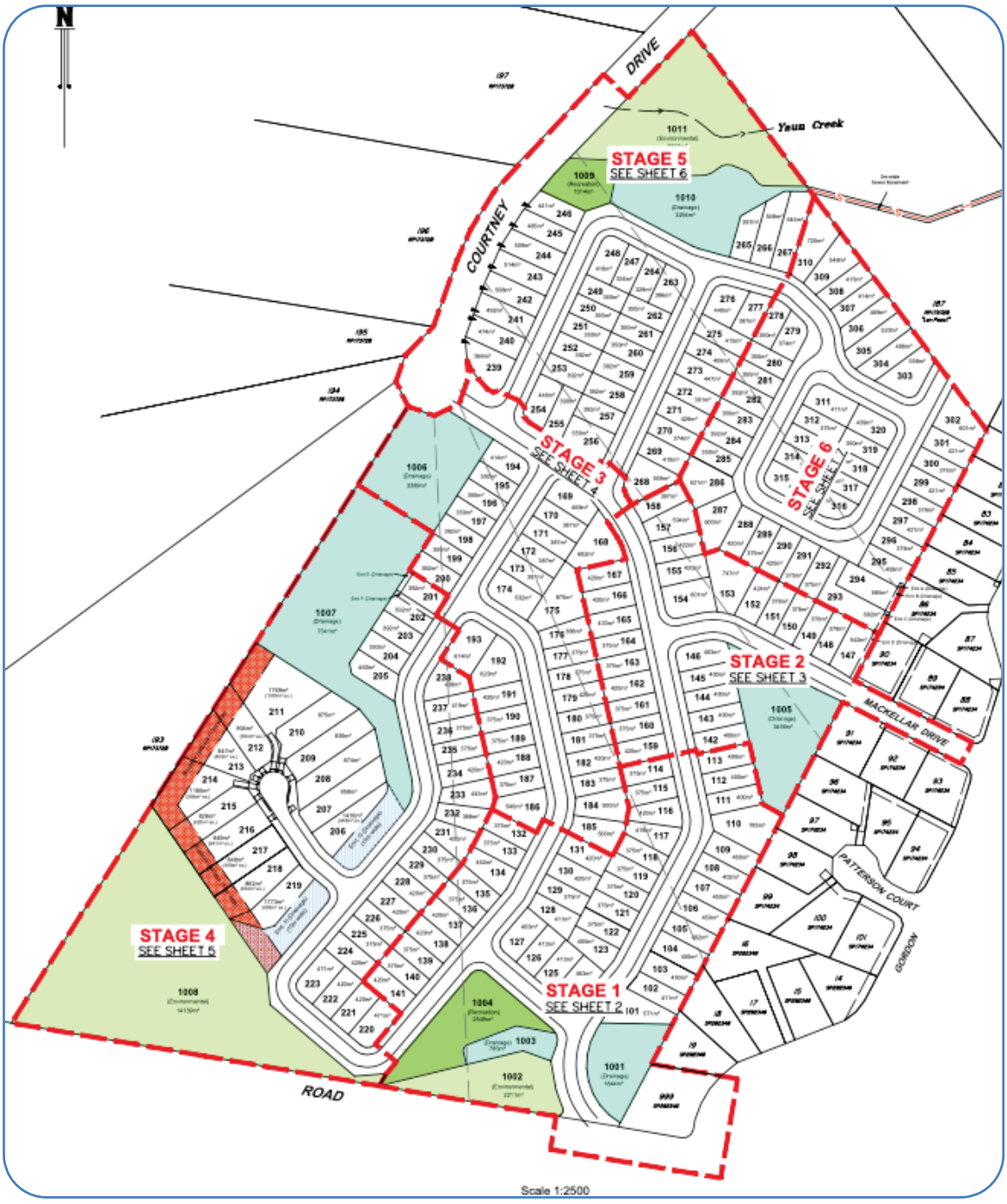

Figure 5.1 Proposed Development Layout (Bennett and Bennett, 2019)

6 Vegetation Field Survey

A flora survey to ground truth the floristic characteristics of the sites' vegetation communities was undertaken on 5 June 2017. The results of this investigation are presented in the following sections.

6.1 Methodology

The field assessment involved an initial walkover of the survey area to ground-truth desktop investigations and identify the presence and extent of vegetation community types. Random meanders were undertaken throughout the survey area generally in accordance with Cropper (1993). This survey technique enabled the identification of a comprehensive flora species list for the survey area.

An assessment of disturbance was undertaken at an association-wide scale.

Data associated with structural formations (i.e. growth form, stratum intervals, crown cover and height) and floristic associations (i.e. species diversity) for each broad vegetation type was collected (Table 6.1).

The vegetation surrounding the site's infrastructure was found to be too modified to represent natural vegetation associations or communities and was excluded from the quantitative assessment.

Table 6.1 Structural Formation Classes for Woody Plant Communities

Vegetation cover equivalents	Foliage Projective Cover	70-100%	30-70%	10-30%	<10%
	Crown Separation	Closed or dense	Mid-dense	Sparse	Very sparse
	Field Criteria	Crowns touching to overlapping	Crowns touching to slightly separated	Crowns clearly separated	Crowns well separated
	CROWNCOVER %	100-81%	81-52%	52-20%	20-0.2%

	GROWTH FORM	Structural Formation Classes			
Growth form and height	Trees >30 m tall	Tall closed forest	Tall Open forest	Tall woodland	Tall Open woodland
	Trees 10-30 m tall	Closed forest	Open forest	Woodland	Open woodland
	Trees <10 m tall	Low closed forest	Low open forest	Low woodland	Low Open woodland
	Shrubs 2– 8 m tall	Closed scrub	Open scrub	Tall shrubland	Tall Open-shrubland
	Shrubs 1-2 m tall	Closed heath	Open heath	Shrubland	Open-shrubland
	Shrubs <1 m tall	-	-	Dwarf shrubland	Dwarf Open-shrubland

Source: DNRW Application Kit for a Property Map of Assessable Vegetation 2004.

6.2 Flora Survey Results

Based on past aerial photography, it appears that much of the site has been historically cleared for rural residential purposes while retaining a small area of bushland on a steep slope in the south-western corner and isolated copses throughout. Cultivated gardens around the existing dwellings are present.

A total of 106 species of flora were identified within the site, comprising 51 endemic species and 55 non-endemic species (Appendix C).

6.3 Vegetation Communities

The vegetation encountered on-site was broadly classified into four associations:

1. *Acacia* low open forest;
2. Spotted Gum / Grey Ironbark Open Forest (RE 12.11.5);
3. *Acacia* low open woodland/mosaic +/- landscaping around dwellings; and
4. Pasturelands +/- copses of native/exotic trees

These vegetation communities are illustrated in Figure 6.1 and are described in greater detail in the following sections.

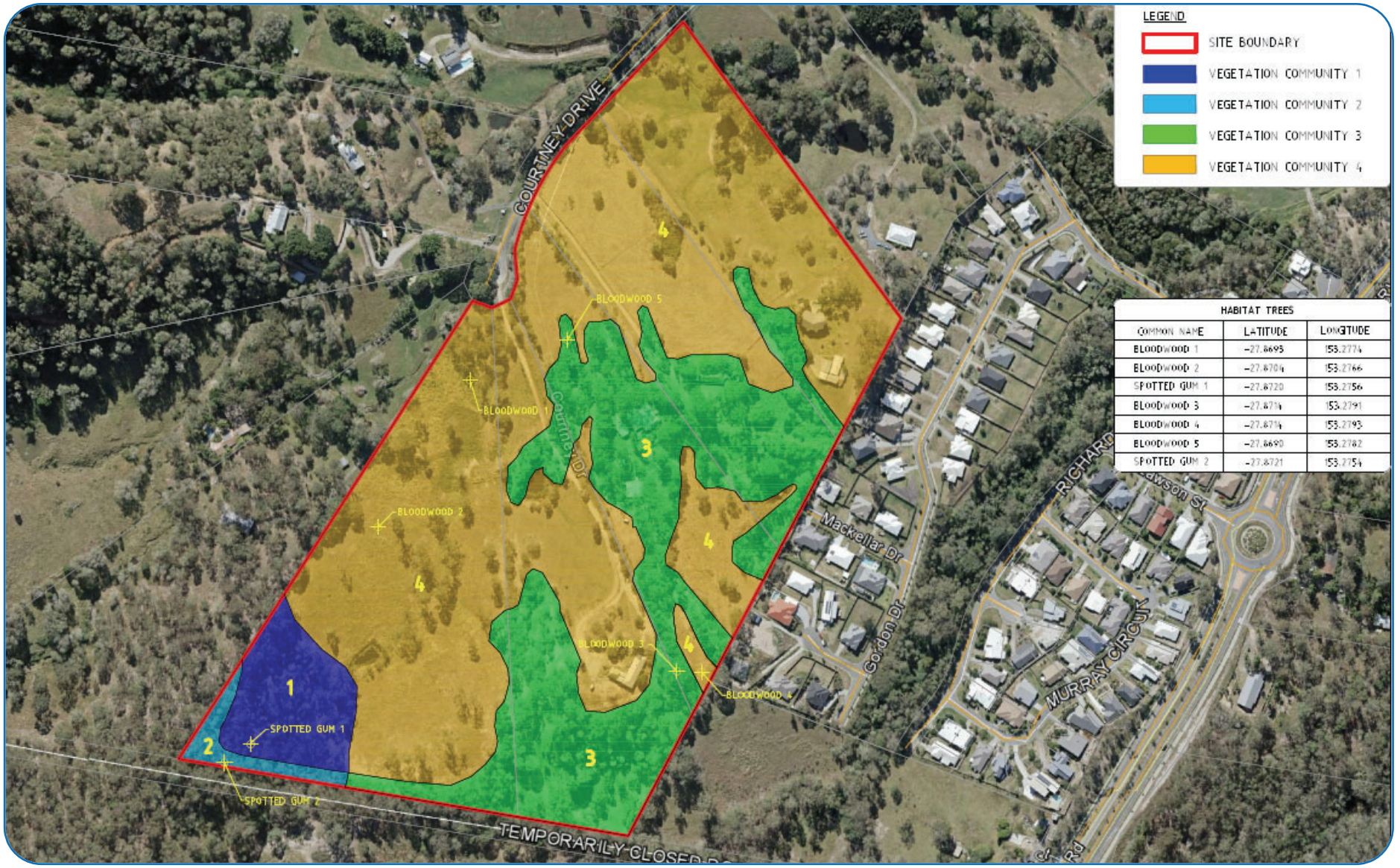

Figure 6.1 Vegetation Communities

6.3.1 Vegetation Community 1 – Acacia low open forest

Vegetation Unit 1 is comprised of mature *Acacia disparrima* regrowth with occasional emergent *Corymbia citriodora, Eucalyptus siderophloia, E. propinqua, and E. tereticornis*. Other common species in the mid stratum include *Lophostemon suaveolens* and *Allocasuarina littoralis*.

The notable disturbance within this vegetation community is the incursion of weeds, with Lantana dominating the shrub layer. Low level livestock grazing is presently occurring.

Figure 6.2 Vegetation Community 1

Table 6.2 Vegetation Community 1 Quantitative Assessments

Stratum	Growth Form	Crown separation	Stratum Height (m)
Upper	Tall tree	Very Sparse	15 - 20
Mid	Small tree	Mid-dense	3 - 15
Lower	Shrub	Mid-dense	0.5 - 3
Ground	Forb	Sparse	<0.5

Tables 6.3 summarises the floristic characteristics of Vegetation Community 1 within each stratum.

Table 6.3 Floristic Association – Community 1

Growth Form	Stratum	Scientific Name	Common Name
Woodland	Upper	*Corymbia citriodora*	Spotted Gum
		Eucalyptus propinqua	Small-fruiting Grey Gum
		Eucalyptus siderophloia	Grey Ironbark
		Eucalyptus tereticornis	Queensland Blue Gum
		Lophostemon confertus	Brush Box

Growth Form	Stratum	Scientific Name	Common Name
Low open-forest	Mid	*Acacia disparrima*	Hickory Wattle
		Allocasuarina littoralis	Black She-oak
		Eucalyptus siderophloia	Grey Ironbark
		Lophostemon confertus	Brush Box
		Lophostemon suaveolens	Swamp Box
-	Lower	*Acacia disparrima*	Hickory Wattle
		Lantana camara	Lantana
-	Ground	*Cymbopogon refractus*	Barbed-wire Grass
		Entolasia stricta	Wiry Panic
		Imperata cylindrica	Blady Grass
		Lomandra multiflora	Many-flowered Mat Rush
		Themeda triandra	Kangaroo Grass

6.3.2 Vegetation Community 2 – Spotted Gum/Grey Ironbark Open Forest (RE 12.11.5)

Vegetation Community 2 comprises a small area of the total subject site in the south-west corner and is an extension of a larger area of the same vegetation type beyond the site boundary. The composition of canopy trees is generally representative of RE 12.11.5. Low level livestock grazing is presently occurring with negligible weed incursion.

Figure 6.3 Vegetation Community 2

Table 6.4 Vegetation Community 2 Quantitative Assessments

Stratum	Growth Form	Crown separation	Stratum Height (m)
Upper	Tall tree	Sparse	15 - 20
Mid	Small tree	Mid-dense	3 - 15
Lower	Shrub	Very Sparse	0.5 - 3
Ground	Forb	Sparse	<0.5

Tables 6.5 summarises the floristic characteristics of Vegetation Community 2 within each stratum.

Table 6.5 Floristic Association – Community 2

Growth Form	Stratum	Scientific Name	Common Name
Open forest	Upper	*Corymbia citriodora*	Spotted Gum
		Eucalyptus siderophloia	Grey Ironbark
Low open forest	Mid	*Corymbia citriodora*	Spotted Gum
		Corymbia intermedia	Pink Bloodwood
		Eucalyptus carnea	Broad-leaved White Mahogany
		Lophostemon confertus	Brush Box
-	Lower	*Acacia disparrima*	Hickory Wattle
		Corymbia citriodora	Spotted Gum
-	Ground	*Cymbopogon refractus*	Barbed-wire Grass
		Entolasia stricta	Wiry Panic
		Imperata cylindrica	Blady Grass
		Lomandra confertifolia	A Mat Rush
		Lomandra longifolia	Spikey-headed Mat Rush
		Themeda triandra	Kangaroo Grass

6.3.3 Vegetation Community 3 - Acacia low open woodland/mosaic +/- landscaping around dwellings

Vegetation Community 3 is primarily mature *Acacia* regrowth proximate to dwellings and outbuildings on the subject site. There are occasional larger eucalypts and small isolated thickets of lantana and vine weeds are common. Low level grazing is presently occurring throughout most of this community. Prevalent flora species for this community are provided below.

Upper Stratum:
Acacia disparrima, Eucalyptus siderophloia, Eucalyptus tereticornis, Lophostemon confertus.

Mid stratum:
Acacia disparrima, Lantana camara, Eucalyptus spp.

Ground Stratum (*exotic species)**:**
*Cynodon dactylon var. dactylon, *Setaria sphacelata, *Panicum megathyrsus.*

Figure 6.4 Vegetation Unit 3

6.3.4 Vegetation Community 4 - Pasturelands +/- copses of native/exotic trees

Vegetation Community 4 covers most of the site comprising introduced pasture species, copses of endemic tree species and trees associated with landscaping. Some of the largest eucalypt trees on site occur as isolated trees or within the copses.

Figure 6.5 Vegetation Community 4

6.4 Conservation Significant Flora

As the site falls within a high-risk area for protected flora species, surveys noted any threatened species listed under state or Commonwealth legislation.

For the purposes of this report, a significant flora species has been defined as a species that is:

- Scheduled as critically endangered, endangered, vulnerable or conservation dependent under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and/or
- Scheduled as endangered, vulnerable, or near threatened under the Queensland *Nature Conservation Act 1992* (NCA).

No conservation significant species were recorded on site during surveys.

6.5 Weed Incursions

In its broadest definition, a weed is "a plant out of place". The State government has applied a hierarchical system of classification to invasive plants according to their estimated economic and environmental impacts. Each level of classification prescribes legal obligations designed to control the spread of declared invasive plants. Other plants that are simply exotic or non-endemic to a particular area may be considered less invasive or non-invasive but are nonetheless "out of place" depending on the given context or land use purpose.

In the context of this ecological assessment, a weed is a plant that is not endemic to any given natural area or ecological unit being assessed.

A total of 55 non-endemic species were identified on the subject site, 15 of which are Invasive Plants under the Queensland *Biosecurity Act 2014* (Table 6.6).

Table 6.6 Weeds Observed On-site

Scientific Name	Common Name	Status
Ageratum houstonianum	Blue Billygoat Weed	
Amaranthus spinosus	Red Amaranth	
Ambrosia artemisiifolia	Ragweed	RIP
Anagallis arvensis	Scarlet Pimpernel	
Asclepias curassavica	Tropical Milkweed	
Asparagus aethiopicus cv. Sprengelii	Ground Asparagus	RIP
Bidens pilosa	Cobbler's Pegs	
Cinnamomum camphora	Camphor Laurel	RIP
Cirsium vulgare	Scotch Thistle	
Conyza canariensis	Canadian Fleabane	
Conyza sumatrensis	Tall Fleabane	
Corymbia torelliana	Cadagi	
Crassocephalum crepidioides	Thickhead	
Crotalaria incana	Woolly Rattlepod	

Scientific Name	Common Name	Status
Crotalaria lanceolata	Lance-leaved Rattlepod	
Cupressus sempervirens	Pencil Pine	
Cyperus papyrus	Papyrus	
Emelia sonchifolia	Emelia	
Gomphocarpus sp.	Cotton Bush	
Hypochaeris radicata	Flatweed	
Jacaranda mimosifolia	Jacaranda	
Lantana camara	Lantana	RIP
Macrotyloma axillare	Horse Gram	
Megathyrsus maximus	Guinea Grass	
Melinis minutiflora	Molasses Grass	OIP
Murraya paniculata	Mock Orange	OIP
Neonotonia wightii	White Glycine	
Nymphaea capensis	Cape Waterlily	
Oxalis corniculata	Yellow Wood Sorrel	
Oxalis debilis var. corymbosa	Soursob	
Paspalum dilatatum	Paspalum	
Passiflora edulis	Passionfruit	
Passiflora foetida	Stinking Passionflower	OIP
Passiflora suberosa	Corky Passionfruit	OIP
Passiflora subpeltata	White Passionflower	OIP
Polygala paniculata	Polygala	
Phytolacca octandra	Inkweed	
Psidium guajava	Yellow Guava	
Ravenala madagascariensis	Traveller's Palm	
Richardia brasiliensis	White Eye	
Schefflera actinophylla	Umbrella Tree	OIP
Senecio madagascariensis	Fireweed	RIP
Senna pendula var. glabrata	Easter Senna	OIP
Setaria sphacelata	Setaria	
Sida cordifolia	Flannel Weed	
Sida rhombifolia	Paddy Lucerne	
Solanum chrysotrichum	Giant Devil's Fig	
Solanum mauritianum	Wild Tobacco	OIP
Solanum capsicoides	Devil's Apple	
Sphagneticola trilobata	Singapore Daisy	RIP

Scientific Name	Common Name	Status
Sporobolus africanus	Paramatta Grass	
Syagrus romanzoffiana	Cocos Palm	OIP
Tagetes minuta	Stinking Roger	
Urena lobata	Urena Burr	
Verbena bonariensis	Purple Top	

*Species listed under the Queensland *Biosecurity Act 2014*, where:

PIP = Prohibited invasive plants must not be kept, moved, given away or sold without a permit. The Biosecurity Act requires that all sightings to be reported to Biosecurity Queensland within 24 hours. By law, everyone has a general biosecurity obligation to take all reasonable and practical steps to minimise the risk of spreading prohibited invasive plants until they receive advice from an authorised officer.

RIP = Restricted invasive plants must not be given away, sold or released into the environment without a permit. The Biosecurity Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws.

OIP = Other invasive plants are not prohibited or restricted, however, by law, everyone has a general biosecurity obligation to take reasonable and practical steps to minimise the risks associated with invasive plants under their control. Local governments must have a biosecurity plan that covers invasive plants and animals in their area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws.

6.6 Habitat Trees

Habitat trees are defined under Schedule 1 of the City Plan as *a living or dead tree greater than 80 centimetres diameter at 1.4 metres that has one or more hollows within its trunk or branches greater than 10 centimetres in entrance diameter*.

While no trees that met with the above definition were identified on the site, several trees with hollows were recorded. The locations of these trees are provided in Table 6.7 and shown in Figure 6.1.

Table 6.7 Habitat Tree Locations

Common Name	Latitude	Longitude
Bloodwood	-27.869329	153.277390
Bloodwood	-27.870399	153.276640
Spotted Gum	-27.871978	153.275604
Bloodwood	-27.871441	153.279087
Bloodwood	-27.871448	153.279290
Bloodwood	-27.869035	153.278187
Spotted Gum	-27.872113	153.275391

6.7 Waterways and Riparian Vegetation

As noted in Section 4, minor waterways (including dams) are mapped as present on the site. Under the *Water Act 2000* these waterways are mapped as a drainage feature.

Field investigations identified these waterways to be degraded and primarily consist of eroded or heavily weed infested ephemeral overland flow paths discharging to dams.

To assist with the description and identification of the site's waterways and associated vegetation, they are discussed with regard to the Lot number on which they occur.

6.7.1 Lot 192

An ephemeral waterway flows through the centre of this allotment (Figure 6.7). The headwater of this waterway arises from the southern site boundary and is characterised by steeply sloping embankments, especially the western slope. The gully is vegetated south of the dam (vegetation community 1) and has notable weed infestations, especially lantana.

Figure 6.6 Waterway Lot 192 (City Plan mapping)

The dam is relatively small and is accessed by livestock (Figure 6.7). Surrounding vegetation is dominated by pasture grasses and regrowth vegetation. There is some evidence of erosion on the dam embankments where ground cover vegetation has been grazed to bare earth. There is very little native vegetation north of the dam (Figure 6.8).

The lack of native vegetation and permanent or temporary water limits the ecological values of the waterway north of the dam. The Draft Concept Plan (GHD, 2017) did not identify any ecological benefits in incorporating this flow path in future development.

Figure 6.7 Dam on Lot 192

Figure 6.8 Waterway Lot 192 (north of dam)

6.7.2 Lot 191

City Plan mapping shows a waterway is present on Lot 191 along the southern boundary (Figure 6.9). The waterway flows from the south of the site and to a large dam (Figure 6.10). The dam overflow is a narrow gully which flows to neighbouring properties to the east, connecting with a stormwater conveyance channel in the residential development.

As with the dam on Lot 192, grazing pressures have resulted in areas of exposed earth along the embankments. The vegetation surrounding the dam is dominated by *Acacia* and lantana.

Downstream flow paths are currently influenced by the dam and are likely to convey water only after the dam has exceeded capacity.

The Draft Concept Plan (GHD, 2017) proposed that the southern waterway be included into the green space network. It has connectivity through an adjacent rural property with the residential development located to the east of the site (refer to Figure 2.3).

Figure 6.9 Waterway Lot 191 (City Plan mapping)

Figure 6.10 Dam on Lot 191

6.7.3 Lot 189

The waterway on Lot 189 is dominated by a large dam. The overflow of this dam discharges to a residential development located to the east (Figure 6.11). Downstream flow paths are likely to convey water only after the dam has exceeded capacity.

The downstream flow paths have been significantly modified through the establishment of a residential community. Inflows to the dam are via a small gully arising from near the dwelling.

Vegetation around the dam is dominated by pasture grass (Figure 6.12) and is accessed by livestock.

Figure 6.11 Waterway Lot 189 (City Plan mapping)

Figure 6.12 Dam on Lot 189

6.7.4 Lot 188

Yaun Creek runs through the northern corner of Lot 188. It arises from neighbouring properties to the west and passes under Courtney Drive via a culvert before flowing through the allotment (Figures 6.13).

Figure 6.13 Waterway Lot 188 (City Plan mapping)

The waterway has eroded and steep embankments. Very little riparian vegetation is present, and horses have direct access (Figure 6.14). The waterway discharges to neighbouring properties to the east. With the exceptions of the dams on all the allotments, this was the only waterway where standing water was present. The waterway is characterised in this reach by a series of shallow pools of still water.

Rehabilitation of this waterway was recommended in the Draft Concept Plan (GHD, 2017).

Figure 6.14 Waterway on Lot 188

7 Fauna Field Survey

With consideration given to the information obtained within the desktop assessment, fauna field surveys were undertaken on 5 June 2017.

Where relevant, observations regarding fauna habitat values on adjacent sites were also recorded, although limited to those that were discernible from within the subject site and/or from publicly accessible land.

The survey methodology incorporated the following survey techniques:

- Diurnal bird surveys;
- Targeted searches for conservation significant species; and
- Opportunistic records and observations of inferential evidence.

7.1 Diurnal bird surveys

Diurnal bird surveys were undertaken over all the site. Bird species were identified through direct observations (i.e. visual sighting) and/or vocalisations. The bird survey involved one observer walking slowly and quietly through the site, looking and listening for birds.

7.2 Targeted Searches for Conservation Significant Species

This section provides an overview of the specific techniques employed for surveys for specific threatened species. The targeted threatened species were identified in the database review as potentially occurring on the site. The survey methodologies described below differ from standard survey techniques.

7.2.1 Koala Searches

An assessment of habitat utilisation of Koala was made using the Randomised Grid-based Koala Spot Assessment Technique to identify Koala activity levels across the site. This technique involves a search of Koala scats to determine the relative activity level of Koalas in the area.

Finding and identifying traces such as faecal pellets and scratch marks allows for the presence of Koalas to be confirmed (Woosnam-Merchez *et al.,* 2012) and allows for past as well as present habitat occupancy to be evaluated. Scats are relatively identifiable and persist for a reasonable period post-departure of the animal (Woosnam-Merchez *et al.*, 2012).

Spot assessment locations were located randomly using a 100 m x 100 m grid overlay of the site. Within each of these grid cells, a Koala Spot Assessment Technique (KSAT) was performed where an adequate number of trees were present. Concurrent with each KSAT, all trees were visually searched for Koala. The methodology employed for the KSAT followed Phillips and Callaghan (2011). A total of two KSAT were conducted within Vegetation Communities 1 and 2 in the south-west corner of the site.

In accordance with Phillips and Callaghan (2011), a centre tree within a 40 m x 40 m (1,600 m^2) plot was selected. Within the plot, the 29 closest trees (of any species) to the central tree were selected. Searches for faecal pellets were made within a radial distance of up to 1 m from the base of the trees. For each tree, the survey effort dedicated to the faecal pellet search was two-person minutes, or until a Koala faecal pellet was found – whichever occurred first.

In refining the KSAT site selection, the center tree was selected on the basis of being:

- A tree beneath which one or more Koala faecal pellets were observed; or
- A preferred Koala food tree.

Tree species were selected for assessment based on the following:

- The tree was a Koala Habitat Tree, as defined by the *Nature Conservation (Koala) Conservation Plan 2006* (i.e. a tree from a genus that is *Angophora, Corymbia, Eucalyptus, Lophostemon* or *Melaleuca*); and
- The tree had a diameter at breast height (DBH) of greater than 100 mm.

7.2.2 Glossy Black-cockatoo Searches

Glossy Black-cockatoos inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur. They feed almost exclusively on the seeds of several species of She-oak (*Casuarina* and *Allocasuarina* species) (NSW Environment and Heritage, 2014). As the birds feed, they drop the remnants of the She-oak cones after stripping the cone of seeds. These distinctive 'orts' are used to determine if Glossy Black-cockatoos have been feeding in the area. Within the subject site, searches were made for She-oaks.

A stand of She-oaks was located at Latitude -27.872105, Longitude 153.275550. The ground underneath these trees was searched for orts.

As with other cockatoo species, the Glossy Black-cockatoo is dependent on large hollow-bearing eucalypts for nest sites. Searches were made for suitable nesting trees within the subject site.

7.3 Opportunistic Records and Observations of Inferential Evidence

Observations of inferential evidence and opportunistic fauna encounters were recorded. Inferential evidence included observation of scratches, scats, tracks, shed skins and nests.

7.4 Survey Limitations

The fauna survey that was undertaken provides an overview of the species present and detectable on the subject site at the time of the survey. Weather and time constraints impact on the detectability of some species. Failure to detect a species during a single survey does not mean it is absent from the site. It cannot be confidently claimed a target species is absent from a site without repeated seasonal surveys.

It is recognised that the full inventory of fauna species utilising the site will not have been recorded. Although assessments of habitat and species ecology do provide an additional measure to predict the presence of species, there are no methodologies that can be used to predict, with absolute certainty, the absence of a species from potential habitat. There may be species that utilise habitats within the region like those on-site but have not been detected due to their occasional usage of the habitat types, rarity or cryptic nature.

Despite the limitations, and given the disturbed nature of the site, the survey effort conducted provides a level of fauna assessment that is consistent with the requirements associated with the preparation of an Ecological Assessment as per the planning scheme guidelines.

7.5 Results

The following section provides the results of the fauna field assessments. Table 7.1 provides a list of the fauna recorded on site. The survey results did not include domesticated livestock (sheep, goats, alpaca and horses), pets (dogs, cats) and caged birds (Red-tailed Black-cockatoo, Major Mitchell Cockatoo and Cockatiel) that were also present on the site.

Table 7.1 Fauna Observed On-Site

Scientific Name	Common Name	Status*	Method**	Comment
Amphibians				
Litoria fallax	Eastern Sedgefrog	LC	H	
Birds				
Sphecotheres vieilloti	Australasian Figbird	LC	S	
Cracticus tibicen	Australian Magpie	LC	S	
Pelecanus conspicillatus	Australian Pelican	LC	S	F/O
Threskiornis molucca	Australian White Ibis	LC	S	O/S
Chenonetta jubata	Australian Wood Duck	LC	S	
Geopelia humeralis	Bar-shouldered Dove	LC	S	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	S	
Bubulcus ibis	Cattle Egret	LC	S	
Phaps chalcoptera	Common Bronzewing	LC	S	
Psophodes olivaceus	Eastern Whipbird	LC	H	
Petrochelidon ariel	Fairy Martin	LC	S	
Cacomantis flabelliformis	Fan-Tailed Cuckoo	LC	S	
Pachycephala pectoralis youngi	Golden Whistler (South-Eastern Australia)	LC	S	
Cracticus torquatus	Grey Butcherbird	LC	S	
Rhipidura albiscapa	Grey Fantail	LC	S	
Sericornis magnirostra	Large-Billed Scrub-wren	LC	S	
Dacelo novaeguineae	Laughing Kookaburra	LC	S	
Meliphaga lewinii	Lewin's Honeyeater	LC	S	
Philemon citreogularis	Little Friarbird	LC	S	
Parvipsitta pusilla	Little Lorikeet	LC	H	
Anseranas semipalmata	Magpie Goose	LC	S	O/S
Grallina cyanoleuca	Magpie-lark	LC	S	
Vanellus miles novaehollandiae	Masked Lapwing (Southern Subspecies)	LC	H	
Philemon corniculatus	Noisy Friarbird	LC	S	
Manorina melanocephala	Noisy Miner	LC	S	

Scientific Name	Common Name	Status*	Method**	Comment
Oriolus sagittatus	Olive-backed Oriole	LC	S	
Anas superciliosa	Pacific Black Duck	LC	S	
Platycercus adscitus palliceps	Pale-headed Rosella (Southern Form)	LC	S	
Geopelia striata	Peaceful Dove	LC	S	
Strepera graculina graculina	Pied Currawong (Eastern Australia)	LC	H	
Porphyrio melanotus	Purple Swamphen	LC	S	O/S
Merops ornatus	Rainbow Bee-eater	LC	H	
Trichoglossus haematodus moluccanus	Rainbow Lorikeet	LC	S	
Malurus melanocephalus	Red-backed Fairy-wren	LC	S	
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	LC	S	
Myzomela sanguinolenta	Scarlet Honeyeater	LC	H	
Zosterops lateralis cornwalli	Silvereye (Eastern)	LC	H	
Dicrurus bracteatus bracteatus	Spangled Drongo (Eastern Australia)	LC	S	
Streptopelia chinensis	Spotted Dove	I	S	
Pardalotus punctatus	Spotted Pardalote	LC	H	
Pardalotus striatus	Striated Pardalote	LC	H	
Plectorhyncha lanceolata	Striped Honeyeater	LC	S	
Cacatua galerita	Sulphur-crested Cockatoo	LC	H	
Corvus orru	Torresian Crow	LC	S	
Malurus lamberti	Variegated Fairy-wren	LC	S	
Hirundo neoxena	Welcome Swallow	LC	S	
Rhipidura leucophrys leucophrys	Willie Wagtail (Southern)	LC	S	
Mammals				
Trichosurus vulpecula	Common Brushtail Possum	LC	S	
Macropus giganteus	Eastern Grey Kangaroo	LC	S	
Lepus europaeus	European Brown Hare	I	S	
Phascolarctos cinereus	Koala	V, V#	S	
Isoodon macrourus	Northern Brown Bandicoot	LC	S	
Wallabia bicolor	Swamp Wallaby	LC	V	

*Status:

As listed within the Queensland *Nature Conservation (Wildlife) Regulation 2006* (*Nature Conservation Act 1992*): E = Endangered, V = Vulnerable, RV = Regionally Vulnerable, NT = Near Threatened, SL = Special Least Concern, LC = Least Concern.

As listed within the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: CE#= Critically Endangered, E#= Endangered, V#= Vulnerable, CD#= Conservation Dependent, I# = Introduced Species.

**Primary method of identification: C = hand caught, H = heard, V = visually observed, S = other signs of presence (e.g. scats, traces etc.).

Comment: F/O = Flying overhead; O/S = Off site

7.5.1 Significant Fauna Species

Evidence of one conservation significant species, Koala, was observed on the subject site. As determined through the assessment of likelihood of occurrence (refer to Table 4.4), the site also provides potential seasonal foraging habitat for Grey-headed Flying-fox.

7.5.2 Amphibians

One species of amphibian was recorded during the field survey, the Eastern Sedgefrog (*Litoria fallax*). This species is the most commonly recorded frog in the greater Brisbane area and is frequently found in suburban gardens (Qld Museum, 1995). It is likely that the site is habitat to more disturbance tolerant amphibian species that can complete their breeding cycle in still water.

7.5.3 Birds

All 47 bird species identified during the field survey are tolerant of disturbed environments. Given the site's connectivity to a much larger remnant bushland unit to the south, it is likely that the subject site would provide occasional foraging opportunities for predatory and nocturnal species with large home ranges.

Despite the presence of stands of She-oak on the site, there was no indication that these were used for foraging by Glossy Black-cockatoos.

7.5.4 Mammals

Scats and/or sign of six mammalian species were observed during the survey.

Indirect evidence of Koala presence was detected based on the results of targeted KSAT, in the form of faecal pellets and/or scratch marks on smooth-barked trees. Koala scats are distinctive in their shape and persist long after the Koala has departed (McAlpine *et al*., 2007; Woosnam *et al*., 2012). The results of the KSAT are provided in Table 7.2. Activity level for each of the KSAT sites is expressed as a percentage of trees under which Koala faecal pellets were found.

Phillips and Callaghan (2011) defined activity levels for three general areas: east coast low, east coast medium-high and western slopes and plains. Koala densities in the east coast low areas were arbitrarily defined at ≤0.1 Koala/ha (Phillips and Callaghan, 2011).

Studies in the Coomera-Pimpama area have identified Koala density to be in the order of 0.23 – 0.37 Koala/ha (Biolink Ecological Consulting 2007; City of Gold Coast, 2014). Based on this density determination, Koala habitat use was compared to the east coast high area defined in Phillips and Callaghan (2011). Within the east coast high areas Phillips and Callaghan (2011) define Low Use is <22.52%, Med ≥22.52% but ≤32.84%, and High >32.84%. Results of the KSAT surveys indicated that the site has a low usage by Koala.

Table 7.2 KSAT Results

KSAT Location	Activity Level (%)	Use Classification
-27.871817, 153.275265	6.67	Low
-27.871524, 153.276303	3.33	Low
Average	**5**	**Low**

8 Ecological Functions

The ecological functions of the site were assessed during the field survey and are described in the sections below.

8.1 Core Habitat

For the purposes of this report, a core habitat area is defined as follows:

Areas that, due to features such as their size, composition, diversity etc., provide important habitat for the conservation of particular plant or animal species, or of a range of plant and animal species.

The low use activity levels recorded in the KSAT indicate that the vegetated area in the south-western corner of the site is currently being used by Koala, at least on a transient basis. It is considered that the site forms part of a larger home range for at least one Koala.

The site does not provide core habitat for any other flora and fauna species recorded during field surveys as most of these species are common and widespread.

8.2 Ecological Corridors

For the purposes of this report, an ecological corridor is defined as:

An area of land or water, including areas above and below ground, that is capable of providing fauna habitat in its own right, and/or has the potential to do so, while allowing fauna to move to and between other habitats.

The site is situated on the edge of an ecological corridor as it directly connects to large areas of existing bushland to the south. Under the *City Plan*, much of this bushland is zoned for conservation.

The proposed development facilitates a minimum 60 m wide linkage along Yaun Creek. The rehabilitation of Yaun Creek would provide a valuable movement corridor for fauna. The rehabilitation of a secondary waterway located in the south-east of the site will provide a major connection to the waterway within the residential community to the east, which is primarily used for storm water conveyance.

8.3 Waterways and Wetlands

There is limited native riparian vegetation along the site's waterways and this, together with livestock access, has resulted in stream bank erosion. Weed incursion in the riparian zone has further degraded the waterways.

Despite being mapped as a waterway under the *City Plan*, they perhaps can better de described as drainage channels as they have short duration flows following rain and no native riparian vegetation. They have been substantially modified through the creation of dams and are degraded through weed incursion and unrestricted livestock access.

Recommendations for the rehabilitation of Yaun Creek and waterways proposed to be retained have been made and are presented in Section 11 of this report.

9 Ecologically Significant Areas

This section provides a review and analysis of the results presented in the previous sections in the context of Matters of Environmental Significance at the Local, State and National levels.

Under the *City Plan*, matters of environmental significance include:

a) Matters of national environmental significance under the *Environmental Protection and Biodiversity Conservation Act 1999*, chapter 2, part 3, being:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements; and
- Commonwealth marine areas.

b) Matters of state environmental significance under the *State Planning Policy July 2017*, being:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992*;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004*;
- Areas within declared fish habitat areas that are management A areas or management B areas under the *Fisheries Regulation 2008*;
- Threatened wildlife under the *Nature Conservation Act 1992* and Special Least Concern animal under the *Nature Conservation (Wildlife) Regulation 2006*.
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
- Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
- Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
- Category R areas on the regulated vegetation management map;
- Areas of essential habitat on the essential habitat map for wildlife prescribed as 'endangered wildlife' or 'vulnerable wildlife' under the *Nature Conservation Act 1992*;
- Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse map;
- Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- High preservation areas of wild river areas under the *Wild Rivers Act 2005*;
- Wetlands in a wetland protection area or wetlands of high ecological significance shown on the Map of Referable Wetlands under the *Environmental Protection Regulation 2008*;
- Wetlands and watercourses in high ecological value waters as defined in the *Environmental Protection (Water) Policy 2009*, schedule 2; and
- Legally secured offset areas.

c) Matters of local environmental significance, being:

- Hinterland core habitat systems;
- Coastal wetlands and islands core habitat systems;
- Substantial remnants;
- Hinterland to coast critical corridors;
- Local significant species and their habitat;
- High priority vegetation;
- Medium priority vegetation;
- General priority vegetation;
- Natural waterways and wetlands and associated buffers;
- Conservation estate, being areas owned or managed by the Council for nature conservation purposes (including Conservation Area, Environmental Reserve, Bushland Reserve and General Reserve);
- Areas subject to a Voluntary Conservation Agreement with the Council or registered voluntary covenant (for ecological purposes);
- Areas subject to a Vegetation Protection Order under the Council's Local Law No. 6 – Vegetation Management or similar mechanism;
- Environmental corridors required to link matters of environmental significance;
- Areas that contain environmental offsets provided in accordance with Queensland Government offset policies; and
- Areas that are subject to a statutory covenant (for ecological purposes).

Table 9.1 provides a summary of the identified ecological values on the site, as defined in the above criteria, that will be impacted by the proposed development.

Table 9.1 Summary of Environmentally Significant Areas

Schedule of Environmentally Significant Areas	Present on Site
Matters of National Environmental Significance under the *Environmental Protection and Biodiversity Conservation Act 1999*, chapter 2, part 3	One MNES determined to occur on the site – Koala (listed as vulnerable under the EPBC Act)
Matters of State Environmental Significance under the *State Planning Policy July 2017*	MSES determined to occur on the site: • Koala (listed as vulnerable under the NCA).
Matters of Local Environmental Significance under the *City Plan* (Version 7)	MLES determined to occur on the site: • Medium priority vegetation; • General priority vegetation; • Natural waterways; and • Koala habitat.

Section 10 provides management and mitigation measures to limit the impacts on the matters of environmental significance occurring on the site.

10 Impact Assessment

As identified in the preceding section, matters of environmental significance (MES) on the site were identified. Based on field investigations and the latest plan of development, potential impacts to MES have been assessed and identified as:

- Impacts to Koala habitat;
- Impacts to general priority vegetation; and
- Impacts to a waterway.

The following sections discuss the impacts to those MES listed above in greater detail and provide clarification on how these impacts are to be avoided, mitigated and/or compensated within the proposed development.

10.1 Koala Habitat

Indirect evidence the vulnerable Koala was recorded during the fauna survey and based on activity levels, use the site on a transient basis.

10.1.1 Avoiding Impacts to Koala Habitat

Koala habitat will be conserved in situ within the proposed environmental area in the south-western corner of the site.

10.1.2 Minimising Impacts to Koala

There is potential that vegetation outside of the mapped Koala habitat may be used by this species on occasion. As such, an experienced Koala spotter-catcher should be present on-site during all clearing works. Any clearing should not commence until approval has been granted in writing from the spotter-catcher. This approval is valid only for the day it is given. Where more than one machine (e.g. bulldozer or excavator) is to be used during clearing operations, it is recommended that there is a minimum of one spotter-catcher per machine.

Clearing works are to be carried out such that Koalas can safely move between any retained habitat. Dispersing wildlife should be guided towards retained vegetation or patches of vegetation off-site through directional clearing.

Should a Koala be observed on the site during vegetation clearing, all works will temporarily cease within a range of 25 m from any tree occupied by a Koala. Works can recommence after the Koala has moved from the tree of its own volition.

During vegetation clearing operations, threats to Koalas are to be mitigated by:

a) Ensuring no tree in which a koala is present or a tree with a crown overlapping a tree containing a koala is cleared;
b) Undertaking clearing of vegetation in stages, and ensuring:
    i. No more than 1 ha is cleared per day for sites less than 6 ha in size;
    ii. No more than 2 ha is cleared per day for sites greater than 6 ha in size;
    iii. That between each stage there is at least 12 hours where no clearing occurs; and
    iv. Koala habitat is always linked to allow koalas to move out of the site;
c) Use of qualified koala spotters;
d) Prohibition of domestic dogs and security dogs on site; and

e) Use of koala safety fencing.

Connectivity to vegetated areas external to the site will be provided through the retention of bushland areas in the south-western corner of the site.

10.1.3 Compensating for loss of Koala Habitat

In accordance with the requirements of the City Plan (Part 8, Section 8.2.6), degraded areas of threatened species habitat will need to be rehabilitated. The rehabilitation is to include the removal of weed species.

10.2 Vegetation

The proposed development has been positioned to avoid or minimise impacts to matters of environmental significance. Nonetheless, the removal of some native vegetation is unavoidable. This vegetation is either unmapped or mapped as general priority vegetation under the City Plan or Category X vegetation under the VMA.

10.2.1 Avoiding Impacts to Medium Priority Vegetation

The proposed development has been planned so that all of the mapped medium priority vegetation will be retained in situ. The medium priority vegetation is within an area to be designated for conservation and managed accordingly.

10.2.2 Avoiding and Minimising Impacts to General Priority Vegetation

The proposed development avoids impacts to general priority vegetation to the greatest possible extent by utilising the cleared areas of the site. Much of the general priority vegetation will be conserved in situ within the environmental reserve in the south-western corner of the site.

10.2.3 Mitigating Impacts to Retained Vegetation

Tree protection fencing is to be erected prior to any vegetation clearing being undertaken, at the limits of the drip zone of all retained vegetation. Tree protection fencing is to clearly delineate the extent of clearing and is to be installed in accordance with Australian Standard *AS4970-2009: Protection of trees on development sites*.

Activities excluded within the tree protection zone include, but are not limited to:

- Construction of unapproved pathways/trails;
- Earthworks;
- Storage of machinery and/or vehicles;
- Dumping of site waste;
- Liquid disposal;
- Stockpiling of mulch/chipped material/soil;
- Refuelling of machinery;
- Wash down and cleaning of equipment;
- Lighting of fires;
- Unauthorised application of pesticides, herbicides or chemicals;
- Preparation of chemicals, including cement products; and
- Physical damage to the tree.

Signage is to be displayed on the tree protection fence clearly identifying the area as a Tree Protection Zone and indicating that no entry is permitted.

All work in areas adjacent to retained vegetation must be carried out without causing damage to the vegetation.

Where a protected tree's root zone and/or trunk could be damaged by the proposed earthworks, a qualified arborist should be contracted to:

- Provide advice regarding the protection of the tree/s;
- Treat any roots that may be exposed during construction; and
- Treat any damage that may occur during construction.

Any road surface treatment within the drip zone of retained vegetation must employ cold pour techniques to minimise any damage to the trees.

Root pruning with a high-pressure needle point water jet is to be undertaken prior to the installation of any root barriers.

Pruning of protected trees is to occur as only where determined necessary by a qualified arborist and any such work on the trunk, foliage, or root system of the tree must adhere to the Australian Standard *AS 4373-2007: Pruning of amenity trees*.

All felled timber must be recycled (milled, chipped or mulched). Where possible, chipped and mulched material is to be incorporated into the landscape features, batter stabilisation techniques or other approved site works.

Non-recyclable debris is to be transported from the site and disposed of at an approved green waste facility. Pit burning or any other method of combustion of vegetation is prohibited.

Any invasive weeds removed from the site are to be disposed of at an approved green waste facility.

10.3 Waterways

As noted in Section 6.7, mapped waterways were assessed for their condition and function. The following sections discuss the mitigation and management of impacts to each of these waterways.

10.3.1 Yaun Creek

Yaun Creek will be incorporated into an environmental reserve that will be managed for conservation. As noted in Section 6, Yaun Creek is degraded with evidence of bank slumping and weed incursion. The riparian zone along the length of Yaun Creek within the site will be rehabilitated. The southern bank of Yaun Creek will have an effective buffer in excess of 60 m through the inclusion of drainage and recreation reserves beyond the rehabilitated riparian zone. Part of the drainage reserve is within 30 m of Yaun Creek (refer to Figure 5.1). However, the bio-retention basins are located beyond 30 m from the creek.

10.3.2 Lot 189

The waterway within Lot 189 comprises a dam with overflow pathway. This waterway will become a drainage reserve, receiving and treating stormwater from the residential areas before it being released downstream through the residential development to the east.

10.3.3 Lot 191

The waterway in Lot 191 provides a fauna movement pathway to areas east of the site. This waterway will be largely incorporated into environmental reserve and appropriately buffered. The buffered riparian zone will be complemented by the provision of both recreation and drainage reserve.

To ensure movement pathways are maintained and reduce the incidence of vehicle strike, a fauna underpass will be created under the road.

10.3.4 Lot 192

The waterway on Lot 192 is heavily degraded and consists of a grassed swale that directs flow from one dam to another. In its current state, this waterway does not provide a fauna movement corridor or have any riparian vegetation communities.

Given its degraded nature, it is proposed that this waterway be realigned, with the water captured near environmental reserve in the south-western corner and directed through the site to a large drainage area on the western site boundary.

The realigned waterway corridor will be 15 m wide and rehabilitated to resemble a natural waterway. The water will flow to a drainage reserve where it will be treated prior to its discharge into a tributary of Yaun Creek.

The realignment and consequent reconstruction of this waterway will enable wildlife corridors to be created and enable water quality to be managed.

10.4 Environmental Areas

Impacts to MES that may not have been specifically address in the preceding sections, will be minimised through the provision of environmental areas. These areas are to be excluded from any future development and managed for conservation.

The environmental areas will enable the on-going protection of Koala habitat, of concern regional ecosystems, mapped medium priority vegetation and the site's waterways.

A management plan should be prepared to guide the environmental areas' protection and to direct any specific rehabilitation that may be required.

10.5 Rehabilitation

Field investigations have determined that the proposed environmental areas are degraded by weed incursion and vegetation clearing.

Fabrication along the realigned waterway and reconstruction in heavily degraded areas, coupled with assisted natural regeneration supported by weed control, will improve the condition of the riparian vegetation and retained bushland areas.

Where it is not deemed safe for hollow-bearing trees to be retained in the development, their loss will be offset within open space areas through the provision of nest boxes.

A Statement of Rehabilitation Intent has been prepared to support this development application (Biome, 2019).

11 Conclusions

This report has been prepared in accordance with the guidelines for preparing an ecological assessment provided in the planning scheme. The report includes the results of desk top assessments and a field survey.

One conservation significant species, Koala, was identified though indirect evidence (scats) as occurring on the site. Habitat for Koalas was identified within two of the vegetation communities present on the subject site Vegetation Community 1 – low *Acacia* forest and Vegetation Community 2 - Spotted Gum/Grey Ironbark open forest. Vegetation Community 2 is mapped as state regulated vegetation and is reflective of Least Concern Regional Ecosystem 12.11.5. These communities have been retained as Environmental Reserve public open space within the proposed development. This will ensure vegetation is protected and habitat connectivity to adjacent bushland is maintained. It will be rehabilitated to improve its existing ecological condition.

Direct impacts to Koalas as a result of the proposed development are expected to be minimal. However, indirect impacts to Koala due to disturbance from human activities, such as vehicle traffic, increased noise and increased risk of injuries from domestic animals may occur.

Clearing of isolated Koala food tree species will be necessary to facilitate the construction of new dwellings. The clearing of these trees and any habitat trees that cannot be retained, will be offset in the areas of the site to be rehabilitated.

Four mapped waterways are present on the site. All are degraded due to lack of riparian vegetation, dominance of weed species, livestock access, modification (for dams) and bank erosion. Two of these waterways (Yaun Creek and the waterway on lot 191) will be buffered and rehabilitated to enhance ecological values and habitat function.

The dam on lot 189 will be modified into a bioretention basin and incorporated into a drainage reserve.

The waterway on lot 192 will be realigned. In its current state, this waterway does not facilitate fauna movement, nor does it have riparian vegetation. Extensive rehabilitation is planned to recreate a natural-looking waterway that will function as a wildlife movement corridor and improve water quality in downstream receiving environments.

11.1 Specialist Reports and Requirements

All vegetation clearing should be guided by a Flora and Fauna Management Plan and be conducted under the supervision of a Department of Environment and Science approved fauna spotter-catcher.

It is recommended that a Rehabilitation Management Plan be prepared to improve the existing ecological condition of the vegetation included within the proposed environmental reserves and to guide the restoration and rehabilitation of waterways. To this end, a Statement of Rehabilitation Intent has been prepared by Biome to accompany the development application.

Areas of the development that are designated public open space will need to be managed in accordance with an Open Space Management Plan. Consequently, an Open Space Management Statement has been prepared to guide the design, management, construction and operational principles of the open space.

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Appendix A

Protected Matters Search Results

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

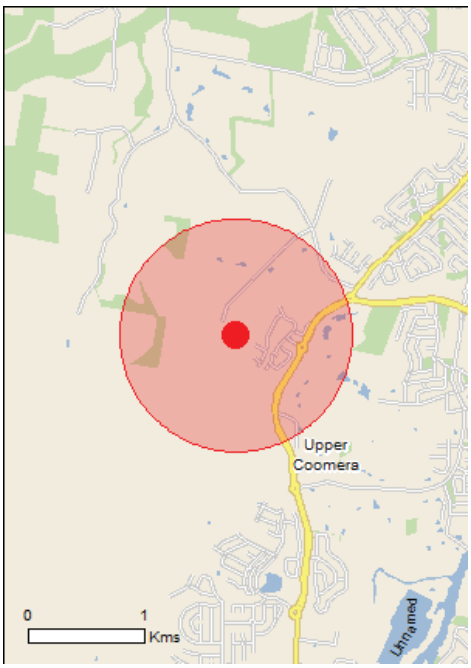
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 02/06/17 13:29:06

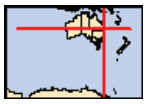
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	36
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	23
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Moreton bay	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Baloghia marmorata Marbled Balogia, Jointed Baloghia [8463]	Vulnerable	Species or species habitat likely to occur within area
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Corchorus cunninghamii Native Jute [14659]	Endangered	Species or species habitat likely to occur within area
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat may occur within area
Endiandra floydii Floyd's Walnut [52955]	Endangered	Species or species habitat likely to occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat likely to occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat may occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Sophora fraseri [8836]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Saiphos reticulatus Three-toed Snake-tooth Skink [88328]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-27.86969 153.27863

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix B

Wildlife Online Database Search Results

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: -27.8697
Longitude: 153.2786
Distance: 2
Email: Nadya.Lees01@gmail.com
Date submitted: Friday 02 Jun 2017 10:43:34
Date extracted: Friday 02 Jun 2017 10:50:03

The number of records retrieved = 140

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			1
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		1
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		1
animals	amphibians	Myobatrachidae	*Pseudophryne raveni*	copper backed broodfrog		C		1
animals	birds	Acanthizidae	*Acanthiza pusilla*	brown thornbill		C		2
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		2
animals	birds	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren		C		1
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		1
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		1
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		3
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		3
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		1
animals	birds	Ardeidae	*Bubulcus ibis*	cattle egret		C		3
animals	birds	Ardeidae	*Butorides striata*	striated heron		C		1
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		2
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		3
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		4
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		4
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		1
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		1
animals	birds	Cacatuidae	*Calyptorhynchus lathami lathami*	glossy black-cockatoo (eastern)		V		2
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		3
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		1
animals	birds	Campephagidae	*Coracina tenuirostris*	cicadabird		C		1
animals	birds	Charadriidae	*Charadrius ruficapillus*	red-capped plover		C		1
animals	birds	Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)		C		1
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		1
animals	birds	Climacteridae	*Cormobates leucophaea metastasis*	white-throated treecreeper (southern)		C		3
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		1
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		4
animals	birds	Columbidae	*Geopelia striata*	peaceful dove		C		3
animals	birds	Columbidae	*Streptopelia chinensis*	spotted dove	Y			1
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		2
animals	birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo		C		1
animals	birds	Estrildidae	*Neochmia temporalis*	red-browed finch		C		1
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		1
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		1
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		5
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		1
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher		C		1
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		2
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		3
animals	birds	Hirundinidae	*Petrochelidon nigricans*	tree martin		C		1
animals	birds	Jacanidae	*Irediparra gallinacea*	comb-crested jacana		C		1
animals	birds	Laridae	*Chroicocephalus novaehollandiae*	silver gull		C		1
animals	birds	Laridae	*Hydroprogne caspia*	Caspian tern		SL		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		2
animals	birds	Maluridae	*Malurus lamberti*	variegated fairy-wren		C		2
animals	birds	Maluridae	*Malurus cyaneus*	superb fairy-wren		C		1
animals	birds	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater		C		2
animals	birds	Meliphagidae	*Acanthorhynchus tenuirostris*	eastern spinebill		C		3
animals	birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater		C		4
animals	birds	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater		C		5
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		5
animals	birds	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater		C		1
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		2
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		3
animals	birds	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater		C		2
animals	birds	Meliphagidae	*Anthochaera chrysoptera*	little wattlebird		C		1
animals	birds	Meliphagidae	*Gavicalis fasciogularis*	mangrove honeyeater		C		1
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		4
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		C		3
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		4
animals	birds	Monarchidae	*Symposiachrus trivirgatus*	spectacled monarch		SL		1
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		1
animals	birds	Neosittidae	*Daphoenositta chrysoptera*	varied sittella		C		4
animals	birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird		C		2
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		2
animals	birds	Pachycephalidae	*Colluricincla megarhyncha*	little shrike-thrush		C		1
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		5
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		3
animals	birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler		C		5
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		5
animals	birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote		C		4
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			1
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		1
animals	birds	Petroicidae	*Petroica rosea*	rose robin		C		5
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		1
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		4
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		1
animals	birds	Phasianidae	*Coturnix ypsilophora*	brown quail		C		1
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		1
animals	birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe		C		1
animals	birds	Psittacidae	*Platycercus eximius*	eastern rosella		C		2
animals	birds	Psittacidae	*Alisterus scapularis*	Australian king-parrot		C		1
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		2
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		3
animals	birds	Psophodidae	*Psophodes olivaceus*	eastern whipbird		C		2
animals	birds	Rallidae	*Gallirallus philippensis*	buff-banded rail		C		1
animals	birds	Rallidae	*Porphyrio melanotus*	purple swamphen		C		3
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		7
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		5

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Scolopacidae	*Xenus cinereus*	terek sandpiper		SL		1
animals	birds	Scolopacidae	*Numenius minutus*	little curlew		SL		1
animals	birds	Scolopacidae	*Actitis hypoleucos*	common sandpiper		SL		1
animals	birds	Scolopacidae	*Calidris ruficollis*	red-necked stint		SL		1
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		V	V	1
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		E	CE	1
animals	birds	Sturnidae	*Sturnus vulgaris*	common starling	Y			1
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		2
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		2
animals	birds	Timaliidae	*Zosterops lateralis*	silvereye		C		2
animals	mammals	Dasyuridae	*Antechinus flavipes flavipes*	yellow-footed antechinus (south-east Queensland)		C		1
animals	mammals	Macropodidae	*Macropus rufogriseus*	red-necked wallaby		C		1
animals	mammals	Miniopteridae	*Miniopterus australis*	little bent-wing bat		C		1
animals	mammals	Muridae	*Melomys cervinipes*	fawn-footed melomys		C		1
animals	mammals	Muridae	*Rattus lutreolus*	swamp rat		C		1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		1
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		1
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		V	V	3
animals	mammals	Vespertilionidae	*Scotorepens orion*	south-eastern broad-nosed bat		C		1
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		1
animals	reptiles	Diplodactylidae	*Nebulifera robusta*	robust velvet gecko		C		1
animals	reptiles	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake		C		1
animals	reptiles	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake		C		1
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		1
animals	reptiles	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink		C		1
animals	reptiles	Scincidae	*Concinnia tenuis*	bar-sided skink		C		1
fungi	club fungi	Basidiomycota	*Leucoagaricus fimetarius*			C		1/1
fungi	club fungi	Basidiomycota	*Stropharia*			C		1/1
plants	higher dicots	Apocynaceae	*Parsonsia straminea*	monkey rope		C		1/1
plants	higher dicots	Fabaceae	*Tephrosia brachyodon var. longipes*			C		1/1
plants	higher dicots	Malvaceae	*Modiola caroliniana*	red-flowered mallow	Y			1/1
plants	higher dicots	Mimosaceae	*Mimosa pudica var. hispida*		Y			1/1
plants	higher dicots	Myrsinaceae	*Ardisia crenata*		Y			1/1
plants	higher dicots	Myrtaceae	*Eugenia uniflora*	Brazilian cherry tree	Y			1/1
plants	higher dicots	Myrtaceae	*Sannantha similis*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus curtisii*	Plunkett mallee		NT		1/1
plants	higher dicots	Myrtaceae	*Backhousia leptopetala*			C		1/1
plants	higher dicots	Passifloraceae	*Passiflora suberosa subsp. litoralis*		Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora edulis*		Y			1/1
plants	higher dicots	Phyllanthaceae	*Glochidion sumatranum*	umbrella cheese tree		C		1/1
plants	higher dicots	Rosaceae	*Rubus ellipticus*	yellow raspberry	Y			1/1
plants	higher dicots	Rubiaceae	*Opercularia diphylla*			C		1/1
plants	higher dicots	Rutaceae	*Murraya paniculata cv. Exotica*		Y			1/1
plants	higher dicots	Sapindaceae	*Cupaniopsis newmanii*	long-leaved tuckeroo		NT		1/1
plants	lower dicots	Lauraceae	*Endiandra floydii*			E	E	1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	lower dicots	Lauraceae	*Endiandra muelleri subsp. bracteata*			C		2/2
plants	lower dicots	Lauraceae	*Endiandra pubens*	hairy walnut		C		1/1
plants	monocots	Asparagaceae	*Asparagus falcatus*		Y			1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix C

Flora Recorded

Flora Recorded Onsite

Scientific Name	Common Name	Status
Acacia disparrima	Hickory Wattle	
**Ageratum houstonianum*	Blue Billygoat Weed	
Allocasuarina littoralis	Black She-oak	
Alphitonia excelsa	Red Ash	
**Amaranthus spinosus*	Red Amaranth	
**Ambrosia artemisiifolia*	Ragweed	RIP
**Anagallis arvensis*	Scarlet Pimpernel	
Aristida calycina	Dark Wire Grass	
**Asclepias curassavica*	Tropical Milkweed	
**Asparagus aethiopicus cv. Sprengeri*	Ground Asparagus	RIP
**Bidens pilosa*	Cobbler's Pegs	
Bothriochloa decipiens	Red Grass	
Breynia oblongifolia	Breynia	
Capillipedium spicigerum	Scented-top Grass	
Centella asiatica	Pennywort	
Chrysocephalum apiculatum	Yellow Buttons	
**Cinnamomum camphora*	Camphor Laurel	RIP
**Cirsium vulgare*	Scotch Thistle	
Clematicissus opaca	Small-leaved Water Vine	
**Conyza canadensis*	Canadian Fleabane	
**Conyza sumatrensis*	Tall Fleabane	
Corymbia citriodora	Spotted Gum	
Corymbia intermedia	Pink Bloodwood	
**Corymbia torelliana*	Cadaghi	
**Crassocephalum crepidioides*	Thickhead	
**Crotalaria incana*	Woolly Rattlepod	
**Crotalaria lanceolata*	Lance-leaved Rattlepod	
**Cupressus sempervirens*	Pencil Pine	
Cyanthillium cinereum	Cyanthillium	
Cymbopogon refractus	Barbed-wire Grass	
Cynodon dactylon var. dactylon	Common Couch	
Cyperus gracilis	Slender Flat Sedge	
**Cyperus papyrus*	Papyrus	
Digitaria divaricatissima	Umbrella Grass	
Eleocharis dulcis	Water Chestnut	
**Emelia sonchifolia*	Emelia	

Scientific Name	Common Name	Status
Entolasia stricta	Wiry Panic	
Eragrostis brownii	Brown's Lovegrass	
Eucalyptus carnea	Large-leaved White Mahogany	
Eucalyptus propinqua	Small-fruited Grey Gum	
Eucalyptus siderophloia	Grey Ironbark	
Eucalyptus tereticornis	Forest Red Gum	
Eustrephus latifolius	Wombat Berry	
Glycine clandestina	Twining Glycine	
Glochidion ferdinandi	Cheese Tree	
Glochidion sumatranum	Umbrella Cheese Tree	
**Gomphocarpus sp.*	Cotton Bush	
Goodenia rotundifolia	Goodenia	
Hovea acutifolia	Purple Pea Bush	
Hypericum gramineum	St. John's Wort	
**Hypochaeris radicata*	Flatweed	
Imperata cylindrica	Blady Grass	
**Jacaranda mimosifolia*	Jacaranda	
Jagera pseudorhus	Foambark Tree	
**Lantana camara*	Lantana	RIP
Lobelia purpurascens	White Root	
Lomandra confertifolia	A Mat Rush	
Lomandra longifolia	Spiny-headed Mat Rush	
Lomandra multiflora	Many-flowered Mat Rush	
Lophostemon confertus	Brush Box	
Lophostemon suaveolens	Swamp Box	
**Macrotyloma axillare*	Horse Gram	
Mallotus philippensis	Red Kamala	
**Megathyrsus maximus*	Guinea Grass	
Melaleuca quinquenervia	Broad-leaved Paperbark	
**Melinis minutiflora*	Molasses Grass	OIP
**Murraya paniculata*	Mock Orange	OIP
**Neonotonia wightii*	White Glycine	
**Nymphaea capensis*	Cape Waterlily	
**Oxalis corniculata*	Yellow Wood Sorrel	
**Oxalis debilis var. corymbosa*	Soursob	
Panicum effusum	Hairy Panic	
Panicum pygmaeum	Pygmy Panic Grass	

Scientific Name	Common Name	Status
Panicum simile	Two-coloured Panic	
Parsonsia straminea	Monkey Rope Vine	
**Paspalum dilatatum*	Paspalum	
Paspalum orbiculare	Ditch Millet	
**Passiflora edulis*	Passionfruit	
**Passiflora foetida*	Stinking Passion Flower	OIP
**Passiflora suberosa*	Corky Passionfruit	OIP
**Passiflora subpeltata*	White Passionflower	OIP
**Polygala paniculata*	Polygala	
**Phytolacca octandra*	Inkweed	
**Psidium guajava*	Yellow Guava	
Pteridium esculentum	Bracken Fern	
**Ravenala madagascariensis*	Traveller's Palm	
**Richardia brasiliensis*	White Eye	
Rubus moluccanus	Molucca Bramble	
Rumex brownii	Swamp Dock	
**Schefflera actinophylla*	Umbrella Tree	OIP
**Senecio madagascariensis*	Fireweed	RIP
**Senna pendula var. glabrata*	Easter Senna	OIP
**Setaria sphacelata*	Setaria	
**Sida cordifolia*	Flannel Weed	
**Sida rhombifolia*	Paddy Lucerne	
**Solanum chrysotrichum*	Giant Devil's Fig	
**Solanum mauritianum*	Wild Tobacco	OIP
**Solanum capsicoides*	Devil's Apple	
**Sphagneticola trilobata*	Singapore Daisy	RIP
**Sporobolus africanus*	Paramatta Grass	
Stephania japonica	Snake Vine	
**Syagrus romanzoffiana*	Cocos Palm	OIP
**Tagetes minuta*	Stinking Roger	
Typha orientalis	Bull Rush	
**Urena lobata*	Urena Burr	
**Verbena bonariensis*	Purple Top	
Wikstroemia indica	Bootlace Shrub	

Key (as per Qld *Biosecurity Act 2014*): **PIP**=Prohibited Invasive Plant; **RIP**=Restricted Invasive Plant; **OIP**=Other Invasive Plant

*=Non-endemic

Appendix D

Code Responses

City Plan code template

This code template supports the preparation of a development application against either the acceptable outcome(s) or performance outcome(s) contained in the code. Development assessment rules are outlined in **Section 5.3.3** of the City Plan.

Please note:

For assessment against the overall outcomes, refer to the appropriate code.

Impact assessable development requires assessment against the strategic framework prior to using this template.

8.2.6 Environmental significance overlay code

8.2.6.1 Application

This code applies to assessing all material change of use, reconfiguration of a lot and operational works (vegetation clearing, changes to ground level, infrastructure) for development on land identified in **Part 5.10 Levels of assessment** and containing the following mapped areas**:**

Overlay map	Mapped area
Environmental significance – Biodiversity areas	**Matters of State Environmental Significance** • Protected Areas **Matters of Local Environmental Significance** • Hinterland core habitat system; • Coastal wetlands and islands core habitat system; • Substantial remnants; • Hinterland to coast critical corridors.
Environmental significance – Priority species	**Matters of State Environmental Significance** • Koala habitat areas; and • State significant species. **Matters of Local Environmental Significance** • Local significant species.
Environmental significance – Vegetation management	**Matters of State Environmental Significance** • Regulated Vegetation. **Matters of Local Environmental Significance**

Overlay map	Mapped area
	• High priority vegetation; • Medium priority vegetation; and • General priority vegetation.

And for all land containing, sharing a property boundary with or within a defined buffer distance of, the following mapped areas:

Overlay map	Mapped area
Environmental significance – Wetlands and watercourses	**Matters of State Environmental Significance** • State significant aquatic systems • State significant wetlands **Matters of Local Environmental Significance** • Major watercourse; • Watercourse; • Local significant wetlands.

When using this code, reference should be made to **Section 5.3.2** and, where applicable, **Section 5.3.3,** in **Part 5**.

Note: Buffers are taken as the maximum distance applicable for the site and are not cumulative.

8.2.6.2 Purpose

(1) The purpose of the Environmental significance overlay code is to identify and protect matters of environmental significance and ensure that development is consistent with, and contributes to, the achievement of the objectives of the Nature Conservation Strategy.

(2) The purpose of the code will be achieved through the following overall outcomes:

(a) Matters of environmental significance are identified, protected in situ and enhanced to maintain flora and fauna diversity within:

(i) Hinterland core habitat systems;

(ii) Coastal wetlands and islands core habitat systems;

(iii) Substantial remnants; and

(iv) Hinterland to coast critical corridors.

(b) Degraded matters of environmental significance are protected and rehabilitated.

(c) High priority vegetation is protected in situ.

(d) Outside of Biodiversity Areas:

(i) Regulated, medium and general priority vegetation is maintained and disturbance is minimised.

(ii) Significant species and their habitat are identified, protected, enhanced and maintained.

(e) Wetlands, watercourses and their associated buffers (as prescribed in SO2) are protected and enhanced.

(f) Buffers are provided between matters of environmental significance and any proposed impacts.

(g) Appropriate tenure and management arrangements are provided for matters of environmental significance and their associated buffers.

(h) Where offsets are required, these are consistent with the *Environmental Offsets Act 2014*.

Editor's Note – in addition to the requirements of this planning scheme, obligations for the protection of matters of environmental significance are established by the Commonwealth and Queensland Government. Additional approvals or referrals may be required.

8.2.6.3 Criteria for assessment

Table 8.2.6-2: Environmental significance overlay code – for assessable development

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
Ecological site assessment			
PO1 All matters of environmental significance on and adjacent to the development site are identified and protected. **Note - An Ecological Site Assessment prepared in accordance with SC6.7 City Plan policy – Ecological site assessments, is Council's preferred method for addressing this performance outcome.**	**AO1** Proposed works do not impact on: (a) areas identified on **Environmental significance – vegetation management overlay map**; (b) buffers to wetlands and watercourses being: (i) 100m from the mapped boundary of a State significant aquatic area, as identified on **Environmental significance – wetlands and watercourse overlay map**; (ii) 100m from the outer landward boundary of a State significant wetland, as identified on Environmental significance – wetlands and watercourse overlay map; (iii) 100m from the outer landward boundary of a Local significant wetland, as identified on Environmental significance **– wetlands and watercourse overlay map**; (iv) 60m from the outer bank of a Major Watercourse identified on Environmental significance – wetlands and watercourse overlay map; or (v) 30m from the outer bank of a Watercourse identified on Environmental significance –	**COMPLIES WITH PO1** An ecological site assessment has been prepared for the site (this report). **COMPLIES WITH AO1 (a)** The proposed works do not impact on areas of environmental significance identified on the vegetation management overlay map. **COMPLIES WITH AO1 (b)(v)** A minimum 30 m buffer to Yaun Creek in the northern corner of the site will be achieved. This buffer will be revegetated and rehabilitated. The drainage channel in the south-eastern corner of the site will be revegetated to the Q100 flood line. This will provide a buffer width of approximately 10-40 m. This area will be incorporated into the public open space network. No recommendations for the buffer width of the drainage channel traversing Lot 192 have been made given its degraded nature, lack of existing native vegetation and lack of fauna connectivity. It is proposed that this drainage channel be filled to accommodate the residential development as is recommended in the Draft Concept Plan (GHD, 2017). **COMPLIES WITH AO1 (c)** All trees within the areas mapped on the priority species overlay will be retained. This area will be rehabilitated to improve its ecological function.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	wetlands and watercourse overlay map; and (c) individual trees within areas mapped on the **Environmental significance – priority species overlay map.**		
Biodiversity areas			
PO2 Development does not impact on Protected Areas as identified on the **Environmental significance– biodiversity areas overlay map.**	**AO2.1** No acceptable outcome provided.	**PO2 NOT APPLICABLE** No protected areas are mapped within the subject site.	
PO3 Development within the Hinterland to Coast Critical Corridors as identified on the **Environmental significance – biodiversity areas overlay map** is located and designed to: (a) provide corridors of sufficient dimensions and characteristics that will enable adequate movement of fauna through the site; (b) protect in situ matters of environmental significance and associated buffers; (c) protect in situ, vegetation identified on the **Environmental significance – vegetation management overlay map** and habitat for native flora and fauna; (d) link matters of environmental significance, existing corridors and/or conservation estate/reserves on adjacent properties; (e) maintain and improve upon the regional connectivity of the Hinterland to Coast Critical Corridors;	**AO3.1** No acceptable outcome provided.	**PO3 NOT APPLICABLE** The site does not fall within the Hinterland to Coast Critical Corridor.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
and (f) allow for the rehabilitation of disturbed, cleared or modified areas that form part of the Hinterland to Coast Critical Corridors. **Note : Recommendations provided in an ecological site assessment (prepared in accordance with SC6.7 City Plan policy – Ecological site assessments) are Council's preferred method for determining corridor dimensions.**			
PO4 Development within Hinterland Core Habitat Systems, Coastal Wetlands and Islands Core Habitat Systems and Substantial Remnant Areas as identified on the **Environmental significance – biodiversity areas overlay map** is located and designed to: (a) protect in situ matters of environmental significance and associated buffers; (b) protect in situ vegetation identified on the **Environmental significance – vegetation management overlay map** and habitat for native flora and fauna; and (c) allow for the rehabilitation of disturbed, cleared or modified areas.	**AO4** No acceptable outcome provided.	**PO4 NOT APPLICABLE** The site does not fall within the Hinterland Core Habitat Systems, Coastal Wetlands and Islands Core Habitat Systems and Substantial Remnant Areas.	
Wetland and watercourse			
PO5 Buffers are provided to wetlands and watercourses identified on the **Environmental significance – wetlands and watercourse overlay map** to ensure the:	**AO5.1** Buffers at least 100m wide are provided between the development and the mapped boundary of a State significant aquatic area, as identified on **Environmental significance – wetlands and watercourse overlay**	**AO5.1 NOT APPLICABLE** No State significant aquatic areas are mapped on the site.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
(a) protection of matters of environmental significance mapped onsite or identified through an ecological site assessment; (b) unimpeded movement of fauna along the watercourse; (c) water quality is maintained; (d) bank stability; and (e) protection of property and infrastructure. **Note: The buffer width for wetlands is measured from the outer, landward boundary of the mapped wetland, as shown on Environmental significance – wetland and watercourse overlay map.** **Note: Recommendations provided in an ecological site assessment (prepared in accordance with SC6.7 City Plan policy – Ecological site assessments) is Council's preferred method for determining alternative buffer widths.** **Note Artificial watercourses are to be addressed through the Coastal erosion hazard overlay code and map. Where a waterbody contains both natural and artificial banks, the natural banks are to be assessed in accordance with this performance outcome.**	**map**.		
	AO5.2 Buffers at least 100m wide are provided between the development and the outer landward boundary of a State significant wetland, as identified on **Environmental significance – wetlands and watercourse overlay map.**	**AO5.2 NOT APPLICABLE** No State significant wetlands are mapped on the site.	
	AO5.3 Buffers at least 100m wide are provided between the development and the outer landward boundary of a Local significant wetland as identified on the **Environmental significance – wetlands and watercourse overlay map.**	**AO5.3 NOT APPLICABLE** No local significant wetlands are mapped on the site.	
	AO5.4 Buffers at least 60m wide are provided between the development and the outer bank of a Major Watercourse as identified on the **Environmental significance – wetlands and watercourse overlay map**.	**AO5.4 NOT APPLICABLE** No major waterways are identified on the site.	
	AO5.5 Buffers at least 30m wide are provided between the development and the outer bank of a watercourse as identified on the **Environmental significance – wetlands and watercourse overlay map**.	**COMPLIES WITH AO5.5** A 30 m buffer to Yaun Creek in the north of the site will be achieved. The buffer will be revegetated and rehabilitated. The drainage channel in the south-eastern corner of the site will be buffered to the width of the Q100 flood line. The buffer width will be approximately 10-40 m. This will enhance riparian connectivity to the east. The drainage channel emanating from the south-western corner of the site will be modified. In its current state, it does not provide any fauna linkages for species that are not highly mobile, the vegetation along its length is	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
		dominated by pasture grasses and there is evidence of bank erosion. Buffers to the waterway/drainage channels are to focus on areas of the site where there are existing habitat linkages. It is proposed that the drainage channel north of and including the dam in Lot 192 be filled to accommodate the residential development, as is recommended in the Draft Concept Plan (GHD, 2017).	
Vegetation management			
PO6 Regulated vegetation is protected in situ when it is: (a) identified on the **Environmental significance – vegetation management overlay map**; and (b) within biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO6** Development does not impact on regulated vegetation.	**PO6 NOT APPLICABLE** No biodiversity areas are mapped on the site	
PO7 Development is designed to maintain regulated vegetation and minimise disturbance when it is: (a) identified on the **Environmental significance – vegetation management overlay map**; and (b) outside of biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO7** Development avoids impacts on regulated vegetation.	**COMPLIES WITH AO7** No state regulated vegetation will be impacted by the development. The regulated vegetation will be conserved and rehabilitated.	
PO8 High priority vegetation as identified on the **Environmental significance – vegetation management overlay map** is protected in situ.	**AO8** No acceptable outcome provided.	**PO8 NOT APPLICABLE** No high priority vegetation is mapped on the subject site.	
PO9	**AO9**	**PO9 NOT APPLICABLE**	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
Medium and general priority vegetation as identified on the **Environmental significance – vegetation management overlay map** within biodiversity areas as identified on the **Environmental significance –biodiversity areas overlay map** is protected in situ.	No acceptable outcome provided.	No biodiversity areas, as identified on the Environmental Significance – biodiversity areas overlay map are present on the subject site.	
PO10 Vegetation is protected when it is: (a) identified as medium priority vegetation on the **Environmental significance – vegetation management overlay map**; and (b) located outside the biodiversity areas identified on the **Environmental significance – biodiversity areas overlay map.**	**AO10** Vegetation is not damaged when it is: (a) identified as medium priority vegetation on the **Environmental significance – vegetation management overlay map**; and (b) located outside the **Environmental significance – biodiversity areas overlay map.** OR Where all attempts have been made to avoid and minimise damage to vegetation as stated above, any significant residual impact is offset consistent with the *Environmental Offsets Act 2014*, at a ratio of 3:1 (area) in accordance with **SC6.8 City Plan policy – Environmental offsets**. OR Damage to medium priority vegetation identified on the **Environmental significance – vegetation management overlay map** and located outside the biodiversity areas identified on the **Environmental significance – biodiversity areas overlay map** is for committed development.	**COMPLIES WITH P10 AND AO10** Medium priority vegetation is excluded from development and will be rehabilitated. This area will be included within the open space network on the site.	
PO11 Disturbance to vegetation is minimised	**AO11** Development avoids impacts on	**COMPLIES WITH PO11 AND AO11** Where possible, general priority vegetation is excluded	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
when it is: (a) identified as General priority vegetation on the **Environmental significance – vegetation management overlay map**; and (b) located outside the **Environmental significance – biodiversity areas overlay map**.	general priority vegetation. Any damage is minimised to the greatest extent possible.	from development. It will be rehabilitated where is occurs within the designated conservation reserve (environmental reserve) of the development or along waterways.	
PO12 Buffers are provided that protect the long term viability of high priority and regulated vegetation located on or adjacent to the site.	**AO12** Buffers at least 30m wide are provided between the development and any retained vegetation identified as high priority or regulated vegetation on the **Environmental significance – vegetation management overlay map** on or adjacent to the site.	**AO12 NOT APPLICABLE** No regulated or high priority vegetation is present on the site.	
Priority species			
PO13 Assessable koala feed and shelter trees are protected in situ when they are located: (a) in koala habitat areas as identified on the **Environmental significance – priority species overlay map**; and (b) within biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map**.	**AO13** Development does not impact on assessable koala feed and shelter trees.	**PO13 NOT APPLICABLE** No biodiversity areas are mapped on the subject site.	
PO14 Assessable koala feed and shelter trees are protected when they are: (a) in koala habitat areas as identified on the **Environmental significance – priority species overlay map**; and (b) outside biodiversity areas as identified on the **Environmental significance – biodiversity areas**	**AO14** Development avoids impacts on assessable koala feed and shelter trees. Any damage is minimised to the greatest extent possible.	**COMPLIES WITH PO14 AND AO14** Mapped koala habitat areas will be wholly within the environmental open space of the proposed development. Where isolated koala food trees exist outside of this area and where they cannot be retained, these trees will be offset in the rehabilitation areas.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
overlay map.			
PO15 Site design provides safe koala movement opportunities by incorporating measures to maintain connectivity between areas of koala habitat on and adjacent to the site. **Note :** *DEHP's Koala-Sensitive Design Guideline* **should be consulted for suitable measures to provide for safe koala movement.**	**AO15** No acceptable outcome provided.	**COMPLIES WITH PO15** The development has been designed so that connectivity with adjacent bushland areas is maintained. The rehabilitation of waterways on the site will increase connectivity to bushland to the north.	
PO16 During the clearing and construction phases, measures are incorporated to protect koalas from death or injury.	**AO16** Threats to koalas as a result of clearing and construction activities are mitigated by: (a) ensuring no tree in which a koala is present or a tree with a crown overlapping a tree containing a koala is cleared; (b) undertaking clearing of vegetation in stages, and ensuring: (i) no more than 1 ha is cleared per day for sites less than 6 ha in size; (ii) no more than 2 ha is cleared per day for sites greater than 6 ha in size; (iii) that between each stage there is at least 12 hours where no	**COMPLIES WITH PO16 AND AO16** No clearing will occur without a registered and experienced koala spotter catcher being present on the site. Best practice industry guidelines will be followed to ensure the impacts to all wildlife are minimised. Clearing and construction works will adhere to the conditions of AO16.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	clearing occurs; and (iv) koala habitat is always linked to allow koalas to move out of the site; (c) use of qualified koala spotters; (d) prohibition of domestic dogs and security dogs on site; and (e) use of koala safety fencing.		
PO17 State significant species, and their habitat, are protected in situ when it is: (a) identified on the **Environmental significance – priority species overlay map,** or through an ecological site assessment; and (b) within biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO17** Development does not impact on State significant species, and their habitat.	**PO17 NOT APPLICABLE** No biodiversity areas are mapped on the subject site.	
PO18 Development protects state significant species, and their habitat or is designed to minimise and mitigate impacts on habitat values when it is: (a) identified on the **Environmental significance – priority species overlay map**; and (b) outside of biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO18.1** Development avoids impacts on state significant species, and their habitat.	**COMPLIES WITH PO18 AND AO18.1** Mapped koala habitat areas will be wholly within the conservation reserve (environmental reserve) of the proposed development. Where isolated koala food trees exist outside of this area and where they cannot be retained, these trees will be offset in the rehabilitation areas.	
	AO18.2 Where development impacts on state significant species and their habitat, the following occurs: (a) flora species are propagated and used in rehabilitation and landscaping onsite; and (b) fauna species are safely relocated by a qualified fauna spotter catcher.	**COMPLIES WITH PO18 AND AO18.2 (b)** All vegetation clearing will be conducted under the guidance of a registered fauna spotter catcher. **AO18.2 (a) NOT APPLICABLE** No threatened flora species have been identified on the site.	

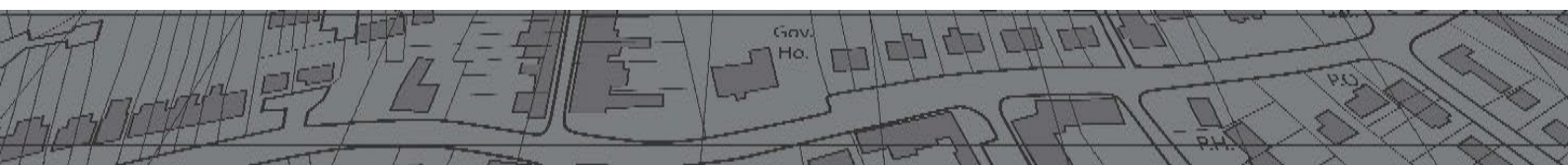
Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
PO19 Local significant species, and their habitat, are protected in situ when it is: (a) identified on the **Environmental significance – priority species overlay map,** or through an ecological site assessment; and (b) within biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO19** Development does not impact on local significant species, and their habitat.	**PO19 NOT APPLICABLE** No biodiversity areas are mapped on the subject site.	
PO20 Development protects local significant species, and their habitat or is designed to minimise and mitigate impacts on habitat values when it is: (a) identified on the **Environmental significance – priority species overlay map**; and (b) outside of biodiversity areas as identified on the **Environmental significance – biodiversity areas overlay map.**	**AO20.1** Development avoids impacts on local significant species, and their habitat.	**COMPLIES WITH PO20 AND AO20.1** Mapped habitat of locally significant species is excluded from the development footprint.	
	AO20.2 Where development impacts on local significant species and their habitat, the following occurs: (a) flora species are propagated and used in rehabilitation and landscaping onsite; and (b) fauna species are safely relocated by a qualified fauna spotter catcher.	**AO20.2 (a) NOT APPLICABLE** No locally significant flora species have been identified on the site. **COMPLIES WITH AO20.2 (b)** All vegetation clearing will be conducted under the guidance of a registered fauna spotter catcher.	
Fauna management			
PO21 Development design and location provides for the safe movement of native fauna through the site.	**AO21** Where infrastructure crosses native fauna movement paths, the design of new development incorporates fauna friendly movement solutions. **Note: Fauna friendly movement solutions developed in accordance with the** *Queensland Government Fauna Sensitive Road Design Manual Volume 2: Preferred Practices; and the QLD Government Koala-Sensitive Design Guidelines* **is Council's preferred method for**	**COMPLIES WITH PO21 AND AO21** The development design incorporates rehabilitated riparian areas that will facilitate the safe movement of wildlife through the site and to neighbouring habitat. Reduced speed limits and traffic calming devices will be installed where necessary to limit wildlife vehicle strike.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
	addressing this outcome.		
PO22 Where fauna habitat is proposed to be damaged, management strategies must be implemented to ensure: (a) the native fauna is safely relocated to an area of similar habitat; (b) the sequence of habitat disturbance ensures that fauna is not isolated from adjoining areas of habitat; (c) fauna relocation occurs immediately prior to habitat disturbance; (d) accredited and experienced spotter catchers, licensed by the Queensland Parks and Wildlife Service, are to be present on the site to direct and undertake the removal and relocation of fauna; and (e) where possible, damaged habitat and nesting sites are rehabilitated outside of development areas. **Note: A Fauna Management Plan prepared by a suitably qualified person is Council's preferred method for addressing this outcome.**	**AO22** No acceptable outcome provided.	**COMPLIES WITH PO22** No clearing will occur without a registered and experienced koala spotter catcher being present on the site. Best practice industry guidelines will be followed to ensure the impacts to all wildlife are minimised. Clearing and construction works will adhere to the conditions of PO22. A fauna and flora management plan will be prepared for the site to guide vegetation clearing and mitigate impacts to flora and fauna on site and in adjacent areas.	
Tenure, ownership and management arrangements			
PO23 Matters of environmental significance and associated buffers, mapped areas as identified on the **Environmental significance – vegetation management overlay map** proposed for retention and areas requiring rehabilitation are suitably protected in perpetuity and will: (a) enable necessary fire management in accordance with an approved fire	**AO23** Matters of environmental significance and associated buffers, mapped areas as identified on the **Environmental significance – vegetation management overlay map** proposed for retention and areas requiring rehabilitation are transferred to Council ownership as Public Open Space. OR	**COMPLIES WITH PO23** Areas of environmental significance (koala habitat and medium priority vegetation areas) are to be retained within the conservation reserve (environmental reserve) open space of the proposed development. Public open space areas will be transferred to Council ownership.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
management plan and any adopted bushfire management plan; (b) allow unimpeded movement of native fauna through matters of environmental significance and associated buffers; (c) enable maintenance access and regular management; (d) enable auditing and reporting of maintenance and management activities; (e) provide for public access along major watercourses, where such access is consistent with the ecological functions; (f) allow for linkages and buffers to adjacent areas of ecological significance; and (g) allow for a coordinated approach to the management of adjacent areas of conservation estate.	Where not required for public access, matters of environmental significance and associated buffers, and mapped areas as identified on the **Environmental significance – vegetation management overlay map** proposed for retention and areas requiring rehabilitation are retained in private ownership and protected under a statutory covenant (under the *Land Title Act 1994*). **Note: Where the area is adjacent to existing public open space, or is a buffer to a major waterway, Council's preference is for the land to be dedicated as Public Open Space.**		
PO24 An Open Space Management Plan prepared in accordance with **SC6.10 City Plan policy – Landscape work** is prepared for areas to be dedicated to Council as Public Open Space.	**AO24** No acceptable outcome provided.	**WILL COMPLY WITH PO24 VIA CONDITIONS** An Open Space Management Plan will be prepared for the site for areas designation public open space.	
PO25 A Covenant Management Plan is prepared for areas to be protected under a statutory covenant. The management plan must include the following details: (a) rehabilitation area and strategy of works; (b) weed eradication and control requirements;	**AO25** No acceptable outcome provided.	**PO25 NOT APPLICABLE** No areas of the proposed development will be protected under a statutory covenant. Public open space will be transferred to Council ownership.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**	Internal use
(c) how the covenant area will be maintained and managed in perpetuity; (d) feral and domestic animal exclusion requirements; and (e) required maintenance access.			
Rehabilitation			
PO26 Disturbed, cleared or modified areas are rehabilitated where they form part of: (a) an ecological corridor; or (b) matters of environmental significance and associated buffers; or (c) areas identified within an Ecological Site Assessment as requiring rehabilitation. **Note : A Rehabilitation Management Plan prepared in accordance with the** *South East Queensland Ecological Restoration Framework* **is Council's preferred method for addressing this outcome.**	**AO26** No acceptable outcome provided.	**WILL COMPLY WITH PO26 VIA CONDITIONS** Environmentally significant areas on the site will be rehabilitated, as will riparian zones along the waterway and drainage channel where connectivity external to the site persists. To guide the rehabilitation procedures, a Rehabilitation Management Plan will be prepared.	

ATTACHMENT 2
Statement of Landscape Intent



ZLA

GALLERY
DEVELOPMENTS

79-99 COURTNEY DRIVE

UPPER COOMERA, QLD

PROJECT REFERENCE L19124

SLI.

REVISION **A** | NOVEMBER **2019**

GOLD COAST
1638 TWEED STREET, BURLEIGH HEADS QLD 4220
PO BOX 3805, BURLEIGH TOWN QLD 4220

GLADSTONE
2/172 GOONDOON ST, GLADSTONE, QLD 4680
PO BOX 5332, GLADSTONE QLD 4680 | PH 07 4972 3831

ADMIN@ZONELANDSCAPE.COM.AU

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1.0
Site Analysis.

Site Analysis

1.1 Project Description

188-192 Courtney Drive, Upper Coomera

Statement of Landscape Intent

Site Information:

The subject site consists of (5) lots totaling approximately 188,490m^2 of land within Division 1 of the City of Gold Coast comprising of lots:

- Lot 188 on RP173728 (79 Courtney Drive, 30,790m^2)
- Lot 189 on RP173728 (89 Courtney Drive, 30,340m^2)
- Lot 190 on RP173728 (91 Courtney Drive, 30,950m^2)
- Lot 191 on RP173728 (97 Courtney Drive, 30,390m^2)
- Lot 192 on RP173728 (99 Courtney Drive, 30,020m^2)

The land is currently zoned as the following:

- Rural
- Rural Residential
- Rural Landscape & Environmental Precinct

The following City of Gold Coast City Plan Overlay Maps impact the site:

- Bushfire Hazard
- Dwelling House
- Environmental Significance - Vegetation Management
  - Vegetation Management
- Environmental Significance - Wetlands & Watercourse
  - Natural Watercourse Line
  - Watercourse 30m Buffer Area
- Landslide Hazard

Design Intent:

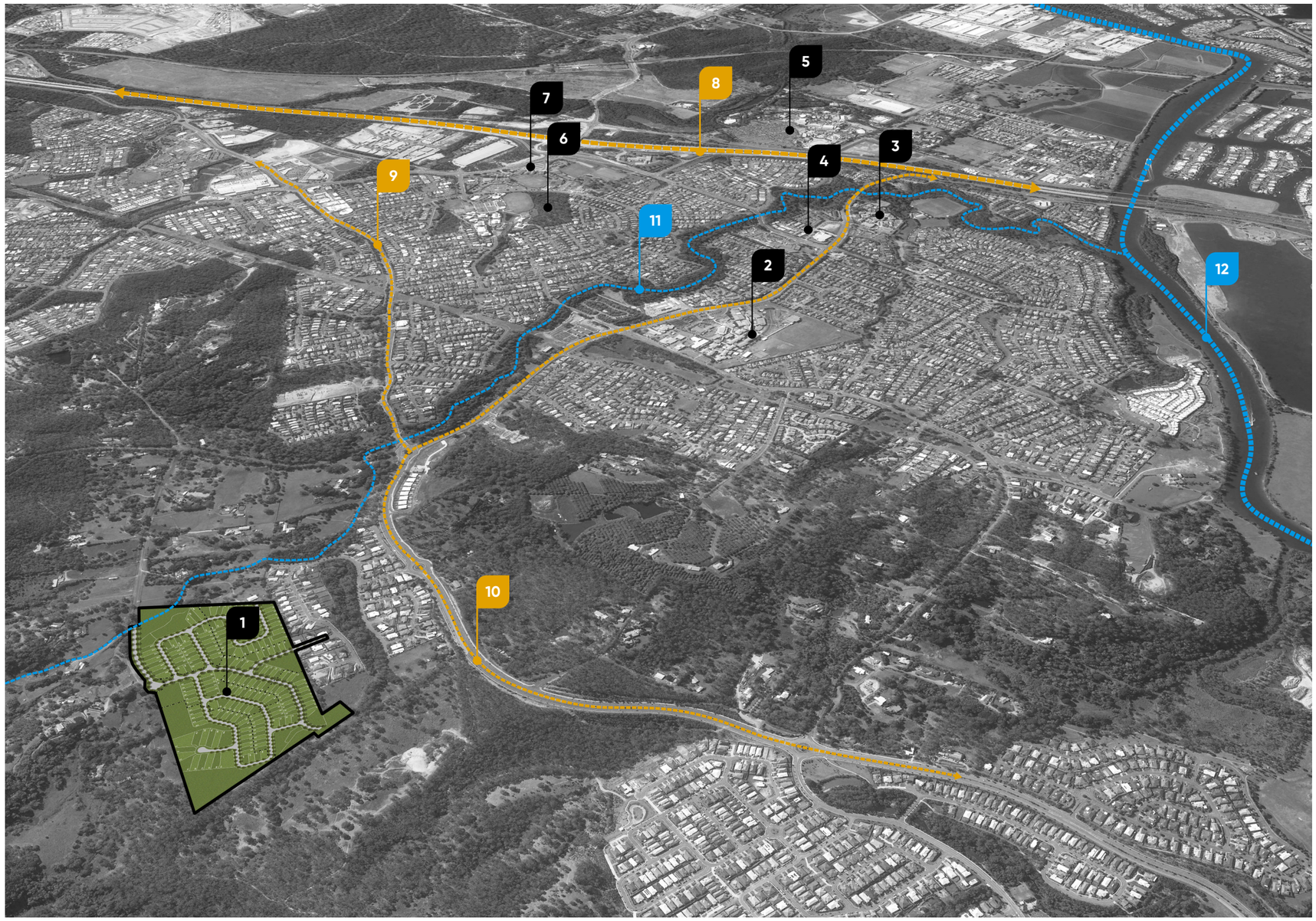
The landscape concept for proposed residential development is based on the surrounding context, response to the proposed urban and civil layout, and the desired outcomes of the City of Gold Coast City Plan.

The design intent is to contribute positively to the image, identity and character of Upper Coomera by providing a contemporary, sensitive and appropriate landscape environment.

The key landscape elements comprise:

- Provide leafy streets
- Connect and link open space typologies to create an interconnected and diverse open space character
- High quality recreation open space interconnected with environmental open space corridors
- Shaded playground and recreation pathways within green open space
- Assisted natural regeneration of environmental open spaces
- A contemporary textually appropriate softscape planting palette which includes a variety of native plant species
- Creating a safe and accessible space, characterised by open sight lines
- Integration of water sensitive urban design elements into residential layout

Landscape Intent to be read in conjunction with Open Space Management Report prepared by Biome Consulting.



Legend

1. Subject Site (77-99 Courtney Drive)
2. Upper Coomera State College
3. Saint Stephens College
4. Upper Coomera Library & Aquatic Centre
5. Dream World
6. Assisi Catholic College
7. Coomera Anglican College
8. Pacific Motorway
9. Old Coach Road
10. Reserve Road
11. Yuan Creek
12. Coomera River

Site Analysis

1.2 Site Context

2.0

Landscape Design.

Legend

1. Recreational Open Space
2. Environmental Open Space
   30m Yaun Creek Buffer
   Assisted Natural Regeneration
   Refer Environmental report for details
3. Proposed Environmental Open Space
   Assisted Natural Regeneration
   Refer Environmental report for details
4. Proposed Bio Basin & Batters
   Refer Stormwater Management Report
5. Adjacent Properties
6. Bushfire Management Buffer Zone
   Refer Bushfire Report

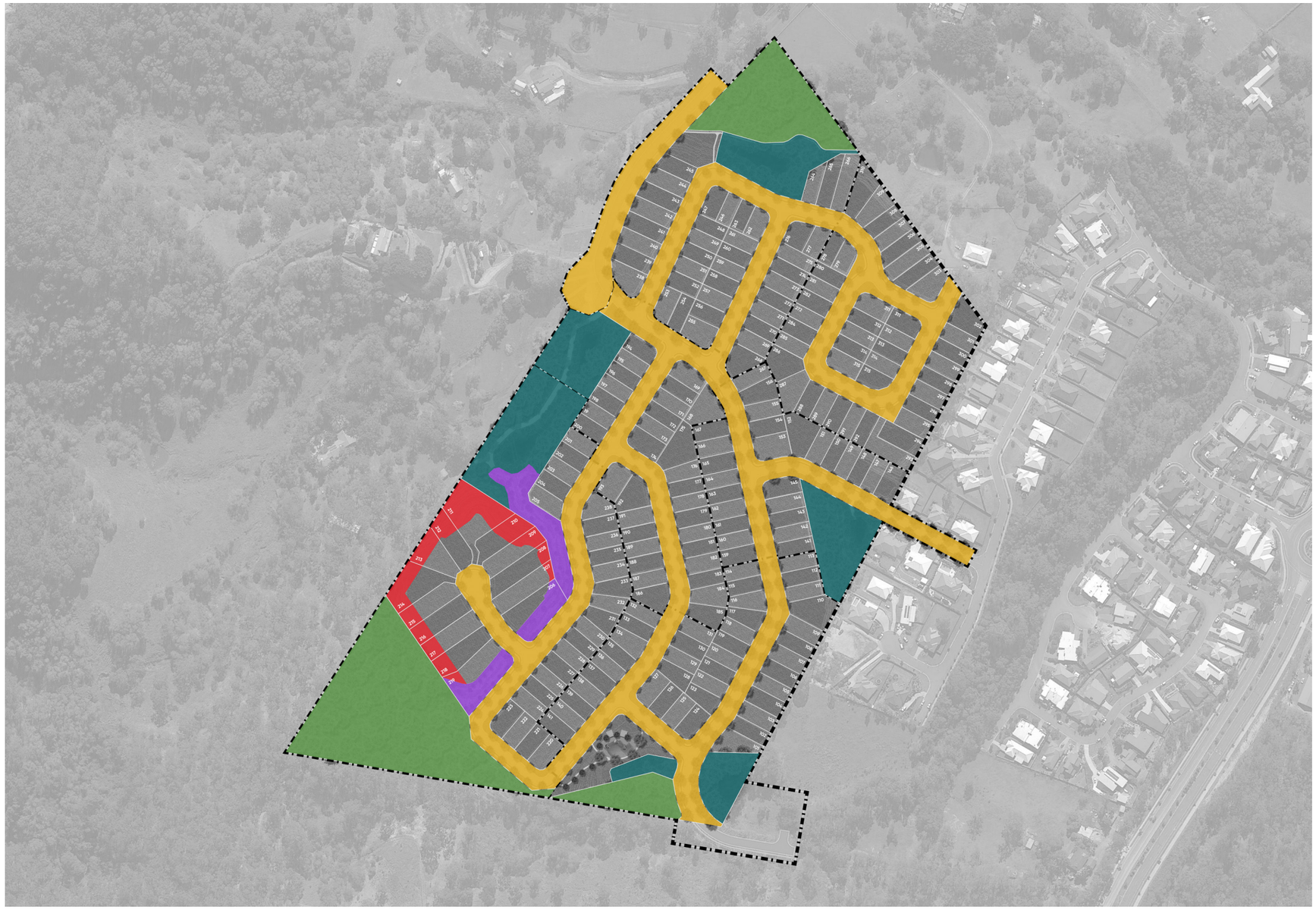
Landscape Design

2.1 Landscape Masterplan

0M 30M 60M 90M 120M

N

November 2019



Legend

Street Tree Planting

Street tree planting to CoGC standards. The streets to feature a range of broadleaf species to establish a strong estate theming and character. Refer Street Tree Planting Page 9 for species and typical setout.

Environmental Areas

Refer Environmental Report (Biome) for details on treatment of these areas.

Bio-Retention Basins & Batters

Bio Retention basins and batters are to be treated with species identified with CoGC LDG Section 13 and WBD Guidelines. Refer also Bio Basin Planting palette Page 23 for proposed species. Refer Storm Water Management Report for Basin Design.

Fire Buffer Area (13m)

13.0, wide bushfire setback as per Bushfire Report. Planting treatment (densities and species selection) to these areas is to reflect best practice for limiting fuel . Fire suitable species palette is provided Page 24. Refer Bushfire Report for more details on acceptable outcomes for this area.

Rock Lined Swale

Area to be treated with rock lined swale with scattered planting throughout the base and larger tree plantings to the swales edge. Placement of larger rocks external to low flow to act as energy dissipaters and also protect copses of trees within this zone. Planting to this area is to ensure nil impedance to low flow channel and to maintain bushfire safe buffers to adjoining dwellings.

Landscape Design

2.2 Landscape Planting Zones

0M 30M 60M 90M 120M

Legend

1 Primary Street Tree
Melaleuca linariifolia (Flying Paperbark)
Flindersia brayleyana (QLD Maple)

2 Secondary Street Tree
Tristaniopsis laurina (Water Gum)
Harpulia pendula (Tulipwood)

3 Tertiary Street Tree
Cupaniopsis anacardiodes (Tuckeroo)
Buckinghamia celsissima (Ivory Curl)

Melaleuca linariifolia (Flying Paperbark)

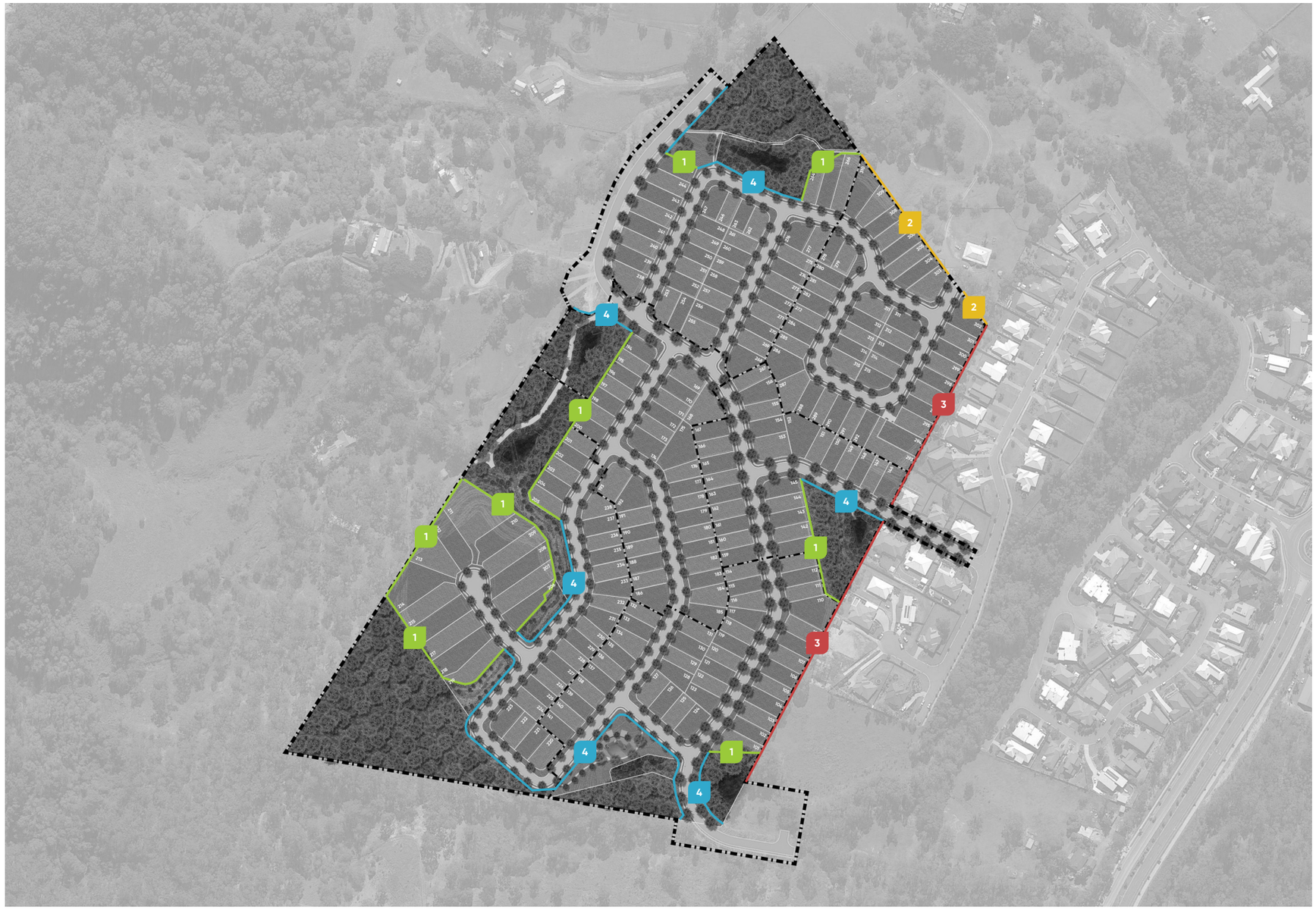
Tristaniopsis laurina (Water Gum)

Cupaniopsis anacardiodes (Tuckeroo)

Landscape Design

2.3 Street Tree Planting

0M 30M 60M 90M 120M



Legend

1. 50% Transparent POS Interface
2. Proposed 1.8m Good Neighbour Fencing
3. Existing 1.8m Good Neighbour Fencing
4. Standard Council Bollard Line 1.5m Centres

Landscape Design

2.4 Fencing & Bollard Locations

0M 30M 60M 90M 120M

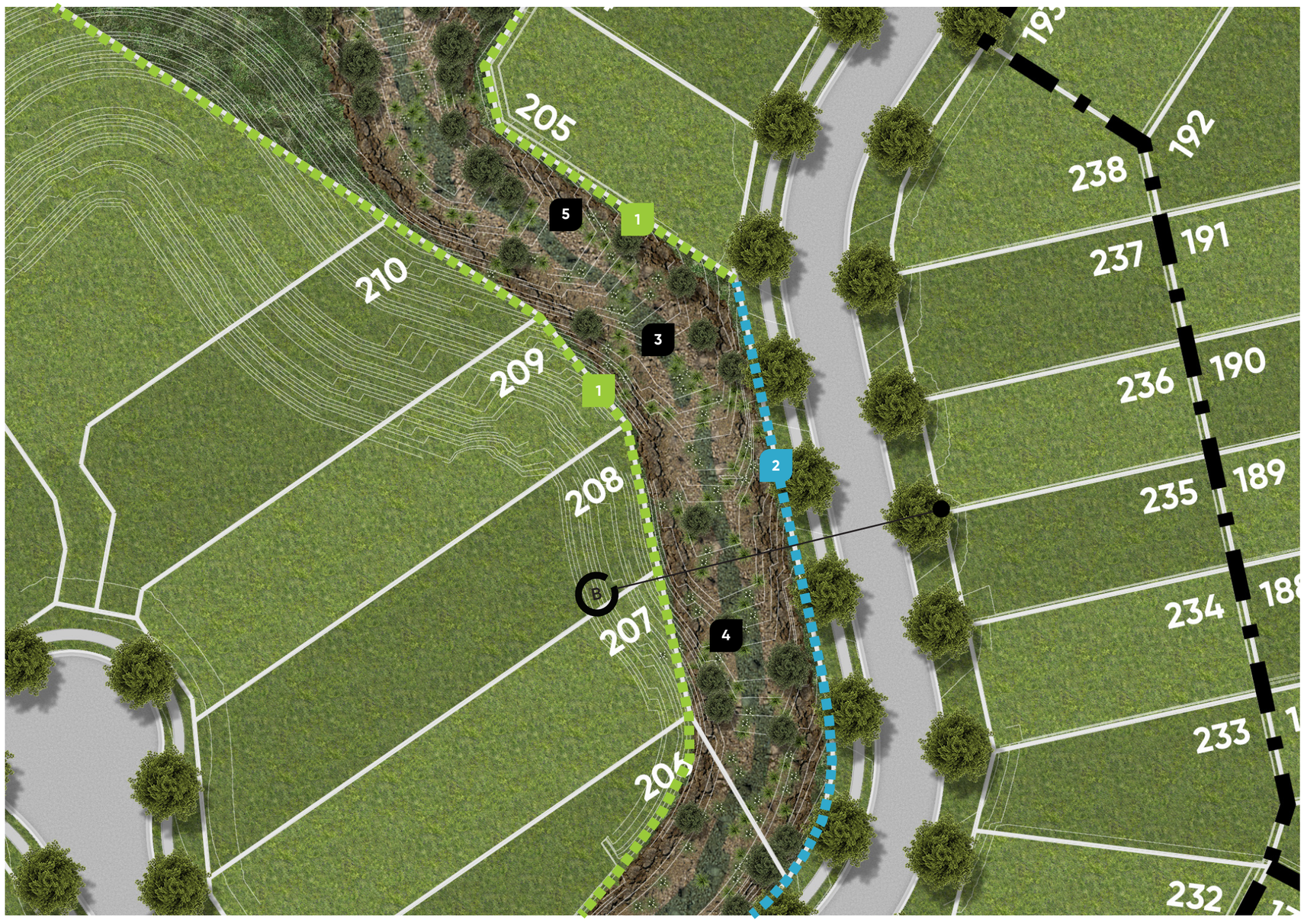
Legend

1 1.2m Wide Brushed Concrete Footpath

Landscape Design

2.5 Footpath Location Plan

0M 30M 60M 90M 120M



Legend

1. 50% Transparent POS Interface
2. Standard Council Bollard Line 1.5m Centres
3. Area to be treated with rock lined swale with scattered planting throughout the base and larger tree plantings to the swales edge. Planting at densities recomended by the Bushfire Report to maintain bushfire safe buffers to adjoining dwellings.
4. Low ground cover species ex. Gahnia sp. to ensure nil impedance to low flow channel .
5. Edges of swale to be constructed from larger rock formations for a natural aesthetic. Top of batter where space allows to be planted with larger broadleaf species ex Melalueca sp. or Casuarina sp. Placement of larger rocks external to low flow to act as energy dissipaters and also protect copses of trees within this zone. Planting to this area is to ensure nil impedance to low flow channel and to maintain bushfire safe buffers to adjoining dwellings. Example imagery provided below.

Refer Environmental Management Report for more details on the treatment of this area. Refer Section B for more details on this location.

Example Image of Rock Lined Swale

Landscape Design

2.6 Natural Rock Lined Swale

0M 15M 30M

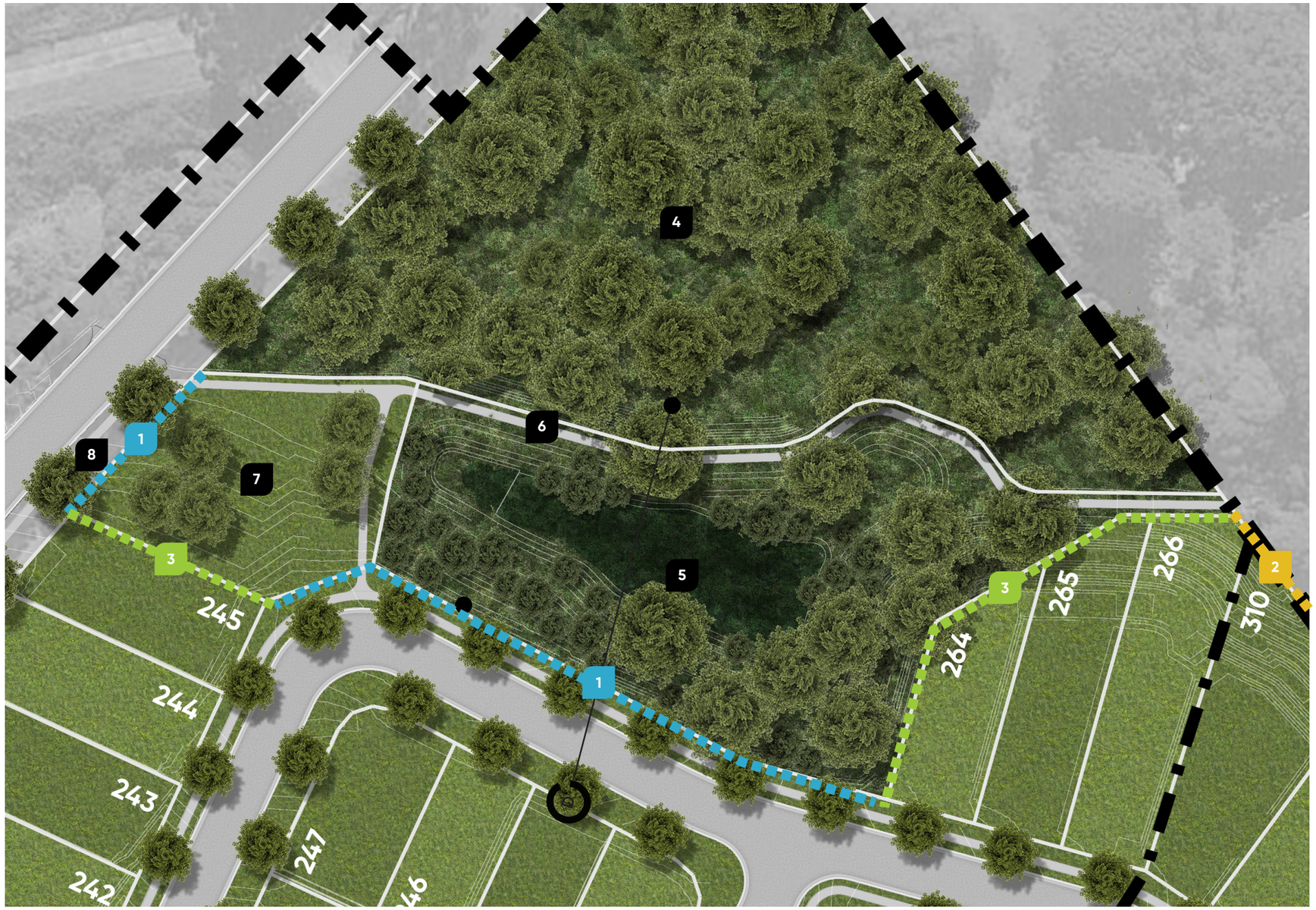
Legend

1. Standard Council Bollard Line 1.5m Centres
2. Existing 1.8m Good Neighbour Fencing
3. 50% Transparent POS Interface
4. Environmental Area - Refer Report (Biome) for details on treatment of these areas.
5. Bio Retention basins and batters are to be treated with a suitable palette for the basins and the stabalisation of the batters. Refer Bio Basin Planting palette this document for information on proposed species. Refer Storm Water Management Report for Basin Design.
6. 1.2m wide brushed concrete footpath to recreational open space and perimeter.
7. Proposed shaded playground comprising large feature climbing structure, swing set etc. Mulch softfall to base and skillion shelter / seating provided.
8. Street front access control comprising of timber bollards and maintenance access gate.

Landscape Design

2.7 Recreational Open Space

0M 15M 30M



Legend

1. Standard Council Bollard Line 1.5m Centres
2. Proposed 1.8m Good Neighbour Fencing
3. 50% Transparent POS Interface
4. Environmental Area - Refer Report (Biome) for details on treatment of these areas.
5. Bio Retention basins and batters are to be treated with a suitable palette for the basins and the stabalisation of the batters. Refer Bio Basin Planting palette this document for information on proposed species. Refer Storm Water Management Report for Basin Design.
6. 1.2m wide brushed concrete footpath to recreational open space and perimeter.
7. Large open turf 'Kick-a-bout' area is proposed to secondary recreational open space area. Pathway through POS allows connections through the site as well as connections through to future adjoining developments.
8. Street front access control comprising of timber bollards and maintenance access gate.

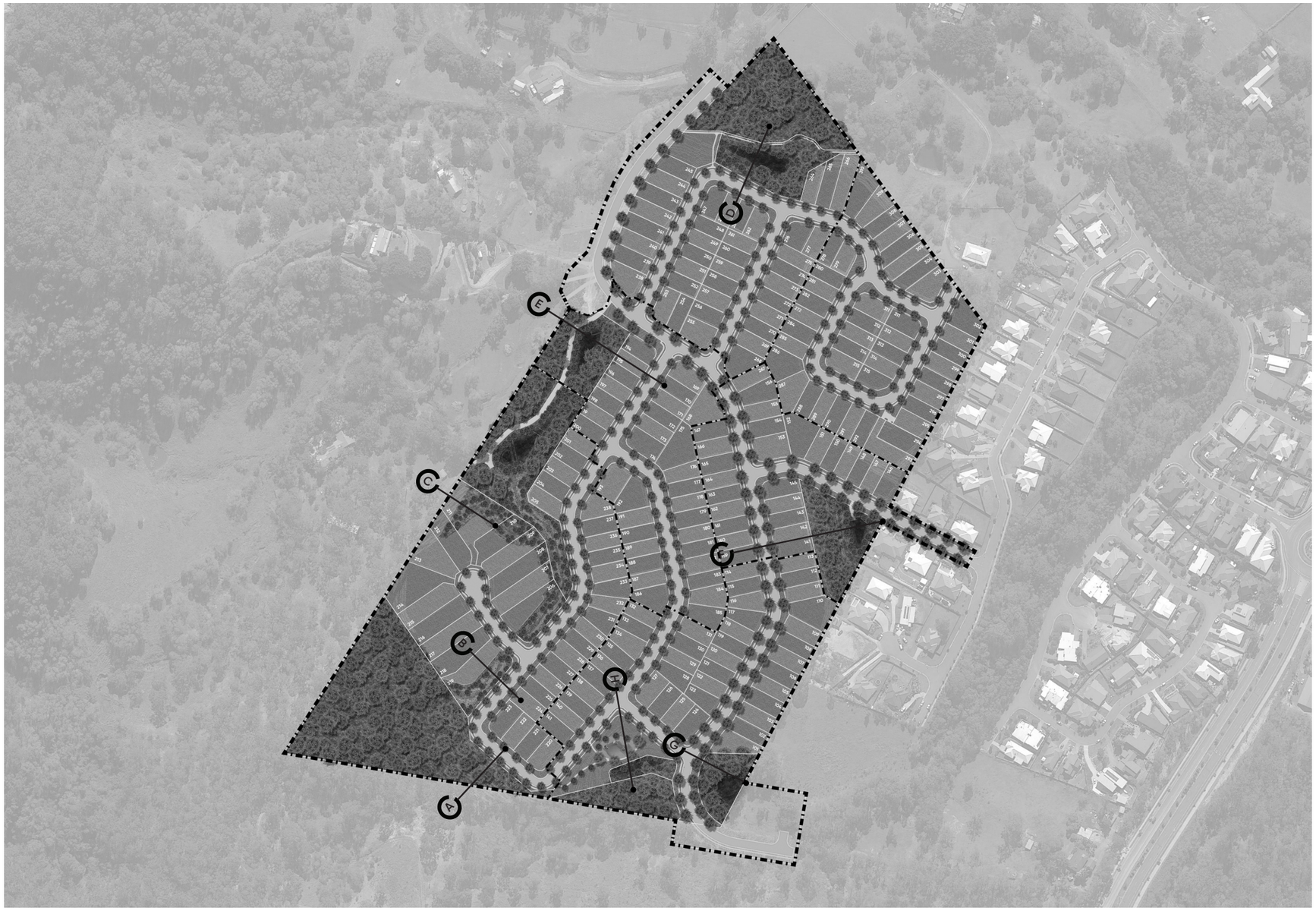
Landscape Design

2.8 Recreational Open Space

0M 15M 30M

3.0

Sections & Elevations.



Legend

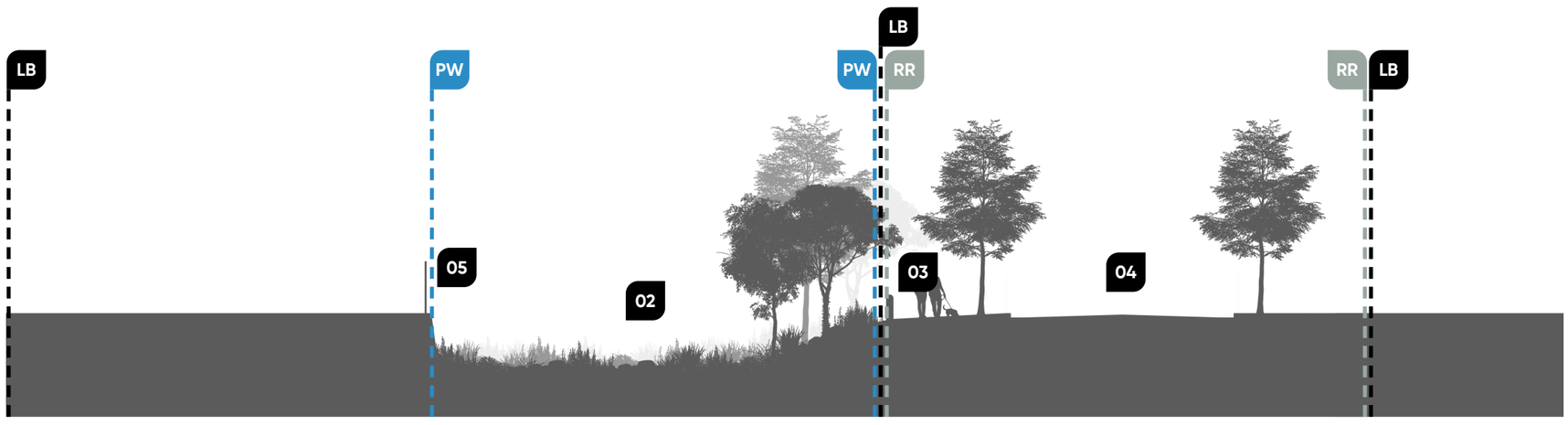
- A 3.2 Section A | PG 17
- B 3.2 Section B | PG 17
- C 3.3 Section C | PG 18
- D 3.3 Section D | PG 18
- E 3.4 Section E | PG 19
- F 3.4 Section F | PG 19
- G 3.5 Section G | PG 20
- H 3.5 Section H | PG 20

Sections & Elevations

3.1 Section Locations

0M 30M 60M 90M 120M

Section A | Lot 1008 (Environmental) & Road 3 Section



Section B | Lot 218 / Private Waterway & Road 3 Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Environmental reserve area. Refer Environmental Report for details.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

05 Proposed retaining wall to Private Waterway. 50% transparent interface fencing to top of wall.

Sections & Elevations

3.2 Sections

Section C - Lot 210 Fire Buffer & Batter Section

Section D | Road 07 & Lot 1010 (Drainage) Basin & Environmental Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Environmental reserve area. Refer Environmental Report for details.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

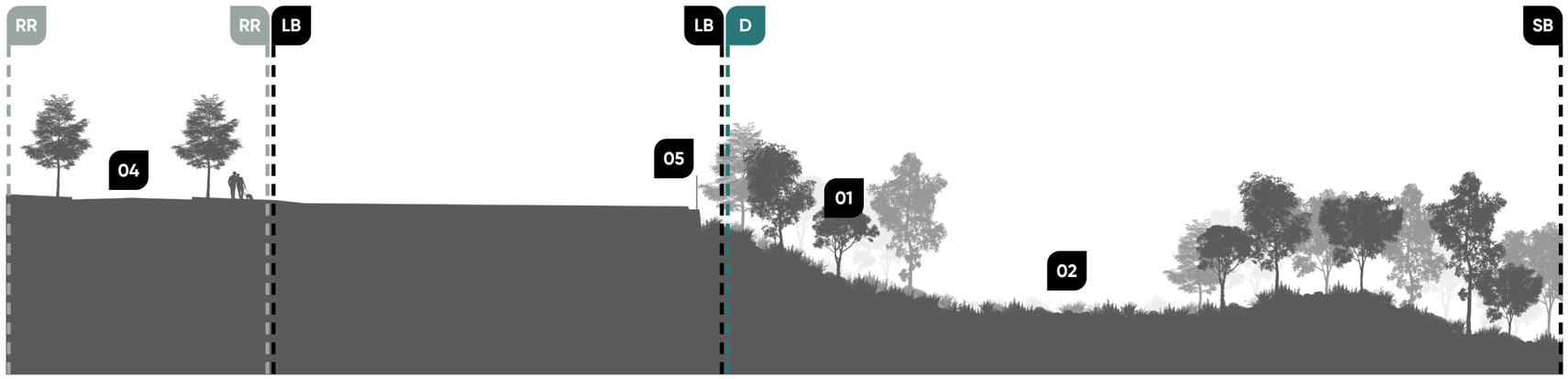
03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

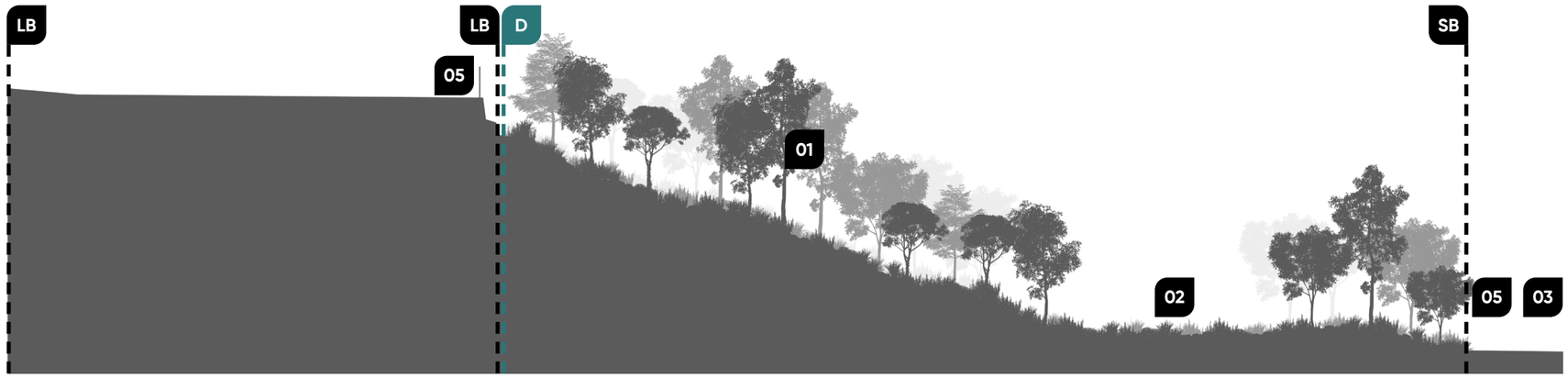
05 13m Bushfire Setback area. Minimal planting to this zone. Refer Bushfire Report for details.

Sections & Elevations

3.3 Sections



Section E | Road 03 & Lot 1006 (Drainage) Basin Section



Section F | Lot 141 & Lot 1005 (Drainage) Basin Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Batter Planting to Lot / Bio Basin Batter Interfaces. Refer Planting Palette.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Adjoining Lot

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

05 Proposed retaining wall to Private Waterway. 50% transparent interface fencing to top of wall.

Sections & Elevations

3.4 Sections

Section G | Road No 1, Lot 1001 & Lot 1005 (Drainage) Basin Section

Section H | Road 3, Lot 1004 (Recreation) & Lot 1003 (Drainage) Basin Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Batter Planting to Lot / Bio Basin Batter Interfaces. Refer Planting Palette.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

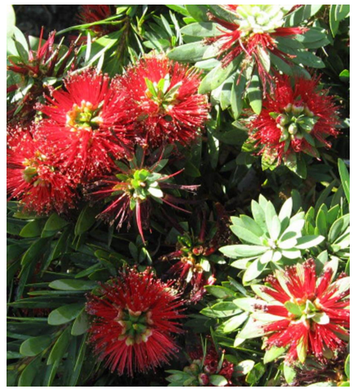
05 Open Space / Recreation area. Playground climbing equipment with meandering footpaths.

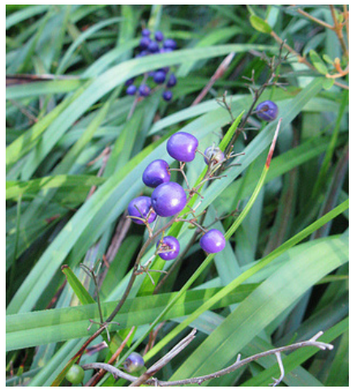
Sections & Elevations

3.5 Sections

4.0

Design Details.





Trees

1	Cupaniopsis anacardiodes	Tuckeroo
2	Tristaniopsis laurina	Water Gum
3	Callistemon viminalis	Bottlebrush
4	Casuarina equisetifolia	Coastal She-Oak
	Corymbia maculata	Spotted Gum
	Elaeocarpus grandis	Blue Quandong
	Grevillea robusta	Water Gum
	Lophostemon confertus	QLD Brush Box
	Melaleuca linarifolia	Flying Paperbark

Shrubs & Strappy Plants

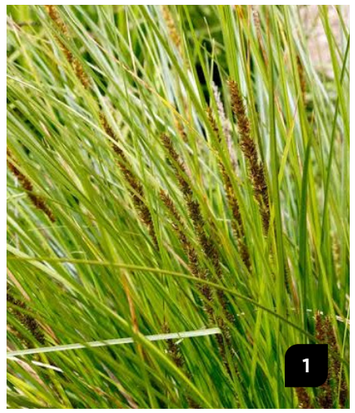
5	Callistemon 'Little John'	Karuri Pine
6	Cordyline 'Rubra'	Red Palm Lily
7	Crinum pedunculatum	River Lily
8	Dianella caerulea	Flax Lily
	Liriope 'Evergreen Giant'	Giant Liriope
	Rhagodia spinenscens	Aussie Flat Bush
	Syzygium sp.	Lilly Pilly
	Westringia 'Grey Box'	Coastal Rosemary

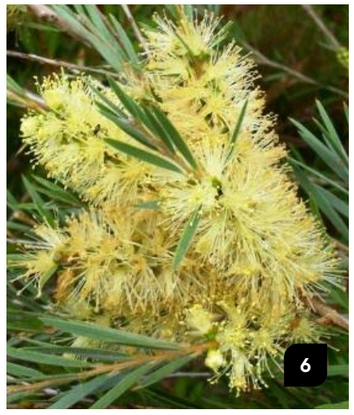
Groundcovers & Climbers

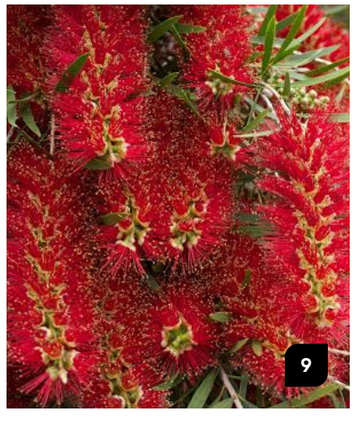
9	Hardenbergia violacea	Native Sarsparilla
10	Myoporum ellipticum	Coastal Boobialla
11	Pandorea pandorana	Wonga Wonga Vine
	Themeda triandra	Kangaroo Grass
12	Trachelospermum jasminoides	Star Jasmine

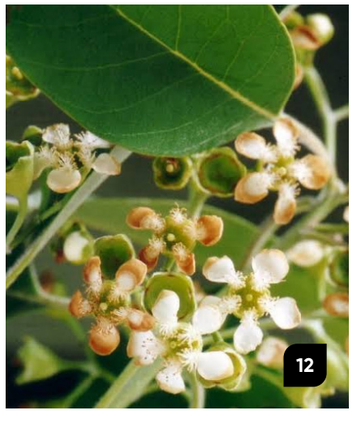
Design Details

4.1 Planting Palette: General Planting









Groundcovers

			Density (Qty/m2)
1	Carrex Appressa	Tall Sedge	6-8
2	Finicia nodosa	Knobby Club Rush	4-6
3	Imperata cylindrica	Blady Grass	6-8
4	Lomandra hystrix	Creek Matt Rush	4-6
	Lomandra longifolia	Matt Rush	4-6
	Myoporum parvifolium	Creeping Boobialla	4-6
	Themeda australis	Kangaroo Grass	6-8

Shrubs

			Density (Qty/m2)
5	Breynia oblongifolia	False Coffee Bush	2-4
6	Callistemon sieberi	River Bottlebrush	1
7	Hardenbergia violacea	Purple Coral Pea	2-4
8	Leptospermum polygalifolium	Wild May	2-4
	Lomatia silaifolia	Crinkle Bush	2-4
	Myoporum acuminatum	Coastal Boobialla	2-4

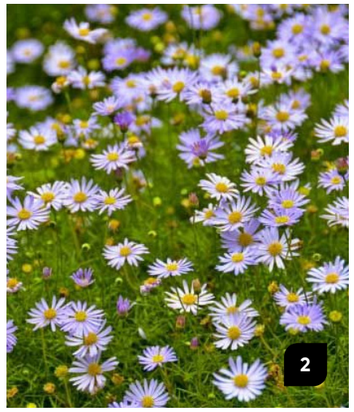
Trees

			Density (Qty/m2)
9	Callistemon viminalis	Weeping Bottle Brush	< 1
10	Eucalyptus obovatus	Hard Quandong	< 1
11	Lophostemon confertus	Brush Box	< 1
12	Lophostemon suaveolens	Swamp Box	< 1
	Melaleuca nodosa	Prickly-leaf Paperbark	2-4
	Melaleuca quinquenervia	Broad-leaved Paperbark	< 1
	Melaleuca sieberi	Small -leaved Paperbark	< 1

Design Details

4.2 Planting Palette: Bio Basins & Batters

1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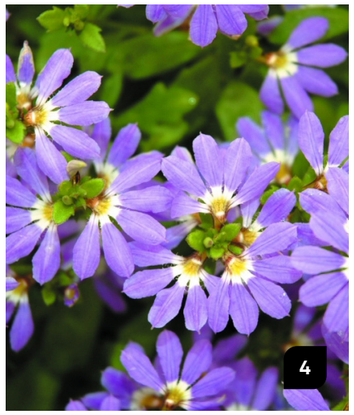
3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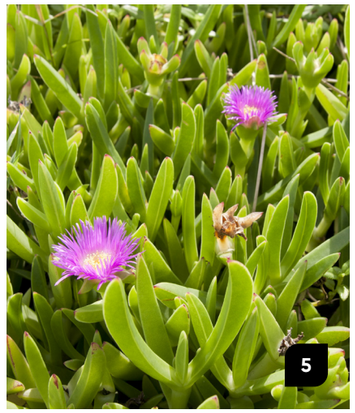

5

6

7

8

9

10

11

12

Groundcovers

1	**Ajuga australis**	Bugleweed
2	**Brachyscome multifidia**	Cut-Leafed Daisy
3	**Dampiera diversifolia**	Blue Dampiera
4	**Scaevola aemula**	Aussie Crawl
5	**Carpobrotus chilensis**	Pig Face
6	**Myoporum parvifolium**	Creeping Boobialla

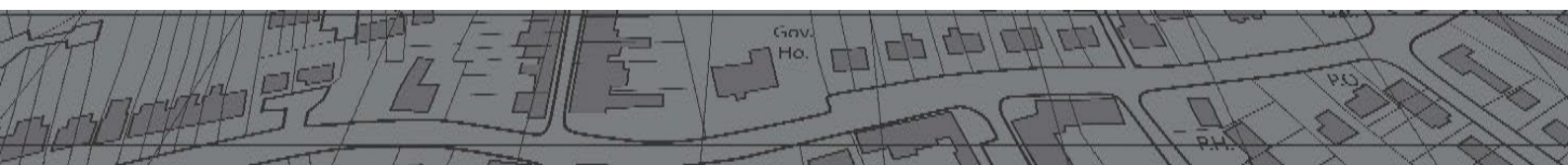
Trees

7	**Magnolia grandiflora**	Bull Bay Magnolia
8	**Magnolia 'Little Gem'**	Little Gem
9	**Acacia howittii**	Sticky Wattle
10	**Acmena smithii**	Lilly Pilly
11	**Cupaniopsis anacardiodes**	Tuckeroo
12	**Eleocarpus reticulatus**	Blueberry Ash

Design Details

4.3 Planting Palette: Bushfire Suitable Species

ATTACHMENT 3
Statement of Rehabilitation Intent



DATE: 06.11.19
PROJECT No. : BC-16090
DRAWING No. : SRI-00
REVISION No. : B

STATEMENT OF REHABILITATION INTENT

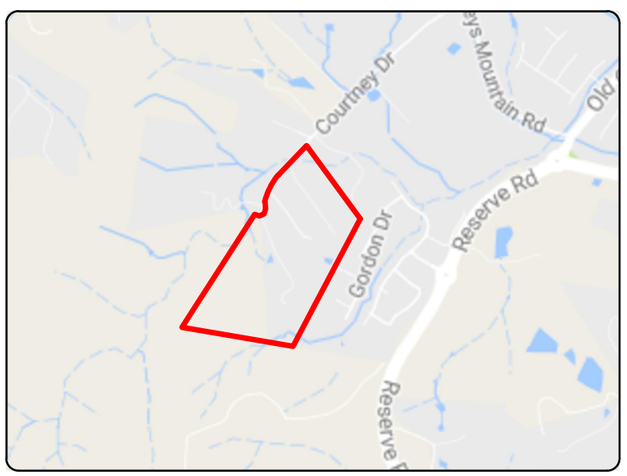
Lots 188-192 on RP173728, 79-99 Courtney Drive, Upper Coomera

for

Gallery Homes

Project No: BC-16090

November 2019



Site Location

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
SRI-00	LOCALITY AND DRAWING INDEX PLAN
SRI-01	EXISTING ECOLOGICAL FEATURES
SRI-02	REHABILITATION STRATEGY & REHABILITATION ZONES
SRI-03	PLANTING SPECIFICATIONS
SRI-04	REHABILITATION PROCEDURES & WEED CONTROL
SRI-05	REHABILITATION AREA MANAGEMENT

BIOME Consulting Pty Ltd
Unit 30201, Southport Central Tower 3,
9 Lawson St, Southport QLD 4215
PO Box 3469, Australia Fair, Southport
O 07 5532 7779
M 0415 935 222
E brad@BIOMEconsulting.com.au
W www.BIOMEconsulting.com.au
ABN 86 166 087 476

EXISTING ECOLOGICAL FEATURES

Vegetation

The vegetation on site has been broadly classified into four (4) vegetation communities:

- V1 - Acacia low open forest
- V2 - Spotted Gum / Grey Ironbark Open Forest (RE 12.11.5);
- V3 - Acacia low open woodland/mosaic +/- landscaping around dwellings
- V4 - Pasturelands +/- copses of native/exotic trees

Vegetation Community V1

V1 is a regrowth extension of Regional Ecosystem vegetation at the site's southwestern boundary corner. It comprises mature Acacia disparrima regrowth with occasional emergent Corymbia citriodora, Eucalyptus siderophloia, E. propinqua, and E. tereticornis. Other common species in the mid stratum include Lophostemon suaveolens and Allocasuarina littoralis. The notable disturbance within this vegetation community is the incursion of weeds with Lantana dominating the shrub layer.

Vegetation Community V2

V2 comprises a small area of the total subject site in the south-west corner and is an extension of a larger area of the same vegetation type beyond the site boundary. The composition of the canopy is generally representative of RE 12.11.5, primarily Corymbia citriodora and Eucalyptus siderophloia. The understorey is a mixture of juvenile canopy species, endemic shrubs and endemic ground species with negligible weed incursion.

Vegetation Community V3

V3 primarily mature acacia regrowth proximate to dwellings and outbuildings on the subject site. There are occasional larger eucalypts and small isolated thickets of lantana and vine weeds are common. Low level grazing is presently active throughout most of this community. Prevalent endemic flora species for this community include Acacia disparrima, Eucalytpus siderophloia, E. tereticornis, Lophostemon confertus, Cynodon dactylon var. dactylon. Prevalent weed species include Lantana camara, Setaria sphacelata, and Panicum megathyrsus.

Vegetation Community V4

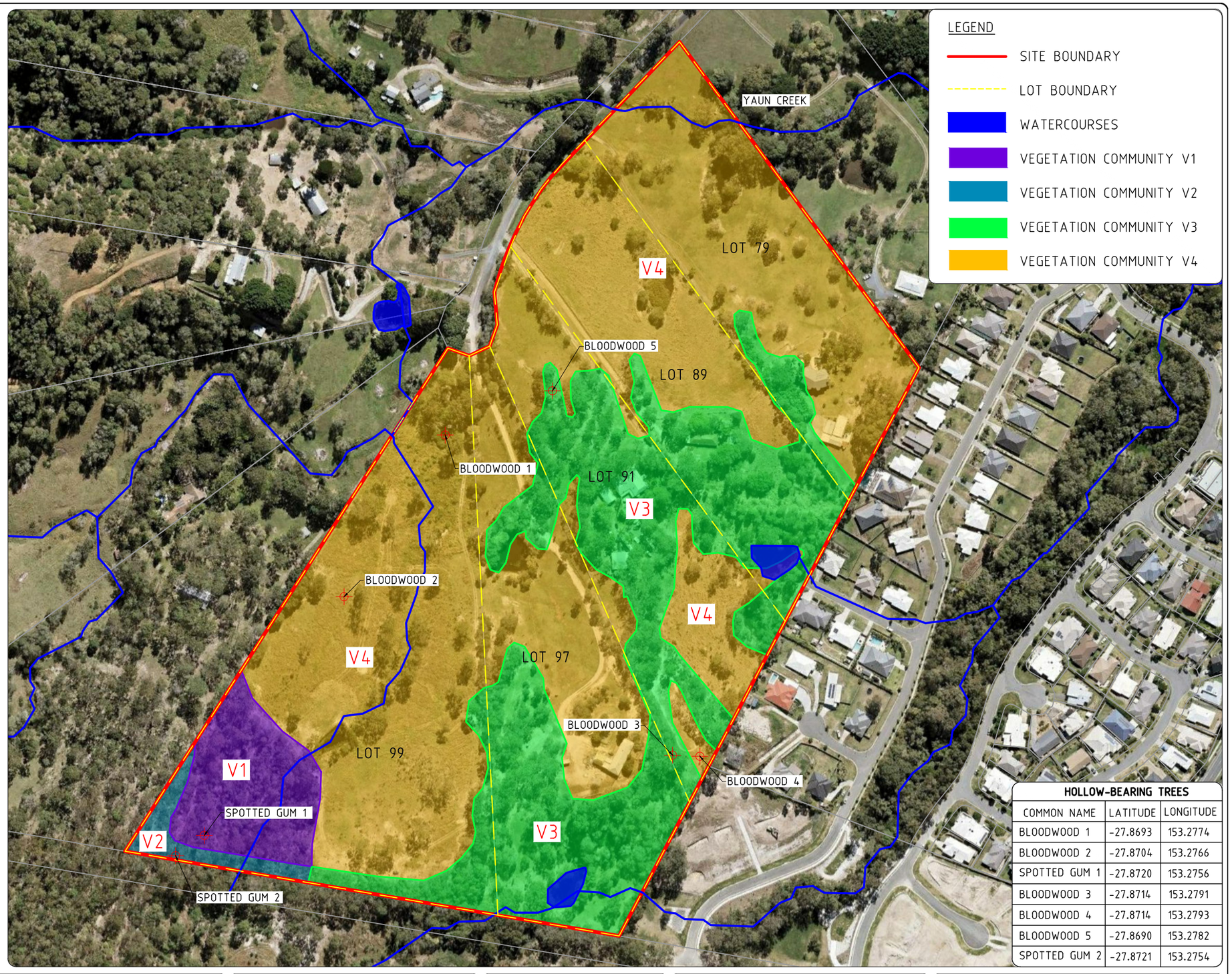
V4 covers the majority of the site and comprises introduced pasture species, copses of endemic tree species and trees associated with landscaping. Some of the largest eucalypt trees on site occur as isolated trees or within the copses.

Hollow-bearing Trees

Seven (7) Hollow-bearing Trees have been identified across the site as shown in the adjacent image.

Watercourses and Drainage Features

The site contains two main drainage lines. Yaun Creek is the primary drainage line which traverses the site's northern corner for approximately 100 m. An ephemeral drainage line, originating at the site's southern boundary, converges with Yaun Creek on the site's central western boundary.



HOLLOW-BEARING TREES

COMMON NAME	LATITUDE	LONGITUDE
BLOODWOOD 1	-27.8693	153.2774
BLOODWOOD 2	-27.8704	153.2766
SPOTTED GUM 1	-27.8720	153.2756
BLOODWOOD 3	-27.8714	153.2791
BLOODWOOD 4	-27.8714	153.2793
BLOODWOOD 5	-27.8690	153.2782
SPOTTED GUM 2	-27.8721	153.2754

DATE: 06.11.19
PROJECT No. : BC-16090
DRAWING No. : SRI-01
REVISION No. : B

PROJECT: STATEMENT OF REHABILITATION INTENT
DRAWING TITLE: EXISTING ECOLOGICAL FEATURES
CLIENT: GALLERY HOMES
ADDRESS: LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

DRAFTED BY :	DESIGNED BY :	CHECKED BY:	PAPER SIZE :	SCALE :
TP / LD	NL	BC	A3	1:3000

APPROVED FOR AND ON BEHALF OF BIOME CONSULTING PTY LTD
ACN 166 087 476
RPEQ No. :

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		29.03.19
B	INFORMATION REQUEST		06.11.19

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BIOME WATER AND ENVIRONMENTAL CONSULTING
BIOME Consulting Pty Ltd
PO Box 3469, Australia Fair, Southport
M 0415 935 222
E brad@BIOMEconsulting.com.au
ABN 86 166 087 476

ORIGINAL SCALE BEFORE REDUCTION
30 0 30 60 90 120 150
1 : 3000 (FULL SIZE) (metres)
CERTIFIED BY
N

REHABILITATION STRATEGY

This Statement of Rehabilitation Intent (SRI) has been prepared to set out the rehabilitation approach for the open space network. It will be used as a basis upon which the detailed Rehabilitation Management Plan will be prepared.
The proposed development includes several open space areas, three of which will require rehabilitation. The rehabilitation strategy has been designed to protect and enhance ecological values.

REHABILITATION OBJECTIVES

The fundamental rehabilitation objective is to construct an ecosystem that will be self-sustaining and resilient to environmental stress (e.g. flooding and drought).
Specific objectives of this SRI are to:

- Provide fauna habitat and movement opportunities;
- Recreate a waterway; and
- Re-establish vegetation reflective of pre-clearing regional ecosystems.

REHABILITATION APPROACHES

Three approaches are required to achieve the rehabilitation objectives:

- Fabrication;
- Reconstruction; and
- Assisted natural regeneration.

Fabrication

Where significant reprofiling of the land's relief is undertaken, subsequent planting is prescribed to achieve the purposes of the modified area.

Reconstruction

Reconstruction of vegetation communities is necessary where the site is highly degraded or altered and has poor regeneration capacity (resilience). Suitable species will be planted at a density of one plant per square meter which, when established, will provide the necessary structure and seed bank to enable successful ongoing rehabilitation.

Assisted Natural Regeneration

Assisted natural regeneration is appropriate where the native plant community is largely healthy and functioning and there is evidence of high ecosystem resilience (e.g. native seedling recruitment). The primary objective for this zone is targeted weed control, although some supplementary planting will be undertaken in disturbed areas. These areas are expected to recover with limited intervention. The control of weeds is intended to facilitate the re-establishment of endemic species via the seed bank or by other natural seed dispersal vectors. Disturbed areas greater than five square meters will be planted with suitable species at a density of one plant per square meter.

REHABILITATION ZONES

Three rehabilitation zones have been proposed according to the approach required.

Zone R1

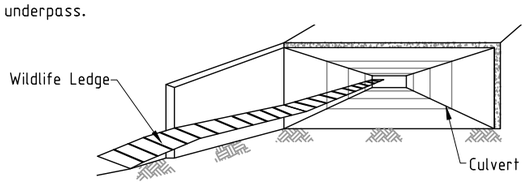
Regional ecosystem 12.11.5 occurs along the fringes of the southern and western boundary with negligible weed incursion. The balance of the area comprises advanced regrowth dominated by Acacia disparrima and other species consistent with RE12.11.5 with moderate weed incursion.
Areas under canopy will require assisted natural regeneration.
Weed control will include:

- Woody and vine weeds either manually removed or treated via cut/paint or drill/inject; and
- Ground layer weeds sprayed with herbicide.

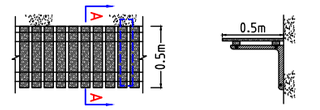
Where gaps in the canopy exceed 5 square meters, infill planting with species selected from planting schedule PS1 will occur.

Zone R2

This restoration zone occurs along waterways. The majority of these areas are cleared of vegetation and highly disturbed.
Areas under canopy will require assisted natural regeneration. Cleared areas will require reconstruction as per planting schedule PS2 and planting module PM2.
The waterway in the south-eastern corner of the site will be piped under the roadway. A fauna underpass will be provided to enable movement corridors to be maintained.
Figure 1 shows detail of the wildlife ledge to be fitted in the fauna underpass.



WILDLIFE LEDGE 3D SECTION



PLAN SECTION A - A

FIGURE 1: WILDLIFE LEDGE DETAIL
SCALE 1:25

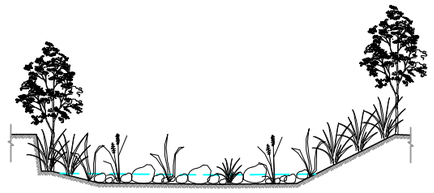


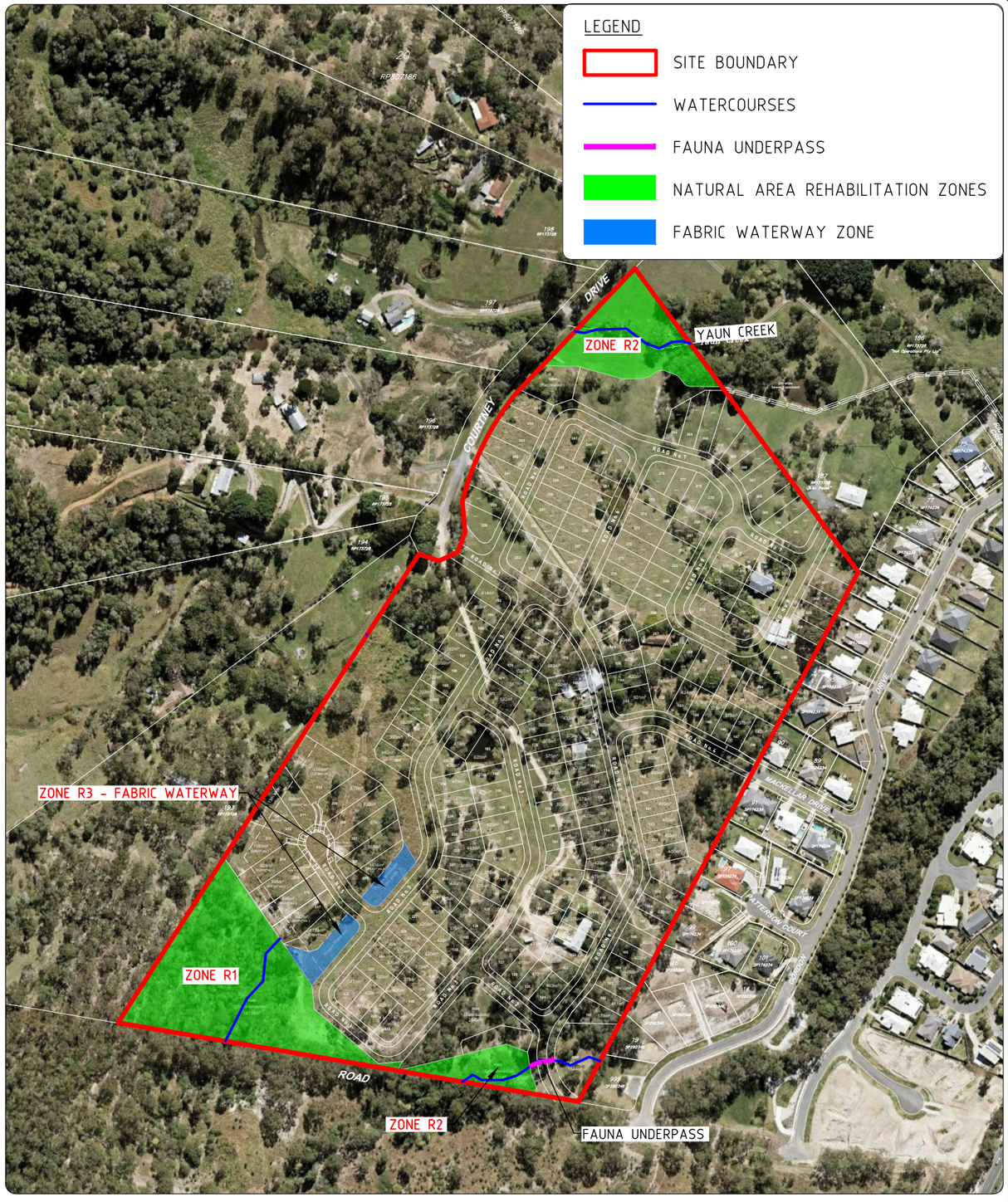
FIGURE 2: WATERWAY CROSS SECTION
SCALE 1:250

Zone R3

This zone is a reconstructed waterway. The aim of the waterway reconstruction is to:

- Emulate a natural waterway to provide linkages from the environmental reserve to Yaun Creek; and
- Provide the required hydraulic conveyance while providing for environmental values in the channel design where possible.

Yaun Creek can be described as a depositional chain-of-ponds; relatively deep, permanent ponds are separated by bars of sediment stabilised with vegetation. These permanent ponds provide water and habitat for a range of wildlife.
The restoration objective within the realigned waterway is to recreate a depositional style chain-of-pools in a channelized stream. The restoration strategy involves creating stable pools and bars.
Bars can be created from low earthen or rock weirs that are well vegetated with appropriate species to prevent erosion. The lower embankment of the weirs should be planted with reeds or semi-aquatic vegetation. Stream verges should be revegetated for stabilising and shading. To recreate the pools, a bed of gullies can be stabilised with rock-chutes, with the crest of the chute set higher than normal. The upstream end of the pool needs to be densely vegetated.



DATE	06.11.19		
PROJECT No. :	BC-16090		
DRAWING No. :	SRI-02		
REVISION No. :	B		

PROJECT: STATEMENT OF REHABILITATION INTENT
DRAWING TITLE: REHABILITATION STRATEGY & REHABILITATION ZONES
CLIENT: GALLERY HOMES
ADDRESS: LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

DRAFTED BY :	DESIGNED BY :	CHECKED BY:	PAPER SIZE :	SCALE :
TP / LD	NL	BC	A3	1:4000

APPROVED FOR AND ON BEHALF OF BIOME CONSULTING PTY LTD
ACN 166 087 476
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A	ORIGINAL ISSUE		29.03.19
B	INFORMATION REQUEST		06.11.19

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BIOME Consulting Pty Ltd
PO Box 3469, Australia Fair, Southport
M 0415 935 222
E brad@BIOMEconsulting.com.au
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40 0 40 80 120 160 200
1 : 4000 (FULL SIZE) (metres)
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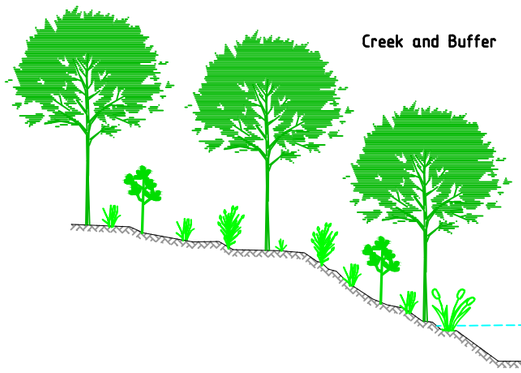
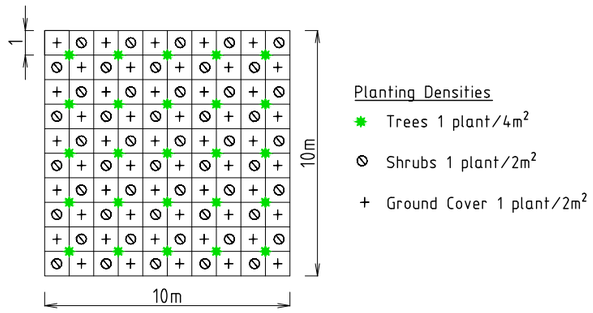
PLANTING SCHEDULE - PS1

Scientific Name	Common Name	Planting Density	Container Size
Trees			
Corymbia intermedia	Pink Bloodwood	1 plant / 4m^2	Tube
Eucalyptus grandis	Flooded Gum		
Eucalyptus tereticornis	Queensland Blue Gum		
Ficus watkinsiana	Strangler Fig		
Grevillea robusta	Silky Oak		
Lophostemon confertus	Brushbox		
Melaleuca bracteata	River Tea Tree		
Tristaniopsis laurina	Water Gum		
Small Trees/Shrubs			
Acacia disparrima	Hickory Wattle	1 plant / 2m^2	Tube
Alphitonia excelsa	Red Ash		
Allocasuarina littoralis	Black Sheoak		
Babingtonia similis	Twiggy Myrytle		
Ficus coronata	Creek Sandpaper Fig		
Glochidion ferdinandi	Cheese Tree		
Glochidion sumatranum	Umbrella Cheese Tree		
Lophostemon suaveolens	Swamp Box		
Melaleuca quinquenervia	Broad-leaved Paperbark		
Groundcovers			
Lomandra hystrix	Creek Mat Rush	1 plant / 2m^2 (along creek)	Tube
Lomandra longifolia	Spiny-headed Mat Rush	1 plant / 2m^2 (beyond creek)	

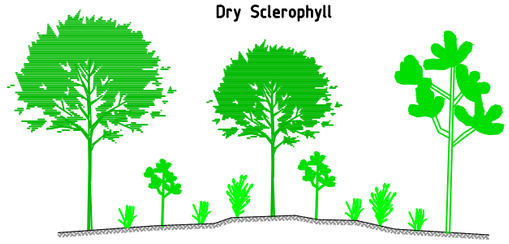


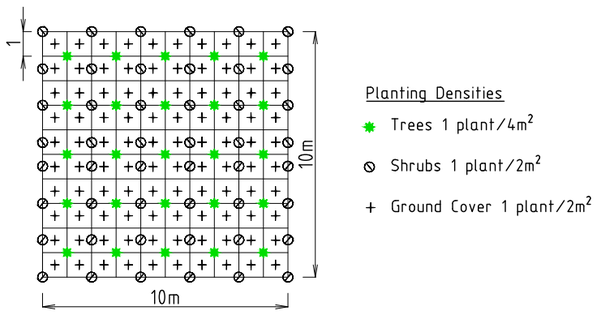


PLANTING MODULE - PM1

PLANTING SCHEDULE - PS2

Scientific Name	Common Name	Planting Density	Container Size
Trees			
Corymbia citriodora	Spotted Gum	1 plant / 4m^2	Tube
Corymbia intermedia	Pink Bloodwood		
Eucalyptus carnea	Broad-leaved White Mahogany		
Eucalyptus propinqua	Small-fruited Grey Gum		
Eucalyptus siderophloia	Grey Ironbark		
Eucalyptus tereticornis	Queensland Blue Gum		
Lophostemon confertus	Brushbox		
Small Trees/Shrubs			
Acacia disparrima	Hickory Wattle	1 plant / 2m^2	Tube
Allocasuarina littoralis	Black Sheoak		
Lophostemon suaveolens	Swamp Box		
Melaleuca salignus	White Bottlebrush		
Groundcovers			
Cymbopogon refractus	Creek Mat Rush	1 plant / 1m^2	Tube
Imperata cylindrica	Blady Grass		
Lomandra longifolia	Spiny-headed Mat Rush		
Themeda triandra	Kangaroo Grass		





PLANTING MODULE - PM2

DATE
06.11.19
PROJECT No. :
BC-16090
DRAWING No. :
SRI-03
REVISION No. :
B

PROJECT
STATEMENT OF REHABILITATION INTENT
DRAWING TITLE
PLANTING SPECIFICATIONS
CLIENT
GALLERY HOMES
ADDRESS:
LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

DRAFTED BY :	DESIGNED BY :	CHECKED BY:	PAPER SIZE :	SCALE :
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VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		29.03.19
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M 0415 935 222
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REHABILITATION PROCEDURES

PLANT PROCUREMENT

Local provenance tube stock is to be utilised for all restoration works involving planting. Where this is not possible due to circumstances out of the control of the applicant, Council approval must be sought.

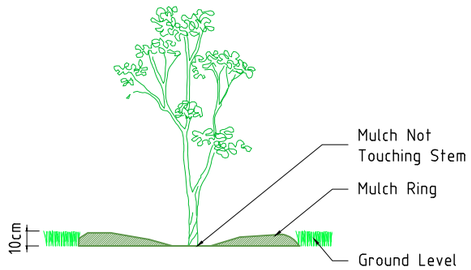
PLANT INSTALLATION PRACTICE NOTES:

- Plants are to be vigorous, well established, hardened off, consistent with species or variety, free from disease and insect pests, with large root systems and no evidence of having been restricted or damaged;
- Plants are to be planted immediately after delivery to the planting site. If not possible, they are to be stored in the shade and watered sufficiently during the day;
- Excavate planting medium to a depth suitable for the installation of tube or pot specimens. In areas where the planting substrate is deemed to be very poor (compacted, nutrient depauperate, hydrophobic etc.) and above areas of potential frequent inundation and water flow, soil shall be suitably prepared (e.g. through use of fertilizer, and mechanical ripping where required) and enough topsoil to sustain long term plant growth shall be used;
- Pre-water plant hole if soil is dry, to decrease root stress upon planting and assess the infiltration of water through the soil;
- Incorporate into the planting substrate the appropriate quantity of prepared water crystals or other suitable hydrating product;
- Place plant into hole and backfill ensuring that the plant is upright, and the stem is not covered in any less than 10 mm or any more than 20 mm of planting medium;
- Plants are to be watered thoroughly immediately after planting (ensure deep irrigation) and thereafter as required during the construction phase of the development depending on climatic conditions. Creation of a concave hollow around the base of each plant will aid water infiltration to the plant roots;
- A complete, slow release fertiliser is recommended, and is to be administered appropriately during planting. Top dressing with slow release fertiliser is preferred to avoid toxic levels of fertiliser accumulating in the plant hole around the plant roots;
- To ensure successful establishment, all planting surfaces must be covered in either:
  - a 10 cm layer of high quality, debris and weed-free composted chip mulch (Note: to avoid possible stem rot in some 'drier' species ensure mulch is 'dished' and not covering plant stem by more than 2 cm); or
  - suitable individual anchored natural fibre weed mat (e.g. jute mat) in areas subject to high velocity flows;
- Mulched material is to be sourced from cleared vegetation if suitably seasoned;
- A long-term slow release fertiliser will be used for all plantings after initial plant establishment;
- Seedling and saplings are to be encouraged and maintained throughout the Establishment period;
- Monitoring and evaluation for site maintenance (watering, weed control, stock replacement, fertilising, managing inappropriate site access etc.) is to occur monthly for the period from October to May and bi-monthly for June to September;
- Where specimens show signs of very poor health, do not replace unless the plant is determined to be dead below ground. Many species are capable of strongly recovering from transplant stress or adjustment to site conditions. If a particular species is consistently doing poorly in certain site conditions, it is recommended to replace with an alternate species; and
- A minimum 90% survival rate must be achieved.

SUPPLEMENTARY PLANTING

Supplementary planting should be undertaken in areas where plants have failed to thrive or where weed removal activities have resulted in site disturbance.

Supplementary planting should consider the existing species composition, for example, in areas with good canopy cover but degraded lower strata, ground cover and understory species are to form the predominant part of the revegetation planting.



MULCHING TECHNIQUE

WEED CONTROL

The control of weeds is essential to the restoration process. The removal of invasive species reduces competition and therefore assists the germination and establishment of native species.

In areas where assisted regeneration is undertaken, weed control should be designed to reduce impacts to existing native vegetation, maintain juvenile species and retain the existing seed bank in the soil profile.

The control of weeds is to be undertaken generally in accordance with the following phases:

- Primary weed control
- Involves selective and strategic removal of weeds rather than the removal of all weed species at once to reduce erosion risks.
- Secondary weed control
- Follows the completion of primary work. This is necessary to manage the growth of weeds and regenerating natives.
- Maintenance and follow-up weed control
- On-going maintenance and follow-up weed control is essential for successful restoration works. The frequency and duration of this process shall vary according to the resilience of native vegetation, viability of weed seed in the seed bank, the proximity of weed sources and the skill level of workers.

All weed control works are to be either actively supervised or undertaken by personnel suitably qualified in botany or bush regeneration disciplines. Weed removal should be undertaken in accordance with the methodologies outlined within the South East Queensland Ecological Restoration Framework: Manual (Chenoweth EPLA and Bushland Restoration Services, 2012). Methods for removing weeds include hand, chemical or mechanical control, or a combination of these.

Specific control techniques for weeds identified on site have been provided in the Covenant Management Plan. General weed control techniques are presented as follows.

WEED CONTROL TECHNIQUES

The following describes the current best practice methods for weed control.

Cut-scrape-paint

This weed control method applies to all woody shrubs, trees and some vines.

- Cut plant low to the ground at an angle.
- Apply Glyphosate immediately at the rate of 1 part Glyphosate to 1.5 parts water, with a paintbrush.
- Scrape sides lightly to reveal green tissue and apply the herbicide to the scraped area.
- Take care that the brush is not contaminated with soil.
- Note - all seed that has high viability and longevity, or plants with a high invasive potential must be removed from the parent and either composted on site or removed from the site.

Stem Injection

This weed control method applies to all woody trees and shrubs with a diameter of about six to ten centimetres or greater.

- With a tomahawk, make a cut the width of the blade, at a slight angle, into the trunk. Note - it is important not to make cuts too deep.
- Apply herbicide immediately into the cut using a tree-injecting device (if using Glyphosate, apply at the rate of 1 part Glyphosate to 1.5 parts water).
- Repeat this procedure in a brickwork pattern around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, make a cut above it. Note - two rows of cuts will be enough for trees with trunks of six to ten centimetres; larger trunk diameters will need correspondingly more.
- Treat all visible lateral roots as per dot point 1.

Spraying

This weed control method is carried out using a backpack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used with the addition of a marker dye. For plants that show some resistance or where growing conditions are not optimal, an acidifying agent is added. Metsulfuron methyl can also be used for resistant species and grasses. It should be used with a surfactant.

Dilution rates for Glyphosate and Metsulfuron methyl are in accordance with the manufacturer's recommendations and any variation requires a permit from the National Registration Authority.

Overspray

This weed control method is applicable to large, dense infestations and where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, protect native seedlings from foragers such as wallabies, and avoid trampling by humans.

- Spray over the top of the infestation, using a weak solution of Glyphosate
- Any native plants that may be under the weed will be protected by the foliage cover of the weed.
- Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.

Alternatively, weeds can be cut and flattened with bush-hooks or loppers and the subsequent regrowth sprayed with Glyphosate. In many cases it is preferable to overspray wherever practicable as this will cause less erosion and trampling of suppressed native plants, such as ferns and seedlings. However, handwork will be necessary to cut-scrape-paint any unsprayed weeds that surround native plants.

Crowning

This weed control method is applicable to weeds which have their growing points below the surface of the ground (corms, bulbs, rhizomes, clumped or fibrous root systems, etc.).

- Grasp the leaves or stems and hold them tightly so that the base of the plant is visible. Plants with sharp leaves or stems should be cut back first.
- Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.
- Cut through the roots close to the base. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.
- Remove the plant. Make sure that the base of the plant where the roots begin is completely removed.

DATE: 06.11.19
PROJECT No. : BC-16090
DRAWING No. : SRI-04
REVISION No. : B

PROJECT: STATEMENT OF REHABILITATION INTENT
DRAWING TITLE: REHABILITATION PROCEDURES & WEED CONTROL
CLIENT: GALLERY HOMES
ADDRESS: LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

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REHABILITATION AREA MANAGEMENT

Monitoring

Routine monitoring must be undertaken monthly. During monitoring, the rehabilitation areas are assessed for:

- New weed infestations;
- Poor health or mortality of plantings;
- Adequate mulch coverage; and
- Presence of rubbish.

Establishment Period

Following primary weed control and plant installation, a 12-month establishment period will be undertaken. During this period, the developer is responsible for the following:

- Control of weeds
- Monthly inspections;
- Supplementary or replacement plantings as required to achieve prescribed densities;
- Monthly litter collection; and
- Irrigation as needed.

On-Maintenance

Upon completion of the establishment period, works shall then undergo a further 12 month on-maintenance period. During this period, the developer is responsible for the following:

- Monthly progress inspections;
- Management of weeds to achieve prescribed outcomes;
- Replacement planting as required to achieve required densities; and
- Irrigation as needed.

Performance Criteria

The following key performance criteria shall be met:

- No invasive plant species as identified under the Biosecurity Act 2014;
- Removal of a minimum of 95% of weeds;
- Achieve a minimum success rate of 90% survival rate of all installed plants
- Achieve a minimum cover of 95% in the reconstruction zone (Zone R1); and
- Removal of all temporary construction structures (if installed).

Compliance

The developer is responsible for undertaking the rehabilitation works. The developer must provide to Council certification from a qualified professional that all works have been implemented on site and plants are established following a minimum establishment period of 12 months and on-maintenance period of 12 months. Certification is to demonstrate that all site works have been completed in accordance with applicable conditions of approval and relevant management plans.

Rehabilitation Schedule

A summary of the rehabilitation schedule has been included in the table below.

Rehabilitation Stage	Actions Required	Timing
Initial site works	Undertake primary weed control	At the commencement of rehabilitation works
	Revegetation in accordance with plans. This will include: • soil preparation; • planting; • fertilising (slow release for native plants); • mulching; and • installation of stakes and seedling protection covers where deemed appropriate.	After primary weed control
Establishment period	Irrigation	Irrigation requirements will depend on rainfall. Irrigation will be undertaken at a minimum every three to five days for first eight weeks depending on weather.
	Routine weed control	Monthly
	Routine management: • reinstate mulch; • application of fertiliser to tube stock; • replacement of staked and tree guards; • replace dead or dying plants; and • remove rubbish.	Following inspection as required
	Monitoring	Monthly
On Maintenance period	Routine weed control	Monthly
	Routine management	Following inspection as required
	Monitoring	Monthly

DATE
06.11.19

PROJECT No. :
BC-16090

DRAWING No. :
SRI-05

REVISION No. :
B

PROJECT
STATEMENT OF REHABILITATION INTENT

DRAWING TITLE
REHABILITATION AREA MANAGEMENT

CLIENT
GALLERY HOMES

ADDRESS:
LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

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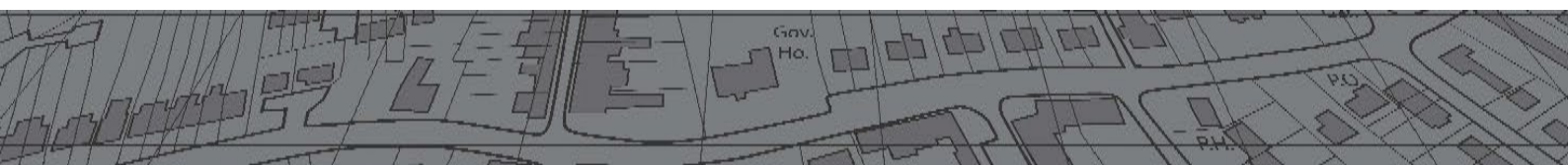
ATTACHMENT 4
Response Letter & Preliminary Earthworks



MORTONS
urbansolutions

Our Reference: 36001-ALL [ID 762851]
Council Reference: COM/2018/82

Civil Engineering
Project Coordination
Urban & Regional Planning

mortons@urbansolutions.net.au
www.urbansolutions.net.au

MUS Pty Ltd t/as:
Mortons - Urban Solutions
ABN: 39 116 375 065

31st October 2019

City of Gold Coast
PO Box 5042
GCMC QLD 9729
Chief Executive Officer

Attention: Karl Allen

Dear Karl

Re: Response to Information Request for COM/2019/82 – Combined MCU / ROL '79 Courtney Drive, Upper Coomera, QLD, 4209'

On behalf of our Client, Gallery Group, we provide the following responses to the civil engineering related items contained within Council's Information Request, dated 12th July 2019. This response is provided as part of a package response prepared by the project's Town Planning consultant, Zone Planning, and should not be read in isolation.

Please see attached revised preliminary engineering and earthworks drawings which have been updated to reflect the proposed layout changes.

The items below are excerpts from Council's RFI with the response following each item.

PART A: City Plan Version 6

16. Retaining structures

The applicant is requested to provide plans which identify the extent, height and type of retaining structures and batters required to facilitate the development. It is requested that the plans demonstrate how proposed retaining structures and batters comply with AO9 or PO9 of the General development provisions code.

We refer Council to MUS Drawings 36001-PE-450 to 460 that show the extent, height and type of retaining structures and batters required to facilitate the development. We note the following:

- Retaining walls will be designed in accordance with AS4678:2002;
- Design dead loads will include full hydrostatic load acting behind the structure with seepage drainage included;
- Proprietary product concrete sleeper walls proposed within private property which will provide a neat architectural and aesthetic appearance;
- Seepage drainage will be provided with outlets to lawful points of discharge;
- Wall design will not impose loadings on adjoining structures or utilities;
- Retaining walls will have a minimum setback of 200mm from property boundaries;
- A bench width between two tiers walls of 600mm is proposed;
- A maximum height single tier wall of 2m is proposed. Two tier walls maximum height of 3m.

It is requested that Council condition the development so that "retaining walls are to be designed and constructed in accordance with the City Plan and the typical sections shown on Drawing 36001-PE-460 (Rev A) where proprietary concrete products are proposed".

We are available to meet with Council to discuss this further if required.

19. Construction of Courtney Drive

The applicant is advised that as part of this proposed subdivision, Courtney Drive fronting the subject site will be required to be constructed to a Residential Collector Street classification (7.5m wide carriageway and k&c on both sides of the road), with construction extending to the northern end of the proposed site.

Note also that the conversion of the existing turning area at the southern end of Courtney Drive to a sweeping bend is acceptable.

It is requested that Council condition their standard requirement that the development upgrades their half of the road frontage to Council's current standards. Where full width construction is proposed due to the new alignment of Courtney Drive into the development, concrete edge restraint has been proposed to minimise the impact on the neighbouring property frontages and to maintain existing stormwater conditions.

There is a small section of approx. 30m length where edge restraint is required to ensure the larger event overland flow is directed to the basin (approx. Ch 630 to 660).

20. Road connection between Road 6 and Road 8

A road connection is required to link Road 6 with Road 8, to provide improved circulation for both pedestrians and vehicles (refer PO15 of the ROL code). Please amend all drawings to show a road connection.

It is noted that very early layout concepts provided the link suggested by Council although this was removed due to the topography and the 16% grade road required to extend MacKellar Dr into the development. An intersection at this grade is not suitable and therefore not achievable.

The project's traffic consultant (SLR Consulting) has also provided the following advice on this connection:

The provision of a direct road connection between Roads 6 and 8 as requested by Council would increase the local dwelling catchment that would find travel via the existing Mackellar Drive most convenient (shortest route) when travelling between the site and Reserve Road. Mackellar Drive has been constructed within a 14.5m road reserve and is defined as a Residential Access street.

The proposed development layout accommodates the connection to Mackellar Drive in line with that illustrated in the Upper Coomera Draft Concept Plan; however, the road network is such that the convenience of Mackellar Drive was limited as much as possible to reduce increases in traffic travelling along the existing lower order link.

In accordance with the Upper Coomera Draft Concept Plan, another connection to Richardson Crescent is proposed to adjoining lands to the north. This connection could be accommodated with a higher hierarchical connection and would serve as the more primary access route compared to Mackellar Drive.

21. Vehicular access to proposed lots 310 to 312

The applicant is requested to provide details on the vehicular access arrangement proposed for lots 310 to 312 to demonstrate there is no conflict between vehicular crossings.

Drawing 36001-PRE-103 proposes a combined driveway layout for these lots which eliminates conflict between crossings.

25. Kerb returns at intersections

Please note that all kerb returns at standard intersections are required to have a 6m (maximum) radius. The proposal drawings appear to show the kerb returns at around 10m. Limiting the kerb radius helps reduce vehicle speeds and provides a safer environment for pedestrians. Please amend all drawing accordingly.

It is confirmed that the preliminary design incorporates 6m kerb returns as per Council standard.

30. Erosion and Sediment Control Plan

The applicant is requested to provide an erosion and sediment control plan. This is required to be submitted in accordance with Healthy waters code and latest State Planning Policy

(SPP). It is particularly advised to adopt control measures to achieve 80% hydraulic efficiency. Please also consider sensitive water environment adjacent to the site to identify the risk and mitigation measures.

The applicant requests this item to be conditioned and it will be provided as part of future submissions to Council.

PART B: Emerging Community Zone

Town Planning

E. Earthworks

A comprehensive plan of development is required to identify how the earthworks interface to lot 187 RP173728 is acceptable. A conceptual earthworks plan needs to be submitted to demonstrate that stormwater drainage, detention and treatment systems proposed on the plan are achievable without any major alteration in the detailed design.

Detailed preliminary earthworks drawings of the area were shown on MUS Drawings 36001-PE-071 and 451. Discussions with the project's stormwater consultant, BIOME Consulting, confirm the proposed earthworks model does not create a worsening on the neighbouring Lot 187 RP 173728 as the pre-development situation was sheet flow across the boundary from a much larger catchment.

If you have any queries in relation to this matter please telephone Matt McLaren of our office on (07) 5571 1099.

Yours faithfully

John Harrison
Mortons – Urban Solutions
(mdm)

Encl. Attachment 1: Mortons-Urban Solutions Preliminary Earthworks Set (36001-PE-SET) refer transmittal
Attachment 2: Mortons-Urban Solutions Preliminary Engineering Set (36001-PRE-SET) refer transmittal

c.c.
Gallery Group - Ashley Nankervis
Zone Planning Group – Nicole Webb

DATA TRANSMITTAL

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
ABN: 39 116 375 065 Tel: (07) 55711099

PROJECT NAME: COURTNEY DRIVE, UPPER COOMERA
JOB NO: 36001-PE

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MONTH	09	04	10
YEAR	18	19	19

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FILE NO.	DESCRIPTION	AMENDMENT		
	GENERAL			
36001-PE-000	COVER SHEET	A	B	C
	EARTHWORKS: EXISTING FEATURES & DEMOLITION			
36001-PE-020	PLAN SHEET 01	A	B	C
36001-PE-021	PLAN SHEET 02	A	B	C
	EARTHWORKS: BULK EARTHWORKS CUT FILL			
36001-PE-040	PLAN SHEET 01	A	B	C
36001-PE-041	PLAN SHEET 02	A	B	C
36001-PE-042	PLAN SHEET 03	A	B	C
36001-PE-043	PLAN SHEET 04	A	B	C
36001-PE-044	PLAN SHEET 05	A	B	C
36001-PE-045	PLAN SHEET 06	A	B	C
	EARTHWORKS: BULK EARTHWORK SECTIONS			
36001-PE-050	SECTIONS KEY PLAN	A	B	C
36001-PE-051	SECTIONS-SHEET 01	A	B	C
36001-PE-052	SECTIONS-SHEET 02	A	A	B
36001-PE-053	SECTIONS-SHEET 03	A	A	B
36001-PE-054	SECTIONS-SHEET 04	A	B	C
36001-PE-055	SECTIONS-SHEET 05	A	A	B
	EARTHWORKS: FINAL SURFACE & SEDIMENT AND EROSION CONTRO			
36001-PE-070	PLAN SHEET 01	A	B	C
36001-PE-071	PLAN SHEET 02	A	B	C
36001-PE-072	PLAN SHEET 03	A	B	C
36001-PE-073	PLAN SHEET 04	A	B	C
36001-PE-074	PLAN SHEET 05	A	B	C
36001-PE-075	PLAN SHEET 06	A	B	C
	RETAINING WALL & DETAIL GRADING			
36001-PE-450	PLAN-SHEET 01	A	B	C
36001-PE-451	PLAN-SHEET 02	A	B	C
36001-PE-452	PLAN-SHEET 03	A	B	C
36001-PE-453	PLAN-SHEET 04	A	B	C
36001-PE-454	PLAN-SHEET 05	A	B	C
36001-PE-455	PLAN-SHEET 06	A	B	C
36001-PE-460	DETAILS SHEET 01	A	A	A

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REASON: **Z** - COUNCIL **R** - REVISION **A** - APPROVAL **C** - CONSTRUCTION **S** - AS REQUESTED **T** - TENDER **P** - PRELIMINARY **X** - INFORMATION	ZA	ZA	ZA

PLEASE CHECK THAT YOU HAVE RECEIVED ALL DOCUMENTS AS LISTED ABOVE.

I hereby acknowledge receipt of the documents as detailed above.
Signed: _____ Date: / /
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COURTNEY DR, UPPER COOMERA

PRELIMINARY EARTHWORKS

OVERALL

No. 36001-PE

SCHEDULE OF DRAWINGS		
NUMBER	REV. NO.	TITLE
GENERAL		
36001-PE-000	C	COVER SHEET
EARTHWORKS: EXISTING FEATURES & DEMOLITION		
36001-PE-020	C	PLAN SHEET 01
36001-PE-021	C	PLAN SHEET 02
EARTHWORKS: BULK EARTHWORKS CUT FILL		
36001-PE-040	C	PLAN SHEET 01
36001-PE-041	C	PLAN SHEET 02
36001-PE-042	C	PLAN SHEET 03
36001-PE-043	C	PLAN SHEET 04
36001-PE-044	C	PLAN SHEET 05
36001-PE-045	C	PLAN SHEET 06
EARTHWORKS: BULK EARTHWORK SECTIONS		
36001-PE-050	C	SECTIONS KEY PLAN
36001-PE-051	C	SECTIONS-SHEET 01
36001-PE-052	B	SECTIONS-SHEET 02
36001-PE-053	B	SECTIONS-SHEET 03
36001-PE-054	C	SECTIONS-SHEET 04
36001-PE-055	B	SECTIONS-SHEET 05
EARTHWORKS: FINAL SURFACE & SEDIMENT AND EROSION CONTROL		
36001-PE-070	C	PLAN SHEET 01
36001-PE-071	C	PLAN SHEET 02
36001-PE-072	C	PLAN SHEET 03
36001-PE-073	C	PLAN SHEET 04
36001-PE-074	C	PLAN SHEET 05
36001-PE-075	C	PLAN SHEET 06
RETAINING WALL & DETAIL GRADING		
36001-PE-450	C	PLAN-SHEET 01
36001-PE-451	C	PLAN-SHEET 02
36001-PE-452	C	PLAN-SHEET 03
36001-PE-453	C	PLAN-SHEET 04
36001-PE-454	C	PLAN-SHEET 05
36001-PE-455	C	PLAN-SHEET 06
36001-PE-460	A	DETAILS SHEET 01

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SUB-CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

LOCALITY PLAN

R. P. DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

DRAWING NUMBER	AMEND.
36001-PE-000	C

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GENERAL

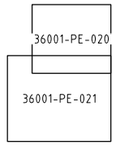
1. EXISTING SERVICES - External Works
   THE LOCATIONS OF ALL EXISTING SERVICES WITHIN THE WORK AREA SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION COMMENCING. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE RELEVANT AUTHORITIES AND TO ENSURE THAT THE EXISTING SERVICES ARE NOT DAMAGED OR DISTURBED IN ANY WAY.
2. EXISTING STRUCTURES -
   ALL EXISTING STRUCTURES AND ASSOCIATED INFRASTRUCTURE TO BE REMOVED AND DISPOSED OF OFF SITE.
3. EXISTING DAMS -
   EXISTING DAMS TO BE DEWATERED. ALL SILT AND DEBRIS ARE TO BE REMOVED AND AND LAWFULLY DISPOSED OF. REPLACEMENT FILL IS TO BE LOCATED AND COMPACTED IN ACCORDANCE WITH LOCAL COUNCIL'S SPECIFICATIONS.

NOTE:
CONTRACTOR TO MAKE ALL NECESSARY ALLOWANCES FOR EXISTING SERVICES DURING BULK EARTHWORKS EXCAVATION.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING FENCE
- EXISTING KERB
- EXISTING EDGE OF BITUMEN
- CONTROL LINE / CENTER OF ROAD
- EXISTING FOOTPATH
- EXISTING EDGE OF VEGETATION
- RM — RM — EXISTING RISING MAIN
- S — S — EXISTING SEWER
- SW — SW — EXISTING STORMWATER
- W — W — EXISTING WATER
- G — G — EXISTING GAS
- E — E — EXISTING UNDERGROUND ELECTRICITY
- E — E — EXISTING OVERHEAD ELECTRICITY
- T — T — EXISTING TELSTRA
- C — C — EXISTING COMMUNICATIONS
- 1.0 EXISTING CONTOURS MAJOR
- 1.5 EXISTING CONTOURS MINOR
- RM — RM — DEMOLISH RISING MAIN
- S — S — DEMOLISH SEWER
- SW — SW — DEMOLISH STORMWATER
- W — W — DEMOLISH WATER
- G — G — DEMOLISH GAS
- E — E — DEMOLISH UNDERGROUND ELECTRICITY
- E — E — DEMOLISH OVERHEAD ELECTRICITY
- T — T — DEMOLISH TELSTRA
- C — C — DEMOLISH COMMUNICATIONS
- SITE BOUNDARY
- STAGE BOUNDARY
- TREE PROTECTION FENCE
- TREES TO BE RETAINED
- TREES TO BE REMOVED

SHEET LAYOUT



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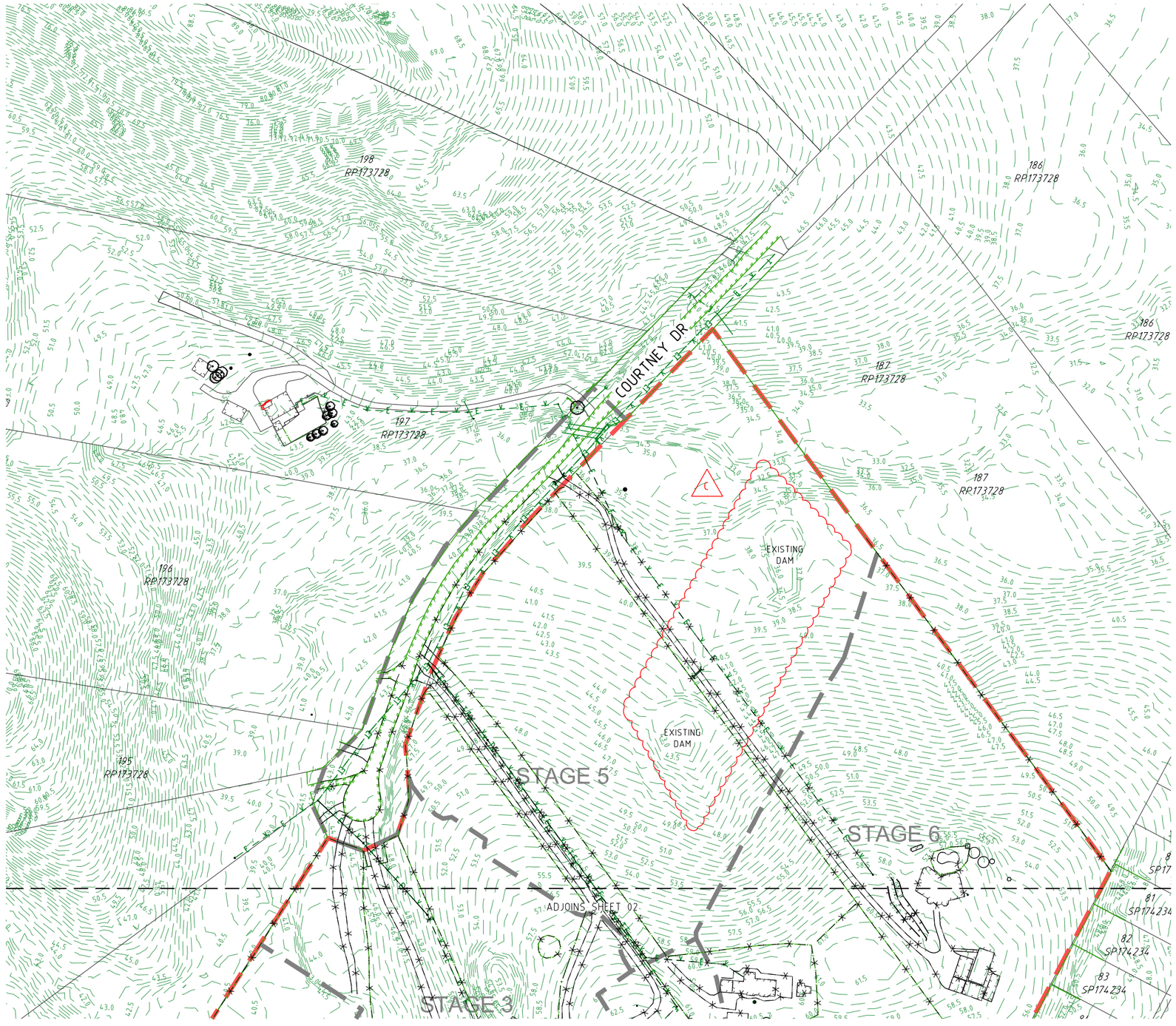

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	EXISTING DAMS LABELLED
B	27-03-19	EXISTING FEATURES & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

EXISTING FEATURES AND DEMOLITION PLAN SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-020 | AMEND. C

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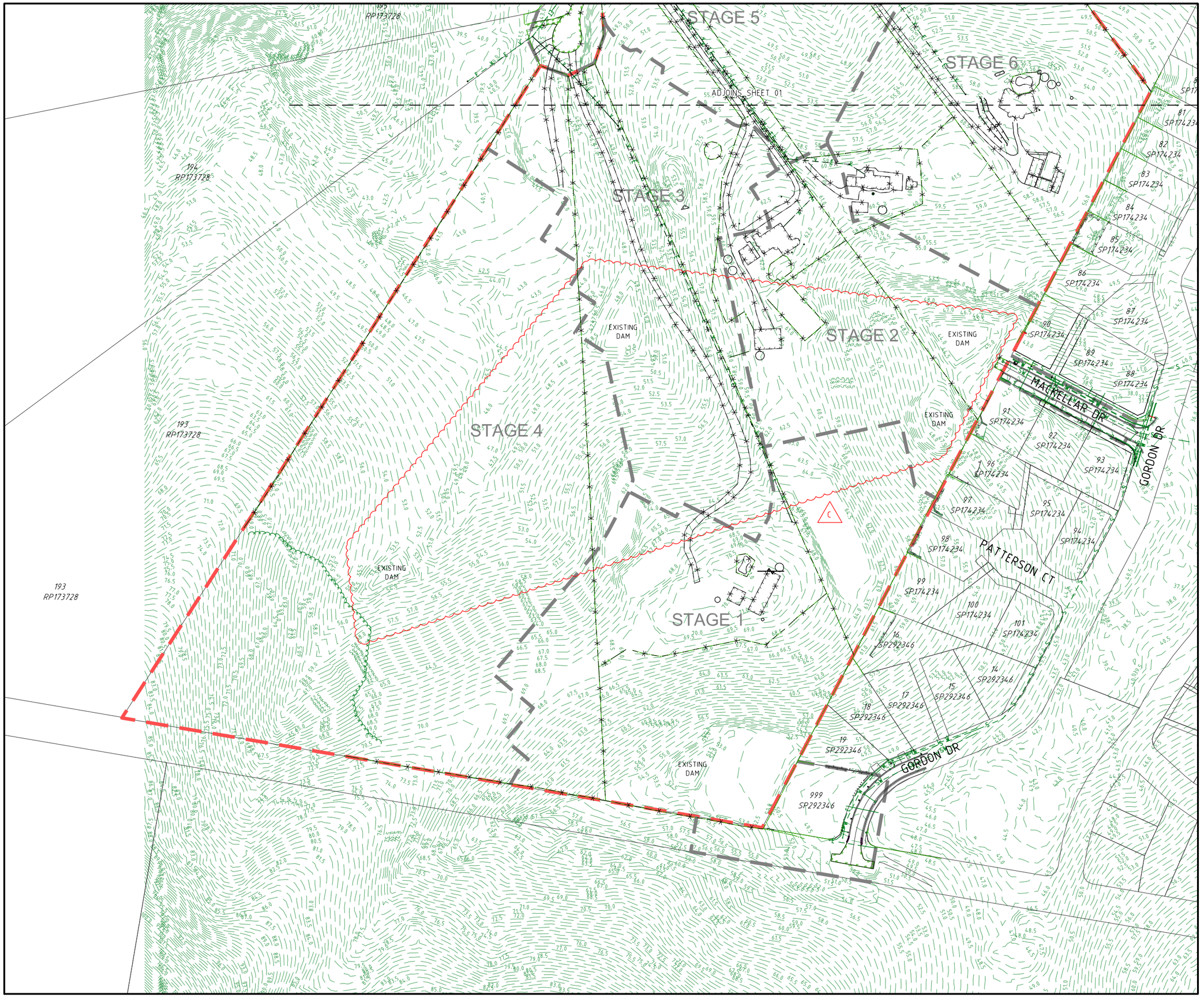

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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THE ART OF LIVING

NORTH

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
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B	27-03-19	EXISTING FEATURES & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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EXISTING FEATURES AND DEMOLITION PLAN SHEET 02

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER	AMEND.
36001-PE-021	C

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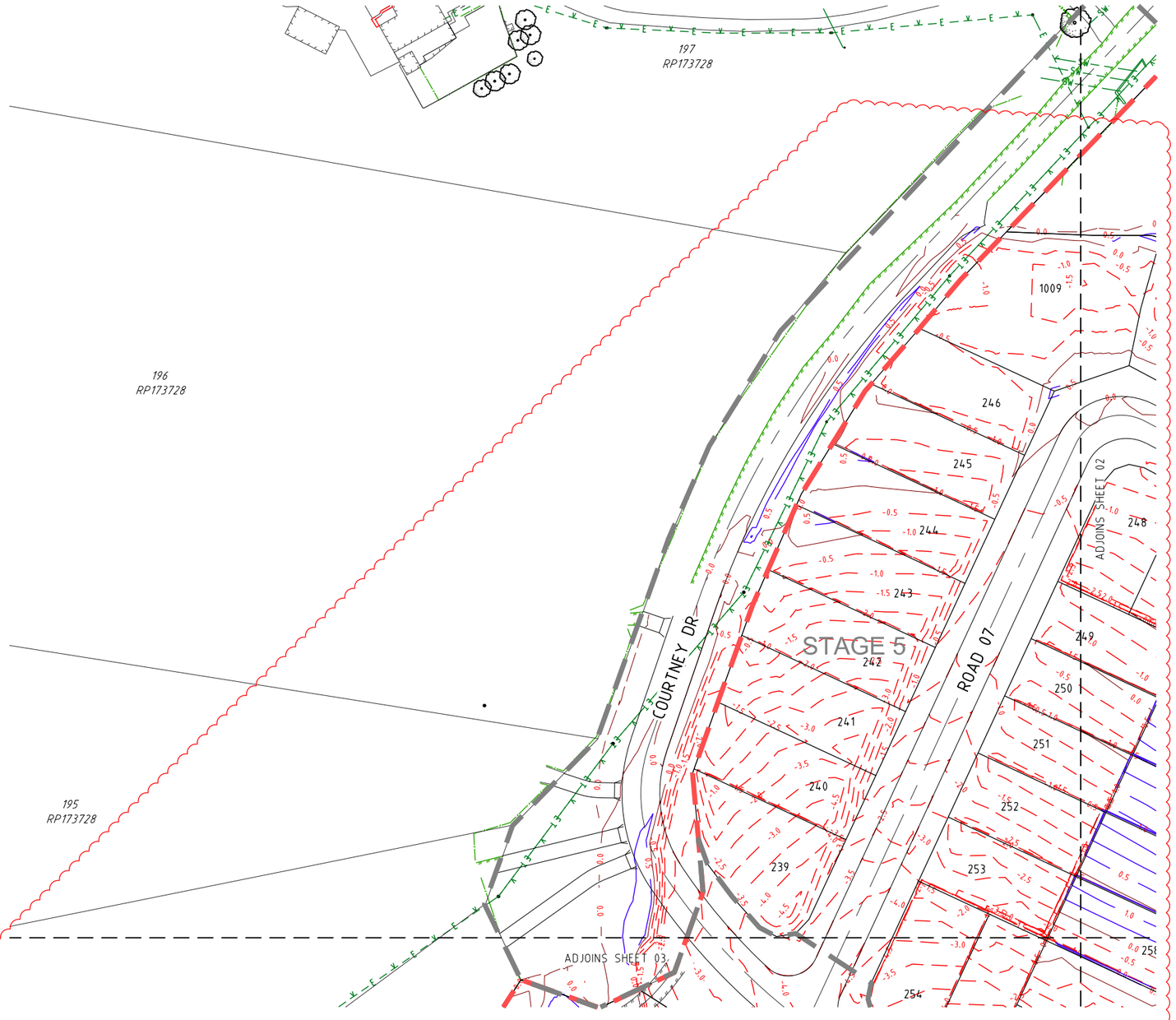
EARTHWORKS

1. TOPSOIL STRIPPING
   TOPSOIL SHALL BE STRIPPED ACROSS THE ENTIRE LIMIT OF THE EARTHWORKS CUT AND FILL AREAS AND SHALL BE STOCKPILED IN A LOCATION APPROVED BY THE SUPERINTENDENT. THE EXISTING STRATA IS TO BE TREATED IN ACCORDANCE WITH THE SPECIFICATION PRIOR TO PLACING ANY FILL.
2. EARTHWORKS LEVELS
   EARTHWORKS LEVELS SHOWN ON DRAWINGS ARE TO FINISHED SURFACE LEVELS AND INCLUDE 100mm OF TOPSOIL.
3. COMPACTION STANDARD
   SITE FILLING AND TRENCH BACKFILL SHALL BE COMPACTED TO THE STANDARDS OUTLINED IN THE LOCAL AUTHORITY'S SPECIFICATIONS.
4. PAVEMENT DEPTHS
   THE DESIGN PAVEMENT DEPTHS ALLOWED IN EARTHWORKS CALCULATIONS ARE BASED ON THE DEPTHS SHOWN IN THE SCHEDULE OF PAVEMENT DEPTHS. THE PAVEMENT DEPTHS GIVEN ARE DESIGN DEPTHS ONLY AND MAY BE VARIED AFTER SUB GRADE TESTS ARE TAKEN AND AUTHORITY APPROVAL.
5. TESTING AND CERTIFICATION
   ALL COMPACTION TESTING SHALL BE CARRIED OUT BY AN APPROVED N.A.T.A. TESTING AUTHORITY. ALL SITE FILLING SHALL BE TESTED AT LEVEL 1 REQUIREMENTS. THE CONTRACTOR IS TO PROVIDE ALL REQUIRED EARTHWORKS CERTIFICATIONS IN ACCORDANCE WITH THE APPROVAL CONDITIONS.
6. TOPSOIL REPLACEMENT
   ALL FOOTPATHS, BATTERS AND ALLOTMENT CUT & FILL AREAS SHALL BE TOPSOILED WITH TOPSOIL FROM ONSITE STOCKPILES.
7. GRASSING
   ALL CUT/FILL AREAS, DISTURBED AREAS AND TRENCHED AREAS SHALL BE GRASSED TO THE SATISFACTION OF THE SUPERINTENDENT AND AUTHORITY.
8. ROCK
   THE CONTRACTOR IS TO INCLUDE ROCK EXCAVATION AS PART OF THEIR EARTHWORKS RATE.
9. EARTHWORKS ZONE
   THE FOLLOWING ACTIVITIES ARE PROHIBITED OUTSIDE THE EARTHWORKS ZONE - STORAGE AND MIXING OF MATERIALS, VEHICLE PARKING, LIQUID DISPOSAL, MACHINERY REPAIRS/REFUELING, PLACEMENT OF SITE OFFICES OR SHEDS, COMBUSTION OF ANY MATERIAL, STOCKPILING OF SOIL, RUBBLE OR DEBRIS, ANY FILLING OR EXCAVATION INCLUDING TRENCHES, TOPSOIL, SKIMMING AND/OR SURFACE EXCAVATION UNLESS OTHERWISE APPROVED BY THE RELEVANT AUTHORITY.
10. CONSTRUCTION - STOCKPILING
    TEMPORARY SILT FENCE TO BE ERECTED 5m FROM TOE OF BATTER ON LOW SIDE OF STOCKPILING. STOCKPILE SITE TO BE CLEAR OF ADJACENT PROPERTY BOUNDARIES SO AS NOT TO CAUSE A NUISANCE TO ADJOINING PROPERTIES. NO STOCKPILES ARE TO BE LOCATED WITHIN THE TREE PROTECTION ZONE, REFER VEGETATION MANAGEMENT PLAN FOR MORE DETAILS. THE CONTRACTOR SHALL NOT CREATE STOCKPILES OF SURPLUS MATERIALS UNLESS DIRECTED BY THE SUPERINTENDENT. ALL MATERIALS ARISING FROM THE WORKS SHALL BE COMPACTED TO FUTURE FILL AREAS AS NOMINATED.
11. TOPSOIL SCREENING
    TOPSOIL SHALL BE SCREENED BY THE CONTRACTOR WHEN DIRECTED BY THE SUPERINTENDENT. ALL UNSUITABLE MATERIAL SCREENED FROM THE TOPSOIL WILL BE TAKEN TO AN OFFSITE TIP BY THE CONTRACTOR AT THE CONTRACTORS EXPENSE.

NOTE:
CONTRACTOR TO MAKE ALL NECESSARY ALLOWANCES FOR EXISTING SERVICES DURING ALL WORKS.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING KERB (INVERT)
- FUTURE KERB (INVERT)
- FUTURE PROPERTY LINE
- SITE BOUNDARY
- STAGE BOUNDARY
- PROPOSED PROPERTY LINE
- PROPOSED KERB (INVERT)
- 0.5 BULK EARTHWORKS FILL CONTOUR
- 0.0 BULK EARTHWORKS INTERFACE CONTOUR
- -0.5 BULK EARTHWORKS CUT CONTOUR



C

STRUCTURAL EARTHWORKS VOLUMES

CUT	-308,400m³
FILL	283,250m³

NOTES:
1. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY, CONTRACTOR TO VERIFY.
2. VOLUMES INDICATE THE STRUCTURAL QUANTITY OF EARTHWORKS, IE BETWEEN THE EXISTING SURFACE STRIP SURFACE AND THE UNDERSIDE OF THE MINIMUM BOX AND UNDERSIDE OF THE TOPSOIL, AS PRESCRIBED IN THE CONTRACT DOCUMENTATION.
3. NO ALLOWANCE FOR COMPACTION OR BULKING FACTOR IS INCLUDED.
4. THE CONTRACTOR IS TO VERIFY EXISTING SURFACE AND TOPSOIL DISTRIBUTION PRIOR TO SIGNING THE CONTRACT.
5. THE CONTRACTOR IS REQUIRED TO EXPORT / IMPORT AS NEEDED TO ACHIEVE THE FINAL SURFACE LEVELS.

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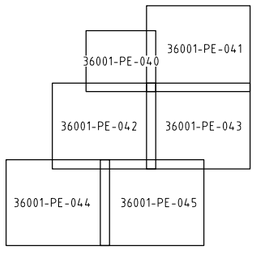
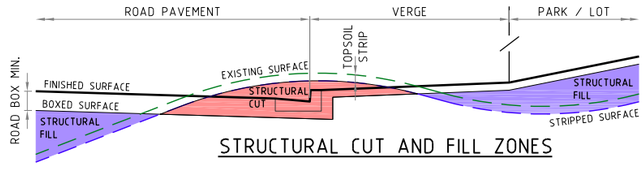
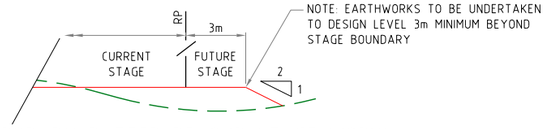
SHEET LAYOUT





STRUCTURAL CUT AND FILL ZONES



TEMPORARY BATTER BEYOND STAGE WORKS

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, CONTOURS & VOLUMES REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-040
AMEND. C

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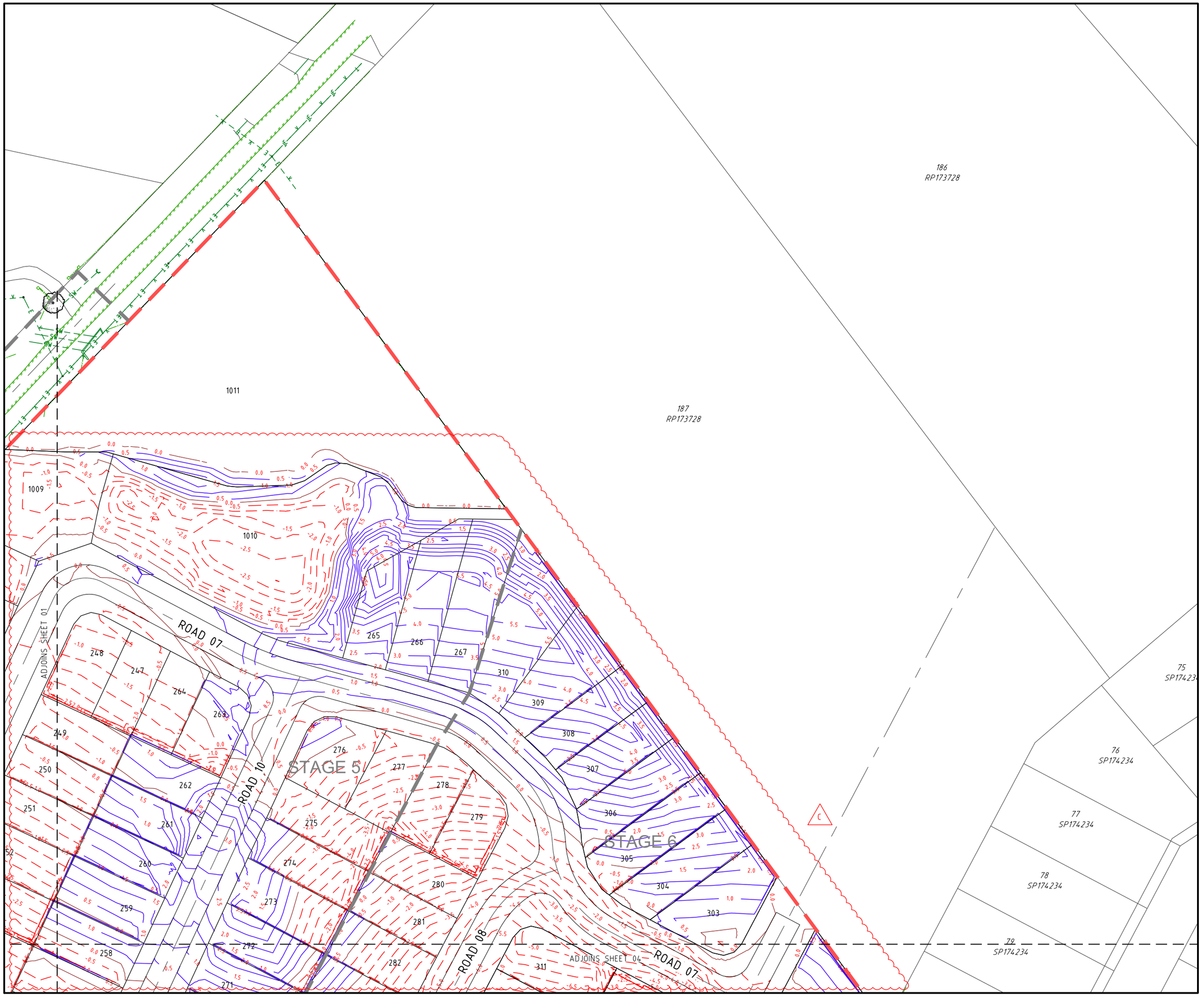

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY
EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 02

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urbansolutions
Urban & Regional Planning
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MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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DRAWING NUMBER	AMEND.
36001-PE-041	C

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ADJOINS SHEET 01

ADJOINS SHEET 04

ADJOINS SHEET 05

ADJOINS SHEET 06

194
RP173728

193
RP173728

ROAD 01

ROAD FIRE 01

ROAD 03

ROAD 04

STAGE 3

STAGE 4

C

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & CONTOURS REVISED
A	27-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 03

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Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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36001-PE-042	C

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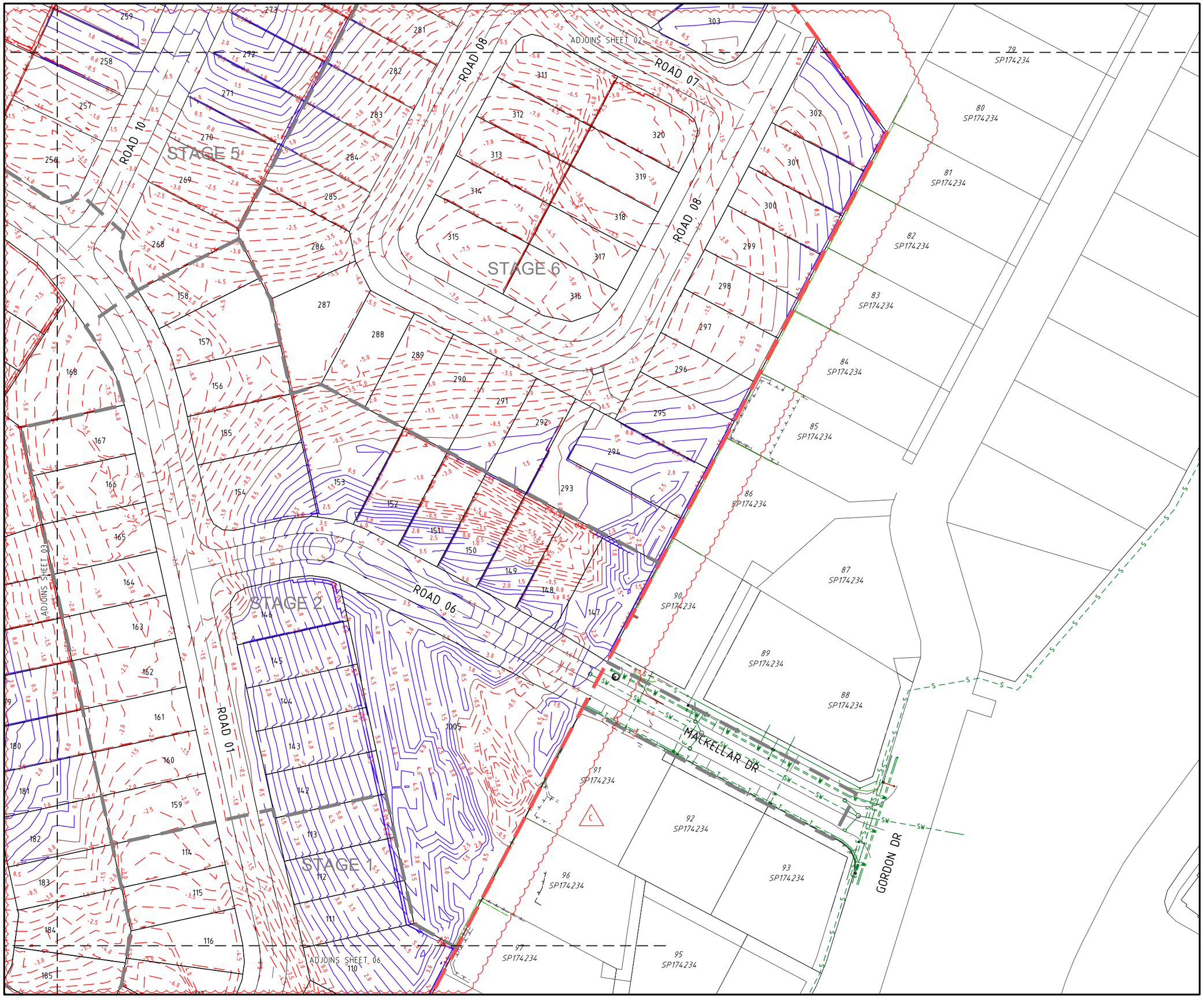

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
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NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & CONTORS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 04

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-043 | AMEND. C

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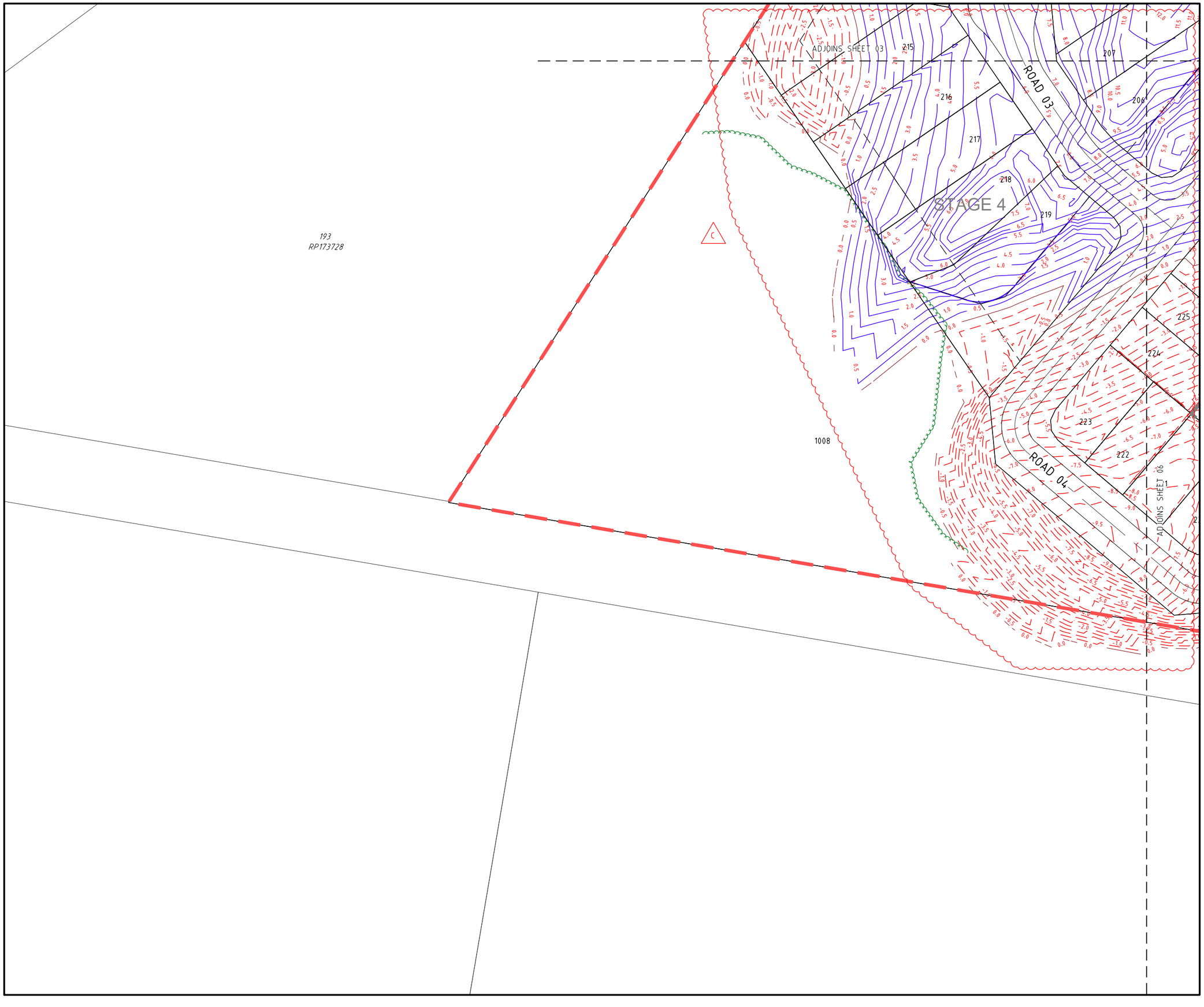

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & CONTOURS REVISED
B	27-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 05

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-044
AMEND. C

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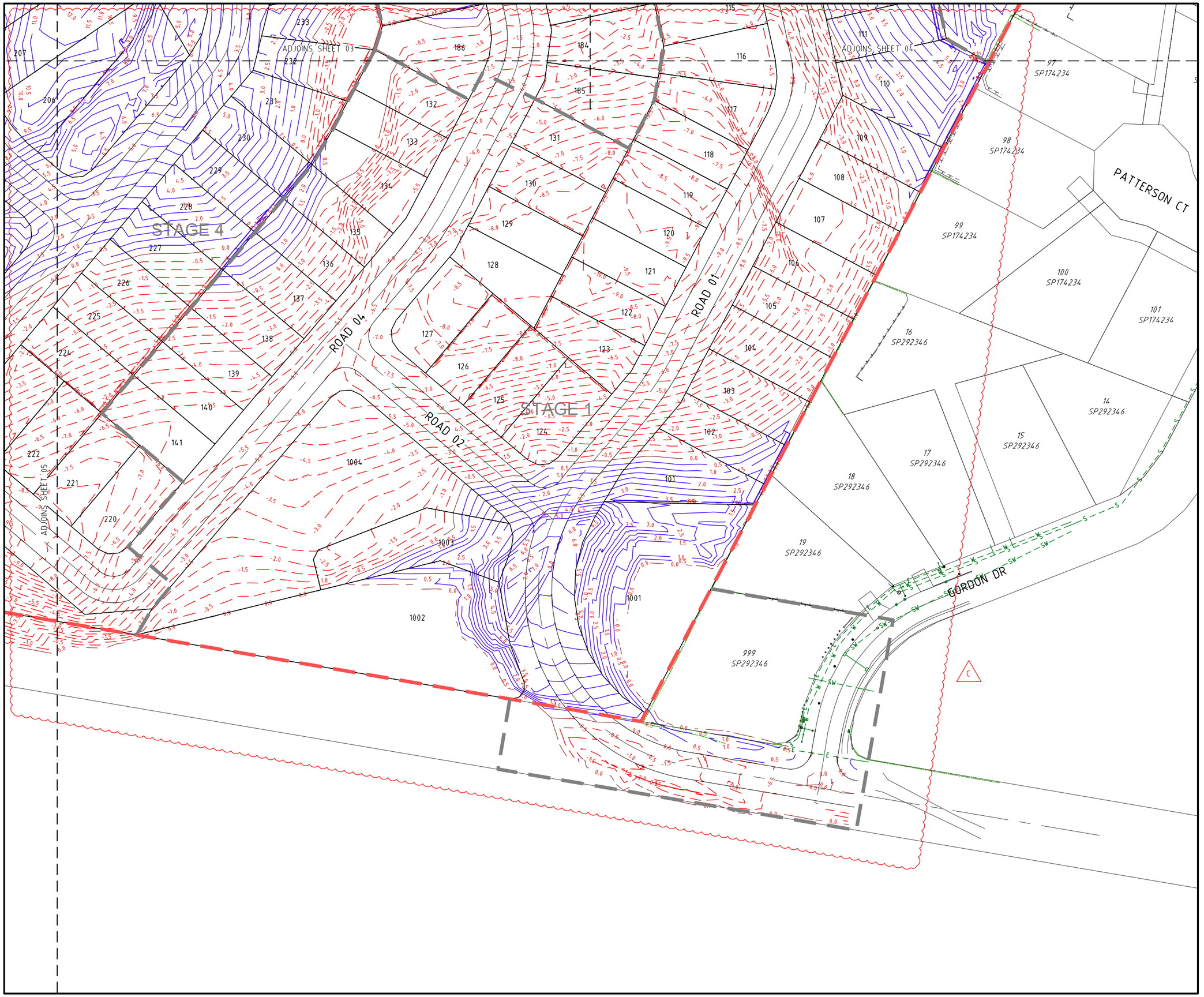

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & CONTOURS REVISED
B	27-03-19	LOT NO'S, STAGES & CONTOURS AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

EARTHWORKS
CUT TO FILL
PLAN
SHEET 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER	AMEND.
36001-PE-045	C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 12.5 25 37.5 50 62.5m
Scale 1:1250 - A1 (1:2500 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & CONTOURS REVISED
B	27-03-19	LOTS, LOT NO'S, STAGES, CONTOURS, SECTIONS AMENDED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

BULK EARTHWORKS
SECTIONS
KEY PLAN

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-050 | AMEND. C

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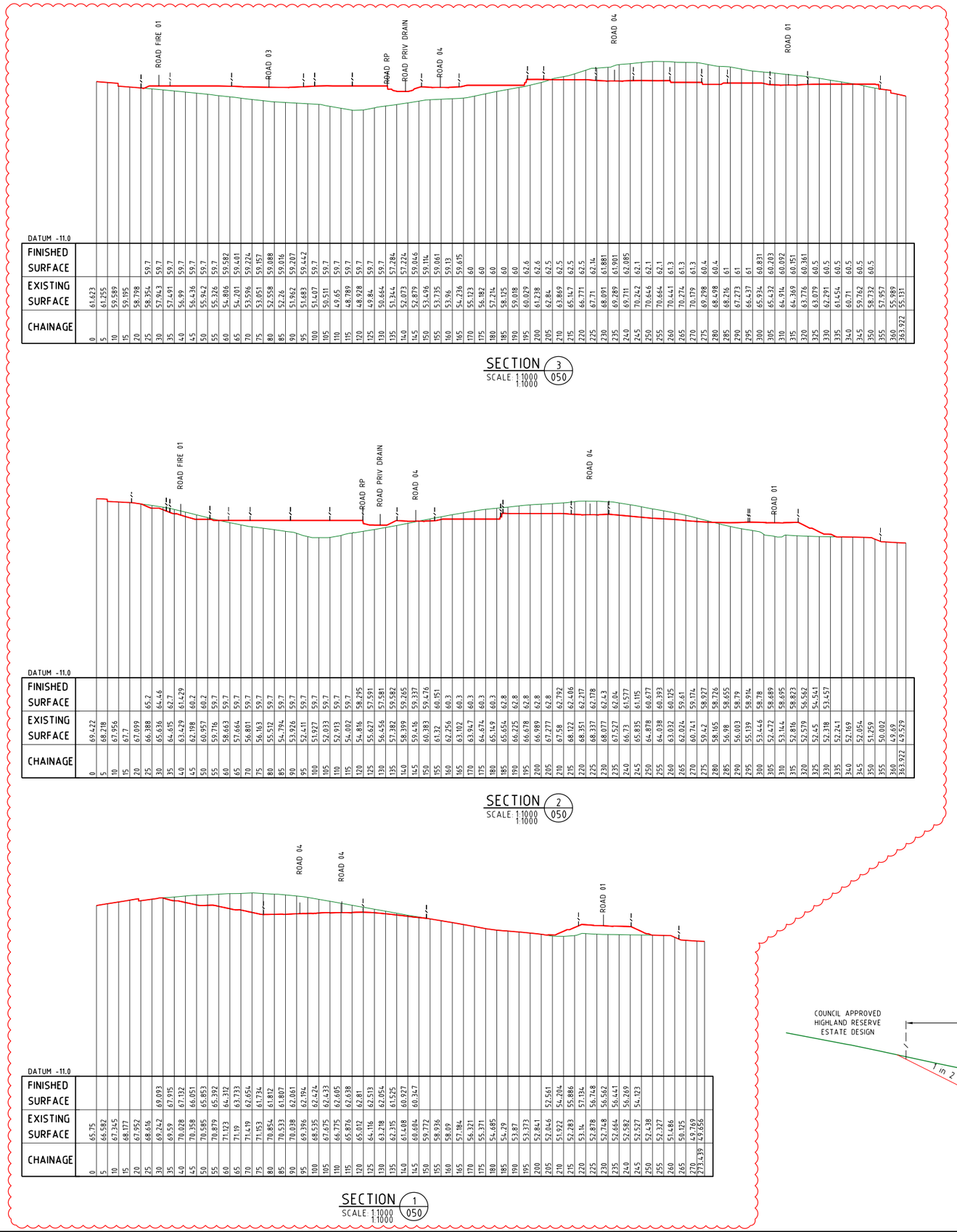

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
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15		59.195
20		58.798
25	59.7	58.354
30	59.7	57.943
35	59.7	57.491
40	59.7	56.99
45	59.7	56.436
50	59.7	55.942
55	59.7	55.326
60	59.582	54.806
65	59.401	54.201
70	59.224	53.596
75	59.157	53.051
80	59.088	52.558
85	59.016	52.26
90	59.207	51.962
95	59.442	51.683
100	59.7	51.407
105	59.7	50.511
110	59.7	49.65
115	59.7	48.789
120	59.7	48.928
125	59.7	49.84
130	59.7	50.664
135	57.284	51.344
140	57.224	52.073
145	59.045	52.879
150	59.114	53.496
155	59.061	53.735
160	59.13	53.96
165	59.615	54.236
170	60	55.123
175	60	56.182
180	60	57.214
185	60	58.125
190	60	59.018
195	62.6	60.029
200	62.6	61.238
205	62.5	62.84
210	62.5	63.869
215	62.5	65.147
220	62.5	66.771
225	62.14	67.71
230	61.881	68.091
235	61.901	69.289
240	62.085	69.711
245	62.1	70.242
250	62.1	70.646
255	62.1	70.441
260	61.3	70.274
265	61.3	70.179
270	61.3	69.298
275	60.4	68.498
280	60.4	68.216
285	61	67.273
290	61	66.437
295	61	65.934
300	60.831	65.432
305	60.703	64.914
310	60.092	64.369
315	60.151	63.776
320	60.361	63.079
325	60.5	62.291
330	60.5	61.454
335	60.5	60.71
340	60.5	59.762
345	60.5	58.732
350	60.5	57.957
355		55.989
360		55.131
363.922		

SECTION 3 / 050
SCALE 1:1000
1:1000

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		69.422
5		68.218
10		67.956
15		67.7
20		67.699
25	65.2	66.388
30	65.446	65.636
35	62.7	64.615
40	61.429	63.429
45	60.2	62.198
50	60.2	60.957
55	59.7	59.716
60	59.7	58.663
65	59.7	57.664
70	59.7	56.801
75	59.7	56.163
80	59.7	55.512
85	59.7	54.794
90	59.7	53.926
95	59.7	52.411
100	59.7	51.927
105	59.7	52.033
110	59.7	52.913
115	59.7	54.002
120	58.295	54.816
125	57.591	55.627
130	57.581	56.456
135	59.582	57.382
140	59.265	58.399
145	59.337	59.416
150	59.476	60.383
155	60.151	61.32
160	60.3	62.256
165	60.3	63.102
170	60.3	63.947
175	60.3	64.674
180	60.3	65.149
185	62.8	65.654
190	62.8	66.225
195	62.8	66.678
200	62.8	66.989
205	62.8	67.277
210	62.792	67.58
215	62.406	68.122
220	62.217	68.351
225	62.178	68.337
230	62.43	68.077
235	62.04	67.527
240	61.577	66.73
245	61.115	65.835
250	60.677	64.878
255	60.393	64.038
260	60.175	63.032
265	59.61	62.024
270	59.174	60.741
275	58.927	59.42
280	58.726	58.165
285	58.655	56.98
290	58.79	56.003
295	58.914	55.139
300	58.78	53.446
305	58.689	52.472
310	58.695	53.144
315	58.823	52.816
320	56.562	52.579
325	54.541	52.45
330	53.457	52.318
335		52.241
340		52.169
345		52.054
350		51.259
355		50.002
360		49.69
363.922		49.529

SECTION 2 / 050
SCALE 1:1000
1:1000

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		65.75
5		66.582
10		67.345
15		68.177
20		67.952
25		68.616
30	69.093	69.242
35	67.915	69.59
40	67.132	70.028
45	66.051	70.358
50	65.893	70.585
55	65.392	70.879
60	64.312	71.123
65	63.733	71.19
70	62.654	71.419
75	61.734	71.153
80	61.812	70.854
85	61.807	70.533
90	62.061	70.038
95	62.394	69.396
100	62.424	68.525
105	62.433	67.675
110	62.605	66.775
115	62.638	65.876
120	62.81	65.012
125	62.513	64.116
130	62.054	63.218
135	61.525	62.315
140	60.927	61.408
145	60.347	60.604
150	59.772	59.772
155	58.938	58.938
160	58.09	58.09
165	57.184	57.184
170	56.321	56.321
175	55.371	55.371
180	54.685	54.685
185	54.29	54.29
190	53.87	53.87
195	53.373	53.373
200	52.841	52.841
205	52.046	52.046
210	51.922	51.922
215	52.283	52.283
220	53.14	53.14
225	52.878	52.878
230	52.748	52.748
235	52.664	52.664
240	52.582	52.582
245	52.527	52.527
250	52.438	52.438
255	52.327	52.327
260	51.486	51.486
265	50.125	50.125
270	49.769	49.769
273.439	49.656	49.656

SECTION 1 / 050
SCALE 1:1000
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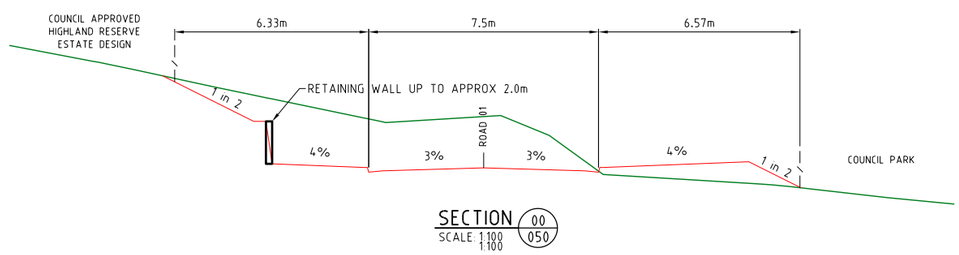

SECTION 00 / 050
SCALE 1:100
1:100

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY
EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE
TENDER	
COUNCIL	11-09-18
CONSTRUCTION	

PRE	DATE	AMENDMENT
C	24-10-19	SECTIONS REVISED
B	27-03-19	SECTION ADDED
A	11-09-18	COUNCIL ISSUE

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zone Planning Group

DRAWING TITLE

BULK EARTHWORKS
SECTIONS
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-051
AMEND. C

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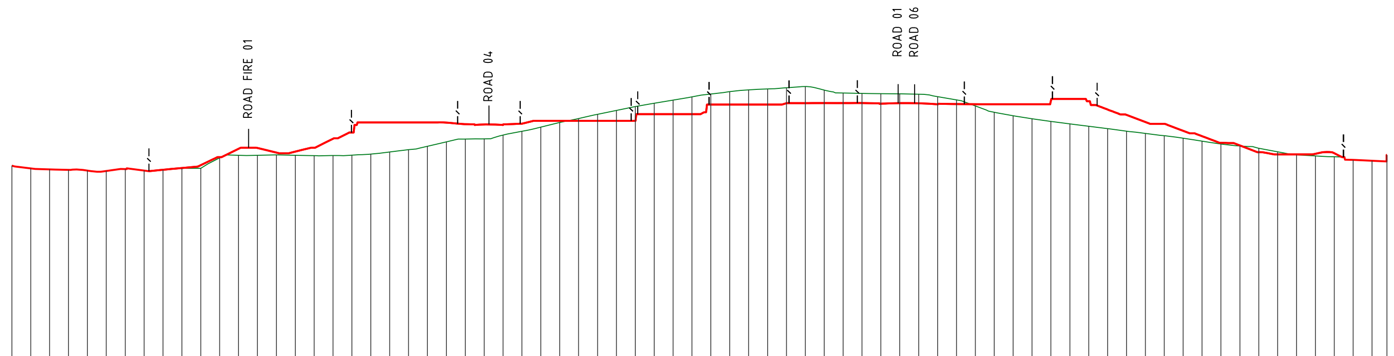

DATUM -11.0

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10		40.23
15		40.102
20		39.95
25		39.841
30		40.33
35		39.928
40	40.138	40.103
45	40.605	40.503
50	41.37	40.552
55	43.5	43.299
60	45.692	43.98
65	45.926	43.969
70	44.69	44.066
75	44.942	43.986
80	46	43.878
85	48.367	43.917
90	50	44.019
95	52.7	44.295
100	52.7	44.86
105	52.7	45.441
110	52.7	46.357
115	52.643	47.536
120	52.265	48.297
125	52.12	48.345
130	52.018	49.351
135	52.369	50.345
140	53.1	51.43
145	53.1	52.677
150	53.1	53.718
155	53.1	54.822
160	53.1	55.863
165	53.1	56.898
170	54.9	57.759
175	54.9	58.6
180	54.9	59.467
185	57.4	60.223
190	57.4	60.82
195	57.4	61.33
200	57.4	61.539
205	57.778	61.863
210	57.8	62.152
215	57.8	61.285
220	57.8	60.476
225	57.82	60.377
230	57.636	60.295
235	57.815	60.248
240	57.756	60.143
245	57.497	59.503
250	57.563	58.635
255	57.5	57.041
260	57.5	55.396
265	57.5	54.434
270	57.5	53.697
275	58.396	52.988
280	58.9	52.26
285	58.3	51.704
290	56.103	51.042
295	54.693	50.361
300	52.782	49.77
305	52.3	49.127
310	50.46	48.478
315	49.05	47.743
320	47.289	47.018
325	46.578	46.454
330	44.8	45.85
335	44.2	44.904
340	44.2	44.101
345	44.346	43.798
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355		42.751
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363.922		44.086

SECTION 6/050
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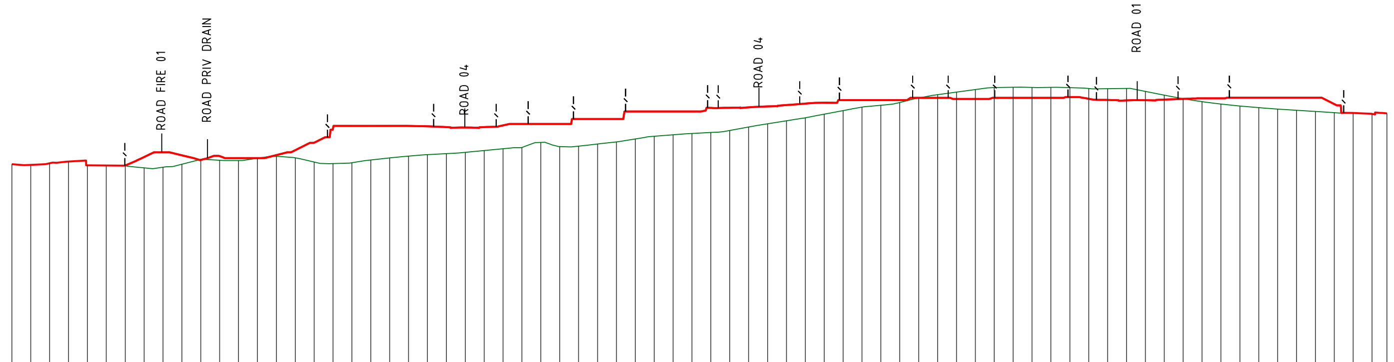

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
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5		42.694
10		43.117
15		43.595
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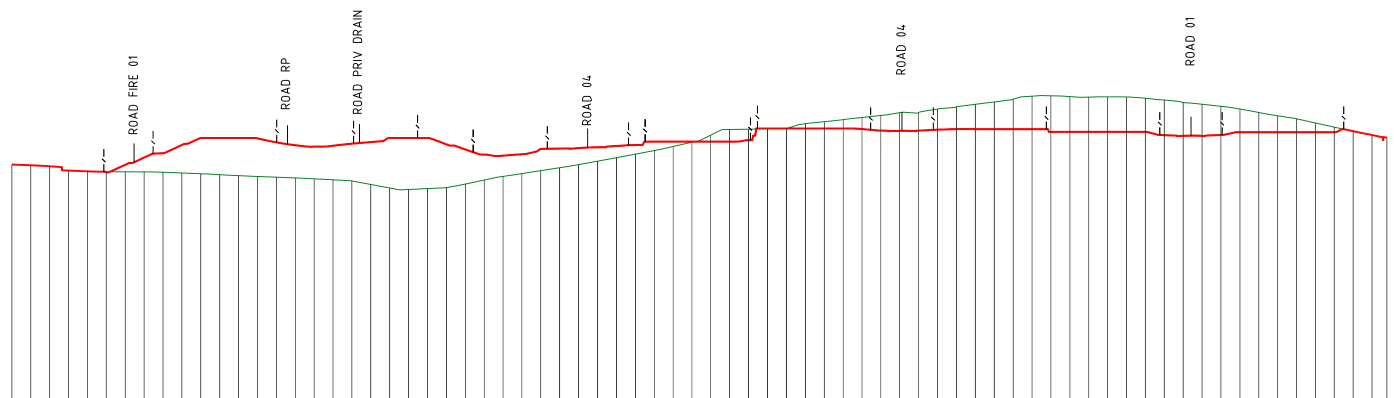
25		42.524
30	42.535	42.469
35	44.77	41.907
40	46	42.086
45	45.236	42.883
50	44.015	44.155
55	45.016	43.924
60	44.5	43.862
65	44.5	44.454
70	45.289	44.941
75	46.569	44.578
80	48.56	43.465
85	52.369	43.057
90	53	43.266
95	53	43.98
100	53	44.551
105	53	45.033
110	52.888	45.396
115	52.662	45.66
120	52.606	45.999
125	52.665	46.473
130	53.122	46.956
135	53.5	47.287
140	53.5	48.643
145	53.5	47.544
150	54.8	47.647
155	54.8	48.223
160	54.8	48.752
165	56.8	49.552
170	56.8	50.252
175	56.8	50.638
180	56.8	50.978
185	57.746	51.253
190	57.791	51.776
195	57.886	52.71
200	58.139	53.558
205	58.501	54.345
210	58.917	55.152
215	59.1	56.101
220	59.8	57.055
225	59.8	57.968
230	59.8	58.451
235	59.8	59.183
240	60.4	60.389
245	60.4	61.246
250	60.1	61.923
255	60.1	62.599
260	60.4	63.122
265	60.4	63.22
270	60.4	63.17
275	60.4	63.171
280	60.6	63.082
285	60.162	62.868
290	59.84	62.824
295	59.724	62.892
300	59.78	62.126
305	59.942	61.142
310	60.131	60.196
315	60.295	59.469
320	60.3	58.857
325	60.45	58.179
330	60.45	57.825
335	60.45	57.441
340	60.45	57.126
345	60.45	56.811
350	58.77	56.495
355		56.386
360		56.166
363.922		56.298

SECTION 5/050
SCALE: 1:1000
1:1000



DATUM -11.0

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15		51.076
20		50.852
25	50.639	50.738
30	52.599	50.721
35	54.487	50.703
40	55.652	50.633
45	57.839	50.442
50	59.7	50.242
55	59.7	49.999
60	59.7	49.744
65	59.593	49.508
70	58.539	49.319
75	57.764	49.124
80	57.384	48.902
85	57.627	48.64
90	58.2	48.325
95	58.599	47.406
100	59.7	46.455
105	59.7	46.063
110	59.7	46.295
115	58.004	46.545
120	56.639	47.494
125	55.296	48.544
130	55.006	49.51
135	55.398	50.269
140	56.811	51.057
145	56.891	51.829
150	57.004	52.656
155	57.237	53.539
160	57.571	54.474
165	57.811	55.422
170	58.7	56.371
175	58.7	57.444
180	58.7	58.565
185	58.7	60.463
190	58.7	61.925
195	59.1	62.011
200	62.2	62.087
205	62.2	62.283
210	62.2	63.458
215	62.2	63.989
220	62.2	64.532
225	62.049	65.108
230	61.68	65.646
235	61.586	66.388
240	61.635	66.391
245	61.853	67.359
250	62	67.919
255	62	68.597
260	62	69.223
265	62	69.957
270	62	70.759
275	61.3	70.867
280	61.3	70.645
285	61.3	70.494
290	61.3	70.565
295	61.3	70.547
300	61.3	70.209
305	60.448	69.73
310	60.248	69.082
315	60.222	68.626
320	60.482	68.071
325	61.2	67.343
330	61.2	66.444
335	61.2	65.548
340	61.2	64.754
345	61.2	63.661
350	61.2	62.56
355		61.51
360		60.469
363.922		59.773

SECTION 4/050
SCALE: 1:1000
1:1000

B

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	SECTIONS REVISED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

BULK EARTHWORKS SECTIONS SHEET 02

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED RB	DRAWN EP	
APPROVED	RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-052 | AMEND. B

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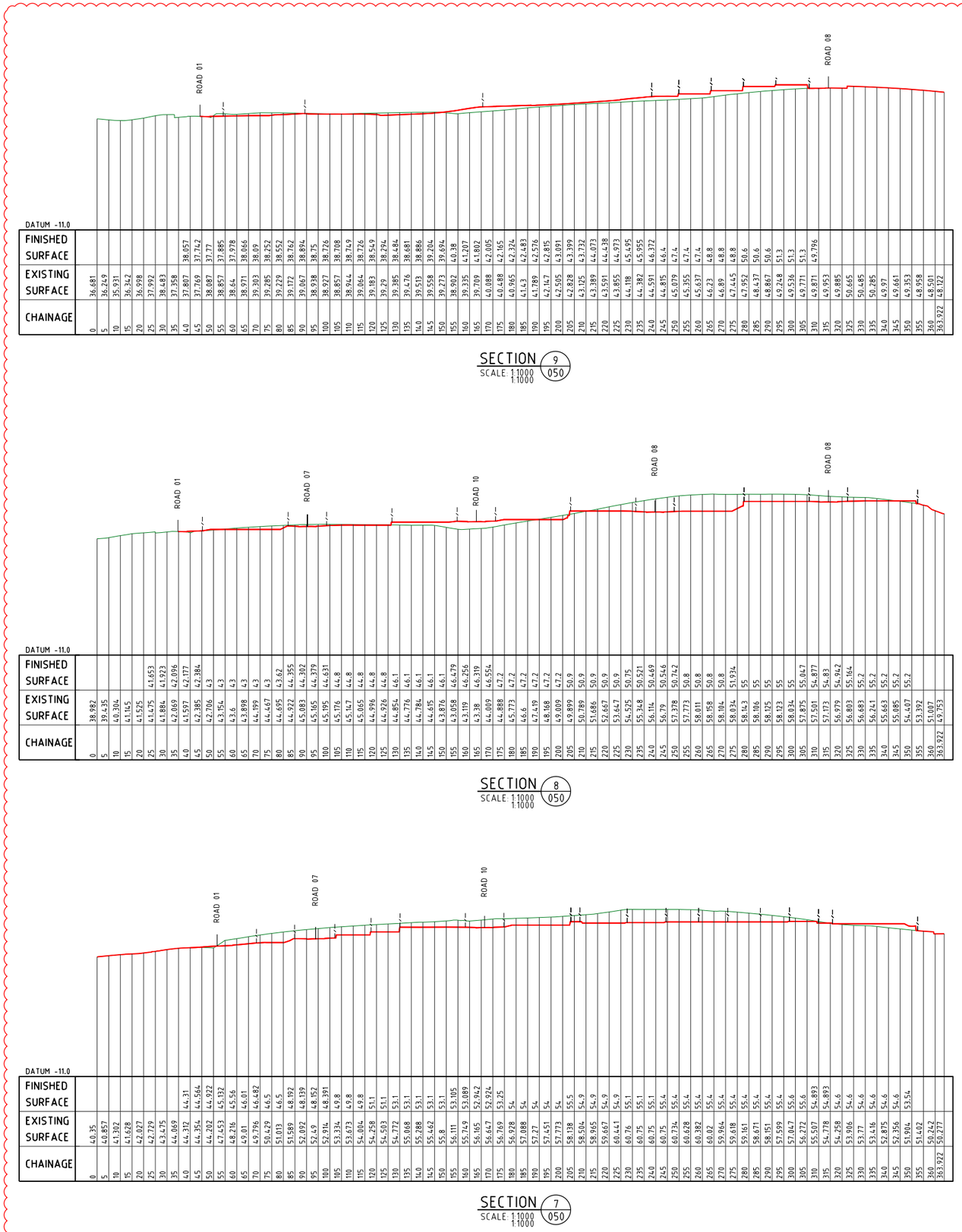

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		36.681
5		36.249
10		35.931
15		36.342
20		36.998
25		37.992
30		38.483
35	38.057	37.358
40	37.807	37.769
45	37.742	37.77
50	38.087	38.087
55	37.885	38.857
60	37.978	38.64
65	38.066	38.971
70	38.09	39.303
75	38.252	39.285
80	38.552	39.229
85	38.762	39.172
90	38.894	39.067
95	38.75	38.938
100	38.726	38.927
105	38.708	38.857
110	38.749	38.944
115	38.726	39.064
120	38.549	39.183
125	38.294	39.29
130	38.484	39.385
135	38.681	39.476
140	38.886	39.513
145	39.204	39.558
150	39.694	39.273
155	40.38	38.902
160	41.207	39.335
165	41.802	39.709
170	42.005	40.088
175	42.165	40.488
180	42.324	40.965
185	42.483	41.43
190	42.576	41.789
195	42.815	42.147
200	43.091	42.505
205	43.399	42.828
210	43.732	43.125
215	44.073	43.389
220	44.438	43.591
225	44.973	43.855
230	45.495	44.118
235	45.995	44.382
240	46.372	44.591
245	46.4	44.815
250	47.4	45.079
255	47.4	45.355
260	47.4	45.637
265	48.8	46.23
270	48.8	46.89
275	48.8	47.445
280	50.6	47.952
285	50.6	48.437
290	50.6	48.867
295	51.3	49.248
300	51.3	49.536
305	51.3	49.771
310	49.796	49.871
315		49.953
320		49.885
325		50.665
330		50.485
335		50.285
340		49.97
345		49.661
350		49.353
355		48.958
360		48.501
363.922		48.122

SECTION 9
SCALE: 1:1000
1:1000
050

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		40.35
5		40.857
10		41.302
15		41.628
20		42.027
25		42.729
30		43.475
35		44.069
40	44.31	44.312
45	44.564	44.354
50	44.922	44.202
55	45.132	47.453
60	45.56	48.216
65	46.01	49.01
70	46.482	49.796
75	46.5	50.429
80	46.5	51.013
85	48.192	51.589
90	48.139	52.092
95	48.152	52.49
100	48.391	52.914
105	49.8	53.334
110	49.8	53.673
115	49.8	54.004
120	51.1	54.258
125	51.1	54.593
130	53.1	54.772
135	53.1	55.068
140	53.1	55.288
145	53.1	55.462
150	53.1	55.8
155	53.105	56.111
160	53.089	55.749
165	52.942	56.165
170	52.924	56.647
175	53.25	56.769
180	54	56.928
185	54	57.088
190	54	57.27
195	54	57.451
200	54	57.773
205	55.5	58.138
210	54.9	58.504
215	54.9	58.965
220	54.9	59.667
225	54.9	60.441
230	55.1	60.76
235	55.1	60.75
240	55.1	60.75
245	55.4	60.75
250	55.4	60.734
255	55.4	60.628
260	55.4	60.382
265	55.4	60.02
270	55.4	59.964
275	55.4	59.618
280	55.4	59.161
285	55.4	58.671
290	55.4	58.151
295	55.4	57.599
300	55.6	57.047
305	55.6	56.272
310	54.893	55.507
315	54.893	54.778
320	54.6	54.258
325	54.6	53.906
330	54.6	53.77
335	54.6	53.416
340	54.6	52.875
345	54.6	52.356
350	53.54	51.904
355		51.482
360		50.242
363.922		50.277

SECTION 8
SCALE: 1:1000
1:1000
050

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		38.982
5		39.435
10		40.304
15		41.145
20		41.525
25	41.653	41.475
30	41.923	41.884
35	42.096	42.069
40	42.177	41.597
45	42.384	42.385
50	43	42.706
55	43	43.154
60	43	43.6
65	43	43.898
70	43	44.199
75	43	44.467
80	43.62	44.695
85	44.355	44.922
90	44.302	45.083
95	44.379	45.165
100	44.631	45.195
105	44.8	45.176
110	44.8	45.147
115	44.8	45.065
120	44.8	44.996
125	44.8	44.926
130	46.1	44.854
135	46.1	44.776
140	46.1	44.784
145	46.1	44.615
150	46.1	43.876
155	46.479	43.058
160	46.256	43.119
165	46.319	43.38
170	46.554	44.009
175	47.2	44.888
180	47.2	45.273
185	47.2	46.6
190	47.2	47.419
195	47.2	48.168
200	47.2	49.009
205	50.9	49.899
210	50.9	50.789
215	50.9	51.686
220	50.9	52.667
225	50.75	53.647
230	50.521	54.525
235	50.469	55.348
240	50.546	56.114
245	50.742	56.79
250	50.8	57.378
255	50.8	57.773
260	50.8	58.011
265	50.8	58.158
270	50.8	58.104
275	51.934	58.034
280	55	58.143
285	55	58.106
290	55	58.125
295	55	58.123
300	55	58.034
305	55.047	57.875
310	54.877	57.501
315	54.83	57.173
320	54.942	56.979
325	55.164	56.803
330	55.2	56.683
335	55.2	56.241
340	55.2	55.663
345	55.2	55.085
350	55.2	54.407
355		53.392
360		51.007
363.922		49.753

SECTION 7
SCALE: 1:1000
1:1000
050

B

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	SECTIONS REVISED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

BULK EARTHWORKS
SECTIONS
SHEET 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-053
AMEND. B

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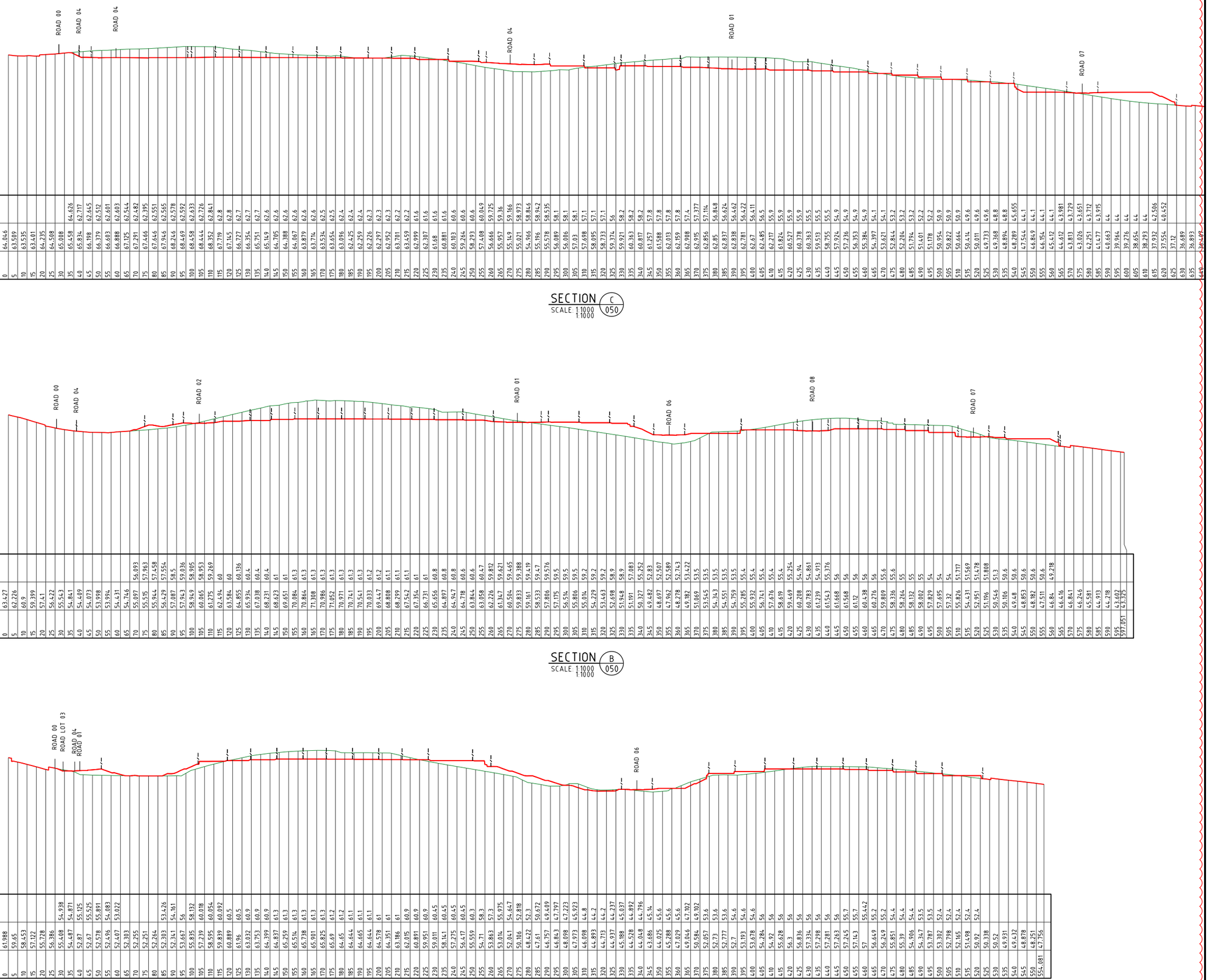

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	SECTIONS REVISED
B	27-03-19	SECTION A AMENDED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

BULK EARTHWORKS
SECTIONS
SHEET 04

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-054
AMEND. C

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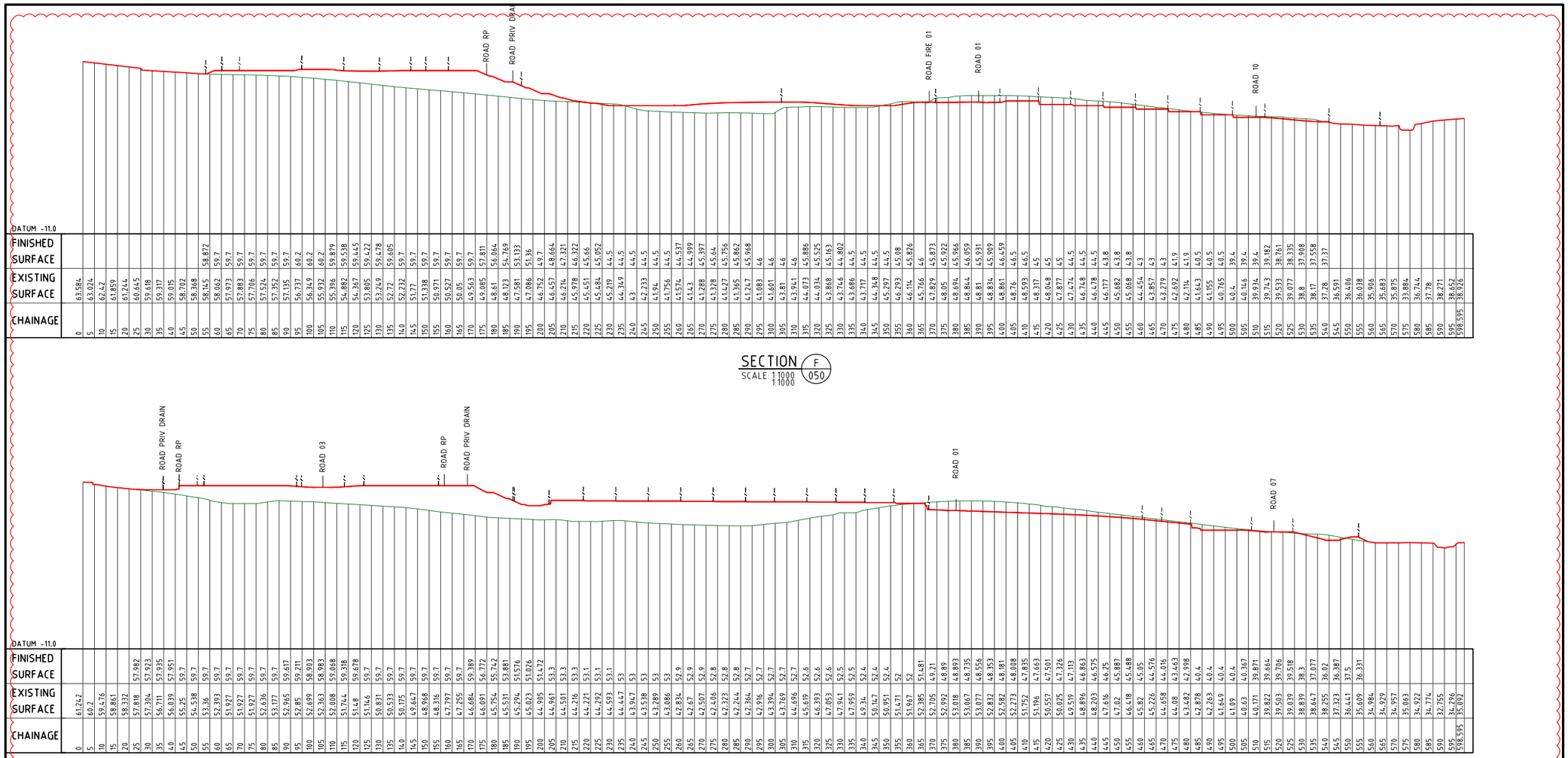

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
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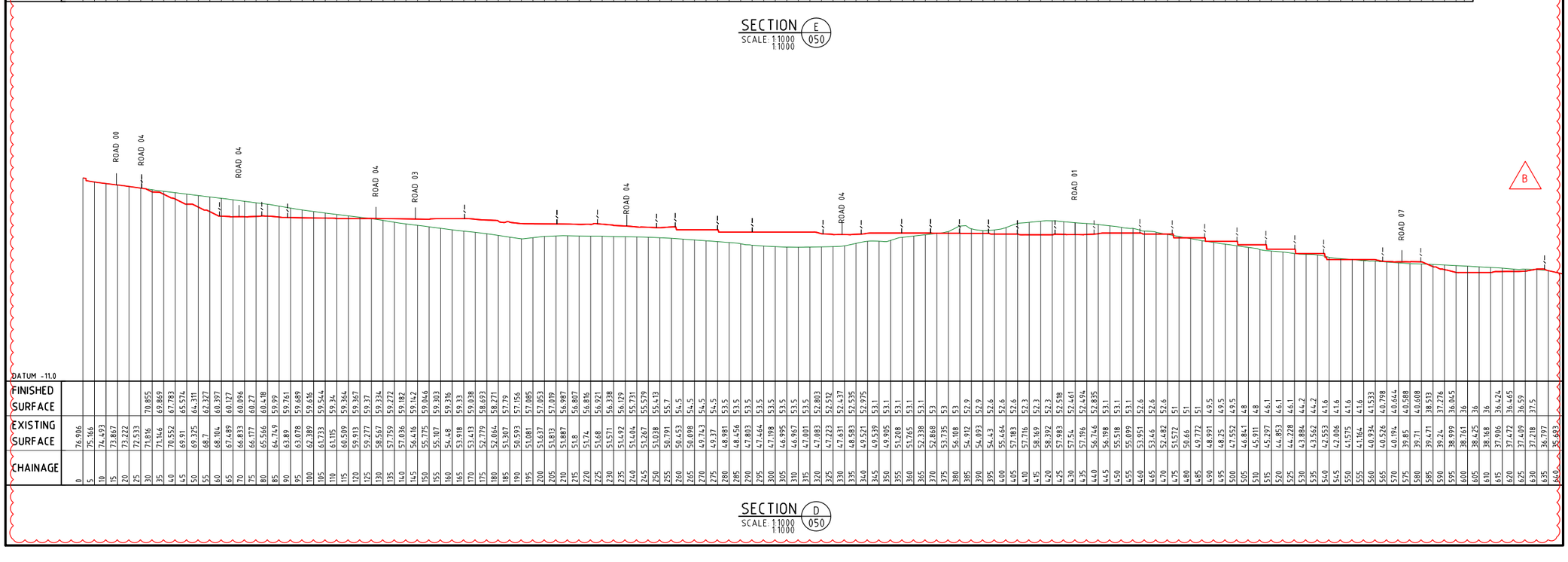
5		63.024
10		62.42
15		61.859
20		61.244
25		60.645
30		59.818
35		59.317
40		59.015
45		58.702
50	58.368	58.145
55	58.872	58.062
60	59.7	57.973
65	59.7	57.883
70	59.7	57.706
75	59.7	57.524
80	59.7	57.352
85	59.7	57.195
90	59.7	56.737
95	60.2	56.349
100	60.2	55.932
105	59.879	55.396
110	59.538	54.882
115	59.445	54.367
120	59.422	54.219
125	59.478	53.805
130	59.605	53.249
135	59.7	52.72
140	59.7	52.232
145	59.7	51.77
150	59.7	51.338
155	59.7	50.971
160	59.7	50.527
165	59.7	50.05
170	59.7	49.563
175	57.811	49.085
180	56.044	48.61
185	54.769	48.123
190	53.133	47.581
195	51.36	47.086
200	49.7	46.752
205	48.664	46.457
210	47.321	46.214
215	46.322	45.978
220	45.66	45.451
225	45.052	45.484
230	44.5	45.219
235	44.5	44.349
240	44.5	44.3
245	44.5	42.233
250	44.5	41.94
255	44.5	41.756
260	44.537	41.574
265	44.999	41.143
270	45.397	41.288
275	45.64	41.328
280	45.756	41.427
285	45.862	41.365
290	45.988	41.247
295	46	41.083
300	46	41.601
305	46	43.81
310	46	43.941
315	45.886	44.073
320	45.525	44.034
325	45.163	43.868
330	44.802	43.746
335	44.5	43.686
340	44.5	43.717
345	44.5	44.348
350	44.5	45.297
355	45.08	46.293
360	45.826	46.114
365	46	45.766
370	45.873	47.829
375	45.922	48.05
380	45.966	48.694
385	46.059	48.84
390	45.931	48.881
395	45.909	48.834
400	46.459	48.861
405	46.5	48.76
410	46.5	48.593
415	45	48.317
420	45	48.048
425	45	47.877
430	44.5	47.474
435	44.5	46.748
440	44.5	46.478
445	44.5	46.177
450	43.8	45.682
455	43.8	45.068
460	43	44.454
465	43	43.857
470	43	43.279
475	41.9	42.692
480	41.9	42.114
485	40.5	41.643
490	40.5	41.155
495	40.5	40.765
500	39.4	40.4
505	39.4	40.146
510	39.4	39.934
515	39.182	39.743
520	38.761	39.533
525	38.335	39.077
530	37.908	38.8
535	37.558	38.17
540	37.37	37.28
545		36.591
550		36.446
555		36.038
560		35.906
565		35.683
570		35.875
575		33.884
580		36.744
585		37.78
590		38.271
595		38.652
598.595		38.976

SECTION F
SCALE: 1:1000
1:1000
050

DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		61.242
5		60.2
10		59.476
15		58.861
20		58.332
25		57.818
30	57.982	57.304
35	57.923	56.711
40	57.951	56.039
45	59.7	55.25
50	59.7	54.538
55	59.7	53.36
60	59.7	52.393
65	59.7	51.927
70	59.7	51.927
75	59.7	51.927
80	59.7	52.636
85	59.7	53.177
90	59.617	52.965
95	59.211	52.85
100	58.903	52.699
105	58.983	52.363
110	59.068	52.008
115	59.318	51.744
120	59.678	51.48
125	59.7	51.146
130	59.7	50.831
135	59.7	50.533
140	59.7	50.175
145	59.7	49.647
150	59.7	48.968
155	59.7	48.316
160	59.7	47.797
165	59.7	47.255
170	59.389	46.684
175	56.772	46.091
180	55.742	45.754
185	53.881	45.531
190	51.576	45.294
195	51.026	45.023
200	51.472	44.905
205	53.3	44.961
210	53.3	44.501
215	53.3	44.216
220	53.1	44.221
225	53.1	44.292
230	53.1	44.593
235	53	44.447
240	53	43.947
245	53	43.538
250	53	43.289
255	53	43.086
260	52.9	42.834
265	52.9	42.67
270	52.9	42.507
275	52.8	42.406
280	52.8	42.323
285	52.8	42.244
290	52.7	42.364
295	52.7	42.916
300	52.7	43.394
305	52.7	43.769
310	52.7	44.696
315	52.6	45.619
320	52.6	46.393
325	52.6	47.053
330	52.5	47.941
335	52.5	47.959
340	52.4	48.34
345	52.4	50.147
350	52.4	50.951
355	52	51.471
360	52	51.967
365	51.481	52.385
370	49.21	52.705
375	48.89	52.992
380	48.893	53.018
385	48.735	53.067
390	48.556	53.077
395	48.353	52.832
400	48.181	52.582
405	48.008	52.273
410	47.835	51.752
415	47.663	51.196
420	47.501	50.557
425	47.326	50.025
430	47.113	49.519
435	46.863	48.896
440	46.575	48.203
445	46.25	47.616
450	45.887	47.02
455	45.488	46.418
460	45.05	45.82
465	44.576	45.226
470	44.016	44.658
475	43.463	44.08
480	42.998	43.682
485	40.4	42.878
490	40.4	42.263
495	40.4	41.649
500	40.4	41.099
505	40.387	40.63
510	39.871	40.171
515	39.664	39.822
520	39.706	39.503
525	39.518	39.039
530	38.3	38.839
535	37.077	38.647
540	36.02	38.255
545	36.387	37.323
550	36.331	36.441
555		35.609
560		34.984
565		34.929
570		34.957
575		35.063
580		34.922
585		34.774
590		32.755
595		34.796
598.595		35.092

SECTION E
SCALE: 1:1000
1:1000
050



DATUM -11.0

CHAINAGE	FINISHED SURFACE	EXISTING SURFACE
0		76.906
5		75.166
10		74.493
15		73.867
20		73.222
25		72.533
30	70.855	71.816
35	69.869	71.146
40	67.783	70.552
45	65.574	69.91
50	64.311	69.325
55	62.327	68.7
60	60.397	68.104
65	60.127	67.489
70	60.096	66.833
75	60.27	66.177
80	60.418	65.566
85	59.99	64.749
90	59.761	63.89
95	59.689	63.078
100	59.616	62.389
105	59.544	61.733
110	59.34	61.115
115	59.364	60.509
120	59.367	59.913
125	59.37	59.277
130	59.334	58.567
135	59.272	57.759
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625	36.59	37.409
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635	36.797	36.797
640	35.683	

SECTION D
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1:1000
050

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 10 20 30 40 50m
Scale 1:1000 - A1 (1:2000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	SECTIONS REVISED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

BULK EARTHWORKS
SECTIONS
SHEET 05

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-055 | AMEND. B

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SEDIMENT AND EROSION

1. THE EROSION AND SEDIMENT CONTROL DEVICES SHOWN ON THESE DRAWINGS ARE INDICATIVE AND PROVIDED FOR SUBMISSION TO LOCAL AUTHORITY ONLY. NOTWITHSTANDING THE EROSION AND CONTROL DEVICES SHOW ON THESE DRAWINGS, THE CONTRACTOR MUST PREPARE AND FOLLOW AN EROSION AND SEDIMENT CONTROL PLAN TO MEET ALL LOCAL AND STATE GOVERNMENT LEGISLATION INCLUDING BUT NOT LIMITED TO:
   a. ENVIRONMENTAL PROTECTION ACT WITH SPECIFIC REFERENCE TO PARTS S440G AND S319
   b. STATE PLANNING POLICY

   PRESCRIBED WATER CONTAMINANTS (AS DEFINED IN THE ENVIRONMENTAL PROTECTION ACT 1994) MUST NOT BE RELEASED FROM THE SITE OR TO WATERS WITHIN THE SITE, OR BE LIKELY TO BE RELEASED SHOULD RAINFALL OCCUR, UNLESS ALL REASONABLE AND PRACTICABLE MEASURES ARE TAKEN TO PREVENT OR MINIMISE THE RELEASE AND CONCENTRATION OF CONTAMINATION. THE ESC PLAN MUST BE DESIGNED, IMPLEMENTED AND MAINTAINED IN ACCORDANCE WITH "BEST PRACTICE EROSION AND SEDIMENT CONTROL" PUBLISHED BY THE INTERNATIONAL EROSION CONTROL ASSOCIATION (AUSTRALASIAN CHAPTER) (IECA, 2008).
2. TO COMPLY WITH THE REQUIREMENTS OF THE EP ACT AND BEST PRACTICE DESIGN, THE SEDIMENT BASINS ON THE SITE MUST BE DESIGNED AND IMPLEMENTED TO ACHIEVE THE FOLLOWING:
   SEDIMENT BASINS ARE TO BE DESIGNED, IMPLEMENTED AND MAINTAINED TO A STANDARD WHICH WOULD ACHIEVE AT LEAST 80% OF THE AVERAGE ANNUAL RUNOFF VOLUME OF THE CONTRIBUTING CATCHMENT TREATED (I.E. 80% HYDROLOGIC EFFECTIVENESS) TO 50MG/L TSS OR LESS AND PH IN THE RANGE 6.5-8.5

   THIS WILL REQUIRE THE INSTALLATION AND OPERATION OF A HIGH-EFFICIENCY SEDIMENT BASIN(S) DESIGNED IN ACCORDANCE WITH THE SPECIFICATIONS CONTAINED IN THE "BEST PRACTICE EROSION AND SEDIMENT CONTROL – APPENDIX B SEDIMENT BASIN DESIGN AND OPERATION" PUBLISHED BY THE INTERNATIONAL EROSION CONTROL ASSOCIATION (AUSTRALASIAN CHAPTER) (IECA, 2016, DRAFT)
3. THE EROSION AND SEDIMENT CONTROL PLAN MUST BE PREPARED AND CERTIFIED BY A CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL AND FOLLOW THE REQUIREMENTS OUTLINED IN IECA'S BEST PRACTICE EROSION AND SEDIMENT CONTROL DOCUMENT AND THE QUEENSLAND URBAN DRAINAGE MANUAL.
4. PRIOR TO THE COMMENCEMENT OF WORKS ONSITE THE CONTRACTOR MUST MAKE THEMSELVES AWARE OF ALL PREVIOUS GEOTECHNICAL REPORTS AND DETERMINE THE DISPERSIVE CHARACTERISTICS OF THE SOIL (INCLUDING PERFORMING ANY SOIL TESTS IF REQUIRED). THE RESULTS OF THIS REVIEW AND ANY TESTS MUST BE INCLUDED IN THE CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN. A COPY OF ALL TEST RESULTS MUST BE PROVIDED TO THE SUPERINTENDENT.
5. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO CONTROL EROSION AND DOWNSTREAM SEDIMENTATION DURING ALL STAGES OF CONSTRUCTION (INCLUDING THE MAINTENANCE PERIOD). NOTWITHSTANDING THE CONTROL MEASURES OR FINISHED EARTHWORKS DESIGN SHOWN ON THESE DRAWINGS, THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING ADDITIONAL OR ALTERNATIVE EROSION & SEDIMENT CONTROL MEASURES TO MINIMISE SEDIMENT ACROSS OR LEAVING THE SITE.
6. AT ALL TIMES THE CONTRACTOR SHALL MONITOR THE PREVAILING WEATHER CONDITIONS (INCLUDING WEEKENDS AND PUBLIC HOLIDAYS) AND AT ALL TIMES REMAINS RESPONSIBLE TO:
   a) CLEAN AND REPAIR CONTROL DEVICES WHENEVER THE ACCUMULATED SEDIMENT REDUCES THEIR CAPACITY BY 50%.
   b) MAINTAIN POSITIVE GRADES OF ALL PERIMETER BANKS AND SWALES TO AN OUTLET.
   c) PROTECT ANY DOWNSTREAM CONSTRUCTION.
   d) CONTROLLING DUST.
   e) MEASURES HAVE BEEN INSTALLED IN ACCORDANCE WITH DETAILS OUTLINED IN THEIR EROSION AND SEDIMENT CONTROL PLAN AND AS DIRECTED BY THE SUPERINTENDENT.
7. THE CONTRACTOR'S PLAN SHALL ALLOW FOR SUITABLE ACCESS TO ALLOW MAINTENANCE OF ALL SEDIMENT CONTROL DEVICES. NO ADDITIONAL VEGETATION CLEARING IS PERMITTED FOR GAINING ACCESS UNLESS APPROVED BY THE SUPERINTENDENT.
8. THE CONTRACTOR MAY REQUEST APPROVAL FROM THE SUPERINTENDENT TO REUSE THE STOCKPILED MULCH FOR STABILISING BATTERS ONLY IN LOCATIONS WHERE THE APPROVED LANDSCAPE OPW DESIGN REQUIRES MULCH ULTIMATELY.
9. CONSTRUCTION STOCKPILING
   a) TOPSOIL SHALL BE STRIPPED AND STOCKPILED IN LOCATIONS NOMINATED ON THE CONSTRUCTION DRAWINGS OR IN LOCATIONS AGREED WITH THE SUPERINTENDENT.
   b) ADDITIONAL VEGETATION CLEARING IS NOT PERMITTED TO FACILITATE THE STOCKPILING OF MATERIALS UNLESS SHOWN ON THE APPROVED VEGETATION MANAGEMENT PLAN.
   c) ANY STOCKPILE SITE MUST BE CLEAR OF ADJACENT PROPERTY BOUNDARIES SO AS NOT TO CAUSE A NUISANCE TO ADJOINING PROPERTIES.
   d) NO STOCKPILES ARE TO BE LOCATED WITHIN THE TREE PROTECTION ZONE OF VEGETATION.
   e) A TEMPORARY SILT FENCE IS TO BE ERECTED APPROXIMATELY 5m FROM TOE OF BATTER ON LOW SIDE OF STOCKPILING.
10. NOTWITHSTANDING THE DETAILS SHOWN IN THE CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN, DURING CONSTRUCTION THE CONTRACTOR MUST:
    a) SIZE ALL TEMPORARY SEDIMENT BASINS APPROPRIATELY TO TREAT THE UPSTREAM CATCHMENT. NOTE THAT THE PERMANENT BIO BASINS SHOWN ON THESE DRAWINGS ARE SIZED FOR THE ULTIMATE CATCHMENT NOT FOR THE CONSTRUCTION PHASE.
    b) PLACE A ROCK BUND AROUND ALL HEADWALLS DURING CONSTRUCTION.
    c) PROVIDE KERB INLET PROTECTION TO ALL GULLIES.
    c) PLACE A MINIMUM 1.0m WIDE TURF STRIP BEHIND ALL KERBS AND IN A HERRINGBONE LAYOUT WITHIN THE ROAD VERGE.
    d) MAINTENANCE (INCLUDING FLOCCULATION IF REQUIRED AND PUMP OUT) OF ALL CONSTRUCTION SEDIMENT BASINS (WHETHER EXISTING OR NEW).
    e) CLEAN OUT OF ALL GROSS POLLUTANT TRAPS, SEDIMENT FOREBAYS AND ALL OTHER PERMANENT SEDIMENT CONTROL DEVICES AT BOTH ON AND OFF MAINTENANCE.
11. CONTRACTOR TO CONFIRM THE EXTENTS OF REQUIRED GRASSING TREATMENTS WITH THE SUPERINTENDENT AT LEAST 7 DAYS PRIOR TO FINAL TRIMMING.
12. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT GRASSING STRIKE RATES ARE ACHIEVED AT THE ON AND OFF MAINTENANCE INSPECTIONS IN ACCORDANCE WITH COUNCIL REQUIREMENTS. THIS INCLUDES THE SUPPLY AND INSTALLATION OF ANY REQUIRED CHEMICAL/FERTILIZER AMELIORATION TO ACHIEVE THE SPECIFIED GRASS STRIKE RATES.
13. GEOFABRIC LINING OF CHANNELS AND CHECK DAMS MAY BE REQUIRED SUBJECT TO THE SITE CONDITIONS.
14. BATTERS WITHIN PUBLIC OPEN SPACE TO BE VEGETATED IN ACCORDANCE WITH APPROVED OPEN SPACE MANAGEMENT PLAN AND LANDSCAPING OPW. CONTRACT DOCUMENTATION WILL SPECIFY WHETHER THIS IS THE CIVIL CONTRACTOR OR THE LANDSCAPE CONTRACTOR'S RESPONSIBILITY TO SUPPLY AND INSTALL. THE CIVIL CONTRACTOR IS RESPONSIBLE FOR PROVIDING SUITABLE ACCESS FOR THE LANDSCAPE CONTRACTOR TO PERFORM THEIR WORKS.
15. MAINTENANCE PERIOD (PRE TO POST CONSTRUCTION)
    a) ALL PROTECTION MEASURES ARE TO BE INSPECTED AND MAINTAINED REGULARLY
    b) REPAIRS ARE TO BE EFFECTED IMMEDIATELY.
    c) SILT AFTER RAIN IS TO BE CLEANED FROM STREETS AND ALLOTMENTS IMMEDIATELY AND CORRECTIVE ACTION TAKEN TO AVOID A RE-OCCURRENCE.
    d) AT OFF-MAINTENANCE AND ONLY WHEN DIRECTED BY COUNCIL, REMOVE AND DISPOSE OFFSITE ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES.

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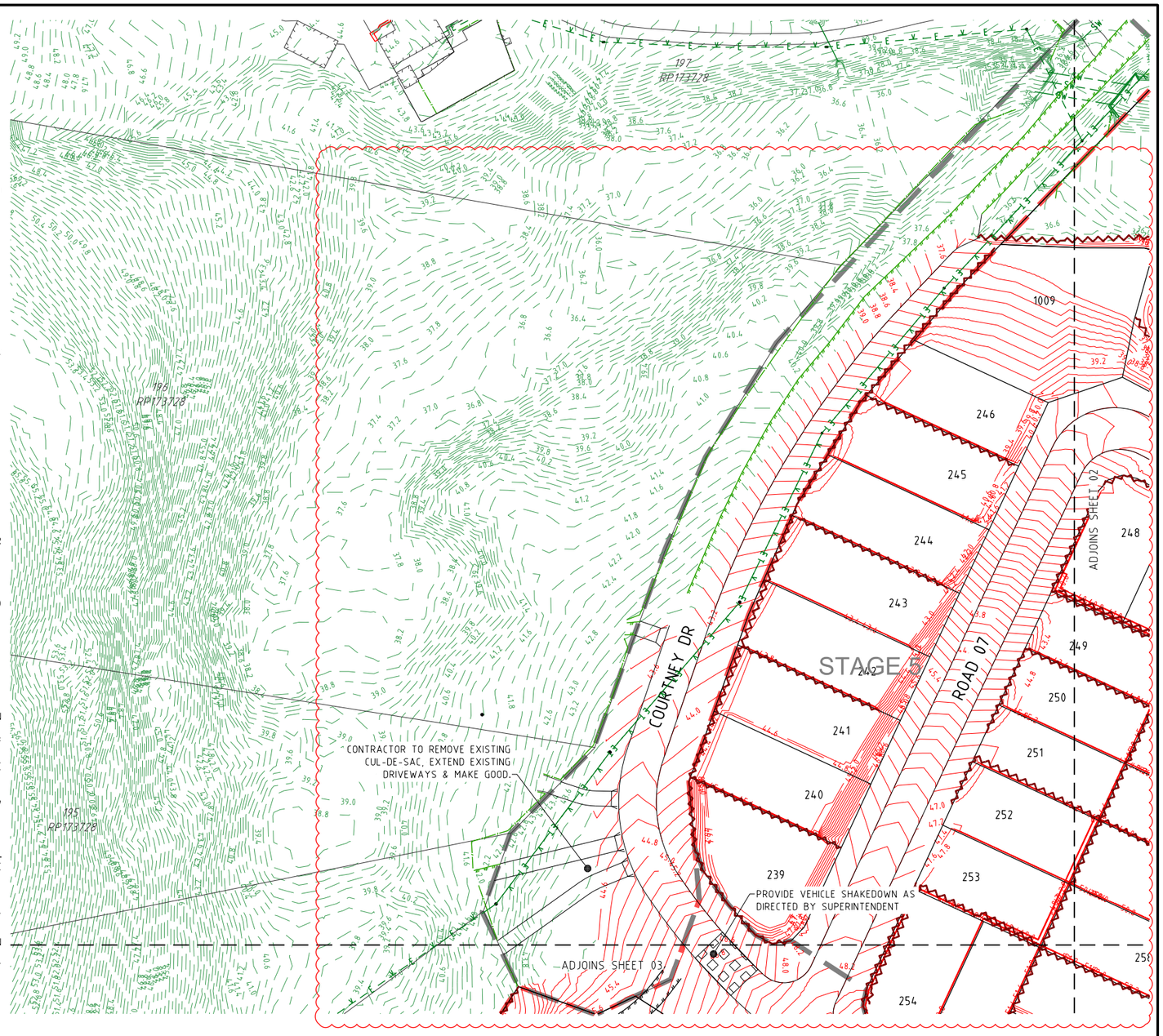
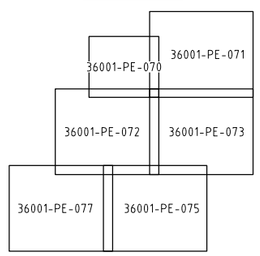


NOTE:
SEDIMENT AND EROSION CONTROL MEASURES SHOWN RELATES TO THE FINISHED SURFACE ONLY.
THE CONTRACTOR IS TO PREPARE A CONSTRUCTION PHASE SEDIMENT AND EROSION CONTROL PLAN.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING KERB (INVERT)
- EXISTING STORMWATER (SW)
- EXISTING CONTOURS (1.0)
- FUTURE PROPERTY LINE
- FUTURE KERB (INVERT)
- FUTURE STORMWATER (SW)
- FUTURE CONTOURS (1.0)
- SITE BOUNDARY
- STAGE BOUNDARY
- PROPOSED PROPERTY LINE
- PROPOSED KERB (INVERT)
- PROPOSED STORMWATER (SW)
- DESIGN CONTOURS (1.0)
- SEDIMENT FENCE
- MANHOLE
- KERB INLET (ON GRADE) PIT
- KERB INLET (SAG) PIT
- HEADWALL
- SCOUR PROTECTION
- TEMPORARY SEDIMENT BASIN
- STORMWATER INLET FILTER
- ROCK CHECK DAM
- VEHICLE SHAKEDOWN
- TREES

SHEET LAYOUT



PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER: 36001-PE-070
AMEND.: C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

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0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN
SHEET 02

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER	AMEND.
36001-PE-071	C

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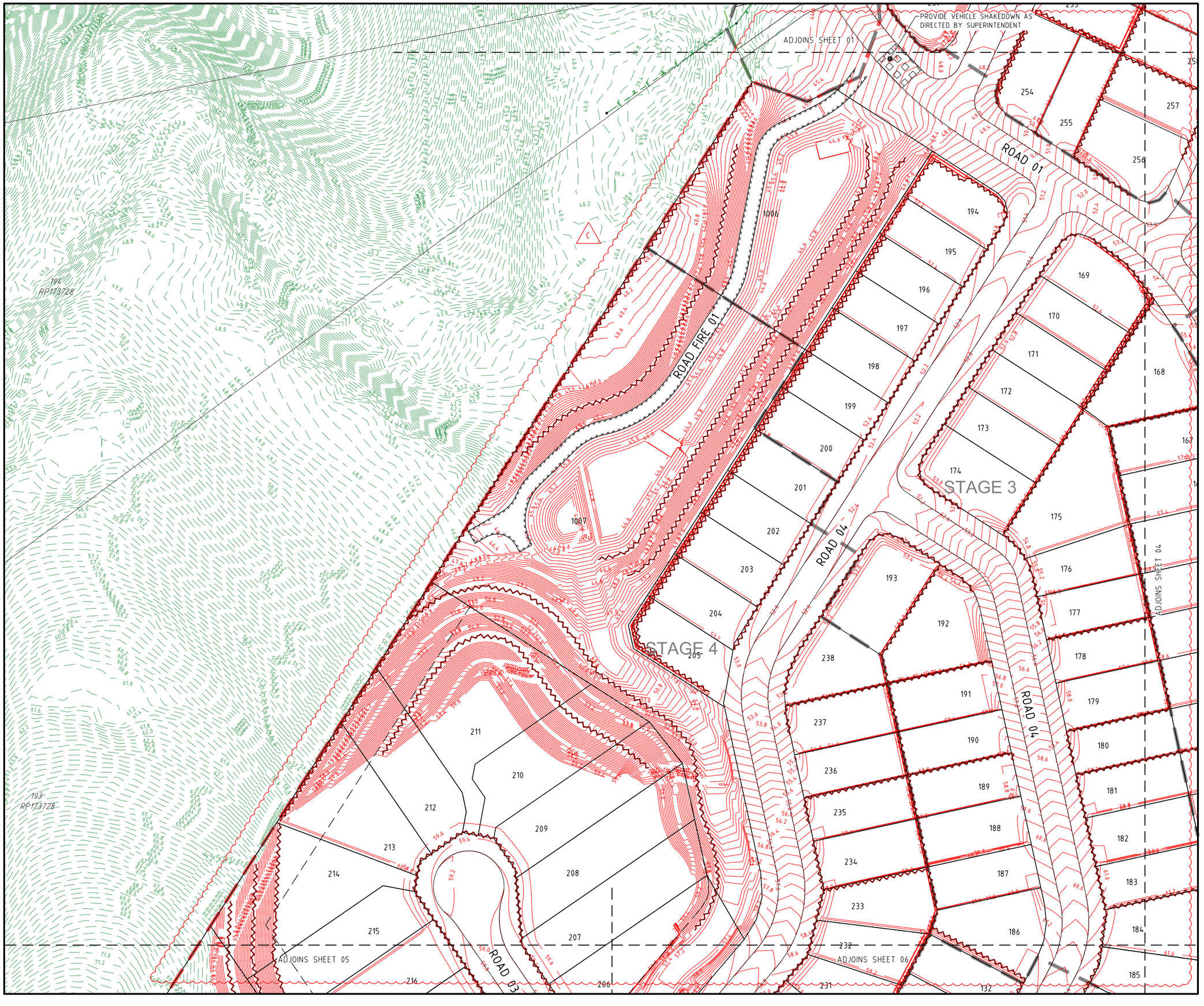

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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zone Planning Group

DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN SHEET 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-072 | AMEND. C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
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PRE	DATE	AMENDMENT

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DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN
SHEET 04

MORTONS
urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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DRAWING NUMBER	AMEND.
36001-PE-073	C

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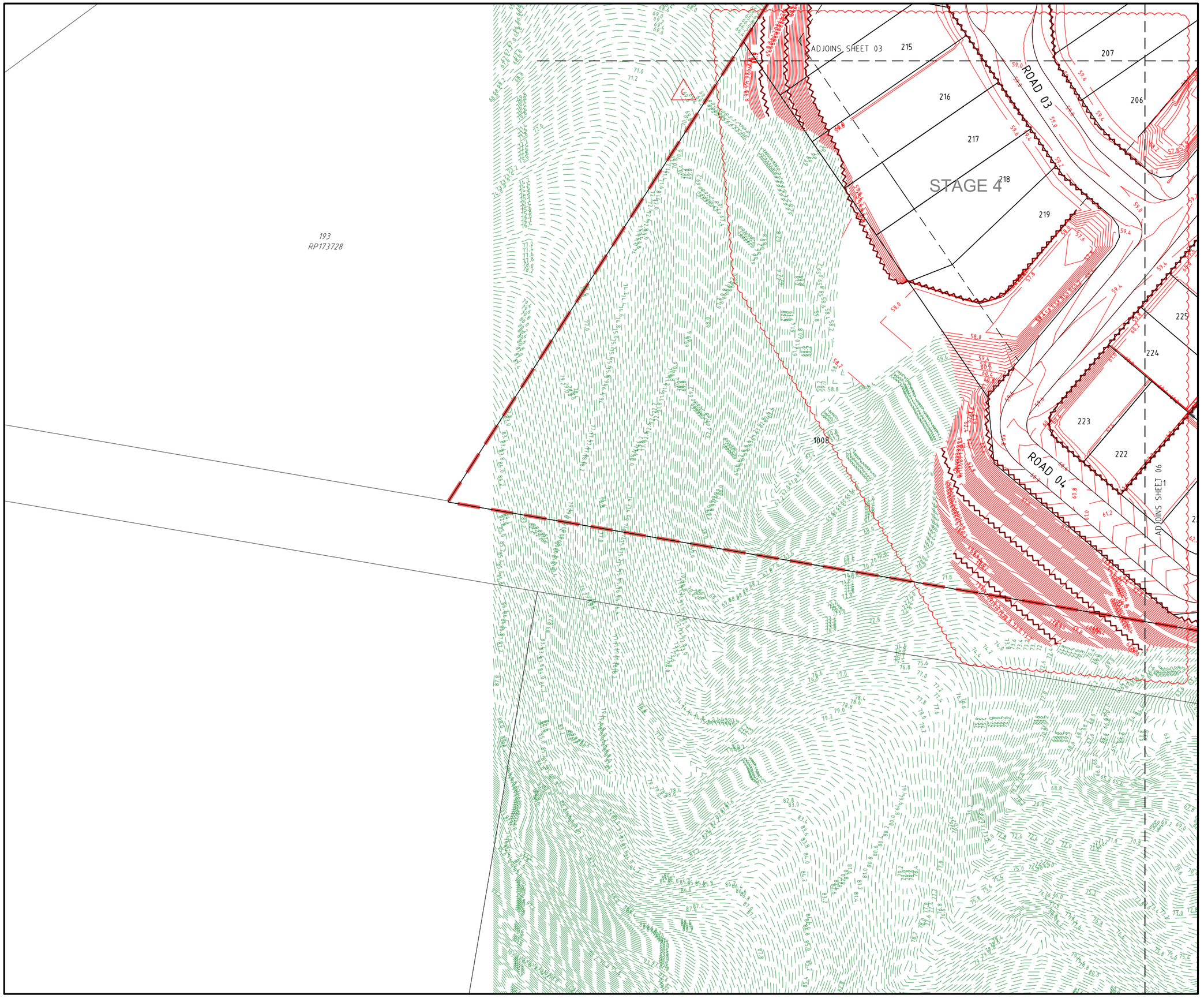

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

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TENDER		
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CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN SHEET 05

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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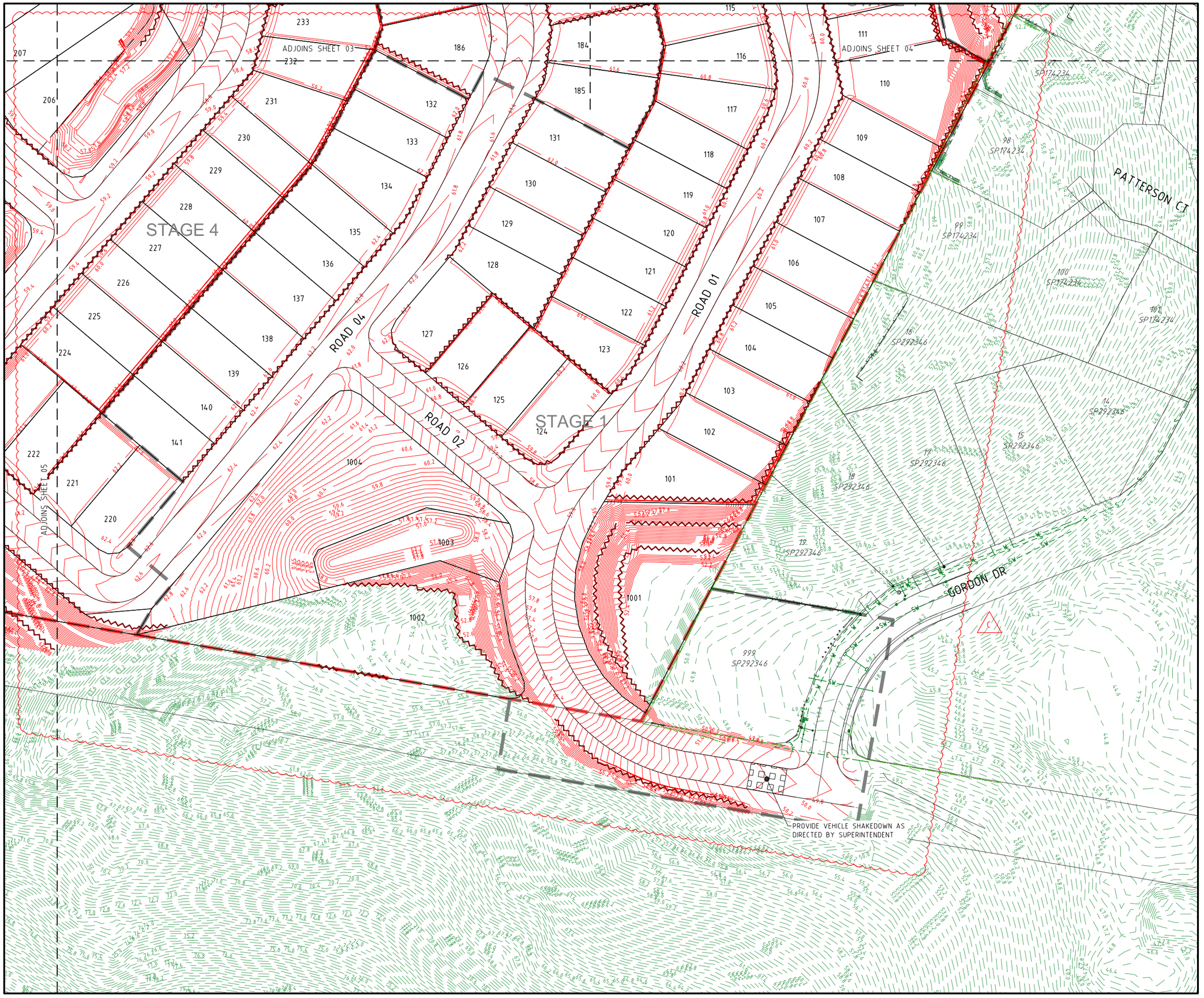

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SILT FENCES & CONTOURS REVISED
B	27-03-19	CONOTURS, SILT FENCES, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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ASSOCIATED CONSULTANTS

BIOME
WATER AND ENVIRONMENTAL CONSULTING

zone
Planning Group

DRAWING TITLE

FINAL SURFACE AND SEDIMENT AND EROSION PLAN SHEET 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED	RPEQ	DATE	09-08-18

DRAWING NUMBER: 36001-PE-075
AMEND.: C

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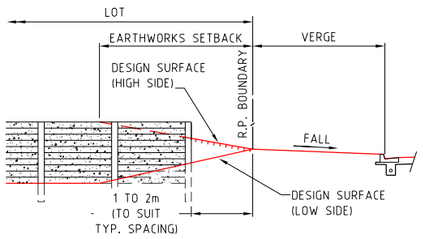
GENERAL

1. CONTRACT SPECIFICATIONS
   ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE CONTRACT SPECIFICATION.
2. SETOUT
   SURVEY SETOUT INFORMATION HAS BEEN ESTABLISHED ON SITE BY THE PRINCIPAL'S SURVEYOR TO ENABLE THE CONTRACTOR TO ACCURATELY SETOUT THE WORKS TO THE CO-ORDINATES SHOWN. SETOUT INFORMATION SHALL NOT BE OBTAINED BY SCALING FROM THESE DRAWINGS.
3. DATUM
   LEVELS SHOWN ARE TO A.H.D.
4. EXISTING SERVICES - EXTERNAL WORKS
   THE LOCATIONS OF ALL EXISTING SERVICES WITHIN THE WORK AREA SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION COMMENCING. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE RELEVANT AUTHORITIES AND TO ENSURE THAT THE EXISTING SERVICES ARE NOT DAMAGED OR DISTURBED IN ANY WAY.
5. ALL MATERIALS ARISING FROM RETAINING WALL CONSTRUCTION ARE TO BE COMPACTED TO FUTURE STAGES, TO LEVEL 1 OR IF DIRECTED BY THE SUPERINTENDENT SHALL BE TRUCKED TO A LICENSED TIP.

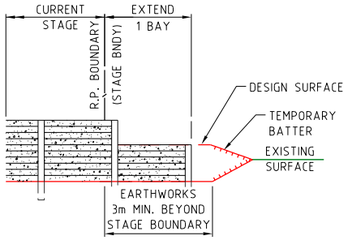
LEGEND

- EXISTING KERB (INVERT)
- EXISTING PROPERTY LINE
- 1.0 EXISTING CONTOURS
- EXISTING RETAINING WALL
- FUTURE KERB (INVERT)
- FUTURE PROPERTY LINE
- 1.0 FUTURE CONTOURS
- FUTURE RETAINING WALL
- PROPOSED KERB (INVERT)
- PROPOSED PROPERTY LINE
- 1.0 DESIGN CONTOURS
- PROPOSED RETAINING WALL
- PL50.4 NOMINAL LOT PAD LEVEL
- **RH1.0** INDICATIVE RETAINED HEIGHT



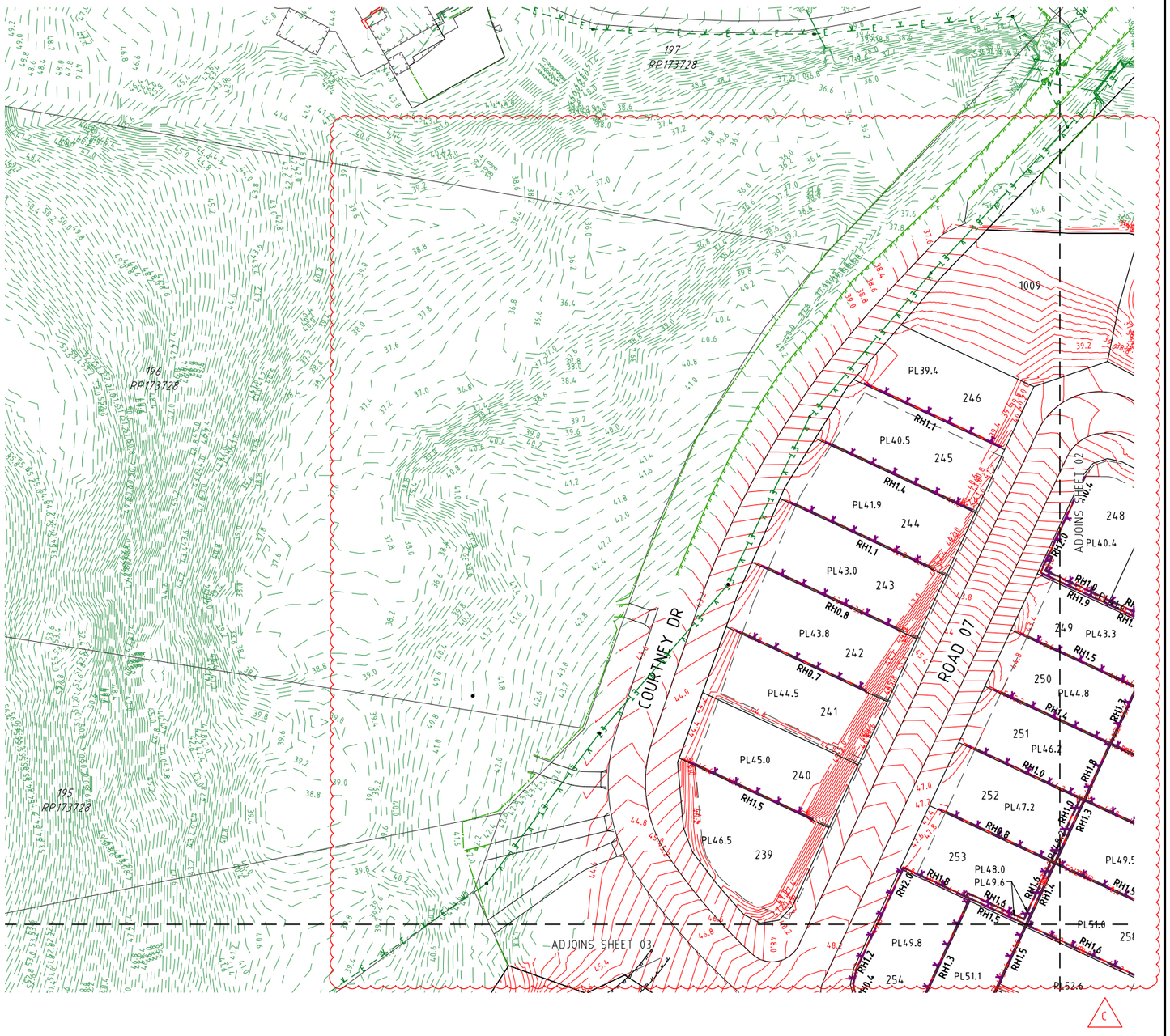
TYPICAL SIDE BOUNDARY CONSTRUCTION

SCALE 1:100 - A1 (1:200 - A3)

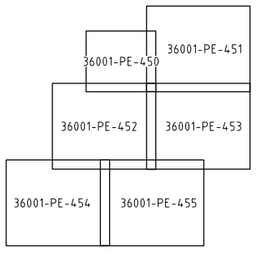


TYPICAL STAGE BOUNDARY CONSTRUCTION

SCALE 1:100 - A1 (1:200 - A3)



SHEET LAYOUT



PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

RETAINING WALL AND DETAIL GRADING PLAN SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-450 | AMEND. C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

RETAINING WALL
AND DETAIL GRADING PLAN
SHEET 02

MORTONS
urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-451 | AMEND. C

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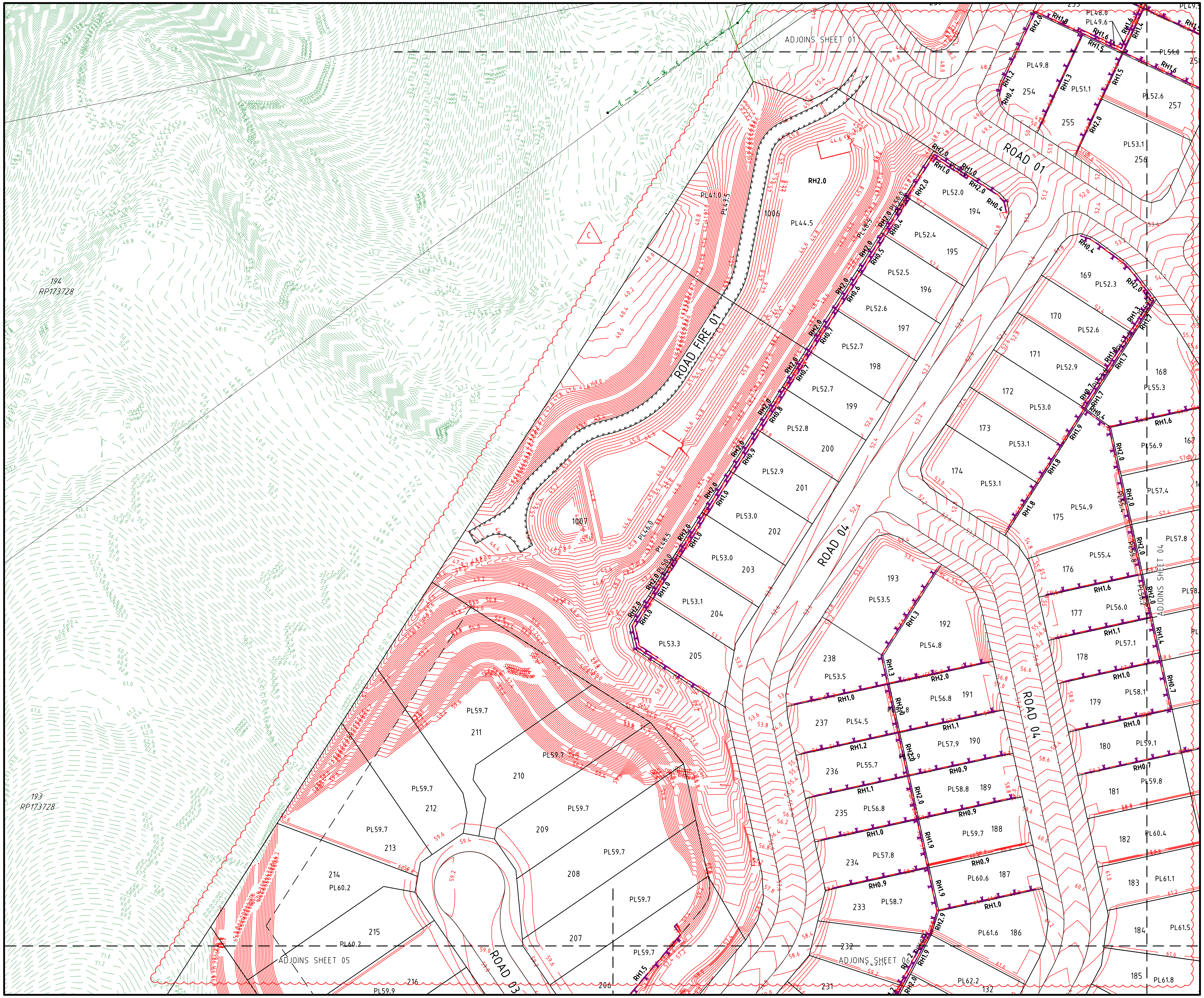

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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RETAINING WALL AND DETAIL GRADING PLAN SHEET 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
Postal Address
PO Box 2484
Southport QLD 4215
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED RB	DRAWN EP	
APPROVED	RPEQ	DATE 09-08-18

DRAWING NUMBER	AMEND.
36001-PE-452	C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

RETAINING WALL
AND DETAIL GRADING PLAN
SHEET 04

MORTONS
urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-453 | AMEND. C

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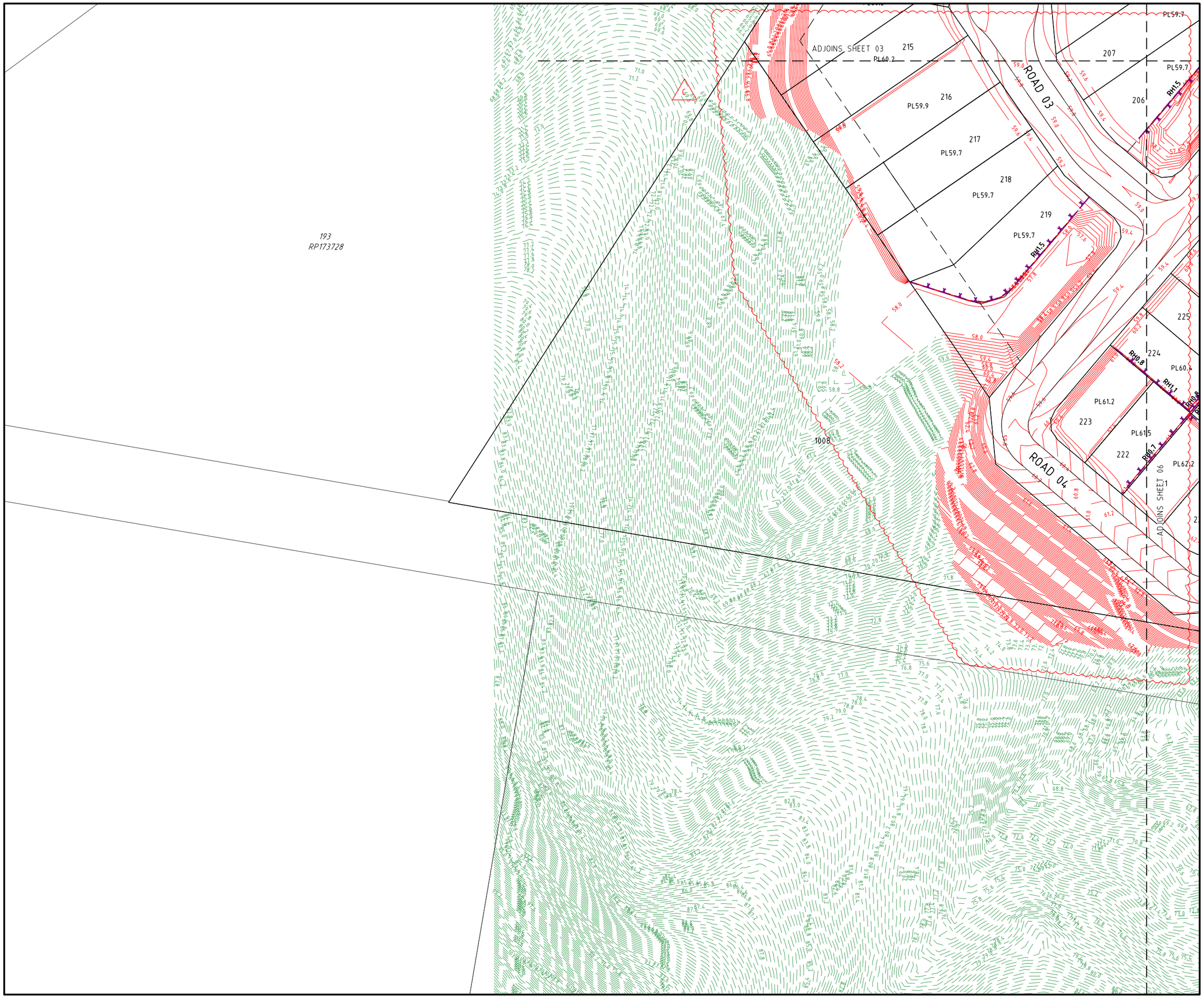

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

RETAINING WALL
AND DETAIL GRADING PLAN
SHEET 05

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER	AMEND.
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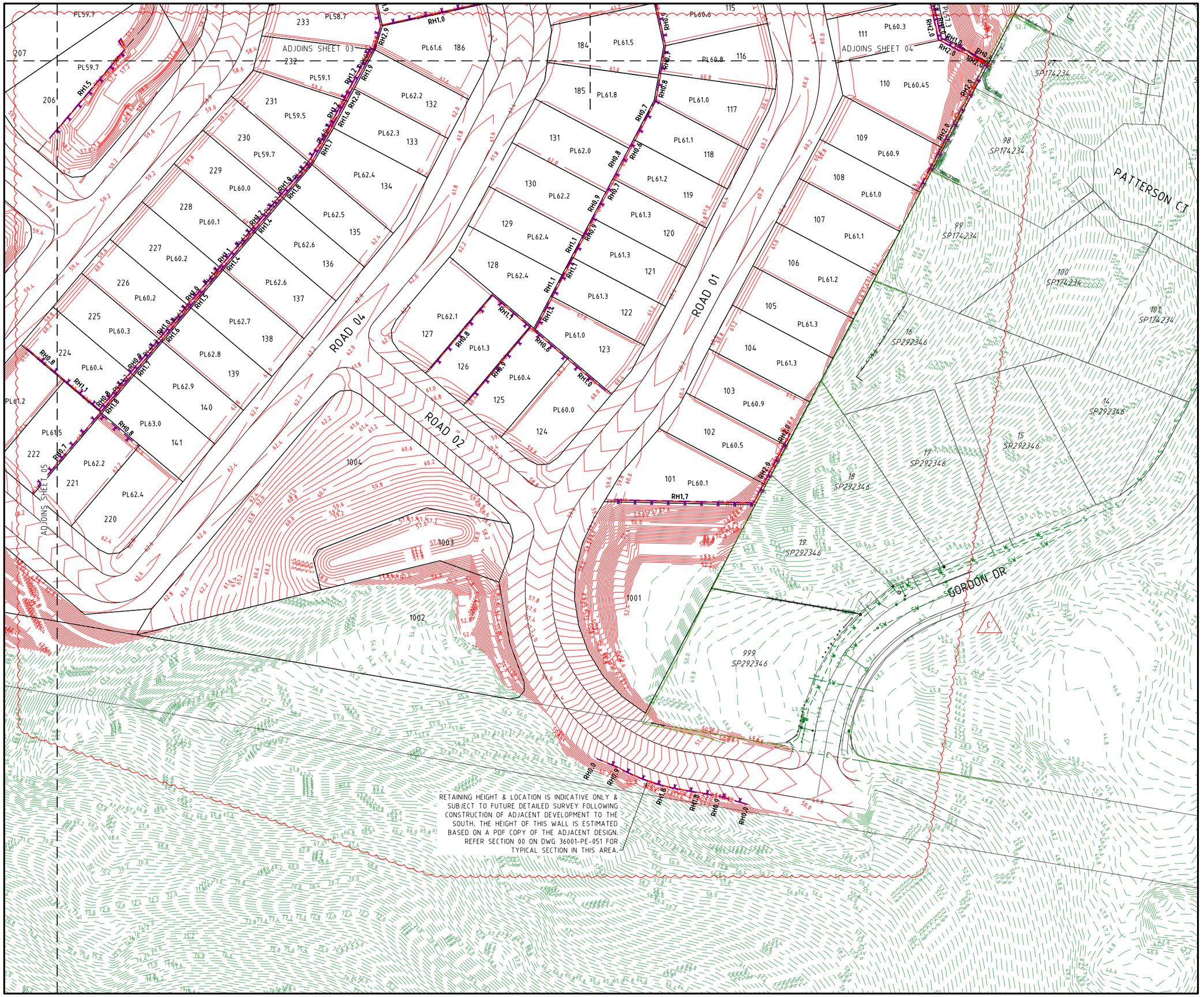

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, WALLS, PAD LEVELS & CONTOURS REVISED
B	27-03-19	R.WALL ADDED,CONTOURS,LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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zone Planning Group

DRAWING TITLE

RETAINING WALL
AND DETAIL GRADING PLAN
SHEET 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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APPROVED		RPEQ	DATE 09-08-18

DRAWING NUMBER 36001-PE-455
AMEND. C

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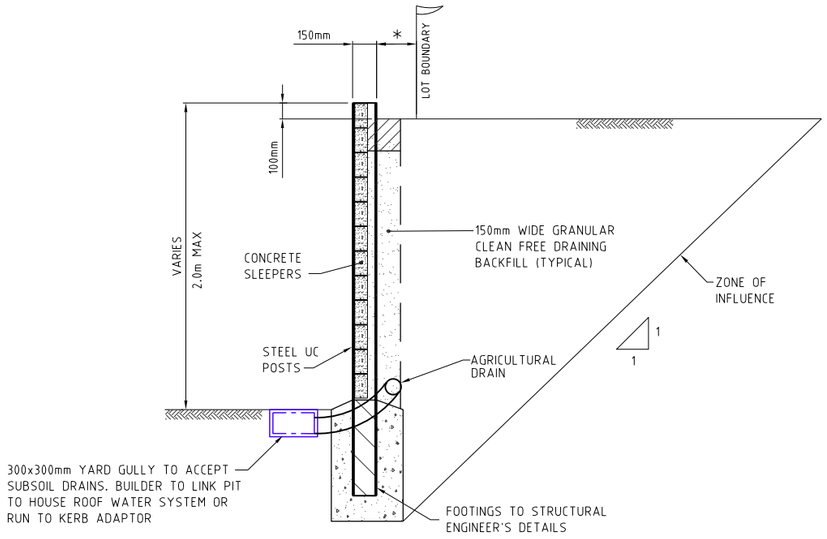
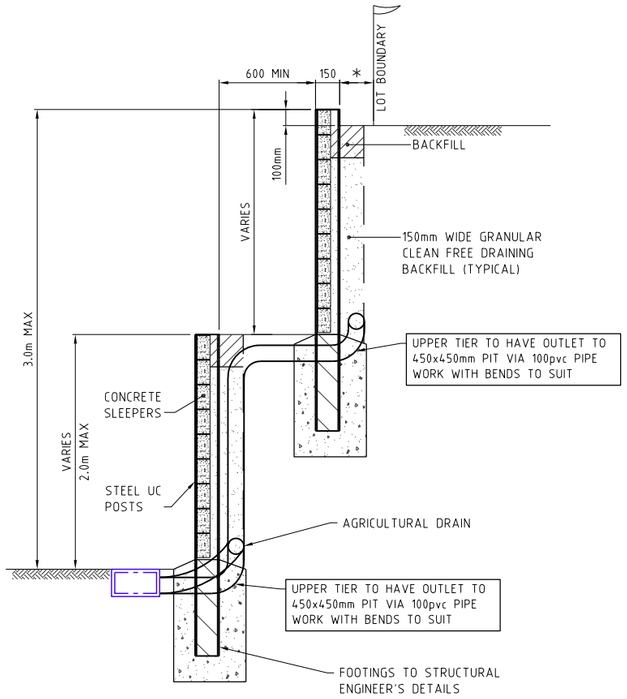


CROSS SECTION OF CONCRETE RETAINING WALL

SCALE 1:20 - A1 (1:40 - A3)



CROSS SECTION OF SPLIT CONCRETE RETAINING WALL

SCALE 1:20 - A1 (1:40 - A3)

NOTES:

1. RETAINING WALL DETAILS ARE INDICATIVE ONLY.
2. CONTRACTOR TO ARRANGE FOR DESIGN AND CONSTRUCTION OF WALLS BY RPEQ STRUCTURAL ENGINEER. CONTRACTOR TO PROVIDE STRUCTURAL CERTIFICATION OF DESIGN AND FINAL CONSTRUCTION.
3. ALLOW FOR 5KPa LOADING TO WALLS EXCEPT ADJACENT TO ROADS WHICH REQUIRE A 10kPa LOADING.
4. CONTRACTOR TO CONFIRM LOCATION OF LOT BOUNDARY PRIOR TO COMMENCING WALL CONSTRUCTION.
5. THE BUILDING ON THE HIGHER SIDE OF THE RETAINING WALL MUST MAINTAIN AN OFFSET OR APPROPRIATE FOUNDATION STRUCTURES (EG; PIERS) IN ORDER TO ENSURE THE ENTIRE DEPTH OF THE RETAINING WALL IS FREE FROM THE ZONE OF INFLUENCE OF THE BUILDING/OVERBURDEN LOAD UNLESS OTHERWISE SPECIFIED BY STRUCTURAL ENGINEER.
6. STRUCTURAL ENGINEER TO DESIGN SLAB AND PIER.
7. AGRICULTURAL DRAIN TO DISCHARGE TO 300x300mm STORMWATER PIT. HOUSE BUILDER TO CONNECT 300x300mm STORMWATER PIT TO ROOFWATER SYSTEM.
8. RETAINING WALL DESIGN TO ALLOW FOR ALL SERVICES (ADJACENT OR BELOW) AND HAVE NO IMPACT.

* LOT - LOT = 0.2m
LOT - ROAD RESERVE = 0.4m

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY EARTHWORKS

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
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LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 0.2 0.4 0.6 0.8 1.0m
Scale 1:20 - A1 (1:40 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

RETAINING WALL DETAILS SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
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DRAWING NUMBER 36001-PE-460

AMEND. A

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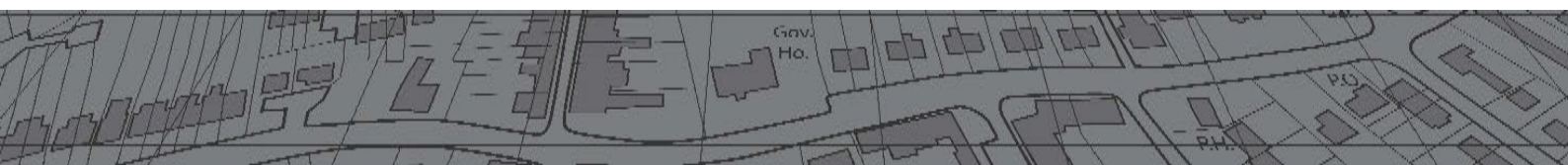
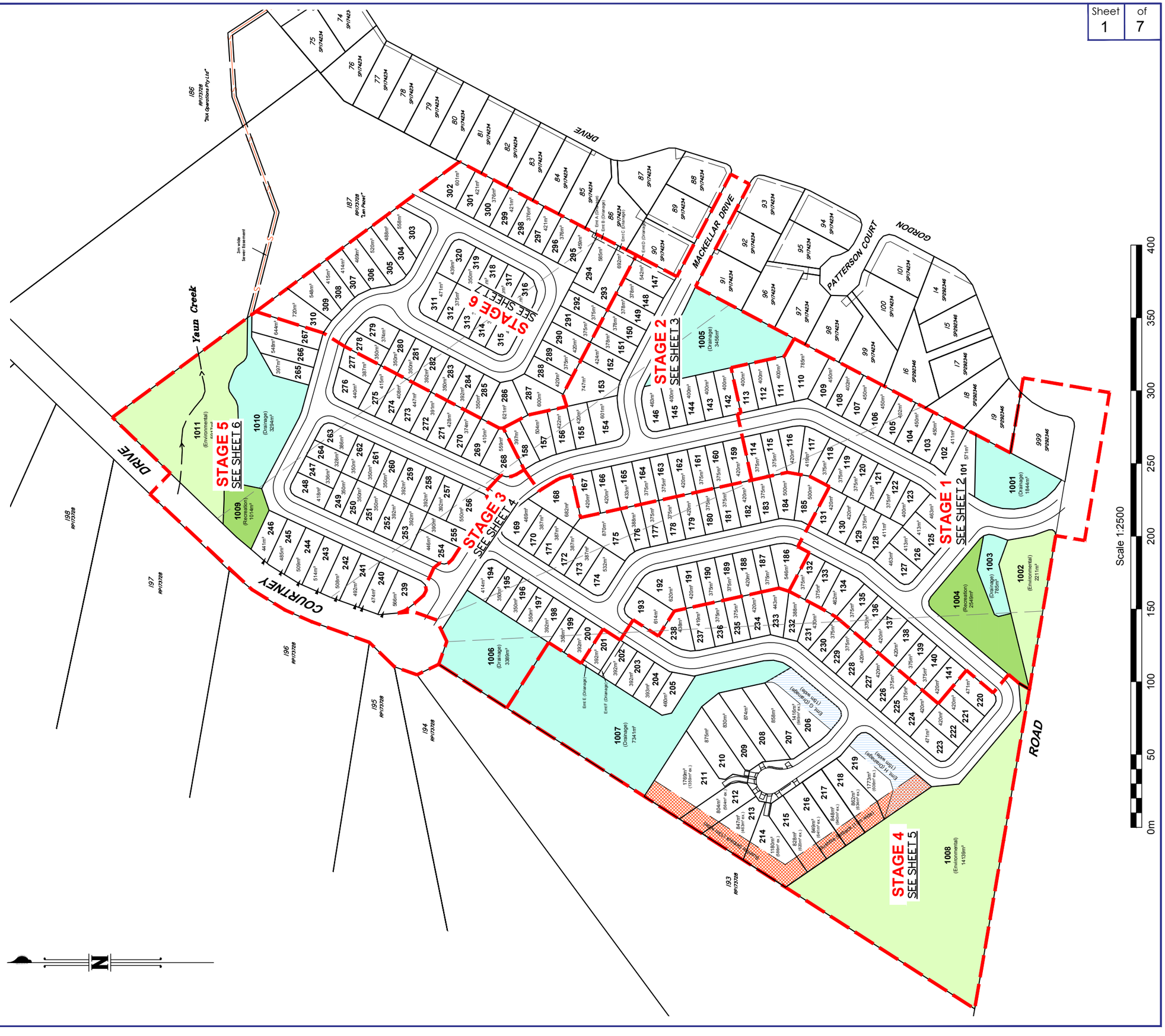
ATTACHMENT 5
Subdivision Layout / Staging Plan & Plan of Development



BENNETT + BENNETT
PO Box 5021, GCMC QLD 9726
Ph: (07) 5631 8000
mail@bennettandbennett.com.au
Surveying, Town Planning & Spatial Services
GOLD COAST | BRISBANE | SUNSHINE COAST | IPSWICH
www.bennettandbennett.com.au



DEVELOPMENT SUMMARY

Stage 1	- 41
Stage 2	- 26
Stage 3	- 33
Stage 4	- 38
Stage 5	- 39
Stage 6	- 43
TOTAL	220 Residential Lots

LEGEND

Stage boundary

Lot Access

DEVELOPMENT AREAS LEGEND

Total Site Area	18.851 ha
Proposed Public Open Space (Environmental)	2.227 ha
Proposed Public Open Space (Drainage)	2.011 ha
Proposed Public Open Space (Recreation)	3563m²
Proposed Net Developable Area	14.257 ha
Net Ha	10.309ha
Net Residential Density	21.3 dwellings/ha
Length of New Road	2330m
Area of New Road	3.948 ha

NOTES:
1. Drawn to scale on an A3 sheet.
2. All dimensions and areas are subject to final survey and approval by G.C.C.C.
3. Dimensions shown are to the nearest decimeter.

Issue	Revision	Int	Date
P	Staging Updated	DJR	28/10/2019
O	Layout Updated	DJR	14/10/2019
N	Layout Updated	DJR	19/09/2019
M	Contours Added	BRJ	14/08/2019
L	GCCC Information response	SDS	7/08/2019
K	Lot No's changed	BRJ	28/03/2019
J	Staging Amended	SDS	25/03/2019
I	Staging Amended	DJL	12/02/2019
H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:2500
Comp File:			
Plan No:	**171101_005_PRO**		

A3

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PO Box 5021, GCMC QLD 9726
Ph: (07) 5631 8000
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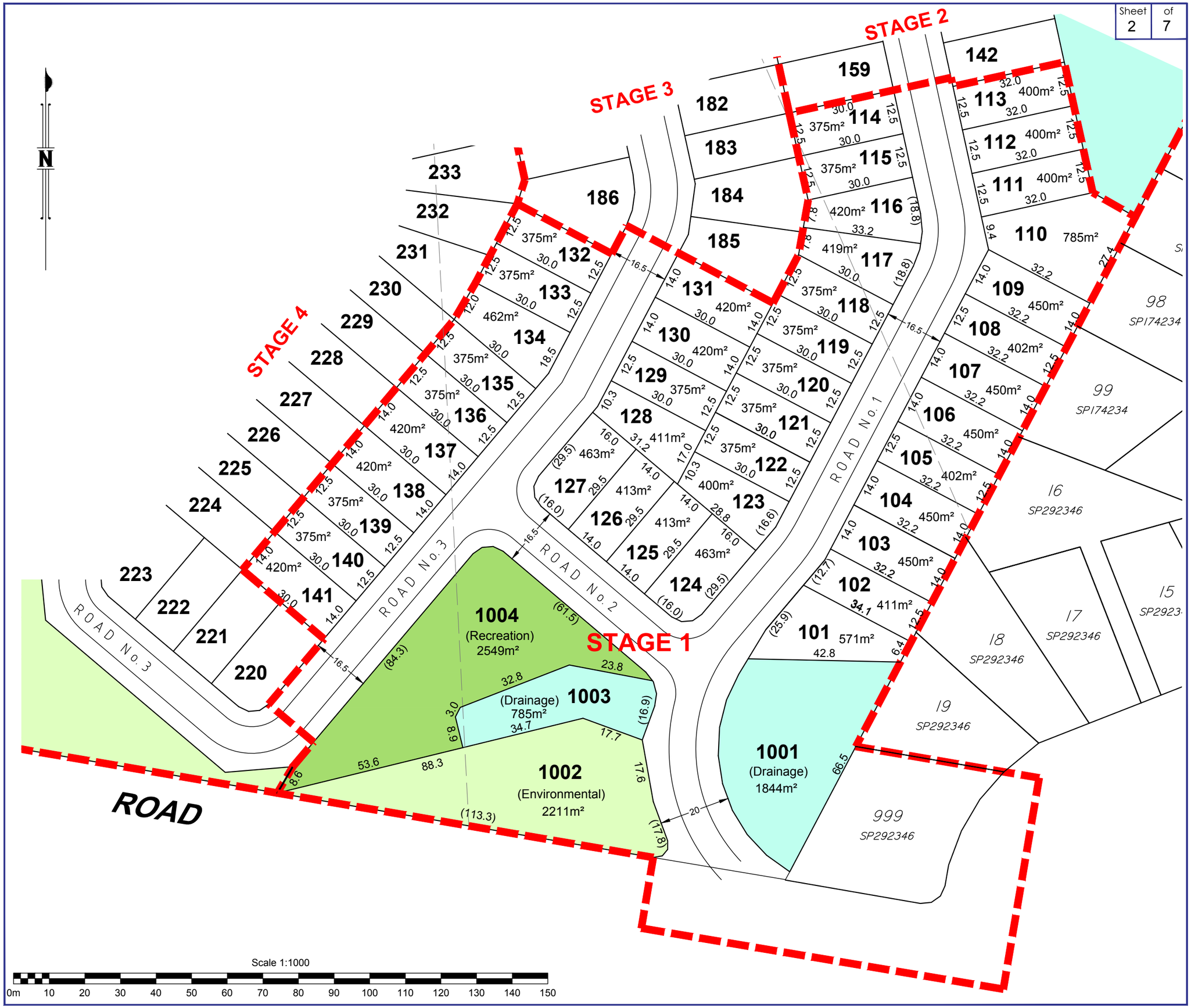

DEVELOPMENT SUMMARY

Stage 1

No of Lots	41
Total Stage Area	3.282ha
Total Recreation Area	2549m²
Total Drainage Area	2629m²
Total Environmental Area	2211m²
Total Development Area	2.544ha
Total Length of New Road	480m
Area of New Road	8201m²

LEGEND

Stage boundary

Lot Access

NOTES:
1. Drawn to scale on an A3 sheet.
2. All dimensions and areas are subject to final survey and approval by G.C.C.C.
3. Dimensions shown are to the nearest decimeter.

Issue	Revision	Int	Date
P	Staging Updated	DJR	28/10/2019
O	Layout Updated	DJR	14/10/2019
N	Layout Updated	DJR	19/09/2019
M	Contours Added	BRJ	14/08/2019
L	GCCC Information response	SDS	7/08/2019
K	Lot No's changed	BRJ	28/03/2019
J	Staging Amended	SDS	25/03/2019
I	Staging Amended	DJL	12/02/2019
H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1000
Comp File:			
Plan No:	**171101_005_PRO**		

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Scale 1:1000

0m 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

DEVELOPMENT SUMMARY

Stage 2

No of Lots	26
Total Stage Area	1.909ha
Total Drainage Area	3456m²
Total Development Area	1.563 ha
Total Length of New Road	270 m
Area of New Road	4388 m²

LEGEND

Stage boundary

Lot Access

NOTES:
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3. Dimensions shown are to the nearest decimeter.

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I	Staging Amended	DJL	12/02/2019
H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
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Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1000
Comp File:			
Plan No:	**171101_005_PRO**		

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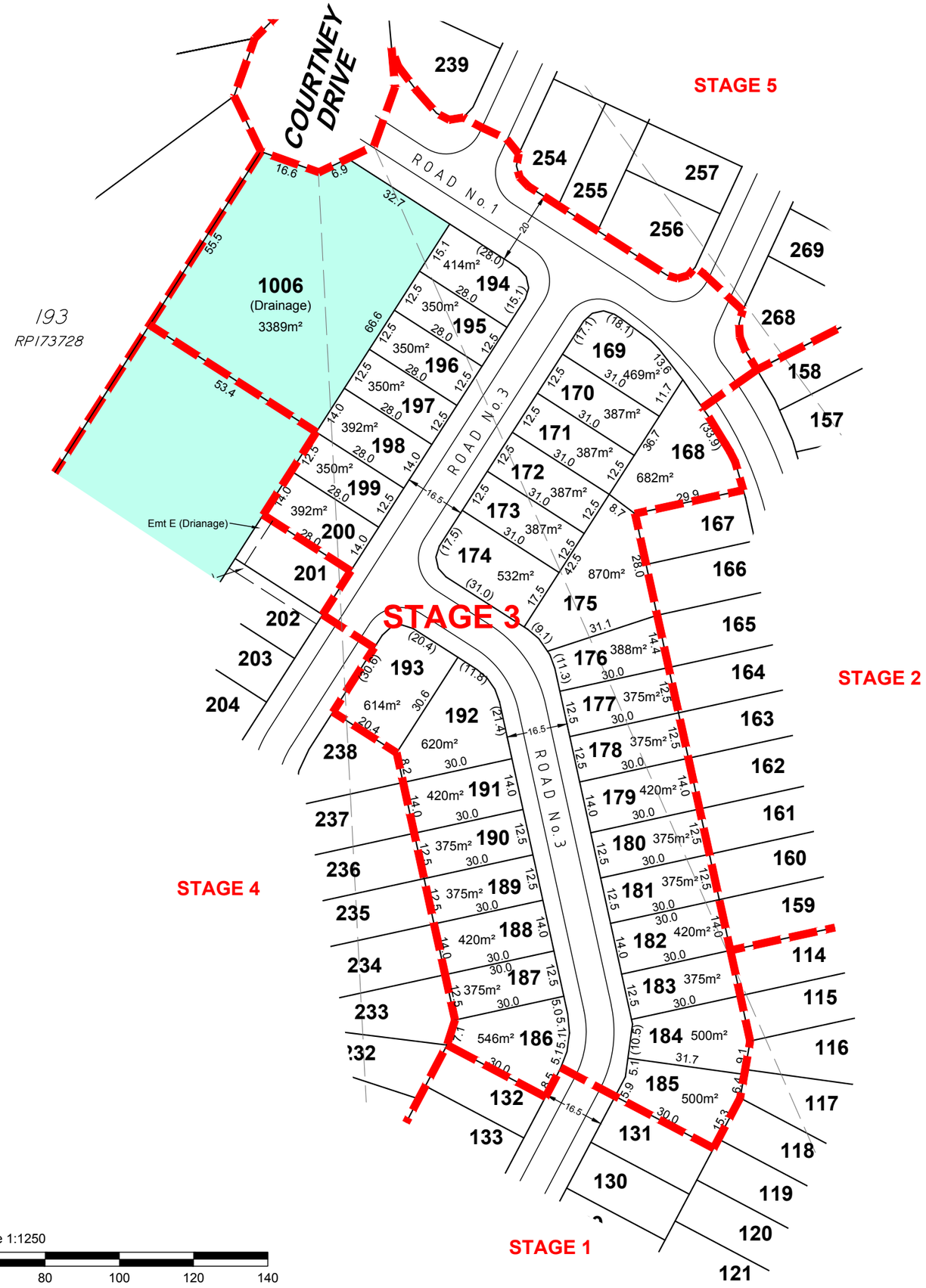

Scale 1:1250

0m 20 40 60 80 100 120 140

N

DEVELOPMENT SUMMARY

Stage 3

No of Lots	33
Total Stage Area	2.480ha
Total Drainage Area	3389m²
Total Development Area	2.141 ha
Total Length of New Road	400 m
Area of New Road	6929m²

LEGEND

Stage boundary

Lot Access

NOTES:
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Issue	Revision	Int	Date
P	Staging Updated	DJR	28/10/2019
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G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1250
Comp File:			
Plan No:	**171101_005_PRO**		

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DEVELOPMENT SUMMARY

Stage 4

No of Lots	38
Total Stage Area	5.325 ha
Total Drainage Area	7341m²
Total Environmental Area	1.414ha
Total Development Area	3.177ha
Total Length of New Road	430 m
Area of New Road	7296m²

LEGEND

Stage boundary

Lot Access

NOTES:
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I	Staging Amended	DJL	12/02/2019
H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1250
Comp File:			
Plan No:	**171101_005_PRO**		

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Yaun Creek

187 RP173728 "Len Pezet"

DRIVE

COURTNEY

197 RP173728

196 RP173728

ROAD No.7

ROAD No.6

ROAD No.1

ROAD No.3

STAGE 5

STAGE 6

STAGE 2

STAGE 3

1011 (Environmental) 5917m²

1010 (Drainage) 3294m²

1009 (Recreation) 1014m²

1006

Lots 239–310, 157–171, 194–198

N

Scale 1:1000

0m 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

DEVELOPMENT SUMMARY

Stage 5

No of Lots	39
Total Stage Area	3.297ha
Total Recreation Area	1014m²
Total Drainage Area	3294m²
Total Environmental Area	5917m²
Total Development Area	2.275ha
Total Length of New Road	360m
Area of New Road	5988m²

LEGEND

Stage boundary

Lot Access

NOTES:
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F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client: **GALLERY HOMES**

Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1000
Comp File:			
Plan No:	**171101_005_PRO**		

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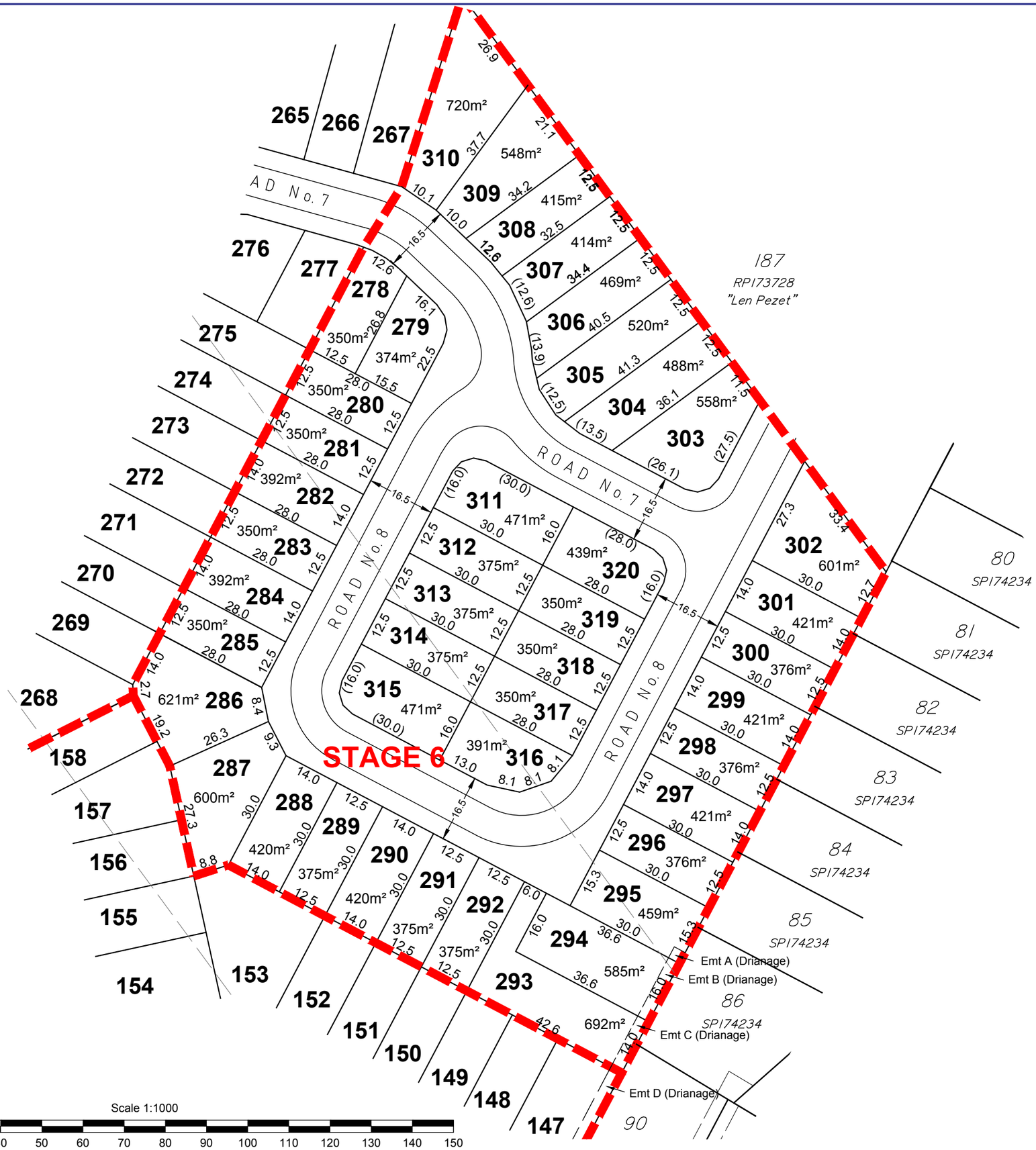

DEVELOPMENT SUMMARY
Stage 6

No of Lots	43
Total Site Area	2.558 ha
Total Development Area	2.558 ha
Total Length of New Road	390m
Area of New Road	6683m²

LEGEND
Stage boundary
Lot Access

NOTES:
1. Drawn to scale on an A3 sheet.
2. All dimensions and areas are subject to final survey and approval by G.C.C.C.
3. Dimensions shown are to the nearest decimeter.

Issue	Revision	Int	Date
P	Staging Updated	DJR	28/10/2019
O	Layout Updated	DJR	14/10/2019
N	Layout Updated	DJR	19/09/2019
M	Contours Added	BRJ	14/08/2019
L	GCCC Information response	SDS	7/08/2019
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H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1000
Comp File:			
Plan No:	**171101_005_PRO**		

A3

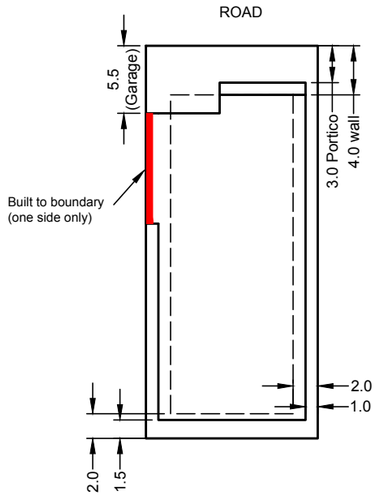
PLAN OF DEVELOPMENT

	Ground	First
Dwelling Setbacks		
Front (Building)	4.0m (3.0m to Portico)	
Front (Garage)	5.5m	N/A
Rear	1.5m	2.0m
Side (Built to Boundary)	Optional - one side only up to 9m long	2.0m
Side (Non Built to Boundary)	1.0m	2.0m
Corner Allotment Setbacks		
Secondary Frontage	2.0m	
Site Coverage (Maximum)		
Courtyard & Traditional Lots Premium Traditional & Large Lots	60% 50% + 10% additional for covered outdoor private open space	

1. Front building setbacks for garages are to be measured to the face of the garage door. Front building setbacks for the balance of the façade are to be measured to the building wall. Side and rear building setbacks are to be measured to the building wall.
2. An encroachment of up to 450mm for eaves, gutters, awnings, sunscreens and privacy screens is permitted within the nominated boundary setbacks.
3. Where compliance with the above siting provisions are not achieved, compliance with the intent of the relevant Performance Outcomes of the Low Density Residential Zone of the Gold Coast City Plan 2016 is to be achieved.
4. Where a retaining structure is proposed along a side or rear boundary, the setback provision is to be measured from the toe of the retaining structure.
5. Secondary frontage being the frontage with the longer dimension
7. Lots 239-246 primary frontage and vehicle access is to be from Courtney Drive. Vehicle access is not permitted from Road No. 7. Setbacks to Road No. 7 is to comply with the Secondary Frontage setbacks.
8. Within the front 3m of the primary frontage, development provides garden beds, planted with native species, along any side and front boundary, excluding driveway area, with a minimum width of 1m and to a minimum of 50% of the frontage/s.

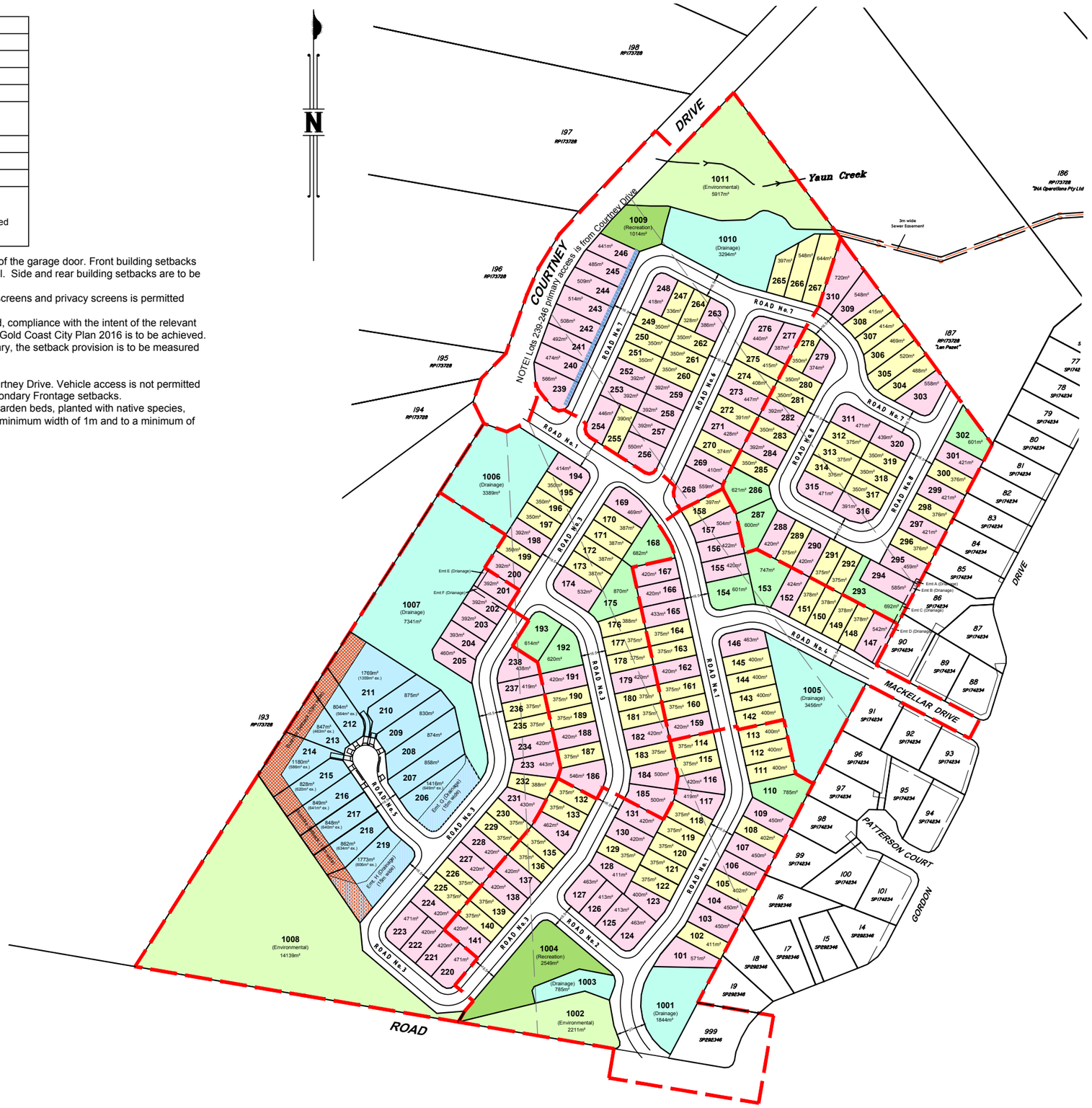
BUILDING ENVELOPE DIAGRAM

Scale 1:500



LEGEND

- Built to Boundary Wall
- Wall (Ground Level)
- Wall (First Level)
- Secondary frontage - No direct vehicle access



Scale 1:3000

0m 100 200 300 400 500 600

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DEVELOPMENT SUMMARY

Large Lots	- 14
Premium Traditional Lots	- 11
Traditional Lots	- 100
Courtyard Lots	- 95
Total No of Lots	- 220

LEGEND

Stage boundary

Lot Access

LOT TYPOLOGY LEGEND

- Courtyard Lot (Min 12.5m wide & Min 350m²)
- Traditional Lot (Min 14.0m wide & Min 350m²)
- Premium Traditional Lot (Min 14.0m wide & Min 600m²)
- Large Lot (Min 12.5m wide & Min 800m²)

NOTES:
1. Drawn to scale on an A3 sheet.
2. All levels are in metres on the Australian Height Datum referred to PM 170053 RL 41.38 AHD.
3. Contour Interval: 2.0m
4. All dimensions and areas are subject to final survey and approval by G.C.C.C.
5. Registered Owner

Issue	Revision	Int	Date
U	Setback Requirements Updated	DJR	8/11/2019
T	Layout Updated and setback requirements adjusted	DJR	7/11/2019
S	Layout Updated	DJR	16/10/2019
R	Layout Updated	DJR	20/09/2019
Q	GCCC Information Request	SDS	08/08/2019
P	Amended Lot No's	BRJ	28/03/2019
O	Detention Basins Amended	JEW	20/09/2018
N	157 - 163 Updated	JEW	18/09/2018
M	New Layout	SDS	20/08/2018
L	New Layout	SDS	19/06/2018

Title:

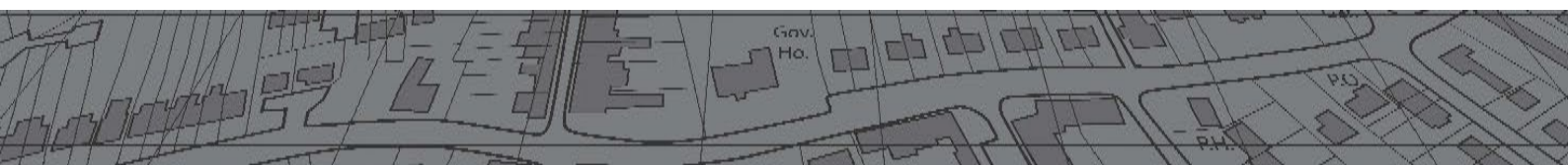
Plan of Development Proposed Lots 101-320

(79-99 Courtney Drive, Upper Coomera)

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SS
Surveyed By:		Approved:	GS
Date Created:	19/9/2017	Scale:	1:3000
Comp File:			
Plan No:	**171101_002_MIS**		

A3

ATTACHMENT 6
Preliminary Engineering Drawings



DATA TRANSMITTAL

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
ABN: 39 116 375 065 Tel: (07) 55711099

PROJECT NAME: COURTNEY DRIVE, UPPER COMERA PRELIMINARY ENGINEERING
JOB NO: 36001-PRE

DAY	11	04	17	30										
MONTH	09	04	04	10										
YEAR	18	19	19	19										

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PROJECT TEAM	1/0/0	0/0/1	0/0/1	0/0/1										
COUNCIL				0/0/1										

FILE NO.	DESCRIPTION	AMENDMENT												
	GENERAL													
36001-PRE-000	COVER SHEET	A	B	C	D									
36001-PRE-005	ROAD HIERARCHY & STAGING PLAN	A	B	B	C									
	EARTHWORKS: COMBINED SERVICES													
36001-PRE-090	PLAN SHEET 01	A	B	B	C									
36001-PRE-091	PLAN SHEET 02	A	B	B	C									
36001-PRE-092	PLAN SHEET 03	A	B	C	D									
36001-PRE-093	PLAN SHEET 04	A	B	C	D									
36001-PRE-094	PLAN SHEET 05	A	B	C	D									
36001-PRE-095	PLAN SHEET 06	A	B	B	C									
~~36001-PRE-096~~	~~PLAN SHEET 07~~	~~A~~												
	ROADS: ROADWORKS													
36001-PRE-100	PLAN SHEET 01	A	B	B	C									
36001-PRE-101	PLAN SHEET 02	A	B	B	C									
36001-PRE-102	PLAN SHEET 03	A	B	B	C									
36001-PRE-103	PLAN SHEET 04	A	B	B	C									
36001-PRE-104	PLAN SHEET 05	A	B	B	C									
36001-PRE-105	PLAN SHEET 06	A	B	B	C									
36001-PRE-120	DETAILS SHEET 01	A	A	A	A									
	ROADS: LONGITUDINAL SECTIONS													
36001-PRE-200	ROAD 01	A	B	B	C									
36001-PRE-201	ROAD 01 (Cont.)	A	A	A	B									
36001-PRE-202	ROAD 02	A	A	A	B									
36001-PRE-203	ROAD 03 & ROAD 05	A	A	A	B									
36001-PRE-204	ROAD 04	A	A	A	B									
36001-PRE-205	ROAD 06 & ROAD 07	A	A	A	B									
36001-PRE-206	ROAD 08 & ROAD 10	A	A	A	B									
	SEWER: SEWER RETICULATION													
36001-PRE-500	PLAN SHEET 01	A	B	B	C									
36001-PRE-501	PLAN SHEET 02	A	B	B	C									
36001-PRE-502	PLAN SHEET 03	A	B	B	D									
36001-PRE-503	PLAN SHEET 04	A	B	B	D									
36001-PRE-504	PLAN SHEET 05	A	B	B	D									
36001-PRE-505	PLAN SHEET 06	A	B	B	C									
~~36001-PRE-506~~	~~PLAN SHEET 07~~	~~A~~												
	DRAINAGE: STORMWATER													
36001-PRE-600	PLAN SHEET 01	A	B	C	D									
36001-PRE-601	PLAN SHEET 02	A	B	C	D									
36001-PRE-602	PLAN SHEET 03	A	B	C	D									
36001-PRE-603	PLAN SHEET 04	A	B	C	D									
36001-PRE-604	PLAN SHEET 05	A	B	C	D									
36001-PRE-605	PLAN SHEET 06	A	B	C	D									
	WATER: WATER RETICULATION													
36001-PRE-700	PLAN SHEET 01	A	B	C	D									
36001-PRE-701	PLAN SHEET 02	A	B	C	D									
36001-PRE-702	PLAN SHEET 03	A	B	C	D									
36001-PRE-703	PLAN SHEET 04	A	B	C	D									
36001-PRE-704	PLAN SHEET 05	A	B	C	D									
36001-PRE-705	PLAN SHEET 06	A	B	C	D									

TYPE: C - CIVILCAD A - AUTOCAD P - PLOT H - PHOTOCOPY OF APPROVED DWG D - Pdfs	D	D	D	D										
REASON: Z - COUNCIL R - REVISION A - APPROVAL C - CONSTRUCTION S - AS REQUESTED T - TENDER P - PRELIMINARY X - INFORMATION	ZA	ZA	ZA	ZA										

PLEASE CHECK THAT YOU HAVE RECEIVED ALL DOCUMENTS AS LISTED ABOVE.

I hereby acknowledge receipt of the documents as detailed above.
Signed: _____ Date: / /
Company: _____

DISCLAIMER

In the event that this transmittal and/or any attachments or associated documents and/or part there of is utilised in any other manner whatsoever other than under the sole control of Mortons Urban Solutions ABN 39 116 375 065 and for the specific purposes for which it was prepared, Mortons Urban Solutions ABN 39 116 375 065 will not be liable for such use nor any damages of whatever type or extent which may result.

COURTNEY DR, UPPER COOMERA

PRELIMINARY ENGINEERING

OVERALL

No. 36001-PRE

SCHEDULE OF DRAWINGS

NUMBER	REV. NO.	TITLE
GENERAL		
36001-PRE-000	D	COVER SHEET
36001-PRE-005	C	ROAD HIERARCHY & STAGING PLAN
EARTHWORKS. COMBINED SERVICES		
36001-PRE-090	C	PLAN SHEET 01
36001-PRE-091	C	PLAN SHEET 02
36001-PRE-092	D	PLAN SHEET 03
36001-PRE-093	D	PLAN SHEET 04
36001-PRE-094	D	PLAN SHEET 05
36001-PRE-095	C	PLAN SHEET 06
ROADS. ROADWORKS		
36001-PRE-100	C	PLAN SHEET 01
36001-PRE-101	C	PLAN SHEET 02
36001-PRE-102	C	PLAN SHEET 03
36001-PRE-103	C	PLAN SHEET 04
36001-PRE-104	C	PLAN SHEET 05
36001-PRE-105	C	PLAN SHEET 06
36001-PRE-120	A	DETAILS SHEET 01
ROADS. LONGITUDINAL SECTIONS		
36001-PRE-200	C	ROAD 01
36001-PRE-201	B	ROAD 01 (Cont.)
36001-PRE-202	B	ROAD 02 & ROAD 03
36001-PRE-203	B	ROAD 04
36001-PRE-204	B	ROAD 04 (Cont.) & ROAD 06
36001-PRE-205	B	ROAD 07
36001-PRE-206	B	ROAD 08 & ROAD 10
SEWER. SEWER RETICULATION		
36001-PRE-500	C	PLAN SHEET 01
36001-PRE-501	C	PLAN SHEET 02
36001-PRE-502	D	PLAN SHEET 03
36001-PRE-503	D	PLAN SHEET 04
36001-PRE-504	D	PLAN SHEET 05
36001-PRE-505	C	PLAN SHEET 06
DRAINAGE. STORMWATER		
36001-PRE-600	D	PLAN SHEET 01
36001-PRE-601	D	PLAN SHEET 02
36001-PRE-602	D	PLAN SHEET 03
36001-PRE-603	D	PLAN SHEET 04
36001-PRE-604	D	PLAN SHEET 05
36001-PRE-605	D	PLAN SHEET 06
WATER. WATER RETICULATION		
36001-PRE-700	D	PLAN SHEET 01
36001-PRE-701	D	PLAN SHEET 02
36001-PRE-702	D	PLAN SHEET 03
36001-PRE-703	D	PLAN SHEET 04
36001-PRE-704	D	PLAN SHEET 05
36001-PRE-705	D	PLAN SHEET 06

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CLIENT

GALLERY
THE ART OF LIVING

SUB-CONSULTANTS

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Planning Group

LOCALITY PLAN

R. P. DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

DRAWING NUMBER 36001-PRE-000 | AMEND. D

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GENERAL

1. CONTRACT SPECIFICATIONS
   ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE CONTRACT SPECIFICATION.
2. SETOUT
   SURVEY SETOUT INFORMATION HAS BEEN ESTABLISHED ON SITE BY THE PRINCIPAL'S SURVEYOR TO ENABLE THE CONTRACTOR TO ACCURATELY SETOUT THE WORKS TO THE CO-ORDINATES SHOWN. SETOUT INFORMATION SHALL NOT BE OBTAINED BY SCALING FROM THESE DRAWINGS.
3. DATUM
   LEVELS SHOWN ARE TO A.H.D.
4. TRENCH SPOIL
   ALL MATERIALS ARISING FROM ROADS AND SERVICES ARE TO BE COMPACTED TO FUTURE STAGES, TO LEVEL 1 OR IF DIRECTED BY THE SUPERINTENDENT SHALL BE TRUCKED TO A LICENSED TIP AT THE CONTRACTOR'S EXPENSE.
5. CHECK ELECTRONIC SETOUT
   CONTRACTOR IS RESPONSIBLE TO ENSURE ANY ELECTRONIC DATA FILES MATCH THE DRAWINGS.
6. PRE START
   a. ERECT SITE SIGNAGE, CONSTRUCT ENTRY AND EXIT POINT AS INDICATED.
   b. CONSTRUCT VEHICLE WASHDOWN AREA AND ASSOCIATED SILT MANAGEMENT DEVICES.
   c. CONSTRUCT SITE OFFICE AND STORAGE COMPOUND AREA.
   d. INSTALL EROSION AND SEDIMENT CONTROL DEVICES AS PER THE CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN.
   e. ERECT TEMPORARY TREE PROTECTION FENCING IN ACCORDANCE WITH THE APPROVED VEGETATION MANAGEMENT PLAN AND AUTHORITIES APPROVAL CONDITIONS (IF REQUIRED).
7. HEALTH AND SAFETY
   ALL WORKS UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE WORKPLACE HEALTH AND SAFETY LEGISLATION.

PROJECT SPECIFIC REPORTS

THE CONTRACTOR MUST FOLLOW THE RECOMMENDATIONS AND PROCEDURES OUTLINED IN THE FOLLOWING REPORTS AT ALL TIMES:

a) GEOTECHNICAL INVESTIGATION REPORTS (INCLUDING ANY ACID SULPHATE OR DISPERSIVE SOIL REPORTING)
b) VEGETATION & FAUNA MANAGEMENT PLANS
c) OTHER MANAGEMENT PLANS NOMINATED IN THE CONTRACT, AUTHORITIES APPROVAL CONDITIONS OR BY THE SUPERINTENDENT.

LEGEND

- 7.5m ROAD — REFER 120 DRAWING SERIES FOR TYPICAL SECTIONS
- EXISTING PROPERTY LINE
- EXISTING KERB (INVERT)
- EXISTING EDGE OF BITUMEN
- FUTURE PROPERTY LINE
- FUTURE KERB (INVERT)
- PROPOSED PROPERTY LINE
- PROPOSED KERB (INVERT)
- PROPOSED EDGE OF BITUMEN
- SITE BOUNDARY
- STAGE BOUNDARY
- LIMIT OF WORKS BOUNDARY

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

NORTH

0 12.5 25 37.5 50 62.5m
Scale 1:1250 - A1 (1:2500 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT,LIMIT WORKS & ROAD HEIRARCHY REVISED
B	28-03-19	LOT NO'S, STAGES & LIMIT OF WORKS AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

ROAD HIERARCHY
AND
STAGING PLAN
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-005 | AMEND. C

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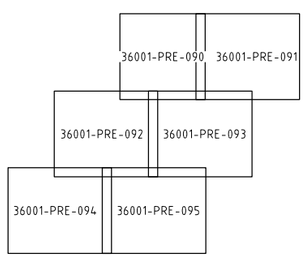
CONSTRUCTION SERVICES

1. CONSTRUCTION OF SEWER/ROOFWATER/STORMWATER/SERVICES
   EXCAVATED MATERIAL TO BE PLACED ON HIGH SIDE OF TRENCH AND TO PROTECT PIPE WORK AND DIRECT SURFACE MATERIAL AWAY FROM EXCAVATIONS.
   TOPSOIL AND GRASS SEED AREAS IN ALLOTMENTS IMMEDIATELY AFTER COMPLETING THE SEWER AND ROOFWATER DRAINAGE CONSTRUCTION.
   DEPRESS GROUND AROUND TEMPORARY FIELD INLETS TO CREATE SILT POND.
2. TRIP HAZARD
   MANHOLES OR STRUCTURES INSTALLED IN THE ROAD, FOOTPATH OR VERGE MUST MATCH NEATLY WITH NO TRIP HAZARD.
3. EXISTING SERVICES - EXTERNAL WORKS
   THE LOCATIONS OF ALL EXISTING SERVICES WITHIN THE WORK AREA SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION COMMENCING. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE RELEVANT AUTHORITIES AND TO ENSURE THAT THE EXISTING SERVICES ARE NOT DAMAGED OR DISTURBED IN ANY WAY.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING KERB (INVERT)
- EXISTING EDGE OF BITUMEN
- EXISTING FOOTPATH
- RM EXISTING RISING MAIN
- S EXISTING SEWER
- SW EXISTING STORMWATER
- RW EXISTING ROOFWATER
- SS EXISTING SUBSOIL
- W100 EXISTING WATER
- W150 EXISTING WATER
- W200 EXISTING WATER
- W225 EXISTING WATER
- W250 EXISTING WATER
- W300 EXISTING WATER
- EXISTING WATER CONDUIT
- PROPOSED PROPERTY LINE
- PROPOSED KERB (INVERT)
- PROPOSED EDGE OF BITUMEN
- PROPOSED FOOTPATH
- RM PROPOSED RISING MAIN
- S PROPOSED SEWER
- SW PROPOSED STORMWATER
- RW PROPOSED ROOFWATER
- SS PROPOSED SUBSOIL
- W PROPOSED WATER
- PROPOSED WATER CONDUIT
- FUTURE PROPERTY LINE
- FUTURE KERB (INVERT)
- FUTURE FOOTPATH
- RM FUTURE RISING MAIN
- S FUTURE SEWER
- SW FUTURE STORMWATER
- RW FUTURE ROOFWATER
- SS FUTURE SUBSOIL
- W100 FUTURE WATER
- W150 FUTURE WATER
- W200 FUTURE WATER
- W225 FUTURE WATER
- W250 FUTURE WATER
- W300 FUTURE WATER
- FUTURE WATER CONDUIT
- SITE BOUNDARY
- STAGE BOUNDARY

SHEET LAYOUT



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198 RP173728

197 RP173728

187 RP173728

COURTNEY DR

ROAD 07

ROAD 10

ROAD 08

STAGE 5

STAGE 6

1009 1010 1011

246 245 244 243 242 241 240 239 248 247 264 263 249 250 262 251 261 252 260 253 259 258 254 265 266 267 310 309 308 307 306 305 276 277 278 279 275 274 280 273 281 272 271 282 311

ADJOINS SHEET 02

ADJOINS SHEET 03

ADJOINS SHEET 04

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT & SERVICES REVISED
B	28-03-19	SHEET LAYOUT, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

COMBINED SERVICES PLAN SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

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RP173728

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RP173728

75
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SP174234

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SP174234

900
SP205578

308

307

306

305

304

303

STAGE 6

C

ADJOINS SHEET 01

ADJOINS SHEET 04

ROAD 07

GORDON DR

RICHARDSON CR

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & SERVICES REVISED
B	28-03-19	LOT NO'S, STAGES & SHEET LAYOUT AMENDED
A	11-09-18	COUNCIL ISSUE

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COMBINED SERVICES
PLAN
SHEET 02

MORTONS
urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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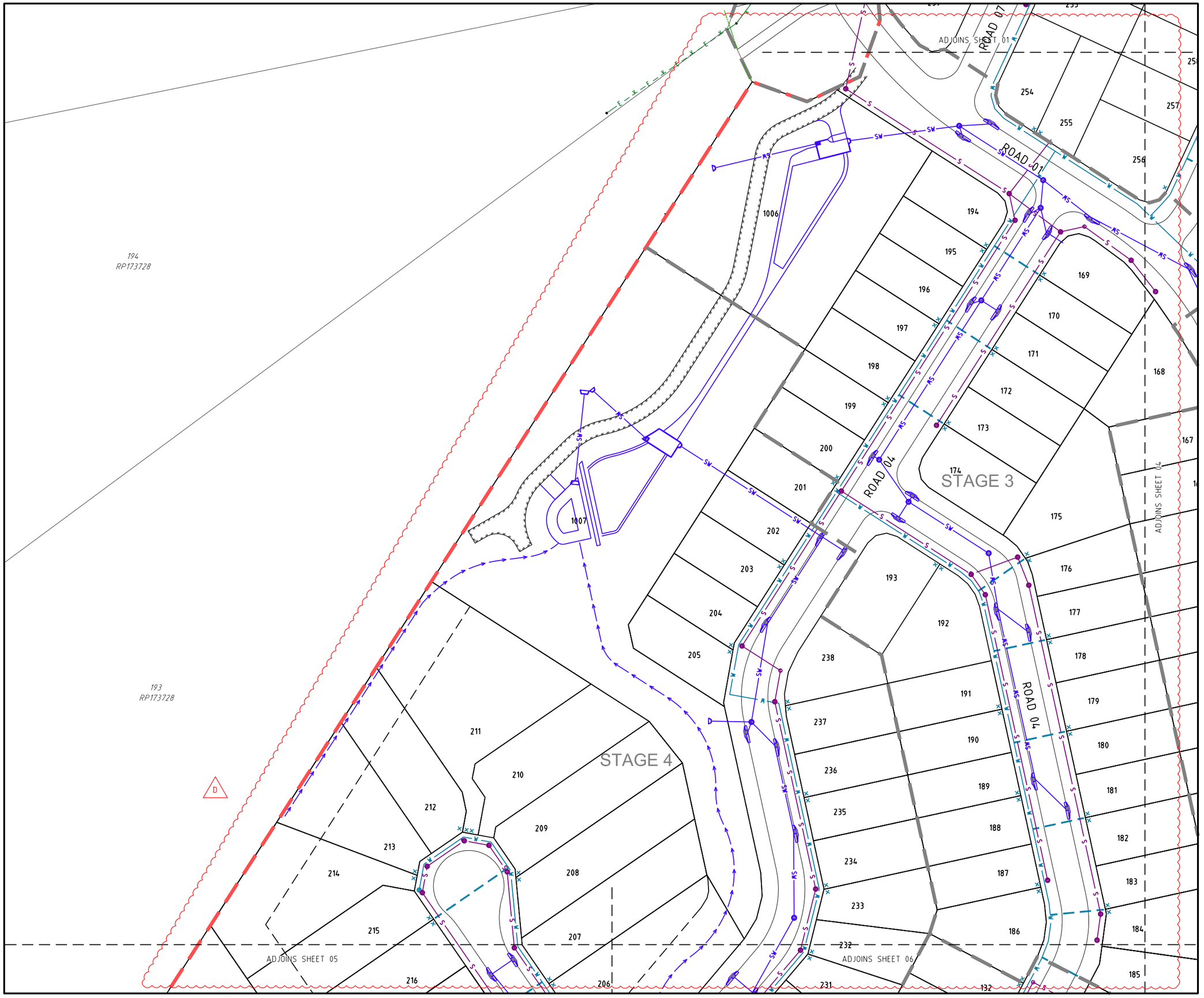

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
D	24-10-19	LOT LAYOUT & SERVICES REVISED
C	16-04-19	SEWER AMENDED
B	28-03-19	LOTS, LOT NO'S, STAGES & SHEET LAYOUT AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

COMBINED SERVICES PLAN
SHEET 03

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Civil Engineering
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MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

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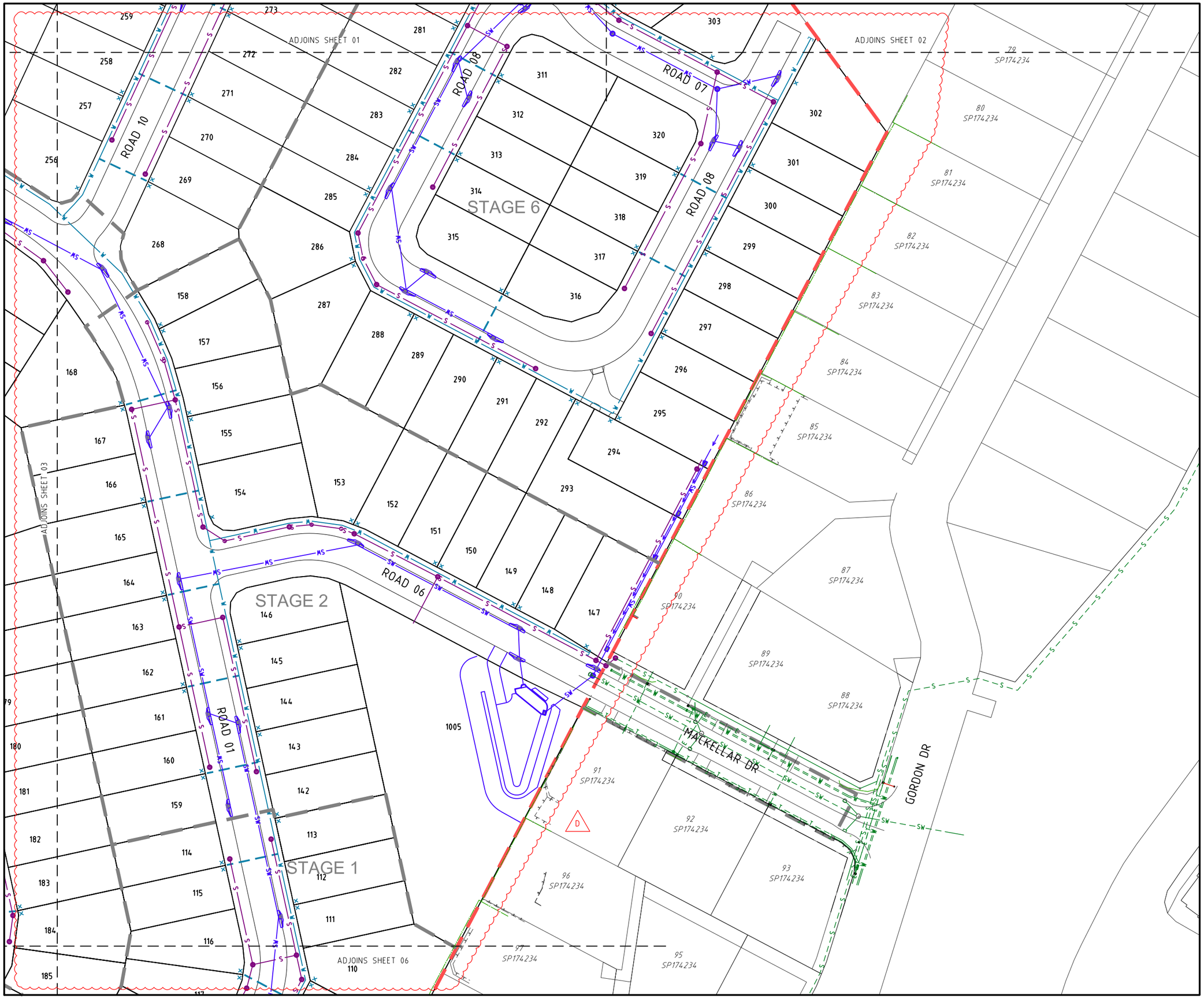

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE
TENDER	
COUNCIL	11-09-18
CONSTRUCTION	

PRE	DATE	AMENDMENT
D	24-10-19	LOT LAYOUT & SERVICES REVISED
C	16-04-19	SEWER AMENDED
B	28-03-19	LOT NO'S, STAGES & SHEET LAYOUT AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

COMBINED SERVICES PLAN
SHEET 04

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MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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36001-PRE-093	D

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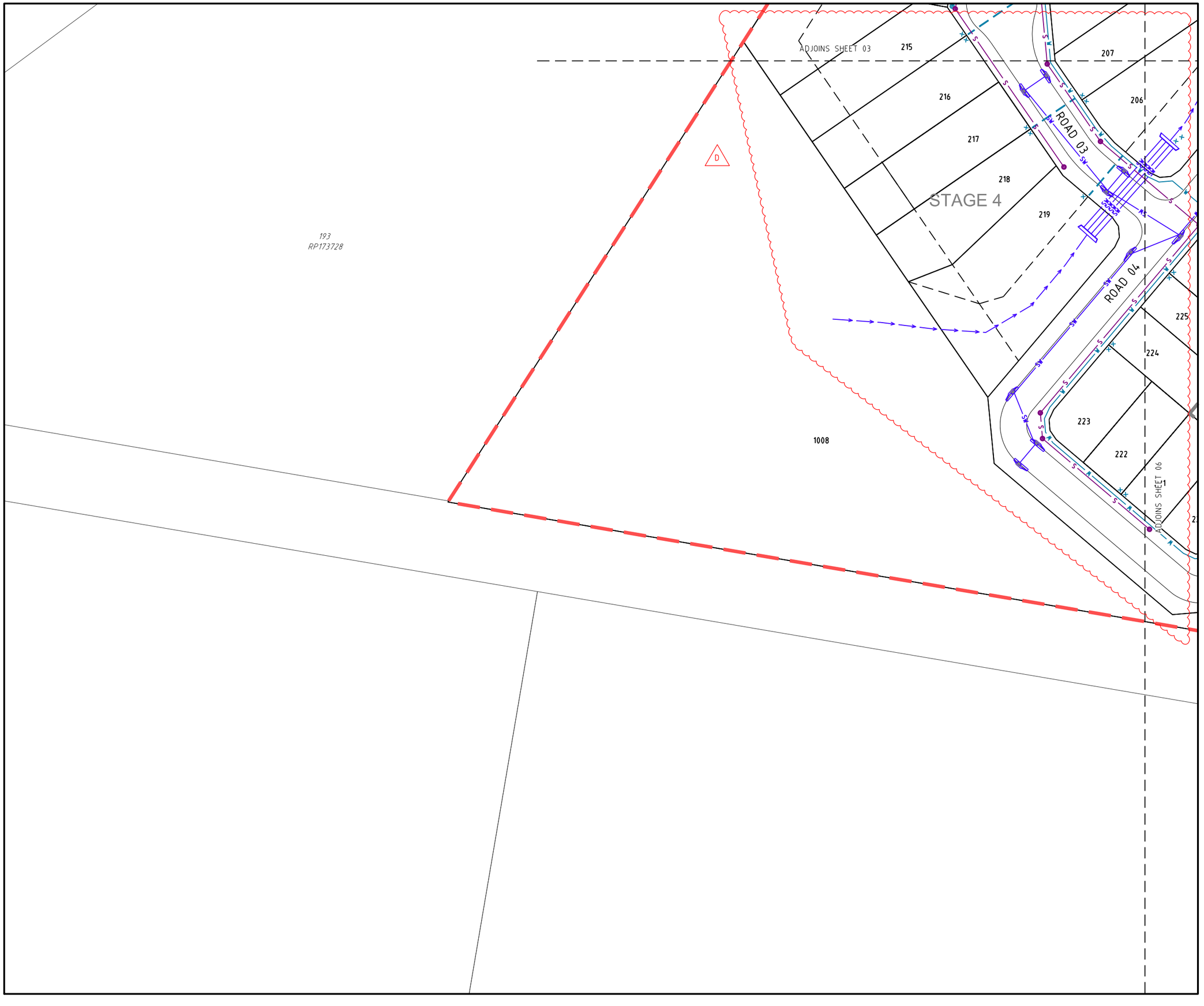

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

D	24-10-19	LOT LAYOUT & SERVICES REVISED
C	16-04-19	SEWER AMENDED
B	28-03-19	LOTS, LOT NO'S, STAGES & SHEET LAYOUT AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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PLAN
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Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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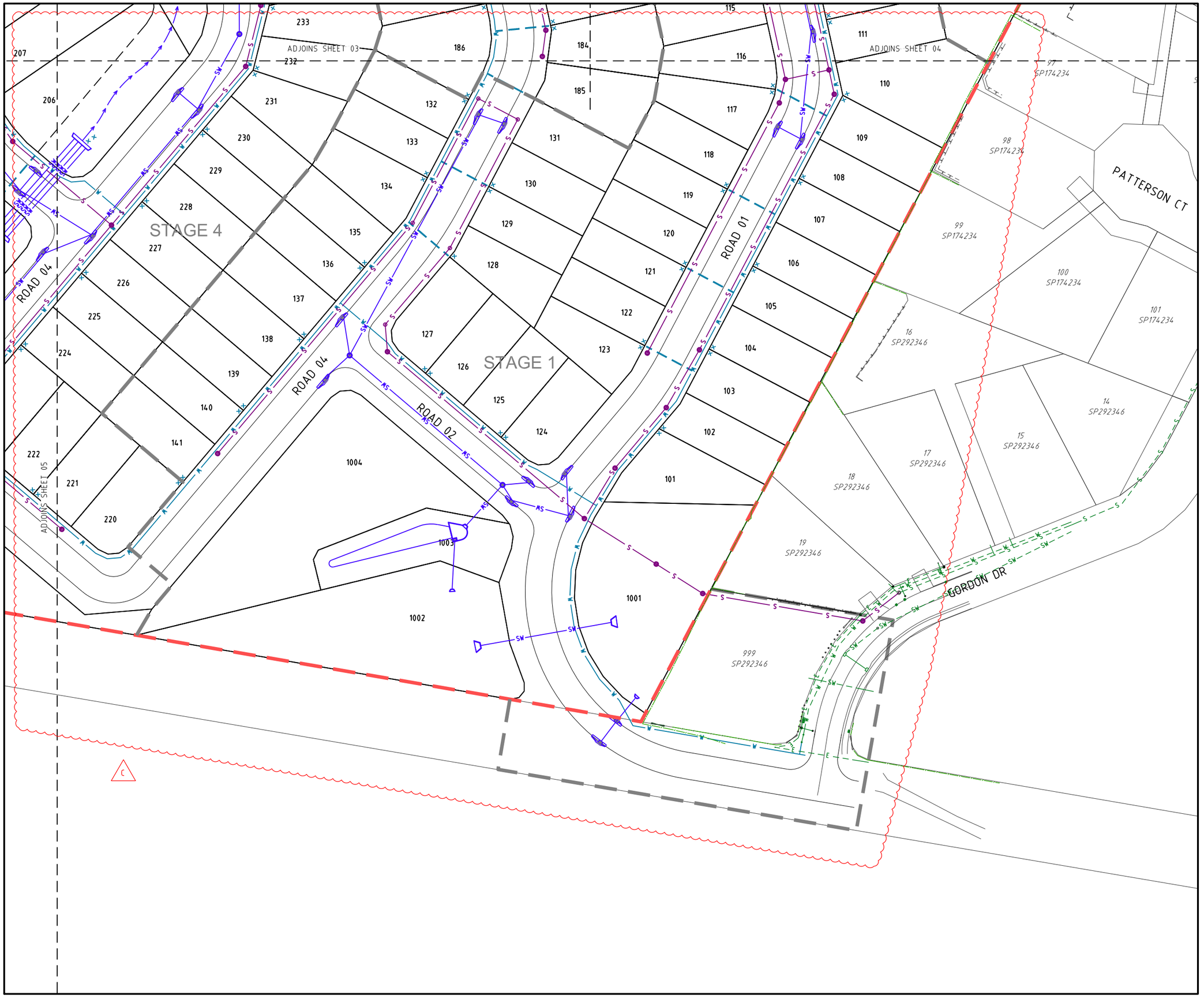

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT & SERVICES REVISED
B	28-03-19	SERVICES, LOT NO'S, STAGES & SHEET LAYOUT AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

COMBINED SERVICES PLAN
SHEET 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
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DRAWING NUMBER 36001-PRE-095 | AMEND. C

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ROADWORKS

1. PAVEMENT DEPTHS
   a) THE DESIGN PAVEMENT DEPTHS ALLOWED IN EARTHWORKS CALCULATIONS ARE BASED ON THE DEPTHS SHOWN IN THE SCHEDULE OF PAVEMENT DEPTHS ON DRAWING 120.
   b) THE PAVEMENT DEPTHS GIVEN ARE DESIGN DEPTHS ONLY AND MAY BE VARIED AFTER SUB-GRADE TESTS ARE TAKEN. THE CONTRACTOR IS TO PROVIDE THE SUPERINTENDENT A SUBGRADE C.B.R. REPORT PREPARED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER.
   THE SUPERINTENDENT WILL COORDINATE THE AUTHORITIES APPROVAL OF THE PAVEMENT DESIGN.
   c) REFER TO DWG. 120 FOR TYPICAL ROAD SECTIONS.
2. TESTING
   ALL COMPACTION TESTING SHALL BE CARRIED OUT BY AN APPROVED N.A.T.A. TESTING AUTHORITY. ALL SITE FILLING SHALL BE TESTED AT LEVEL 1 REQUIREMENTS.
3. SUBSOIL DRAINS
   SUBSOIL DRAINS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE LOCAL AUTHORITY'S SPECIFICATIONS. SUBSOIL DRAINS SHALL BE PLACED UNDER ALL KERB STRUCTURES AND ARE TO BE CONSTRUCTED TO A DEPTH GREATER THAN THAT OF THE INVERT OF THE DEEPEST SERVICE CROSSING.
4. MITRE DRAINS
   MITRE DRAINS ARE TO BE CONSTRUCTED ALONG THE CUT/FILL INTERFACE AND SAG/LOW POINTS OF ALL ROADS. CONTRACTOR TO REQUEST DIRECTION FROM SUPERINTENDENT WHETHER TO INSTALL MITRE DRAIN AT ROCK ENCOUNTERED IN SUBGRADE. ALL MITRE DRAINS MUST BE FREE DRAINING AND TIE INTO THE ADJACENT SUBSOIL DRAINS.
5. ROCK
   THE CONTRACTOR IS TO INCLUDE ROCK EXCAVATION AS PART OF THEIR RATES.
6. TURF
   1.0m TURF STRIP TO BE INSTALLED BEHIND THE BACK OF ALL KERBS. A PERPENDICULAR TURF STRIP AT MAXIMUM 10m INCREMENTS MUST BE INSTALLED TO FULL VERGE WIDTH FOR SEDIMENT AND EROSION CONTROL PURPOSES.
7. KERBS
   ALL KERBS TO BE CONSTRUCTED IN ACCORDANCE WITH AUTHORITY STANDARDS
8. PAVEMENT TIE-IN
   PAVEMENT TIE-IN TO BE IN ACCORDANCE WITH DWG. 120

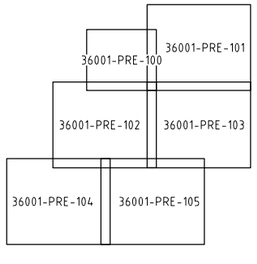
LEGEND

- EXISTING KERB (INVERT)
- EXISTING KERB (LIP & BACK)
- EXISTING FOOTPATH
- EXISTING EDGE OF BITUMEN
- EXISTING PROPERTY LINE
- EXISTING CONTOURS
- FUTURE KERB
- FUTURE FOOTPATH
- FUTURE PROPERTY LINE
- FUTURE CONTOURS
- CONTROL LINE / CENTER OF ROAD
- PROPOSED KERB (INVERT)
- PROPOSED KERB (LIP & BACK)
- PROPOSED EDGE OF BITUMEN
- PROPOSED FOOTPATH
- PROPOSED PROPERTY LINE
- SITE BOUNDARY
- STAGE BOUNDARY
- DESIGN CONTOURS
- PROPOSED CONCRETE
- 41.065 CENTRELINE CHAINAGE

KERB TYPE NOTE:

1. FOR KERB TYPES REFER TO DWG. 120

SHEET LAYOUT



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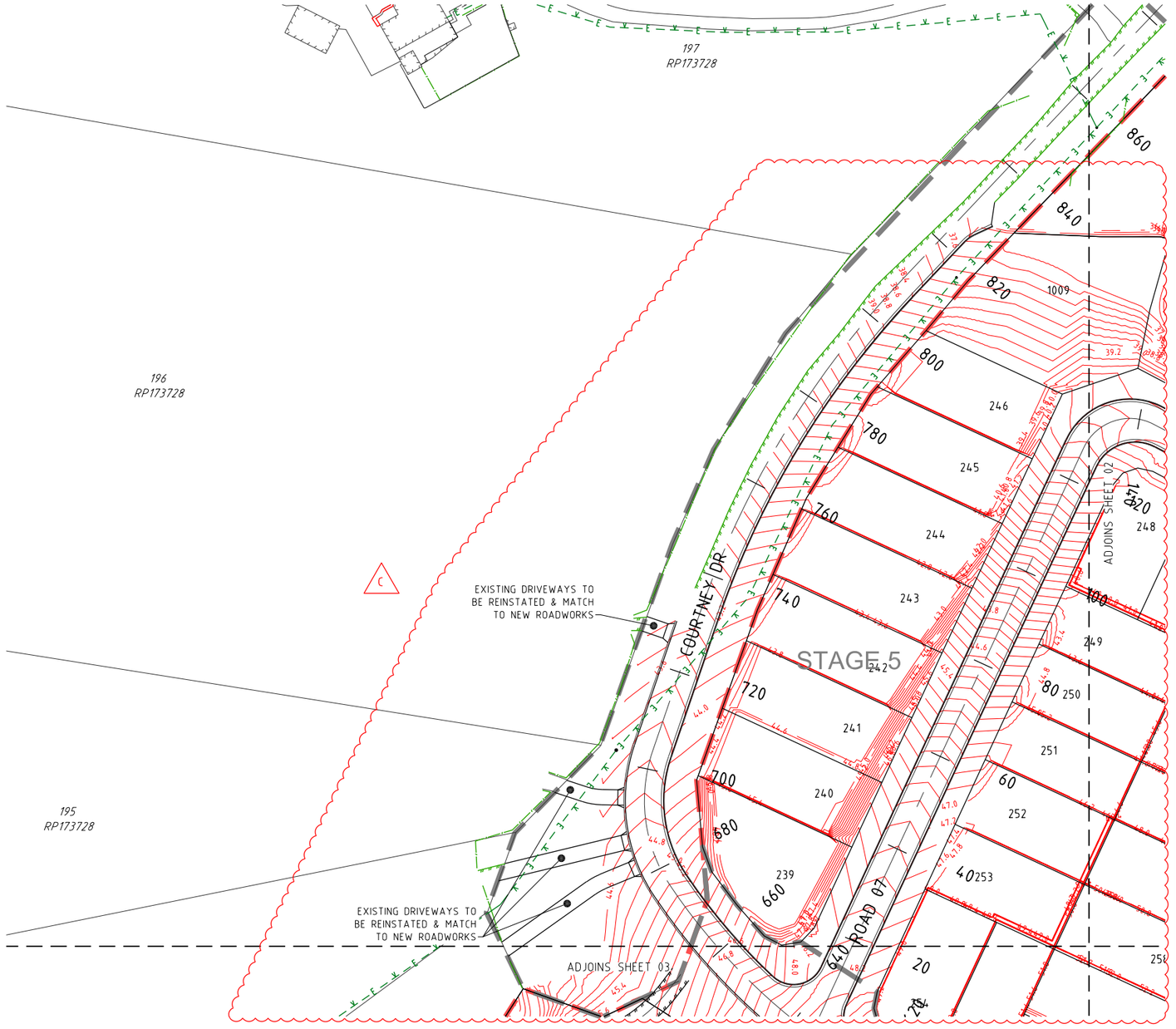

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, ROADS & CONTOURS REVISED
B	28-03-19	LOT NO'S & STAGES AMENDED, NOTES ADDED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

ROADWORKS
PLAN
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-100 | AMEND. C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, ROADS & CONTOURS REVISED
B	28-03-19	LOT NO'S & STAGES AMENDED, NOTE ADDED
A	11-09-18	COUNCIL ISSUE

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ROADWORKS
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SHEET 02

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Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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EXISTING DRIVEWAYS TO BE REINSTATED & MATCH TO NEW ROADWORKS

ADJOINS SHEET 01

TRANSITION FROM KERB & CHANNEL TO EDGE RESTRAINT

ROAD 07

ROAD 01

ROAD 04

ROAD 01

ADJOINS SHEET 04

ADJOINS SHEET 05

ADJOINS SHEET 06

STAGE 3

STAGE 4

194
RP173728

193
RP173728

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, ROADS & CONTOURS REVISED
B	28-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

ROADWORKS
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SHEET 03

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Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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DRAWING NUMBER: 36001-PRE-102
AMEND.: C

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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

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B	28-03-19	LOT NO'S & STAGES AMENDED, NOTE ADDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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ROADWORKS
PLAN
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MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
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APPROVED	RPEQ	DATE 14-08-18

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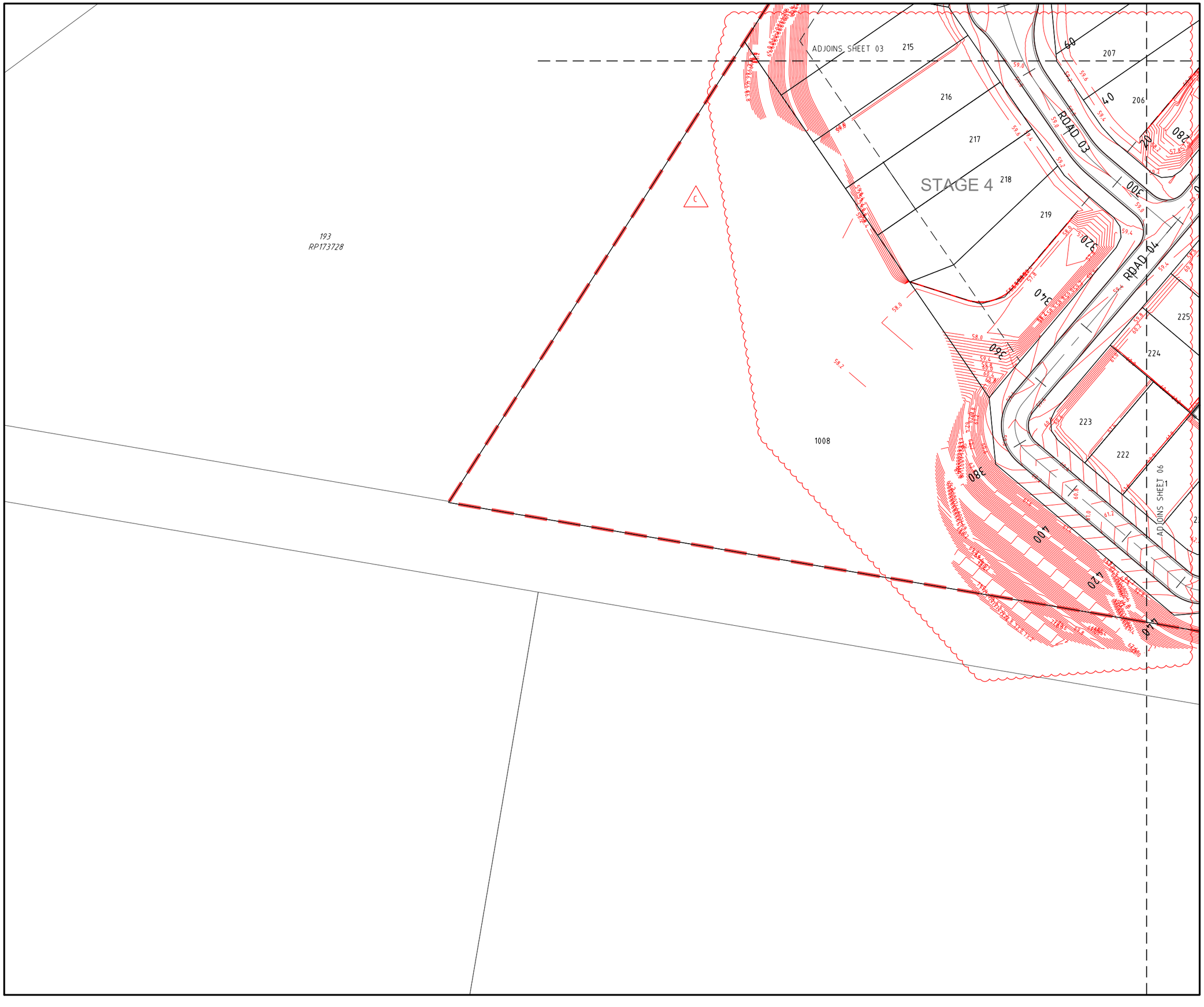

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, ROADS & CONTOURS REVISED
B	28-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

ROADWORKS
PLAN
SHEET 05

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Urban & Regional Planning
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MUS Pty Ltd T/As
Mortons Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

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Suite 9, 19 Short St
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APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER	AMEND.
36001-PRE-104	C

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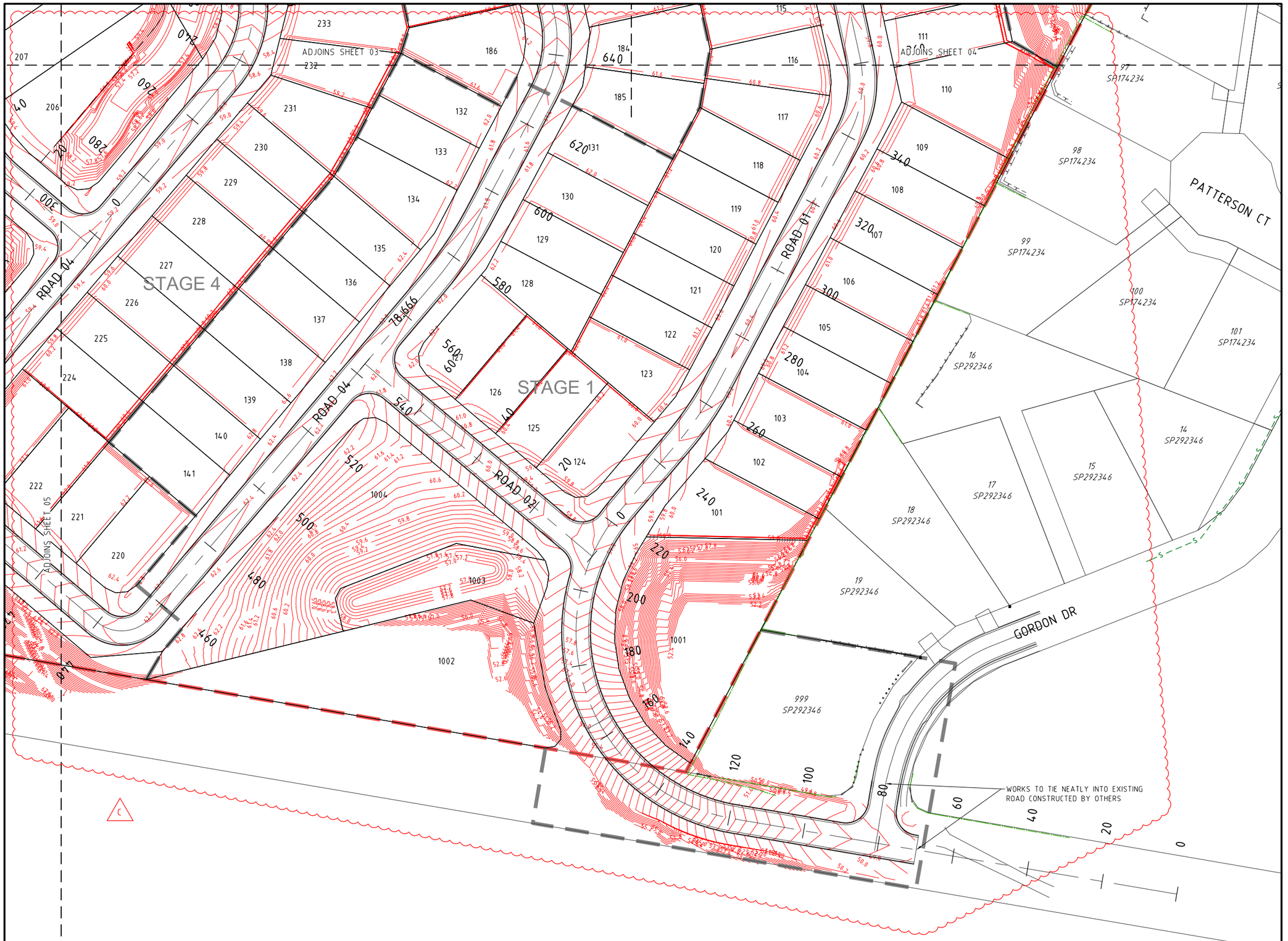

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LOT LAYOUT, ROADS & CONTOURS REVISED
B	28-03-19	LOT NO'S, STAGES & CONTOURS AMENDED, NOTE ADDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

ROADWORKS
PLAN
SHEET 06

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MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE	14-08-18

DRAWING NUMBER	AMEND.
36001-PRE-105	C

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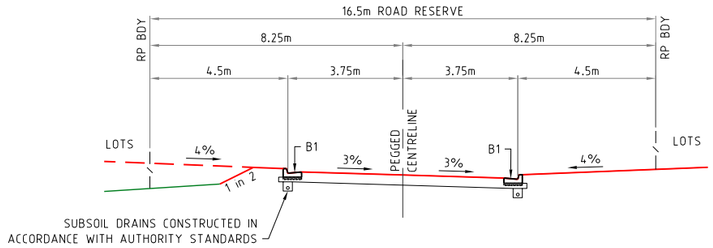
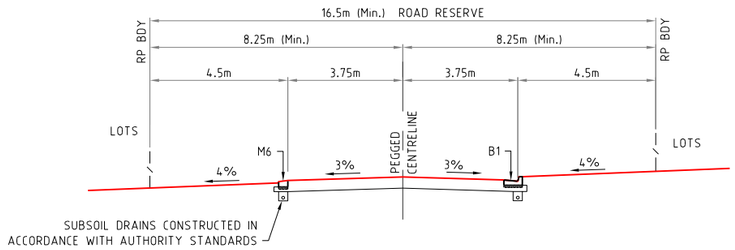


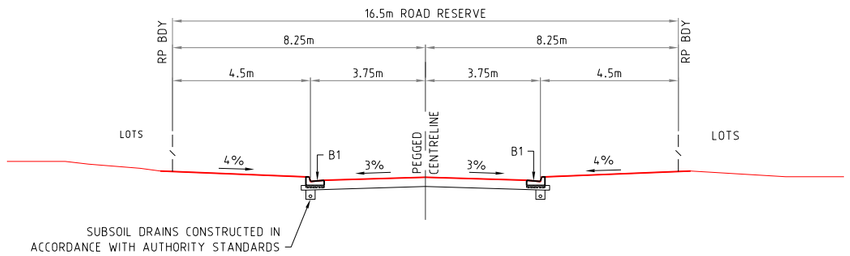
TYPICAL SECTION - ONE WAY CROSSFALL
7.5m ROAD-16.5m ROAD RESERVE

SCALE 1:100 - A1 (1:200 - A3)



TYPICAL SECTION - EDGE RESTRAINT TO BASIN
7.5m ROAD-16.5m (Min.) ROAD RESERVE

SCALE 1:100 - A1 (1:200 - A3)



TYPICAL SECTION - TWO WAY CROSSFALL
7.5m ROAD-16.5m ROAD RESERVE

SCALE 1:100 - A1 (1:200 - A3)

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 1 2 3 4 5m
Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
A	11-09-18	COUNCIL ISSUE

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zone Planning Group

DRAWING TITLE

ROADWORKS
DETAILS
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
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Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
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AMEND. A

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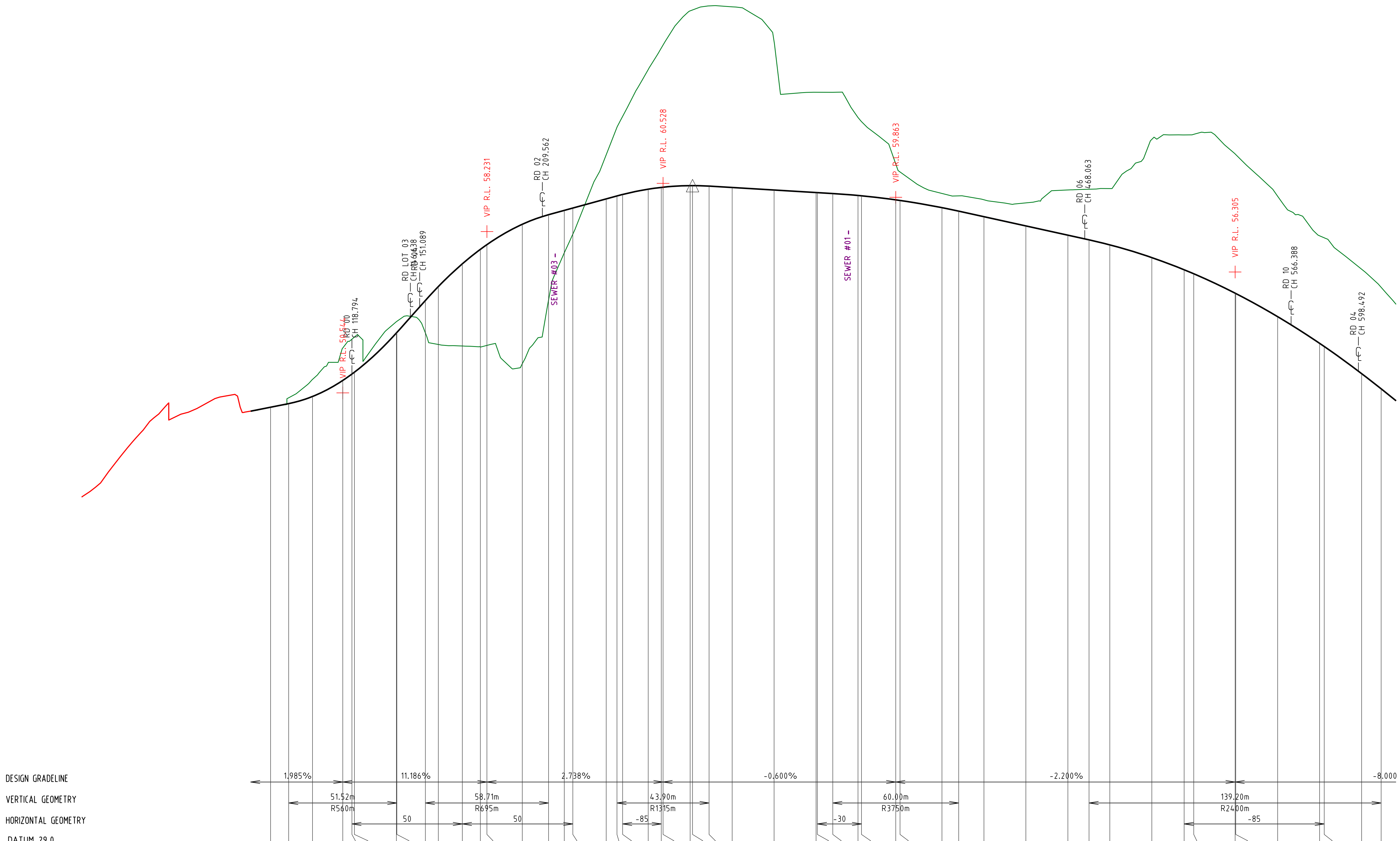

CHAINAGE	CONTROL LINE LEVELS	EXISTING SURFACE	DEPTH
0		46.393	
20		48.861	
40		49.598	
60		50.417	
80	49.86	49.85	-0.01
88.671	50.032	50.311	0.278
100	50.372	51.187	0.815
114.432	51.136	52.68	1.544
118.794	51.441	53.101	1.66
120	51.531	53.202	1.671
140	53.404	53.939	0.535
140.194	53.425	53.954	0.529
153.796	54.947	53.419	-1.528
160	55.613	52.852	-2.761
171.424	56.695	52.778	-3.917
180	57.384	52.734	-4.65
183.151	57.611	52.807	-4.803
200	58.579	51.93	-6.649
212.506	59.034	54.995	-4.039
220	59.24	57.219	-2.021
224.055	59.351	58.106	-1.244
240	59.787	61.892	2.105
245.119	59.927	63.199	3.271
247.822	59.999	63.723	3.724
260	60.251	65.952	5.702
266.243	60.336	66.978	6.642
267.067	60.345	67.12	6.775
280	60.42	68.751	8.331
281.125	60.42	68.793	8.373
289.015	60.397	68.986	8.589
300	60.331	68.941	8.611
320	60.211	67.293	7.082
340	60.091	64.868	4.777
340.62	60.087	64.868	4.781
347.972	60.043	64.872	4.83
360	59.951	63.664	3.713
361.645	59.936	63.472	3.536
377.972	59.743	61.455	1.713
380	59.714	61.073	1.359
400	59.37	60.049	0.679
407.972	59.203	59.932	0.729
420	58.938	59.746	0.808
440	58.498	59.598	1.099
460	58.058	60.214	2.156
470.107	57.836	60.25	2.414
480	57.598	60.279	2.682
500	56.992	62.622	5.63
515.421	56.411	62.838	6.427
520	56.22	62.864	6.645
539.707	55.295	61.931	6.636
540	55.28	61.902	6.621
560	54.175	59.912	5.737
580	52.902	58.027	5.124
582.18	52.754	57.933	5.179
600	51.463	56.438	4.975
609.307	50.737	55.575	4.838

LONGITUDINAL SECTION ROAD 01

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)
0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
C	24-10-19	LONG SECTION REVISED
B	28-03-19	ROAD 01 LONG SECTION AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 01

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Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
Postal Address
PO Box 2484
Southport QLD 4215
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Gold Coast Office
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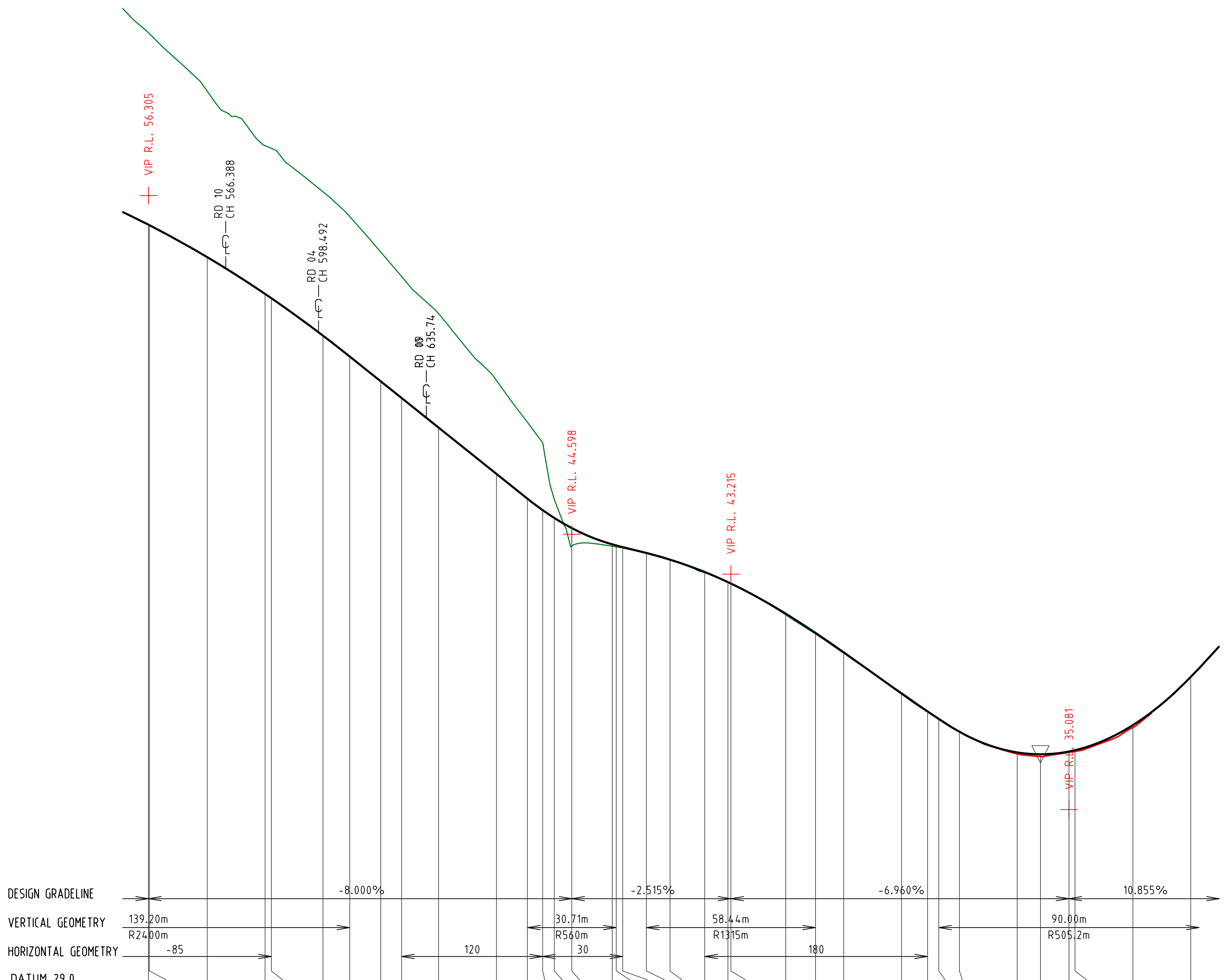

CONTROL LINE LEVELS	55.295	55.28	54.175	52.902	52.754	51.463	50.737	49.881	49.305	48.281	46.681	45.827
EXISTING SURFACE	61.931	61.902	59.912	58.027	57.933	56.438	55.575	54.351	53.507	52.219	49.91	48.474
DEPTH	6.636	6.621	5.737	5.124	5.179	4.975	4.838	4.469	4.202	3.938	3.229	2.647
CHAINAGE	539.707	540	560	580	582.18	600	609.307	620	627.198	640	660	670.681

CONTROL LINE LEVELS	45.43	45.159	44.809	44.249	44.212	44.155	43.95	43.718	43.288	42.939	42.89	41.855
EXISTING SURFACE	47.761	45.797	44.192	44.183	44.162	44.119	43.925	43.696	43.272	42.935	42.889	41.811
DEPTH	2.33	0.639	-0.617	-0.066	-0.05	-0.036	-0.025	-0.022	-0.016	-0.003	-0.001	-0.044
CHAINAGE	675.947	680	686.038	700	701.395	703.668	711.815	720	731.985	740	741.037	760

CONTROL LINE LEVELS	41.181	40.503	39.111	38.483	38.213	37.769	37.054	36.99	37.086	37.131	38	39.66
EXISTING SURFACE	41.149	40.484	39.07	38.449	38.194	37.783	37.004	36.91	37.056	37.09	37.916	
DEPTH	-0.031	-0.019	-0.041	-0.034	-0.02	0.014	-0.05	-0.08	-0.029	-0.041	-0.084	
CHAINAGE	770.26	780	800	809.021	812.897	820	840	848.057	857.897	860	880	900

LONGITUDINAL SECTION ROAD 01 (Cont.)

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)
0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	LONG SECTION REVISED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 01 (Cont.)

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED RB	DRAWN EP	
APPROVED	RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-201 AMEND. B

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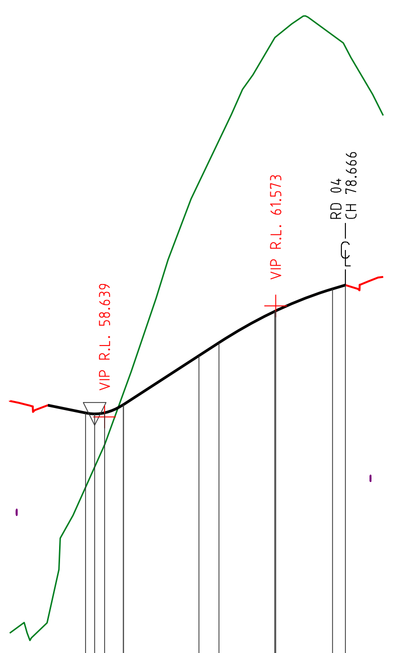
f:\autocad client\360 - gallery homes\01 - courtney drive\Overall\engineering drawings\preliminary engineering\Current\36001-PRE-200.dwg, ROAD 02 & ROAD 03, 31/10/2019 4:37:35 PM, 1:2

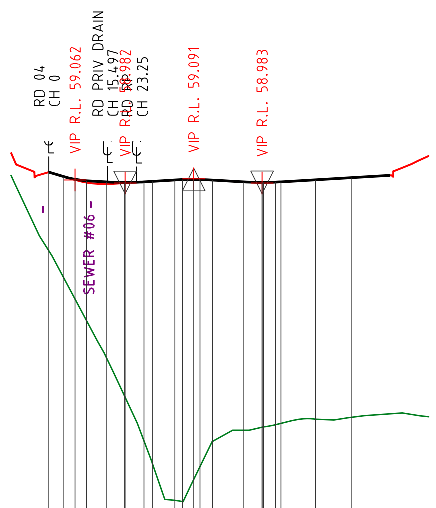


DESIGN GRADELINE	-2.062% · 6.488% · 3.000%
VERTICAL GEOMETRY	10.00m R116.9m · 30.00m R859.9m
HORIZONTAL GEOMETRY	

DATUM 46.0

CONTROL LINE LEVELS		58.742	58.717	58.746	58.96	58.963	60.258	60.6	61.429	61.442	62.023	62.125
EXISTING SURFACE	53.243	56.776	57.315	57.893	59.256	59.27	64.842	65.945	68.665	68.692	68.739	68.424
DEPTH		-1.965	-1.402	-0.853	0.296	0.306	4.584	5.345	7.236	7.25	6.716	6.299
CHAINAGE	0	10.047	12.459	15.047	20	20.047	40	45.271	60	60.271	75.271	78.666

LONGITUDINAL SECTION ROAD 02



DESIGN GRADELINE	-3.000% · -0.600% · 0.600% · -0.600% · 0.600%
VERTICAL GEOMETRY	6.00m R250m · 10.00m R833.3m · 10.00m R833.3m · 10.00m R833.2m
HORIZONTAL GEOMETRY	30 · 45

DATUM 44.0

CONTROL LINE LEVELS	59.271	59.152	59.08	59.044	59.012	58.997	58.997	59.012	59.026	59.061	59.071	59.076	59.075	59.061	59.013	58.998	58.998	58.998	59.005	59.013	59.067	59.124	
EXISTING SURFACE	57.191	56.472	55.909	55.347	54.372	53.357	53.315	52.159	51.567	50.59	50.553	51.14	51.478	52.15	52.441	52.521	52.521	52.529	52.592	52.624	52.734	52.784	52.878
DEPTH	-2.08	-2.68	-3.17	-3.697	-4.641	-5.64	-5.682	-6.854	-7.459	-8.472	-8.518	-7.936	-7.597	-6.911	-6.572	-6.477	-6.477	-6.469	-6.414	-6.389	-6.333	-6.341	
CHAINAGE	0	3.975	6.975	9.975	15.197	20	20.197	25.197	27.419	33.363	35.391	38.363	40	43.363	51.447	56.446	56.447	56.817	60	61.447	70.511	80	90.682

LONGITUDINAL SECTION ROAD 03

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)
0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	LONG SECTIONS REVISED & ADDED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING
zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS ROAD 02 & ROAD 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED RB	DRAWN EP
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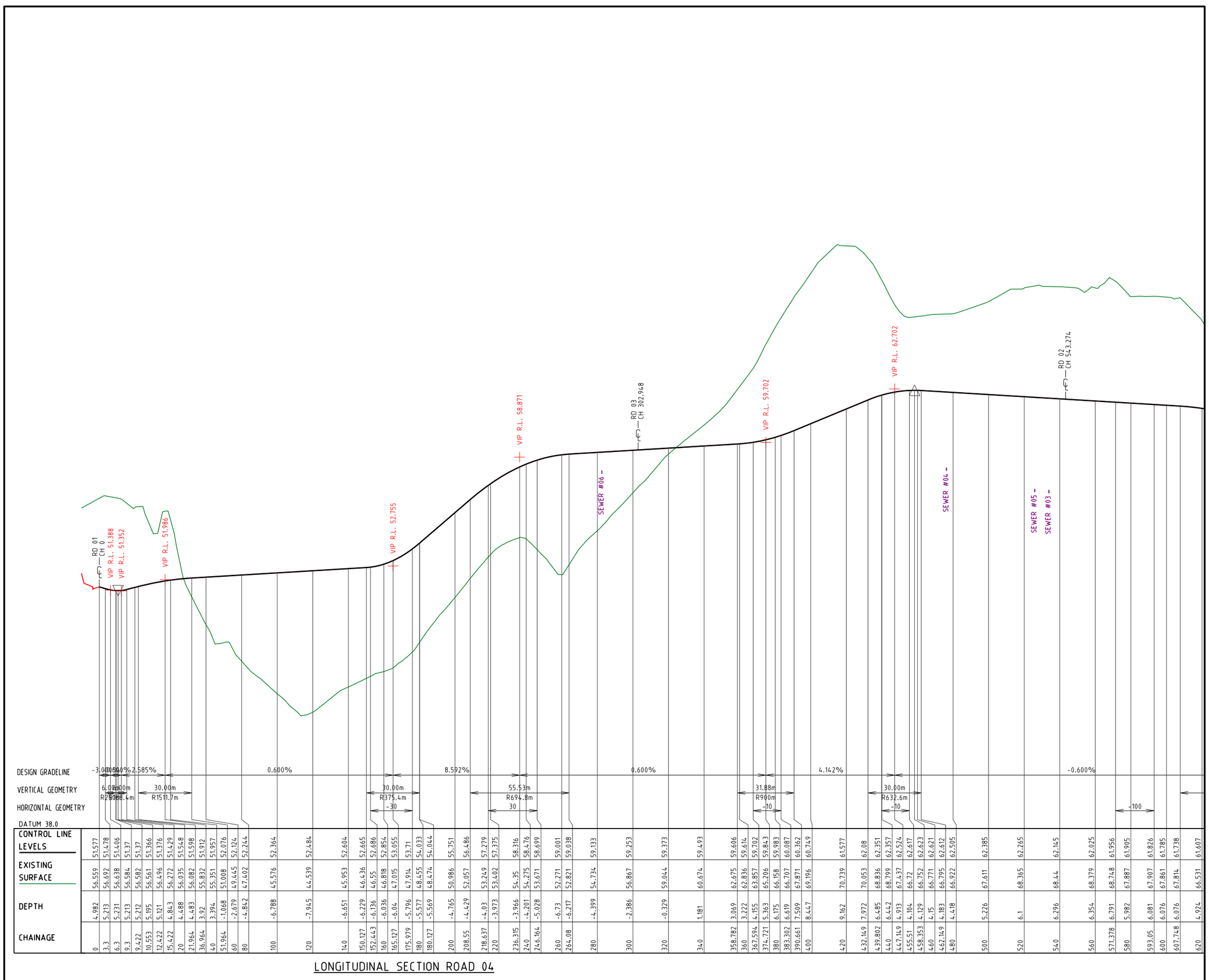
DRAWING NUMBER 36001-PRE-202	AMEND. B



CHAINAGE	CONTROL LINE LEVELS	EXISTING SURFACE	DEPTH
0	51.577	56.559	4.982
3.3	51.478	56.692	5.213
6.3	51.406	56.638	5.231
9.3	51.37	56.584	5.213
9.422	51.37	56.582	5.212
10.553	51.366	56.561	5.195
12.422	51.376	56.496	5.121
15.422	51.429	56.272	4.843
20	51.548	56.035	4.488
21.964	51.598	56.082	4.483
36.964	51.912	55.832	3.92
40	51.957	55.351	3.394
51.964	52.076	51.008	-1.068
60	52.124	49.445	-2.679
80	52.244	47.402	-4.842
100	52.364	45.576	-6.788
120	52.484	44.539	-7.945
140	52.604	45.953	-6.651
150.127	52.665	46.436	-6.229
152.443	52.686	46.55	-6.136
160	52.854	46.818	-6.036
165.127	53.055	47.015	-6.04
175.979	53.71	47.914	-5.796
180	54.033	48.455	-5.577
180.127	54.044	48.474	-5.569
200	55.751	50.986	-4.765
208.55	56.486	52.057	-4.429
218.637	57.279	53.249	-4.03
220	57.375	53.402	-3.973
236.315	58.316	54.35	-3.966
240	58.476	54.275	-4.201
246.164	58.699	53.671	-5.028
260	59.001	52.271	-6.73
264.08	59.038	52.821	-6.217
280	59.133	54.734	-4.399
300	59.253	56.867	-2.386
320	59.373	59.044	-0.329
340	59.493	60.674	1.181
358.782	59.606	62.675	3.069
360	59.614	62.836	3.222
367.594	59.702	63.857	4.155
374.721	59.843	65.206	5.363
380	59.983	66.158	6.175
383.302	60.087	66.707	6.619
390.661	60.362	67.871	7.509
400	60.749	69.196	8.447
420	61.577	70.739	9.162
432.149	62.08	70.053	7.972
439.802	62.351	68.836	6.485
440	62.357	68.799	6.442
447.149	62.524	67.437	4.913
455.51	62.617	66.72	4.104
458.353	62.623	66.752	4.129
460	62.621	66.771	4.15
462.149	62.612	66.795	4.183
480	62.505	66.922	4.418
500	62.385	67.611	5.226
520	62.265	68.365	6.1
540	62.145	68.44	6.296
560	62.025	68.379	6.354
571.378	61.956	68.748	6.791
580	61.905	67.887	5.982
593.05	61.826	67.907	6.081
600	61.785	67.861	6.076
607.748	61.738	67.814	6.076
620	61.607	66.531	4.924

LONGITUDINAL SECTION ROAD 04

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)

0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	LONG SECTIONS REMOVED & ADDED
A	11-09-18	COUNCIL ISSUE

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zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 04

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-203 | AMEND. B

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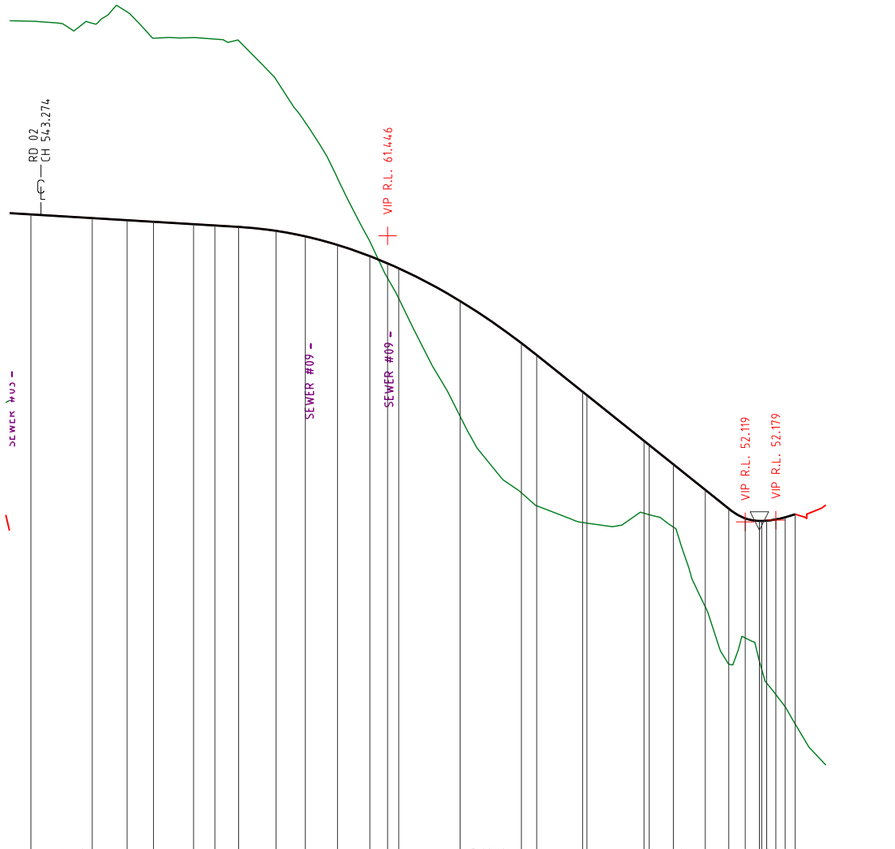

CONTROL LINE LEVELS	62.145		62.025	61.956	61.905	61.826	61.785	61.738	61.607	61.427	61.149	60.785	60.548	60.386	59.32			57.949	57.56		56.359	56.248		54.759	54.623	53.995	53.159	52.549	52.234	52.149	52.151	52.16	52.161	52.197	52.269	52.368
EXISTING SURFACE	68.44		68.379	68.748	67.887	67.907	67.861	67.814	66.531	65.142	63.335	61.267	60.065	59.403	55.564			53.066	52.642		52.098	52.079		52.402	52.353	51.947	49.342	47.479	48.336	47.575	47.314	46.862	46.861	46.487	46.094	45.53
DEPTH	6.296		6.354	6.791	5.982	6.081	6.076	6.076	4.924	3.715	2.186	0.482	-0.482	-0.984	-3.756			-4.882	-4.917		-4.261	-4.169		-2.358	-2.27	-2.047	-3.818	-5.069	-3.898	-4.573	-4.837	-5.298	-5.299	-5.709	-6.174	-6.838
CHAINAGE	540		560	571.378	580	593.05	600	607.748	620	629.512	640	650.537	656.366	660	680			700	704.984		720	721.387		740	741.703	749.557	760	767.634	773.009	777.634	778.384	780	780.009	783.009	786.009	789.309

LONGITUDINAL SECTION ROAD 04 (Cont.)

CONTROL LINE LEVELS	57.881		57.798	56.901	56.26	56.206	54.911	53.729	52.957	51.951		48.751	47.783	45.725	43.644	43.38	41.749	41.26	40.72						
EXISTING SURFACE	60.243		60.181	55.462	53.412	53.29	50.282	49.313	48.491	47.571		43.998	43.523	43.523	43.422	42.765	41.736	41.26	40.731	39.729	38.623	37.555	37.593		
DEPTH	2.362		2.383	-1.44	-2.848	-2.916	-4.63	-4.417	-4.466	-4.38		-4.753	-4.26	-2.202	-0.222	-0.615	-0.013	0	0.011						
CHAINAGE	0		2.753	20	27.659	28.233	40	48.684	53.714	60		80	86.052	100	117.406	120	140	148.76	160	180	200	220	224.561		

LONGITUDINAL SECTION ROAD 06

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)

0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	LONG SECTIONS REVISED & ADDED
A	11-09-18	COUNCIL ISSUE

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 04 (Cont.)
&
ROAD 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-204 | AMEND. B

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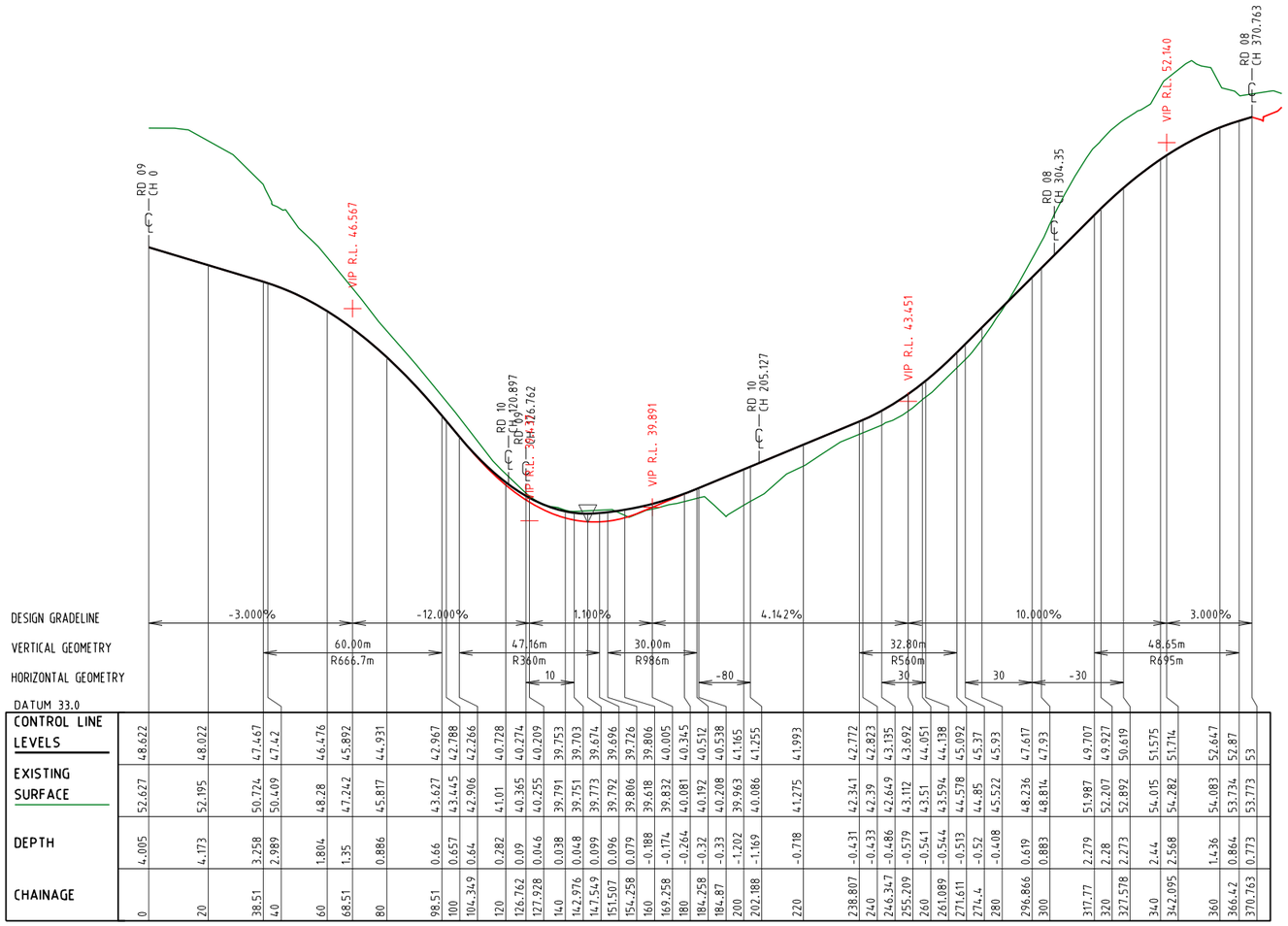

CHAINAGE	DEPTH	EXISTING SURFACE	CONTROL LINE LEVELS
0	4.005	52.627	48.622
20	4.173	52.195	48.022
38.51	3.258	50.724	47.467
40	2.989	50.409	47.42
60	1.804	48.28	46.476
68.51	1.35	47.242	45.892
80	0.886	45.817	44.931
98.51	0.66	43.627	42.967
100	0.657	43.445	42.788
104.349	0.64	42.906	42.266
120	0.282	41.01	40.728
126.762	0.09	40.365	40.274
127.928	0.046	40.255	40.209
140	0.038	39.791	39.753
142.976	0.048	39.751	39.703
147.549	0.099	39.773	39.674
151.507	0.096	39.792	39.696
154.258	0.079	39.806	39.726
160	-0.188	39.618	39.806
169.258	-0.174	39.832	40.005
180	-0.264	40.081	40.345
184.258	-0.32	40.192	40.512
184.87	-0.33	40.208	40.538
200	-1.202	39.963	41.165
202.188	-1.169	40.086	41.255
220	-0.718	41.275	41.993
238.807	-0.431	42.341	42.772
240	-0.433	42.39	42.823
246.347	-0.486	42.649	43.135
255.209	-0.579	43.112	43.692
260	-0.541	43.51	44.051
261.089	-0.544	43.594	44.138
271.611	-0.513	44.578	45.092
274.4	-0.52	44.85	45.37
280	-0.408	45.522	45.93
296.866	0.619	48.236	47.617
300	0.883	48.814	47.93
317.77	2.279	51.987	49.707
320	2.28	52.207	49.927
327.578	2.273	52.892	50.619
340	2.44	54.015	51.575
342.095	2.568	54.282	51.714
360	1.436	54.083	52.647
366.42	0.864	53.734	52.87
370.763	0.773	53.773	53

LONGITUDINAL SECTION ROAD 07

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)

0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
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COUNCIL	11-09-18	
CONSTRUCTION		

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 07

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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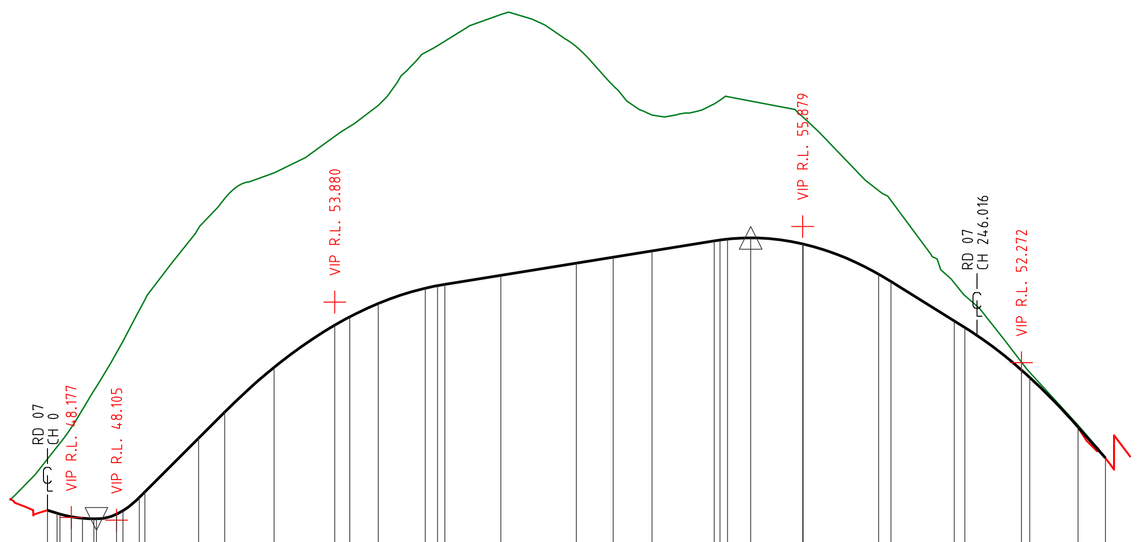


DESIGN GRADELINE: -3.000% | 4.600% | 10.000% | 1.614% | -6.227% | -11.354%

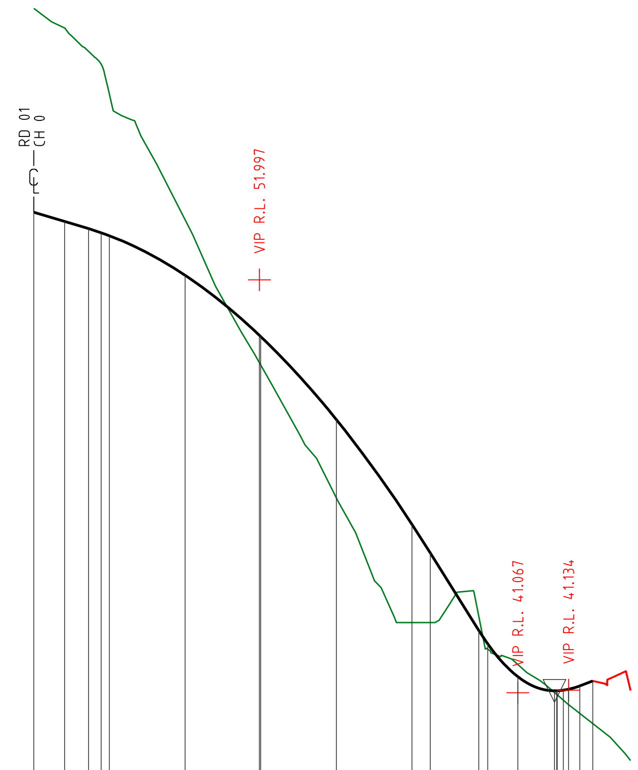
VERTICAL GEOMETRY: 6.00m R250m | 12.00m R113.2m | 58.28m R695m | 46.78m R596.5m | 30.00m R585.2m

HORIZONTAL GEOMETRY: -30 | -10 | -18

DATUM 28.0

CHAINAGE	CONTROL LINE LEVELS	EXISTING SURFACE	DEPTH
-0	48.366	49.723	1.358
2.554	48.289	50.048	1.759
3.3	48.267	50.143	1.876
6.3	48.195	50.554	2.36
9.3	48.159	51.025	2.866
12.3	48.141	51.541	3.401
12.979	48.138	51.644	3.506
18.3	48.264	52.529	4.266
20	48.356	52.839	4.483
24.3	48.705	53.659	4.955
25.783	48.853	53.938	5.085
40	50.275	55.833	5.559
46.911	50.966	56.626	5.661
60	52.151	57.3	5.149
76.051	53.269	58.27	5.001
80	53.487	58.53	5.043
87.533	53.841	59.085	5.244
100	54.247	60.484	6.237
103.241	54.316	60.668	6.352
105.191	54.35	60.788	6.438
120	54.589	61.49	6.901
140	54.912	60.637	5.725
149.741	55.069	59.614	4.545
160	55.235	58.83	3.595
176.488	55.501	59.127	3.625
178.016	55.524	59.226	3.703
180	55.547	59.319	3.771
186.119	55.579	59.202	3.623
199.877	55.42	58.789	3.369
200	55.417	58.777	3.36
220	54.617	56.83	2.213
223.266	54.422	56.571	2.148
240	53.38	54.385	1.005
242.788	53.207	54.051	0.844
257.788	52.08	52.291	0.21
260	51.882	52.017	0.136
272.788	50.569	50.614	0.044
280	49.751	49.751	0

LONGITUDINAL SECTION ROAD 08



DESIGN GRADELINE: -3.000% | -16.000% | 0.500% | 3.800%

VERTICAL GEOMETRY: 90.35m R695m | 20.63m R125m | 6.00m R181.8m

HORIZONTAL GEOMETRY: -30

DATUM 33.0

CHAINAGE	CONTROL LINE LEVELS	EXISTING SURFACE	DEPTH
0	53.786	59.184	5.397
8.19	53.541	58.663	5.122
14.476	53.352	58.05	4.698
17.817	53.244	57.699	4.455
20	53.164	56.908	3.744
40	52.118	53.591	1.474
59.651	50.529	49.803	-0.726
60	50.495	49.741	-0.754
80	48.298	46.222	-2.075
100	45.524	42.925	-2.599
104.826	44.769	42.925	-1.844
117.652	42.717	43.086	0.369
120	42.363	42.22	-0.143
127.965	41.492	41.814	0.322
137.652	41.117	41.072	-0.045
138.277	41.118	41.018	-0.101
138.376	41.119	41.009	-0.11
140	41.134	40.868	-0.266
141.376	41.158	40.75	-0.408
144.376	41.248	40.515	-0.732
147.776	41.377	40.249	-1.128

LONGITUDINAL SECTION ROAD 10

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY THE ART OF LIVING

0 5 10 15 20 25m
Horiz. Scale 1:500 - A1 (1:1000 - A3)

0 1 2 3 4 5m
Vert. Scale 1:100 - A1 (1:200 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
B	24-10-19	LONG SECTIONS REVISED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

LONGITUDINAL SECTIONS
ROAD 08
&
ROAD 10

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED RB	DRAWN EP	
APPROVED	RPEQ	DATE 14-08-18

DRAWING NUMBER 36001-PRE-206 | AMEND. B

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SEQ CODE SEWER NOTES

SEQ CODE NOTES COPIED DIRECTLY FROM DRAWING SEQ-SEW-1101-3.

ALL ENVIRONMENT PROTECTION MEASURES SHALL BE IMPLEMENTED PRIOR TO ANY CONSTRUCTION WORK, INCLUDING CLEARING, COMMENCING.

VEGETATION PROTECTION

A. TREES LOCATED ALONG THE FOOTPATH SHALL BE, TRANSPLANTED PRIOR TO CONSTRUCTION, OR REPLACED IF DESTROYED.
B. WHEN WORKING WITHIN 4m OF TREES, RUBBER OR HARDWOOD GIRDLES SHALL BE CONSTRUCTED WITH 1.8 m BATTENS CLOSELY SPACED AND ARRANGED VERTICALLY FROM GROUND LEVEL. GIRDLES SHALL BE STRAPPED TO TREES PRIOR TO CONSTRUCTION AND REMAIN UNTIL COMPLETION.
C. TREE ROOTS SHALL BE TUNNELLED UNDER, RATHER THAN SEVERED. IF ROOTS ARE SEVERED THE DAMAGED AREA SHALL BE TREATED WITH A SUITABLE FUNGICIDE. CONTACT RELEVANT COUNCIL ARBORIST FOR FURTHER ADVICE.
D. ANY TREE LOPPING REQUIRED SHOULD BE UNDERTAKEN BY AN APPROVED ARBORIST.

SOIL

A. TOPSOIL AND SUBSOIL SHALL BE STOCKPILED SEPARATELY.
B. CARE SHALL BE TAKEN TO PREVENT SEDIMENT FROM ENTERING THE STORMWATER SYSTEM. THIS MAY INVOLVE PLACING APPROPRIATE SEDIMENT CONTROLS AROUND STOCKPILES.
C. IF ACID SULPHATE SOILS EXIST IN THE WORKS AREA. THE CONTRACTOR MUST PREPARE A RISK ASSESSMENT BASED ON THE QUEENSLAND ACID SULPHATE SOIL TECHNICAL MANUAL AND MANAGE THE ACID SULPHATE SOILS AS PER THE MANUAL.

CREEK CROSSINGS

A. SILTATION CONTROL MEASURES SHALL BE PLACED DOWNSTREAM OF ANY EXCAVATION WORK.
B. APPROPRIATE SEDIMENT CONTROLS SHALL BE USED TO PREVENT SEDIMENT FROM ENTERING THE CREEK.
C. NO SOIL SHALL BE STOCKPILED WITHIN 5 m OF THE CREEK.

REHABILITATION

A. PREDISTURBANCE SOIL PROFILES AND COMPACTION LEVELS SHALL BE REINSTATED.
B. PREDISTURBANCE VEGETATION PATTERNS SHALL BE RESTORED.

SAFETY

A. THE DESIGN AND CONSTRUCTION OF THE WORKS SHALL COMPLY WITH ALL QUEENSLAND LEGISLATION.

GENERAL

1. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT SOUTH EAST QUEENSLAND SEWERAGE CODE SPECIFICATIONS AND STANDARDS.
2. UNLESS SPECIFIED OTHERWISE ALL MATERIALS AND WORK SHALL COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS.
3. THE CONSTRUCTION OF THE SEWERAGE WORK SHOWN ON THIS DRAWING SHALL BE SUPERVISED BY AN ENGINEER WHO HAS RPEQ REGISTRATION. SEWERAGE WORKS NOT COMPLYING WITH THIS REQUIREMENT WILL NOT BE PERMITTED TO CONNECT INTO THE SEQ SERVICE PROVIDER SEWERAGE SYSTEM.
4. ALL WORK ASSOCIATED WITH LIVE SEWERS OR MAINTENANCE HOLES SHALL BE CARRIED OUT BY DEVELOPER'S APPROVED CONTRACTOR UNDER THE SUPERVISION OF SEQ'S AGENT AT THE DEVELOPER'S COST.
5. ALL PIPES AND MATERIALS SHALL COMPLY WITH THE REQUIREMENTS OF THE "ACCEPTED PRODUCTS AND MATERIALS" LIST.
6. EACH ALLOTMENT SHALL BE SERVED BY A DN100 PVC PROPERTY CONNECTION. FOR ALLOTMENTS OTHER THAN SINGLE RESIDENTIAL, A DN160 PE (OR DN150 PVC) PROPERTY CONNECTION SHALL BE PROVIDED.
7. PROPERTY CONNECTIONS SHALL BE LOCATED WITHIN THE PROPERTY AS SHOWN IN THE DRAWINGS.
8. PROPERTY CONNECTION BRANCHES SHALL EXTEND INTO THE PROPERTY A MINIMUM OF 300 mm AND A MAXIMUM OF 750 mm. UNITYWATER REQUIRES MINIMUM EXTENSION OF 500 mm INTO PROPERTY.
9. WHERE PIPES ARE LAID IN FILL, THE FILLING SHALL BE CARRIED OUT IN LAYERS NOT EXCEEDING 300 mm (LOOSE) IN DEPTH AND SHALL BE COMPACTED UNTIL THE COMPACTION IS NOT LESS THAN 95% OF THE MATERIALS MAXIMUM COMPACTION WHEN TESTED IN ACCORDANCE WITH A.S. 1289 (MODIFIED COMPACTION). TESTING SHALL BE CARRIED OUT AFTER EACH ALTERNATE LAYER. IN ALL SUCH CASES APPROVAL OF CONSTRUCTED SEWERS WILL NOT BE ISSUED BY THE SEQ SERVICE PROVIDER UNLESS CERTIFICATES ARE PRODUCED CERTIFYING THAT THE REQUIRED COMPACTION HAS BEEN ACHIEVED.
10. WHERE SEWERS HAVE A GRADE OF 1 IN 20 OR STEEPER,BULKHEADS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE SEQ SEWER CODE.
11. THE CONTRACTOR SHALL VERIFY THE LOCATION AND DEPTH OF EXISTING SERVICES WITH RELEVANT AUTHORITIES BEFORE COMMENCING WORKS.
12. SEWERS SHALL BE DISUSED /ABANDONED IN ACCORDANCE WITH PROCEDURES SET OUT IN THE SEQ SEWER CODE.
13. BENCH MARK AND LEVELS TO AHD.
14. THE EXISTING DWELLING ON LOT 3, REFER SEQ-SEW-1100, SERVED BY A SEPTIC SYSTEM, SHALL BE CONNECTED TO THE NEW SEWER BY A LICENCED PLUMBER IN ACCORDANCE WITH THE RELEVANT STATUTORY AND COUNCIL REQUIREMENTS. THE SEPTIC SYSTEM, INCLUDING TRENCHES,SHALL BE REMOVED AT THE DEVELOPER'S COST. ALL FIXTURES SHALL BE UPGRADED IF REQUIRED BY PLUMBING CODE.
15. EXISTING ALLOTMENTS REQUIRING A PROPERTY CONNECTION FROM EXISTING SEWERS SHALL BE PROVIDED BY THE SEQ SERVICE PROVIDER AT THE DEVELOPERS COST.

PROJECT SPECIFIC SEWER NOTES

a. ALL SEWER MAINS TO BE AS PER SEWER PIPE SPECIFICATIONS TABLE.
b. NOTWITHSTANDING THE STANDARD SEQ NOTES ABOVE, ALL MATERIALS AND WORKS MUST BE IN ACCORDANCE WITH THE SERVICE PROVIDER'S APPROVAL CONDITIONS AND THE SEQ WS&S D&C CODE.
c. THE CONTRACTOR IS TO INCLUDE ROCK EXCAVATION AS PART OF THEIR SEWER RATES UNLESS SCHEDULED OTHERWISE WITHIN THE CONTRACT.
d. THE CONTRACTOR TO PROVIDE CALCAREOUS CONCRETE WHERE SPECIFIED IN THE SEQ CODE BY THE RELEVANT AUTHORITY.
e. WATER AND ELECTRICAL CROSSING LOCATIONS ARE INDICATIVE ONLY. REFER TO PLANS TO DETERMINE PRECISE CROSSING LOCATIONS. WHERE SERVICE INDICATES CLASH WITH SEWER, SEWER TO TAKE PRECEDENCE, SERVICE TO BE CONSTRUCTED OVER OR UNDER SEWER ACCORDING TO SUPERINTENDENTS INSTRUCTION
f. ALL BENDS TO BE LONG RADIUS BEND, 3m RADIUS U.N.O.
g. CONTRACTOR TO VERIFY DOWNSTREAM EXISTING PIPE LEVELS PRIOR TO COMMENCEMENT OF WORKS ON-SITE.
h. PROPERTY CONNECTIONS HAVE BEEN DESIGNED TO CONTROL THE REQUIRED SERVICE AREA OF EACH LOT AT A GRADE OF 1:60 AND A MAXIMUM DEPTH OF PROPERTY CONNECTION AT 1.5m. UNLESS OTHERWISE STATED.
REFER SEQ STD. DWGS SEQ-SEW-1106-01 TO SEQ-SEW-1106-7 FOR JUNCTION DETAILS.
i. CONTRACTOR TO PAY ALL FEES AND CHARGES ASSOCIATED WITH CONNECTIONS

LEGEND

- EXISTING SEWER
- EXISTING RISING MAIN
- EXISTING KERB (INVERT)
- EXISTING EDGE OF BITUMEN
- EXISTING PROPERTY LINE
- EXISTING RETAINING WALL
- EXISTING CONTOURS
- FUTURE SEWER
- FUTURE RISING MAIN
- FUTURE KERB (INVERT)
- FUTURE PROPERTY LINE
- FUTURE RETAINING WALL
- FUTURE CONTOURS
- SITE BOUNDARY
- STAGE BOUNDARY
- PROPOSED KERB (INVERT)
- PROPOSED EDGE OF BITUMEN
- PROPOSED PROPERTY LINE
- PROPOSED RETAINING WALL
- DESIGN CONTOURS
- PROPOSED SEWER
- PROPOSED RISING MAIN
- SEWER MANHOLE
- SEWER RODDING END
- SEWER BEND
- SEWER MAINTENANCE SHAFT
- SEWER END CAP
- SEWER PUMP STATION

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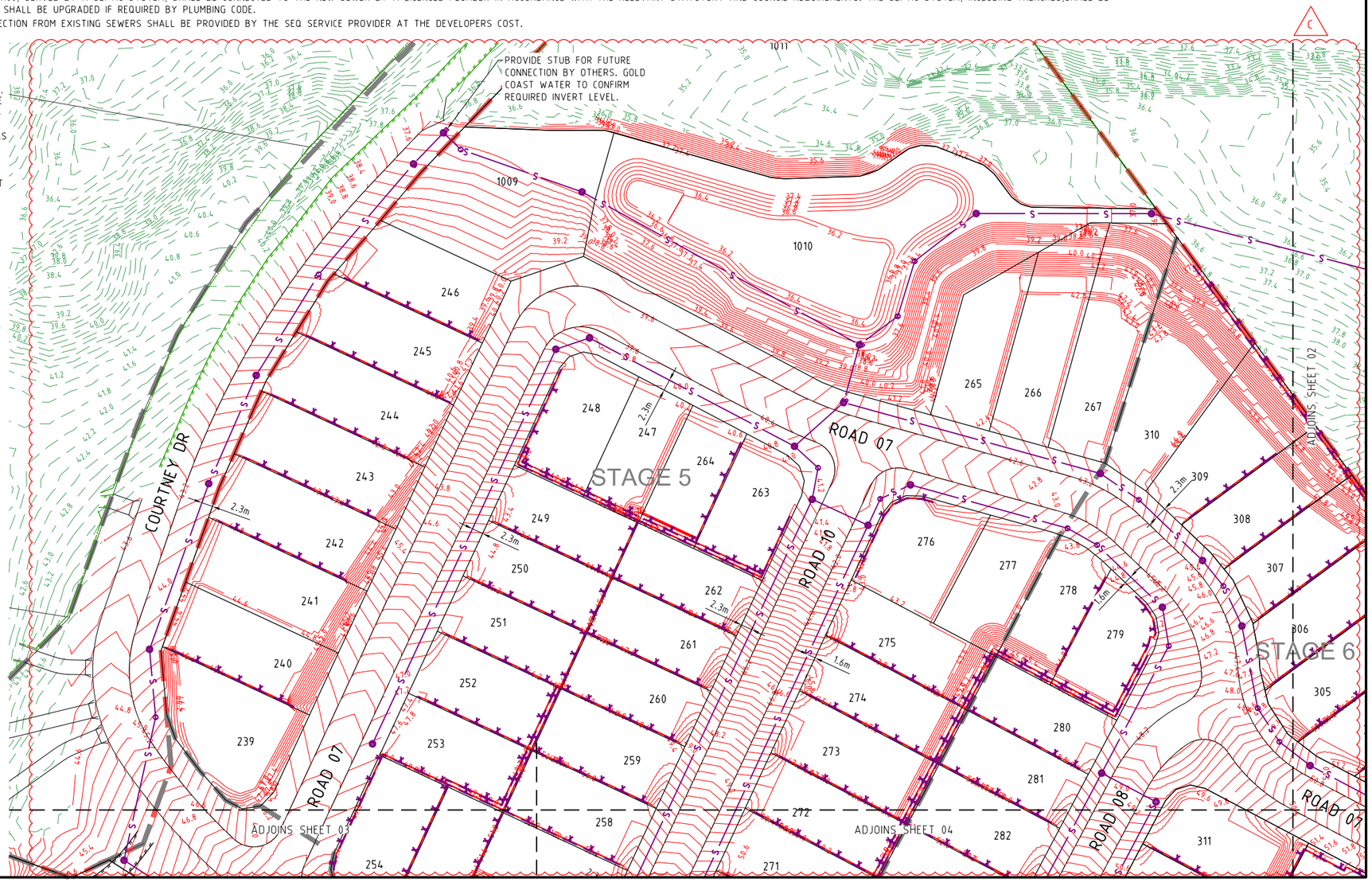
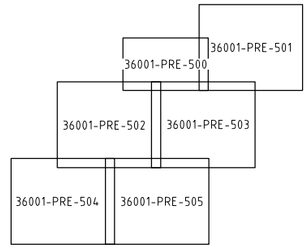


SHEET LAYOUT



PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SEWER & CONTOURS REVISED
B	28-03-19	SEWER, SHEET LAYOUT, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

SEWER RETICULATION PLAN AND NOTES SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

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36001-PRE-500	C

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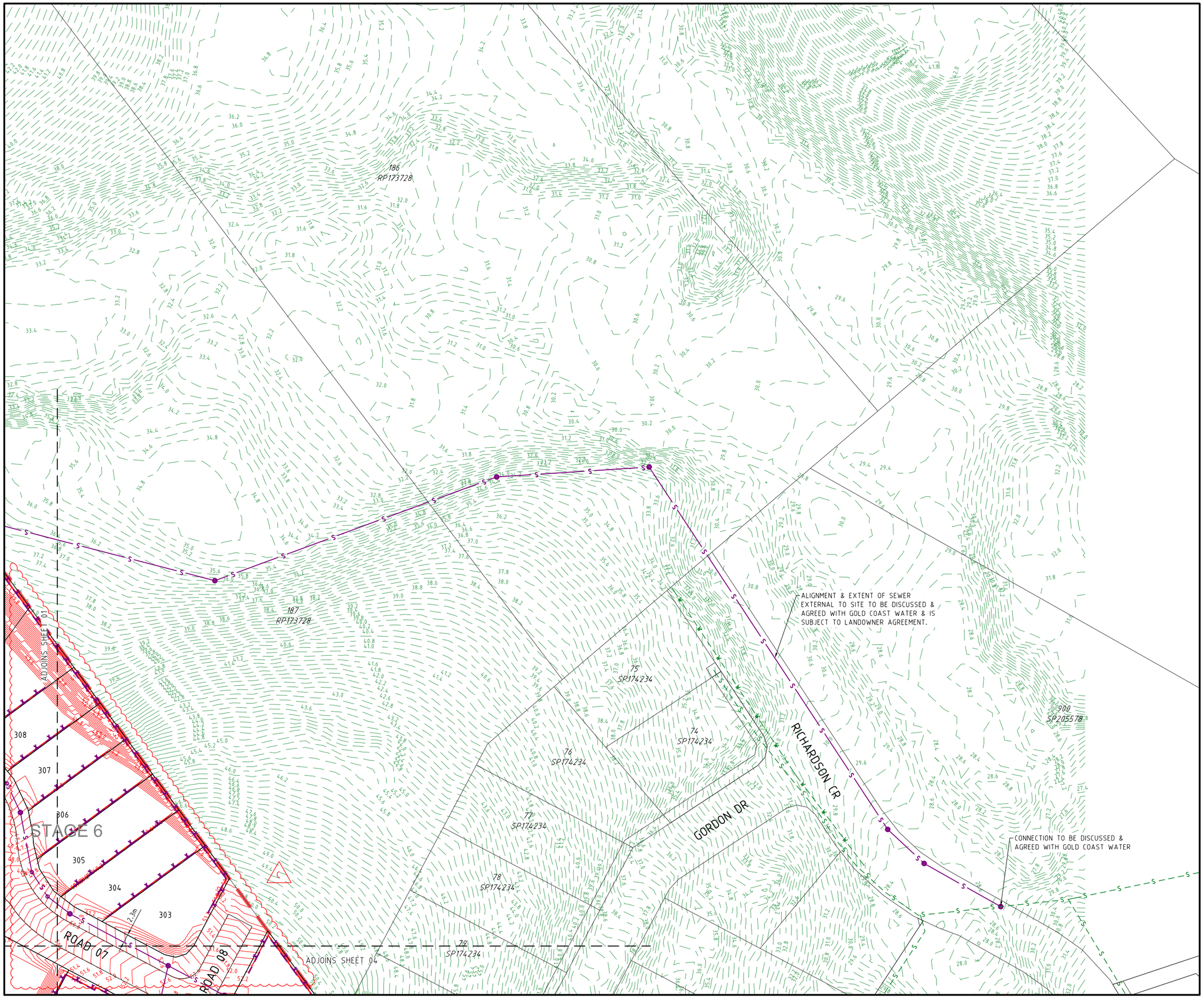

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

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NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SEWER & CONTOURS REVISED
B	28-03-19	SHEET LAYOUT, LOT NO'S, NOTES & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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zone Planning Group

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SEWER RETICULATION
PLAN AND NOTES
SHEET 02

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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36001-PRE-501	C

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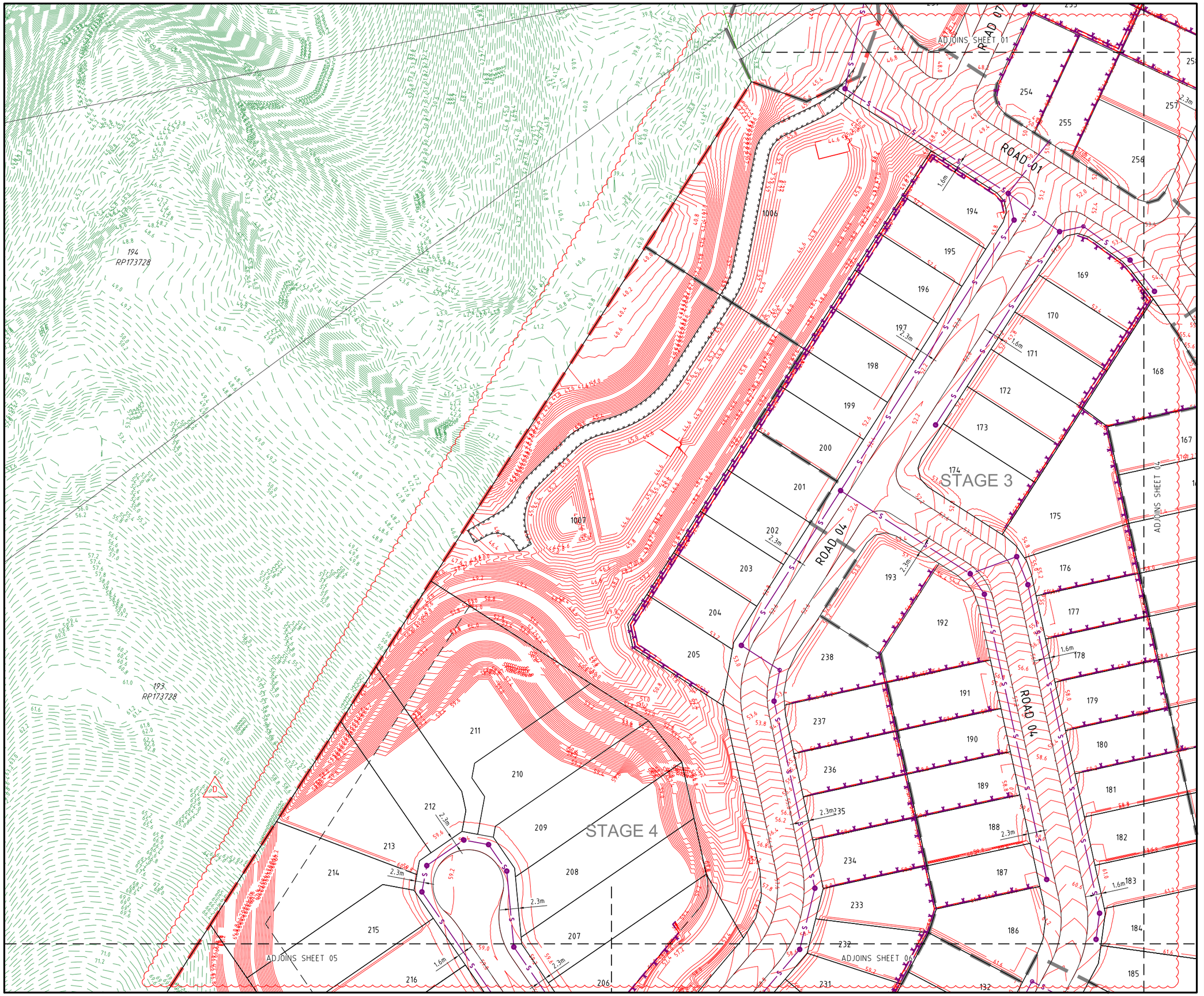

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

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NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

D	24-10-19	LOT LAYOUT, SEWER & CONTOURS REVISED
C	16-04-19	SEWER AMENDED
B	28-03-19	LOTS, SHEET LAYOUT, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

SEWER RETICULATION
PLAN AND NOTES
SHEET 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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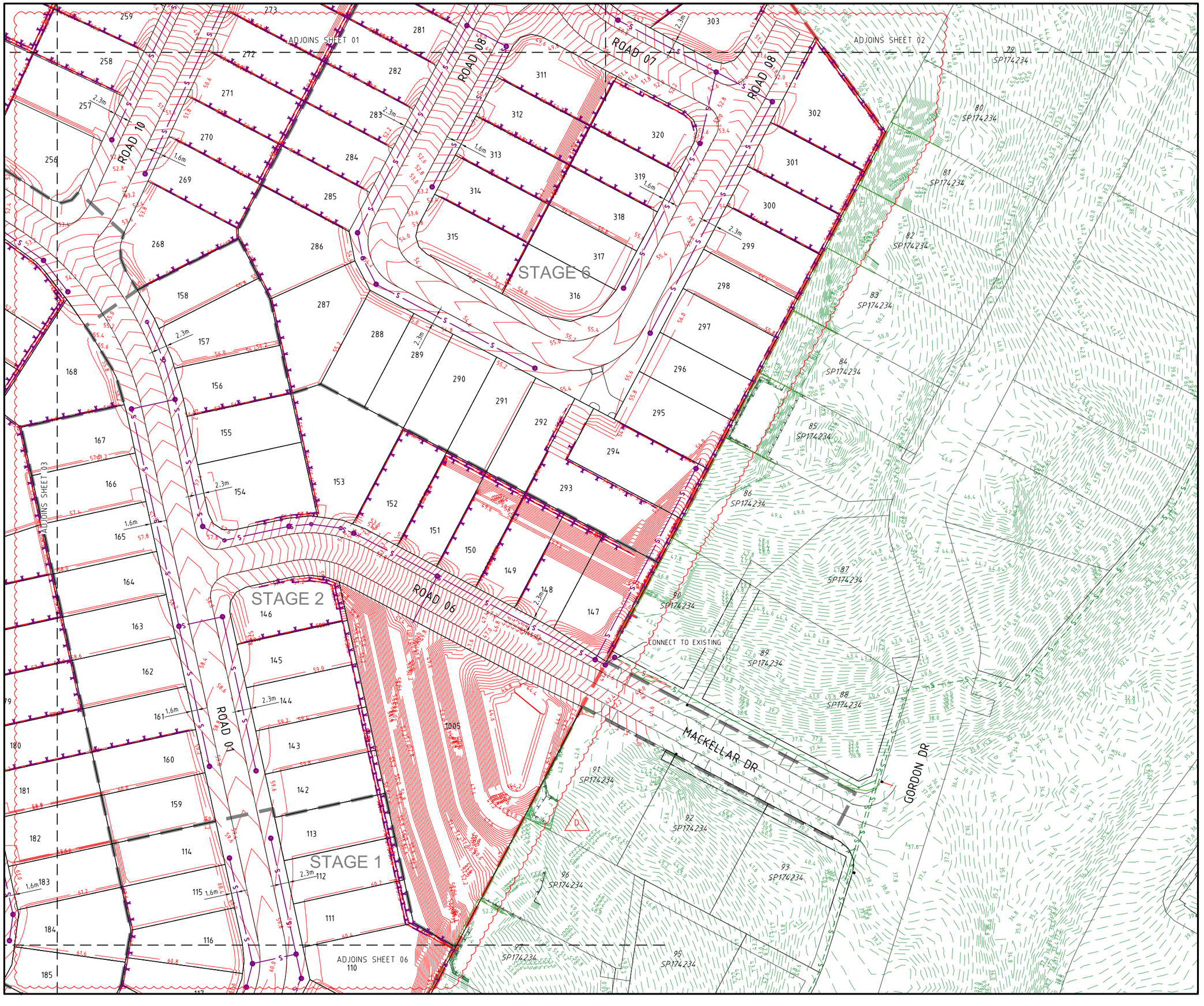

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
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SEWER RETICULATION
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SHEET 04

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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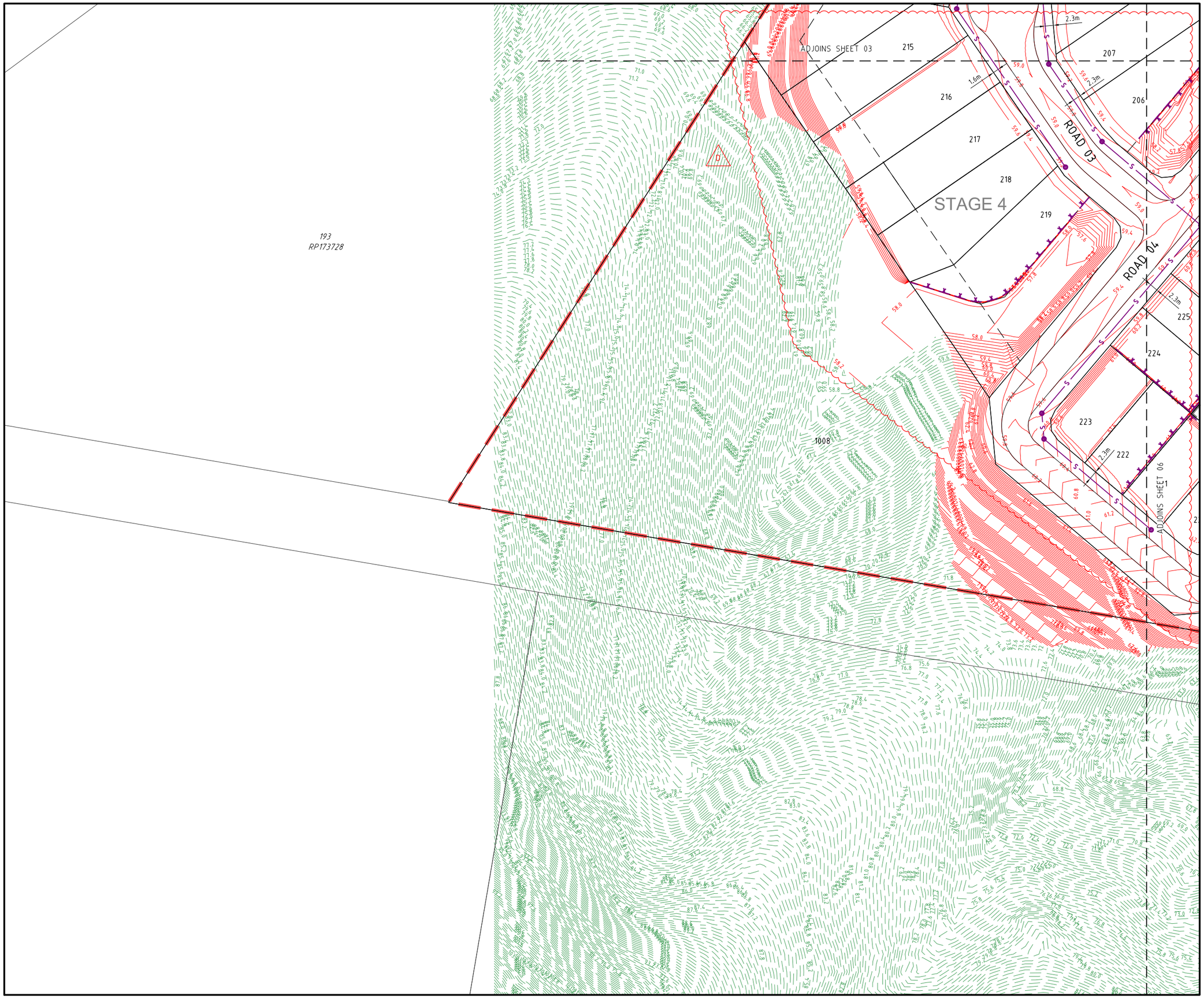

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
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CONSTRUCTION		

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D	24-10-19	LOT LAYOUT, SEWER & CONTOURS REVISED
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B	28-03-19	LOTS, SHEET LAYOUT, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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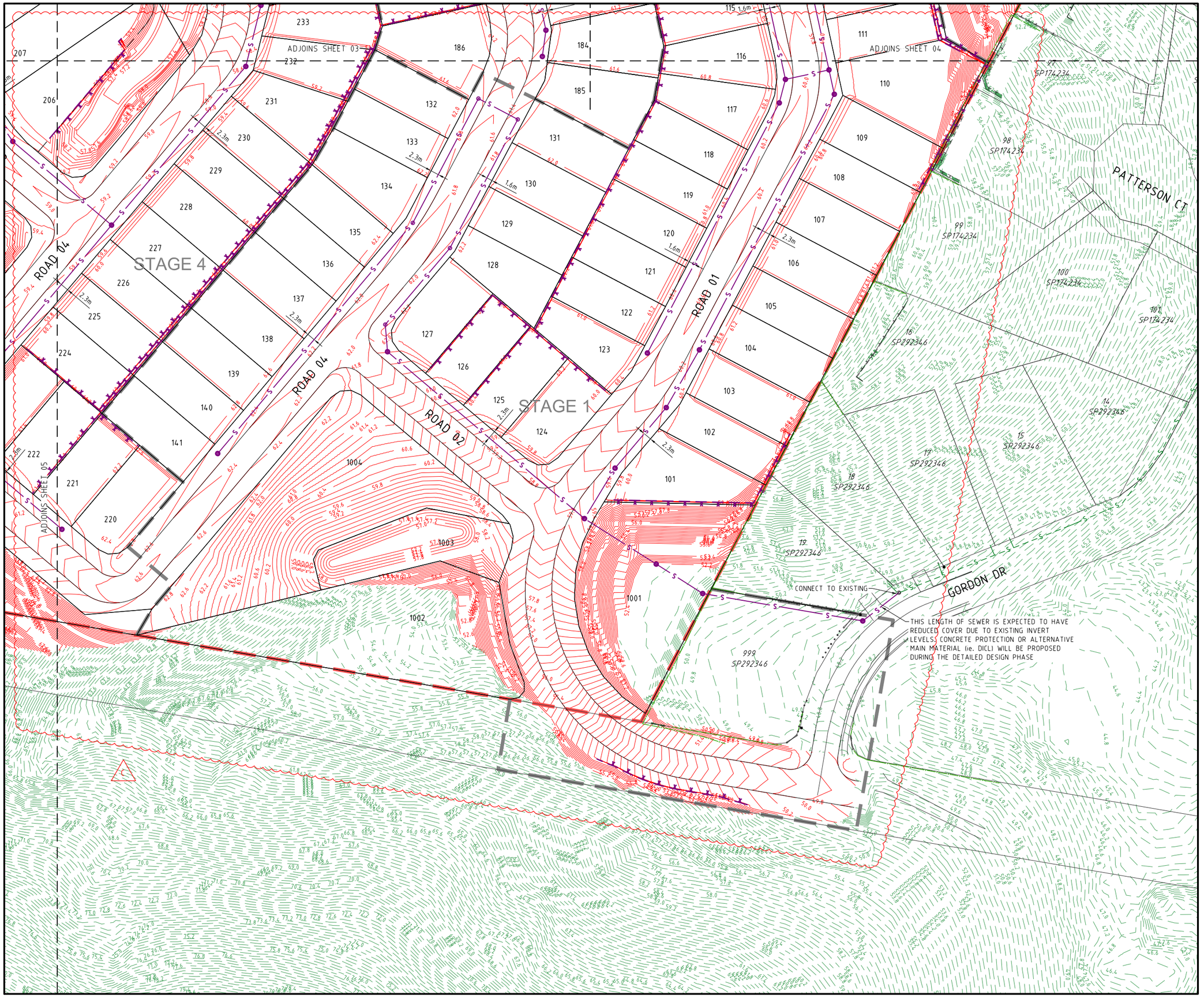

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CONSTRUCTION		

C	24-10-19	LOT LAYOUT, SEWER & CONTOURS REVISED
B	28-03-19	SHEET LAYOUT,LOT NO'S,STAGES AMENDED,NOTES ADDED
A	11-09-18	COUNCIL ISSUE
PRE	DATE	AMENDMENT

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DRAWING TITLE

SEWER RETICULATION
PLAN AND NOTES
SHEET 06

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EP
APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER	AMEND.
36001-PRE-505	C

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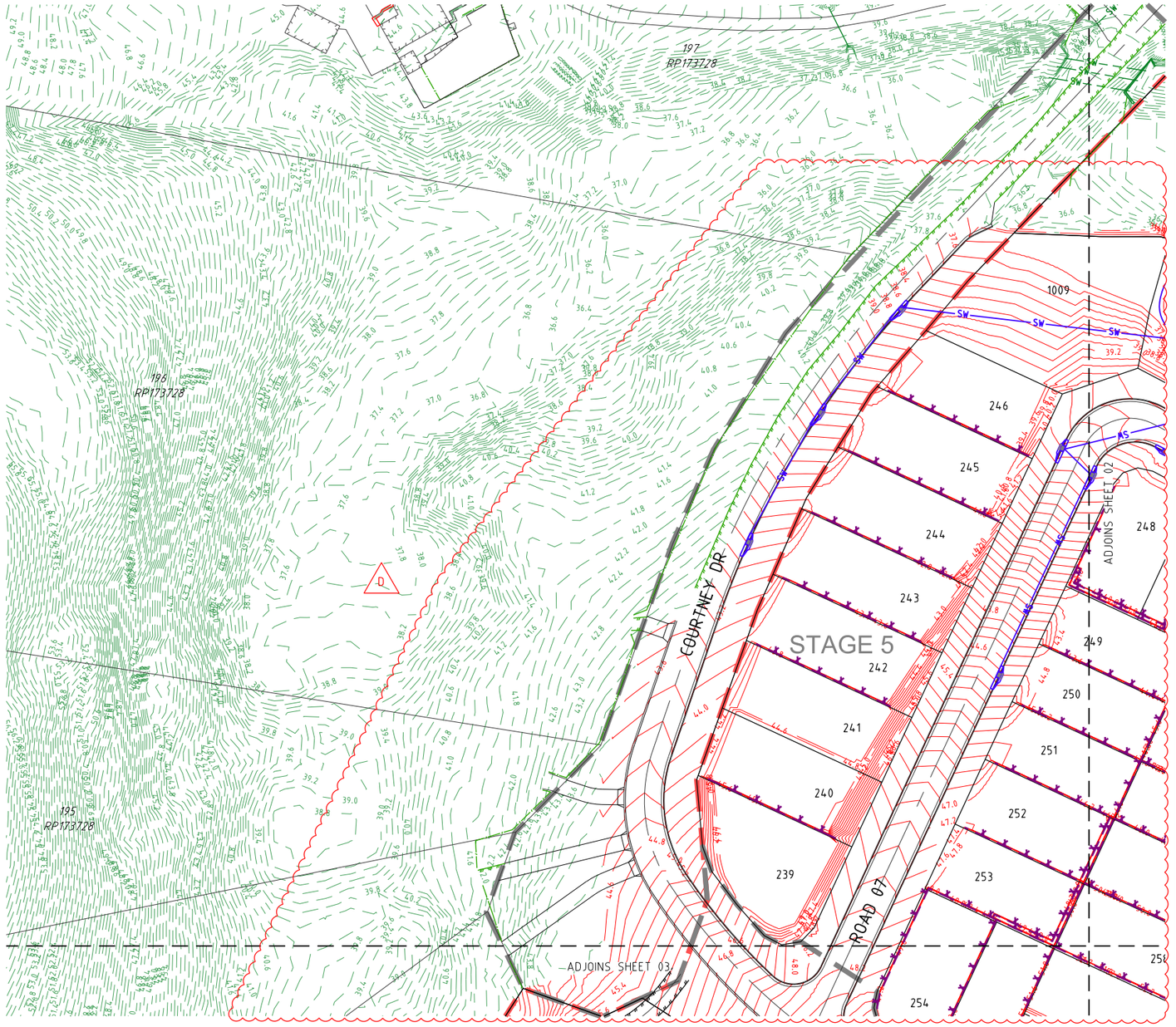
STORMWATER

1. ALL FIELD GULLIES SHALL CONTAIN A 150mm DIA STUB 600mm BELOW GRADE LEVEL FOR FUTURE ROOFWATER DRAINAGE.
2. MANHOLES TO BE IN ACCORDANCE WITH IPWEAQ STANDARD DRAWING No DS-010, DS-015, DS-018, DS-019, DS-020, DS-021 OR STRUCTURAL DRAWINGS (STRUCTURAL DRAWINGS TAKE PRECEDENCE).
3. OUTLET HEADWALLS TO BE IN ACCORDANCE WITH LOCAL COUNCIL STANDARD DRAWINGS.
4. ALL HEADWALLS WITH A FALL GREATER THAN 900mm HIGH REQUIRE INSTALLATION OF PEDESTRIAN SAFETY FENCES.
5. ALL PIPES 600mm DIA OR LESS TO BE SOCKETED CONCRETE PIPES WITH RUBBER RING JOINTS. PIPED GREATER THAN 600mm DIA SHALL BE BUTT OR FLUSH JOINTED.
6. ALL ALLOTMENTS TO BE GRADED SUCH THAT FUTURE ROOFWATER DRAINAGE DISCHARGES TO KERB OR TO PIPED DRAINAGE SYSTEM.
7. ALL PIPE 300mm DIA AND GREATER SHALL BE CONSTRUCTED USING SRC OR FRC PIPES. CONTRACTOR MAY ELECT TO USE PVC PIPES WITHIN ALLOTMENTS FOR PIPES SMALLER THAN 300mm DIA.
8. FOR SETOUT DETAILS REFER TO 640 SERIES DRAWINGS (PROFILES AND PIT DETAILS).
9. GULLY PITS TO BE IN ACCORDANCE WITH IPWEAQ STANDARD DRAWING No DS-060, DS-061, DS-062, DS-063. WHERE PITS ARE CONSTRUCTED AS DRAINWAY PITS, TO BE IN ACCORDANCE WITH IPWEAQ STANDARD DRAWINGS No 05-068.
10. LOTS WHICH CAN DRAIN OVERLAND FLOW TO THE STREET SWALE / DRAINAGE WITHOUT FLOWING THROUGH ADJOINING PROPERTIES NEED TO PROVIDE FOR Q100 OVERLAND FLOW TO THE ROAD
11. LOT EARTHWORKS DURING BUILDING CONSTRUCTION MUST NOT CHANGE FLOW PATH DIRECTION UNLESS IT IS REPLACED WITH ANOTHER FLOW PATH DRAINING TO THE ROAD SWALE / DRAINAGE.
12. THE CONTRACTOR IS TO INCLUDE ROCK EXCAVATION AS PART OF THEIR STORMWATER RATE.
13. PIPE CLASS - PIPE CLASSES/TRENCH BEDDING SHOWN ON THE DRAWINGS ARE SUBJECT TO THE CONTRACTORS PREFERRED INSTALLATION METHOD. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING THE APPROPRIATE PIPE CLASSES AND BEDDING.
14. KERB ADAPTORS ARE TO BE INSTALLED TO AUTHORITIES REQUIREMENTS.
15. ALL RCBC BASE SLABS ARE TO BE CAST INSITU.
16. DRIVEWAY LOCATIONS ARE INDICATIVE ONLY TO SHOW STORMWATER DESIGN IS SUITABLE FOR PROPOSED LOT LAYOUT.

LEGEND

- EXISTING KERB (INVERT)
- EXISTING KERB (LIP & BACK)
- EXISTING EDGE OF BITUMEN
- EXISTING PROPERTY LINE
- EXISTING RETAINING WALL
- EXISTING STORMWATER
- EXISTING ROOFWATER
- EXISTING SUBSOIL
- EXISTING CONTOURS
- FUTURE KERB
- FUTURE PROPERTY LINE
- FUTURE RETAINING WALL
- FUTURE STORMWATER
- FUTURE ROOFWATER
- FUTURE SUBSOIL
- SITE BOUNDARY
- STAGE BOUNDARY
- CONTROL LINE / CENTER OF ROAD
- PROPOSED KERB (INVERT)
- PROPOSED KERB (LIP & BACK)
- PROPOSED EDGE OF BITUMEN
- PROPOSED PROPERTY LINE
- PROPOSED RETAINING WALL
- DESIGN CONTOURS
- PROPOSED STORMWATER
- PROPOSED ROOFWATER
- PROPOSED SUBSOIL
- MANHOLE
- FIELD INLET
- KERB INLET (ON GRADE) PIT
- KERB INLET (SAG) PIT
- HEADWALL
- SCOUR PROTECTION
- 10/001 DRAINAGE PIT & LINE NO.

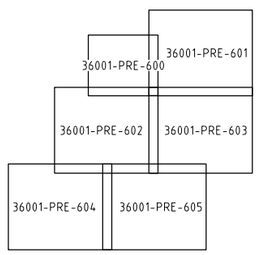


REFERENCE POINT LOCATION FOR DRAINAGE STRUCTURES

STRUCTURE TYPE	HORIZONTAL CONTROL (Reference Point Location)	VERTICAL CONTROL (Reference Level)
MANHOLE	CENTRE OF MANHOLE	FINISHED SURFACE LEVEL
GULLY PIT	LIP AT CENTRE OF PIT	FINISHED SURFACE LEVEL (LIP OF CHANNEL)
HEADWALL	INTERSECTION OF HEADWALL FACE & PIPE CENTRELINE	INVERT LEVEL

REFER TO DWG SERIES 640 FOR ALL DRAINAGE STRUCTURE SETOUT AND/OR CUSTOM DETAILS.

SHEET LAYOUT



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PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

GALLERY
THE ART OF LIVING

NORTH

0 5 10 15 20 25m
Scale 1:500 - A1 (1:1000 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
D	24-10-19	LOT LAYOUT, STORMWATER & CONTOURS REVISED
C	16-04-19	DRIVEWAYS REMOVED
B	28-03-19	NOTES, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

zone Planning Group

DRAWING TITLE

STORMWATER
DRAINAGE
PLAN
SHEET 01

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ	DATE 14-08-18

DRAWING NUMBER: 36001-PRE-600
AMEND.: D

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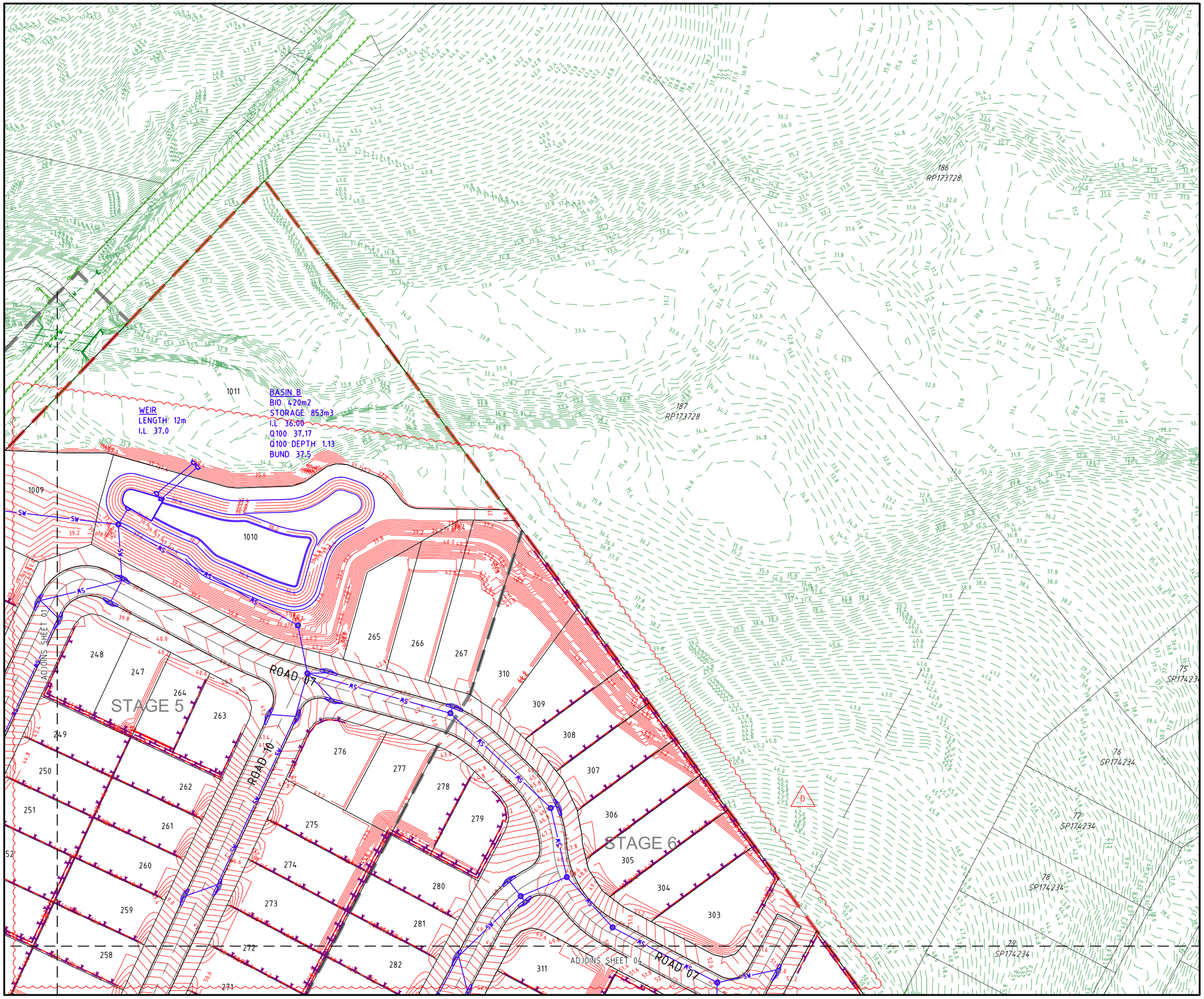

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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CONSTRUCTION		

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DRAWING TITLE

STORMWATER
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SHEET 02

MORTONS
urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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DESIGNED RB	DRAWN EP
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DRAWING NUMBER 36001-PRE-601 | AMEND. D

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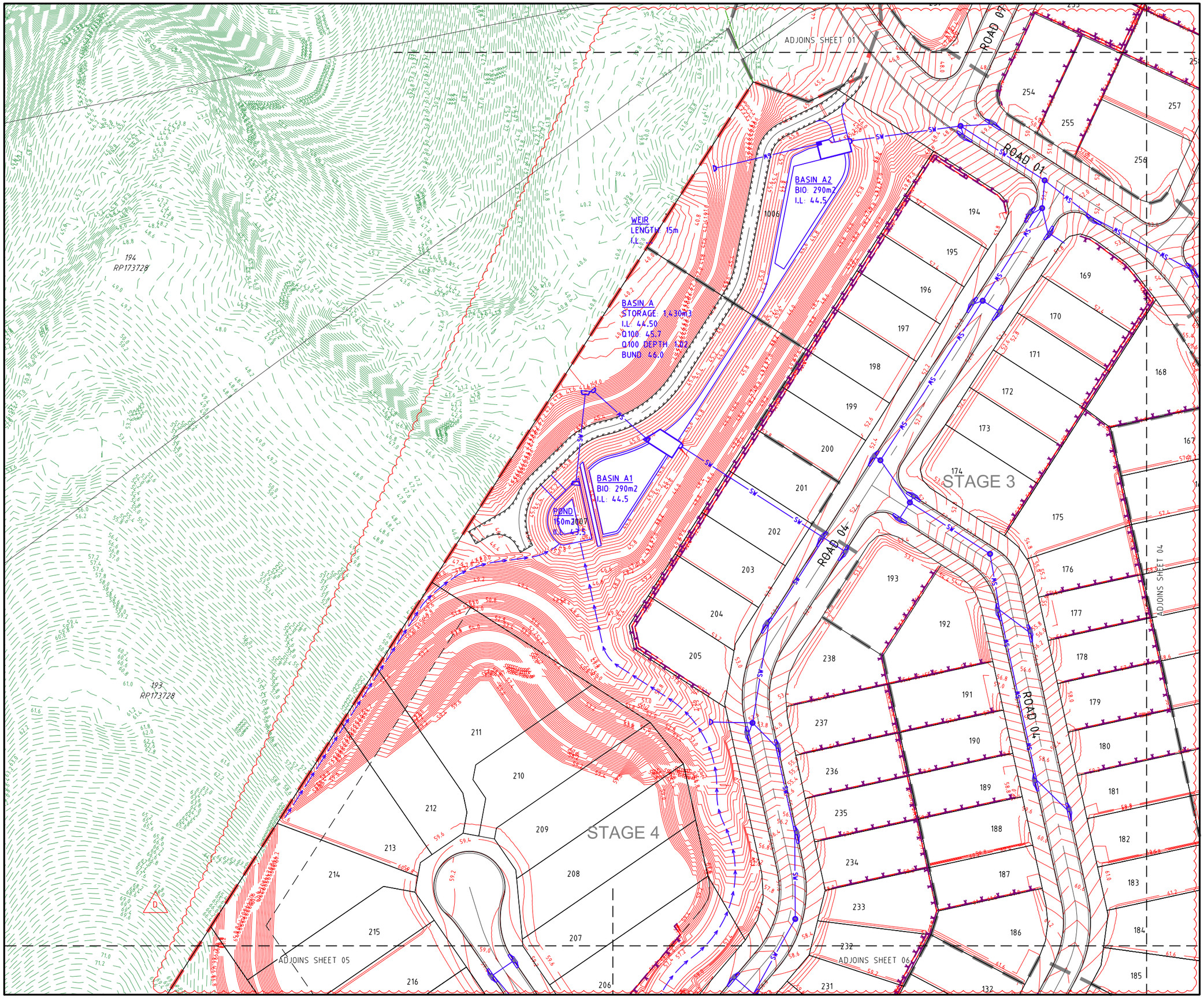

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

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0 5 10 15 20 25m
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ISSUES	DATE
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COUNCIL	11-09-18
CONSTRUCTION	

PRE	DATE	AMENDMENT
D	24-10-19	LOT LAYOUT, STORMWATER & CONTOURS REVISED
C	16-04-19	DRIVEWAYS REMOVED
B	28-03-19	LOTS, LOT NO'S & STAGES AMENDED
A	11-09-18	COUNCIL ISSUE

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DRAWING TITLE

STORMWATER DRAINAGE PLAN SHEET 03

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination
MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088
Postal Address
PO Box 2484
Southport QLD 4215
Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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36001-PRE-602	D

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ADJOINS SHEET 02

ADJOINS SHEET 03

ADJOINS SHEET 06

STAGE 6

STAGE 2

STAGE 1

ROAD 10

ROAD 08

ROAD 07

ROAD 06

ROAD 01

MACKELLAR DR

GORDON DR

CONNECT TO EXISTING

BASIN 'C'
BIO: 175m2
STORAGE: N/A
I.L. 44.20
Q100: N/A
BUND: 0.8
DEPTH: 2.3 (NOM.)

1005

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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ISSUES	DATE	
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PRE	DATE	AMENDMENT

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DRAWING TITLE

STORMWATER
DRAINAGE
PLAN
SHEET 04

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Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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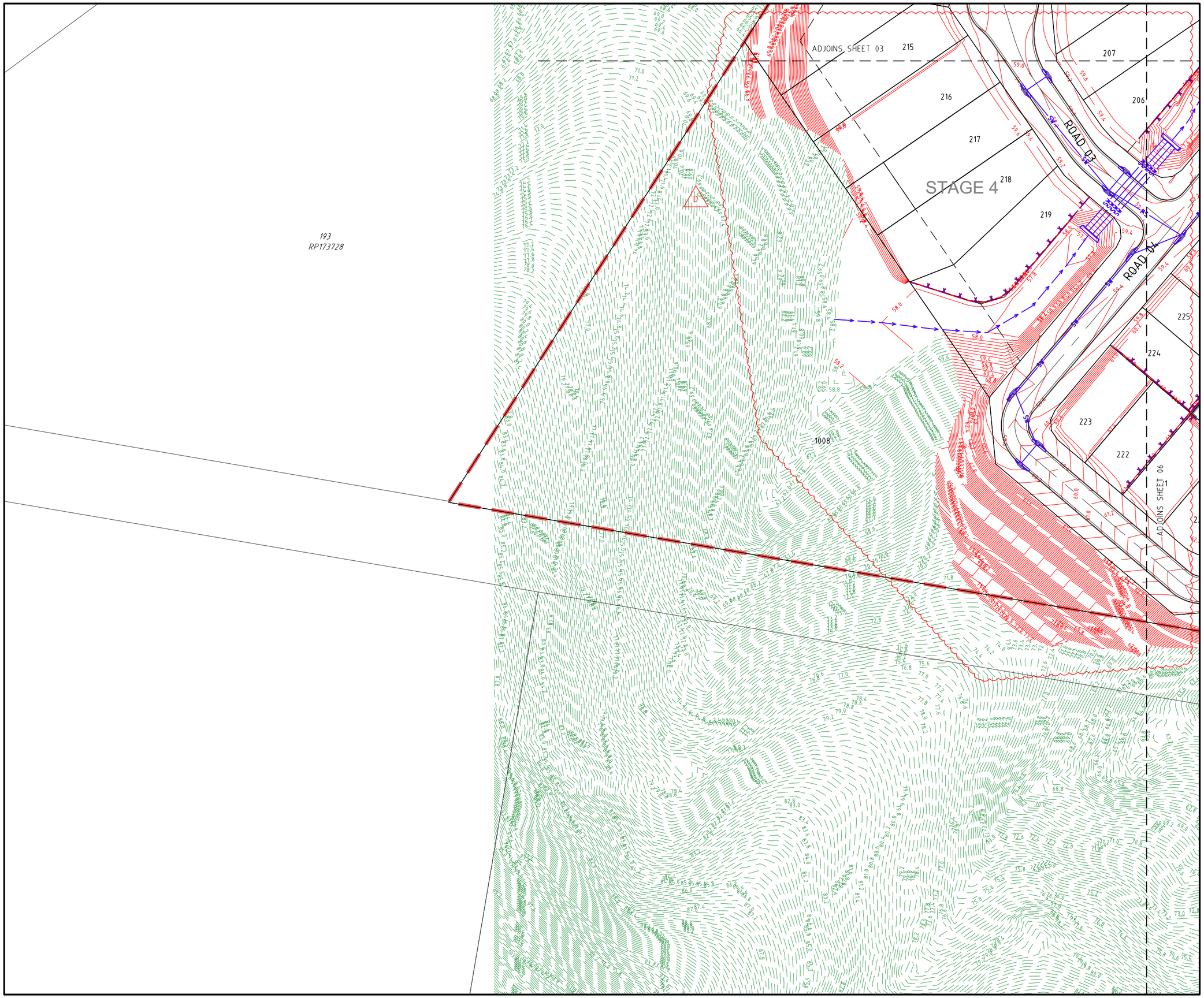

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
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ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

PRE	DATE	AMENDMENT
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MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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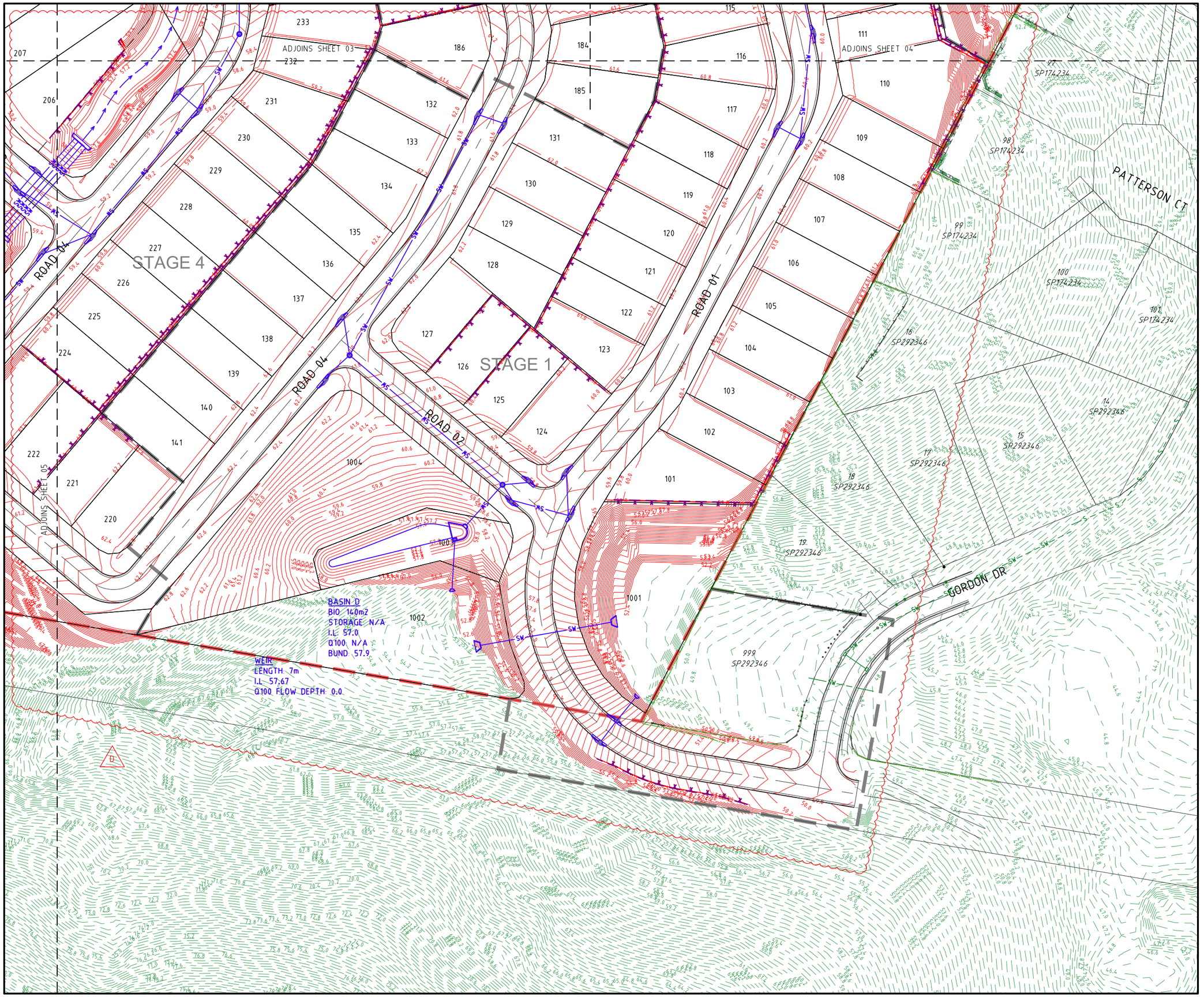

PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
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ISSUES	DATE	
TENDER		
COUNCIL	11-09-18	
CONSTRUCTION		

D	24-10-19	LOT LAYOUT, STORMWATER & CONTOURS
C	16-04-19	DRIVEWAYS REMOVED
B	28-03-19	S/WATER, CONTOURS, LOT NO'S & STAGES AMENDED
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DRAWING TITLE

STORMWATER
DRAINAGE
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SHEET 06

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Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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SEQ CODE WATER NOTES

SEQ CODE NOTES COPIED DIRECTLY FROM DRAWING SEQ-WAT-1101-3.

VEGETATION PROTECTION

A. TREES LOCATED ALONG THE FOOTPATH SHALL BE, TRANSPLANTED PRIOR TO CONSTRUCTION, OR REPLACED IF DESTROYED.
B. WHEN WORKING WITHIN 4m OF TREES, RUBBER OR HARDWOOD GIRDLES SHALL BE CONSTRUCTED WITH 1.8m BATTENS CLOSELY SPACED AND ARRANGED VERTICALLY FROM GROUND LEVEL. GIRDLES SHALL BE STRAPPED TO TREES PRIOR TO CONSTRUCTION AND REMAIN UNTIL COMPLETION.
C. TREE ROOTS SHALL BE TUNNELLED UNDER, RATHER THAN SEVERED. IF ROOTS ARE SEVERED THE DAMAGED AREA SHALL BE TREATED WITH A SUITABLE FUNGICIDE. CONTACT RELEVANT COUNCIL ARBORIST FOR FURTHER ADVICE.
D. ANY TREE LOPPING REQUIRED SHOULD BE UNDERTAKEN BY AN APPROVED ARBORIST.

SOIL

A. TOPSOIL AND SUBSOIL SHALL BE STOCKPILED SEPARATELY.
B. CARE SHALL BE TAKEN TO PREVENT SEDIMENT FROM ENTERING THE STORMWATER SYSTEM. THIS MAY INVOLVE PLACING APPROPRIATE SEDIMENT CONTROLS AROUND STOCKPILES.
C. IF ACID SULPHATE SOILS EXIST IN THE WORKS AREA. THE CONTRACTOR MUST PREPARE A RISK ASSESSMENT BASED ON THE QUEENSLAND ACID SULPHATE SOIL TECHNICAL MANUAL AND MANAGE THE ACID SULPHATE SOILS AS PER THE MANUAL.

CREEK CROSSINGS

A. SILTATION CONTROL MEASURES SHALL BE PLACED DOWNSTREAM OF ANY EXCAVATION WORK.
B. APPROPRIATE SEDIMENT CONTROLS SHALL BE USED TO PREVENT SEDIMENT FROM ENTERING THE CREEK.
C. NO SOIL SHALL BE STOCKPILED WITHIN 5m OF THE CREEK.

REHABILITATION

A. PREDISTURBANCE SOIL PROFILES AND COMPACTION LEVELS SHALL BE REINSTATED.
B. PREDISTURBANCE VEGETATION PATTERNS SHALL BE RESTORED.

GENERAL NOTES

1. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT SOUTH EAST QUEENSLAND WATER SUPPLY CODE SPECIFICATIONS AND STANDARDS.
2. UNLESS SPECIFIED OTHERWISE ALL MATERIALS AND WORK SHALL COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS.
3. ADOPT LIP OF KERB OR SHOULDER OF ROAD AS PERMANENT LEVEL.
4. COVER ON MAINS FROM PERMANENT LEVEL TO BE AS SHOWN IN SEQ-WAT-1200-2.
5. CONDUITS TO BE INSTALLED IN ACCORDANCE WITH THE STANDARD DRAWINGS.
6. A WATER METER SUPPLIED AT THE DEVELOPER'S COST, IS TO BE INSTALLED AT THE SERVICE POINT OF EACH LOT IN ACCORDANCE WITH THE STANDARD DRAWING FOR THE SEQ-SP.
7. ALL MATERIALS USED IN THE WORKS SHALL COMPLY WITH THE SEQ-SP's ACCEPTED PRODUCTS AND MATERIALS LIST OR BE APPROPRIATELY SHOWN, LISTED AND DEFINED IN THE ENGINEERING SUBMISSION SO THAT THE ALTERNATIVE PRODUCT OR MATERIAL CAN BE ASSESSED AND IF APPROPRIATE, APPROVED BY THE SEQ-SP.
8. ALL CONCRETE FOOTPATHS TO BE CLEAR OF WATER MAINS.
9. TEST/CHLORINATION POINTS TO BE INSTALLED IN ACCORDANCE WITH STANDARD DRAWING NO.SEQ-WAT-1410-1.
10. THE CONSTRUCTION OF THE WATER RETICULATION WORK SHOWN ON THIS DRAWING MUST BE SUPERVISED BY AN ENGINEER WHO HAS RPEQ REGISTRATION. WORKS NOT COMPLYING WITH THIS REQUIREMENT WILL NOT BE PERMITTED TO CONNECT TO THE RETICULATION SYSTEM.

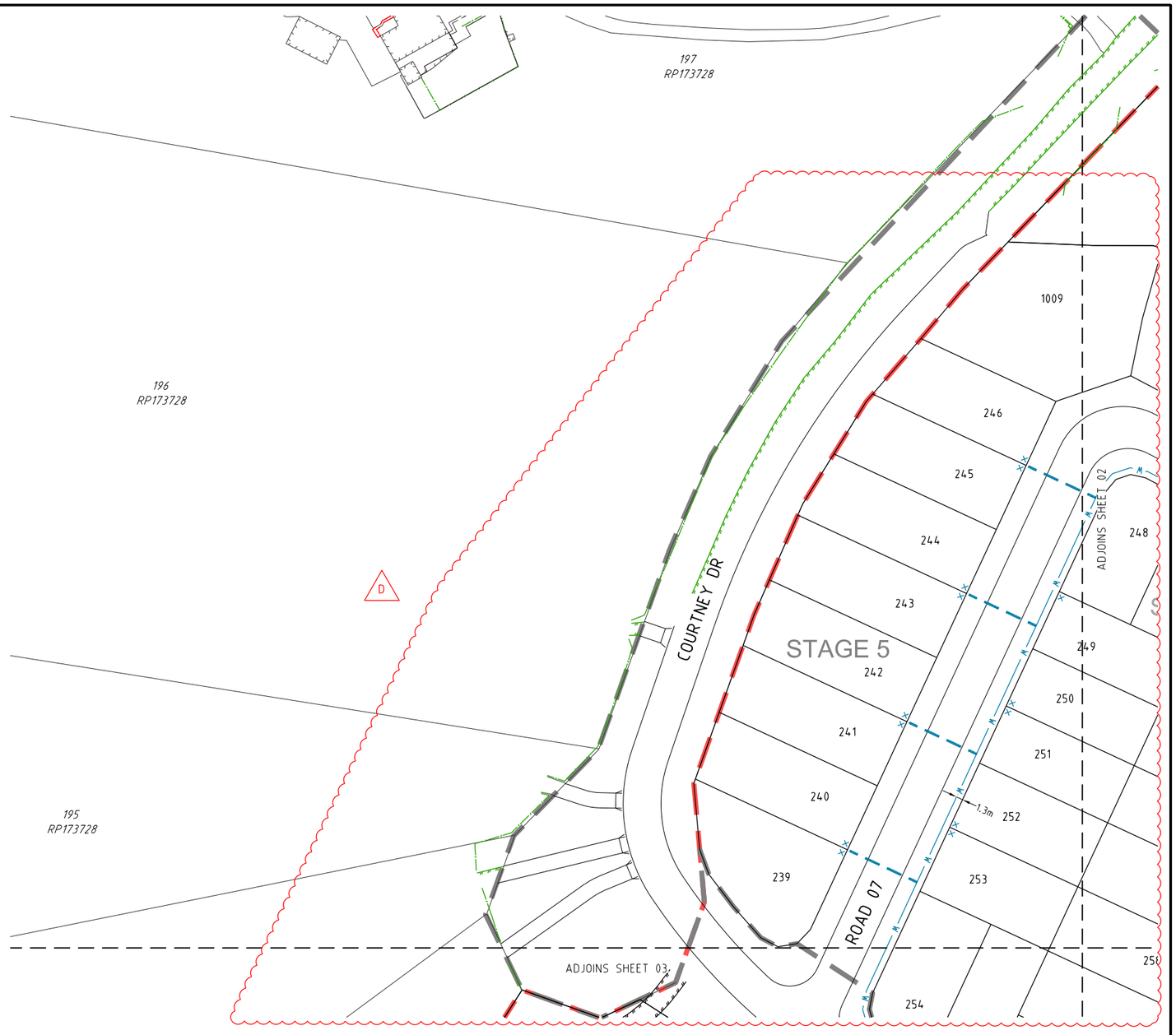
ALL ENVIRONMENT PROTECTION MEASURES SHALL BE IMPLEMENTED PRIOR TO ANY CONSTRUCTION WORK, INCLUDING CLEARING, COMMENCING.

PROJECT SPECIFIC WATER NOTES

a. ALL PROPERTY CONNECTION ROAD CROSSINGS TO BE SLEEVED WITH DN100 mPVC CONDUIT.
b. ALL MATERIALS ARE TO BE SUPPLIED AND CONSTRUCTED IN ACCORDANCE WITH SEQ CODE.
c. WATER METERS ARE TO BE SUPPLIED AND INSTALLED AT ALL WATER SERVICE / CONNECTION POINTS IN ACCORDANCE WITH SEQ-WAT-1106 TO SEQ-WAT-1110-2.
d. THRUST BLOCKS, TRENCH STOPS AND BULK HEADS TO BE LOCATED AND INSTALLED BY CONTRACTOR IN ACCORDANCE WITH SEQ CODE.
e. TRENCH STOPS TO BE IN ACCORDANCE WITH SEQ-WAT-1201-1.
f. THE CONTRACTOR IS TO INCLUDE ROCK EXCAVATION AS PART OF THEIR WATER RATES UNLESS SCHEDULED OTHERWISE WITHIN THE CONTRACT.
g. FOOTPATHS SHOWN FOR INFORMATION PURPOSES ONLY.
h. ALL WATER CONSTRUCTION WORK UNDERTAKEN BY THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE WORKPLACE HEALTH AND SAFETY LEGISLATION.
i. MINIMUM WATERMAIN COVER TO BE IN ACCORDANCE WITH SECTION 7.4.2 TABLE 7.2 OF THE SEQ AMENDMENT TO WATER SUPPLY CODE OF AUSTRALIA.
j. CONTRACTOR TO PAY ALL FEES AND CHARGES ASSOCIATED WITH CONNECTIONS.
k. END OF LINE ARRANGEMENTS (EG. CUL-DE-SAC HEADS) TO BE CONSTRUCTED IN ACCORDANCE WITH SEQ-WAT-1104-1.
l. TEMPORARY CONSTRUCTION HYDRANTS TO BE PROVIDED IN ACCORDANCE WITH SEQ-WAT-1303-1 AND SEQ-WAT-1303-2 AT ALL CONNECTIONS.
m. ALL LIVE CONNECTIONS ARE TO BE ORGANISED BY THE CIVIL CONTRACTOR AND UNDERTAKEN BY COUNCIL AT THE DEVELOPERS EXPENSE.

LEGEND

- W100 EXISTING 100Ø WATER MAIN
- W150 EXISTING 150Ø WATER MAIN
- W200 EXISTING 200Ø WATER MAIN
- W225 EXISTING 225Ø WATER MAIN
- W250 EXISTING 250Ø WATER MAIN
- W300 EXISTING 300Ø WATER MAIN
- EXISTING KERB (INVERT)
- EXISTING PROPERTY LINE
- EXISTING EDGE OF BITUMEN
- W100 FUTURE 100Ø WATER MAIN
- W150 FUTURE 150Ø WATER MAIN
- W200 FUTURE 200Ø WATER MAIN
- W225 FUTURE 225Ø WATER MAIN
- W250 FUTURE 250Ø WATER MAIN
- W300 FUTURE 300Ø WATER MAIN
- FUTURE KERB (INVERT)
- FUTURE PROPERTY LINE
- PROPOSED KERB (INVERT)
- PROPOSED EDGE OF BITUMEN
- PROPOSED PROPERTY LINE
- SITE BOUNDARY
- STAGE BOUNDARY
- W PROPOSED 100Ø WATER MAIN
- METER LOCATION
- SERVICE CONDUIT



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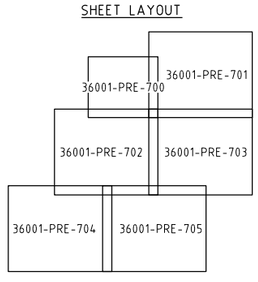
SHEET LAYOUT



PROJECT NAME

COURTNEY DR UPPER COOMERA

PRELIMINARY ENGINEERING

RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

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THE ART OF LIVING

NORTH

0 5 10 15 20 25m
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Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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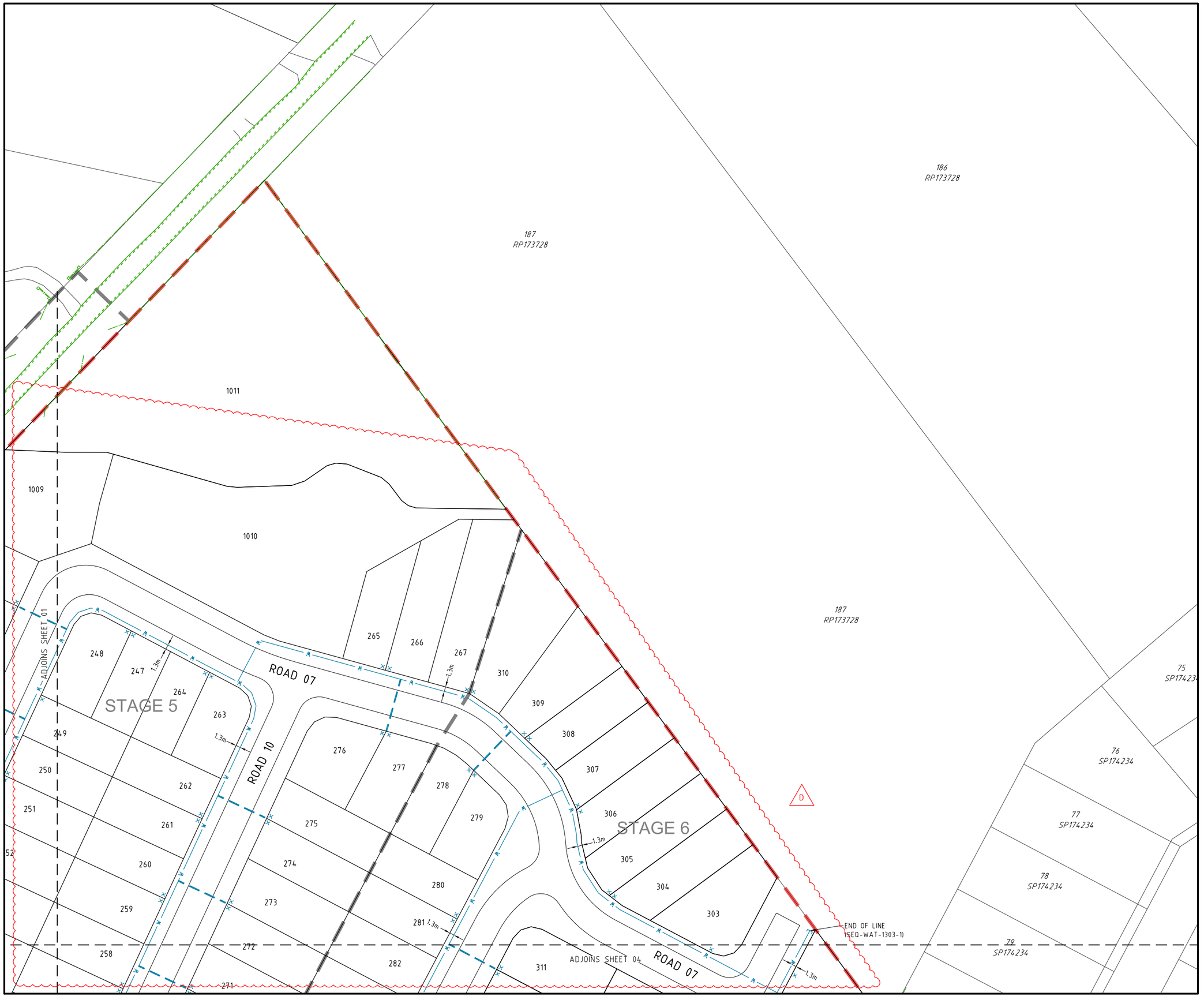

PROJECT NAME

COURTNEY DR UPPER COOMERA

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RP DESCRIPTION
LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

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Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065

Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

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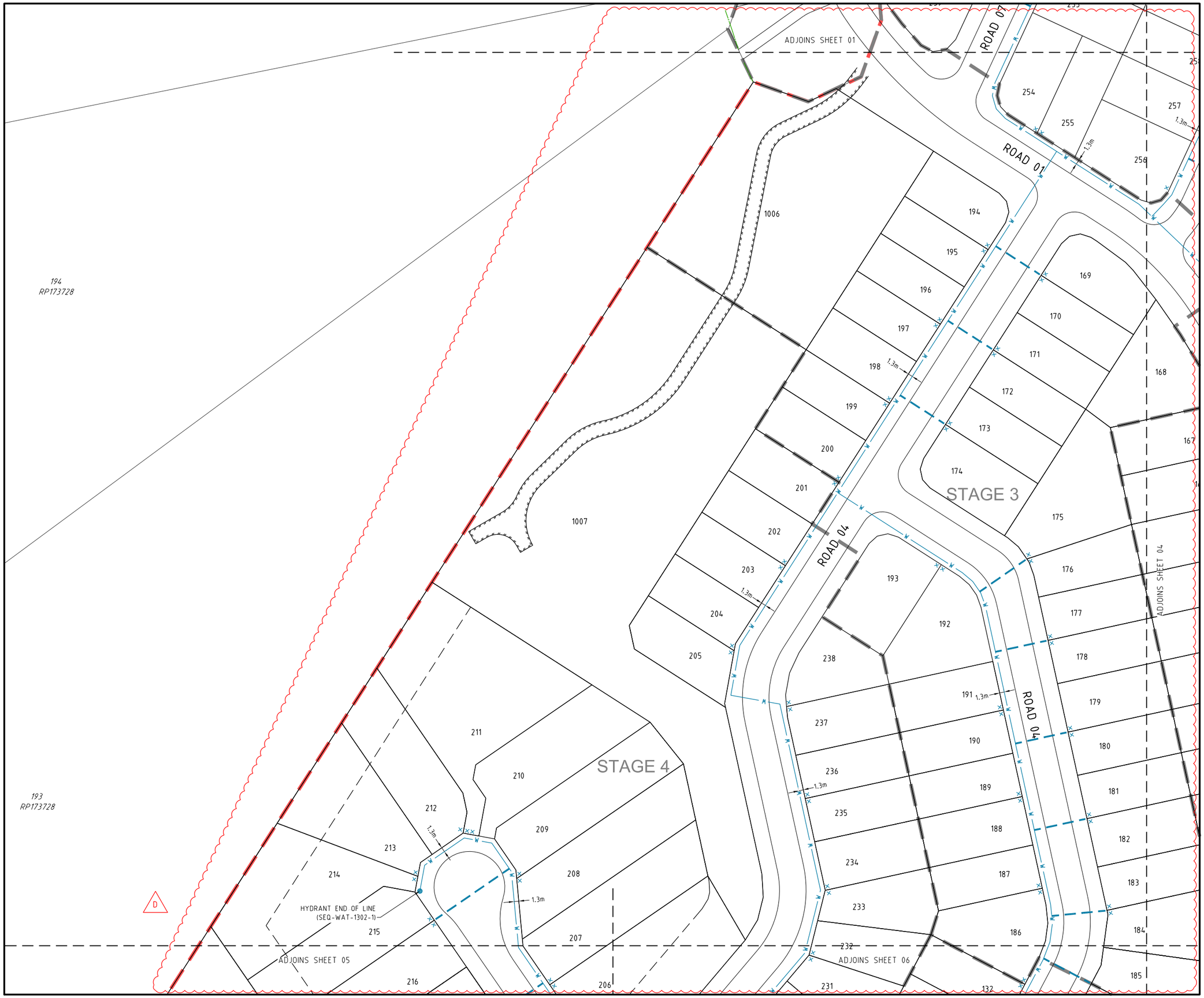

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Civil Engineering
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MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
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ROAD 06

ROAD 01

ADJOINS SHEET 03

ADJOINS SHEET 06

STAGE 6

STAGE 2

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END OF LINE
(SEQ-WAT-1303-1)

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COURTNEY DR UPPER COOMERA

PRELIMINARY
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MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
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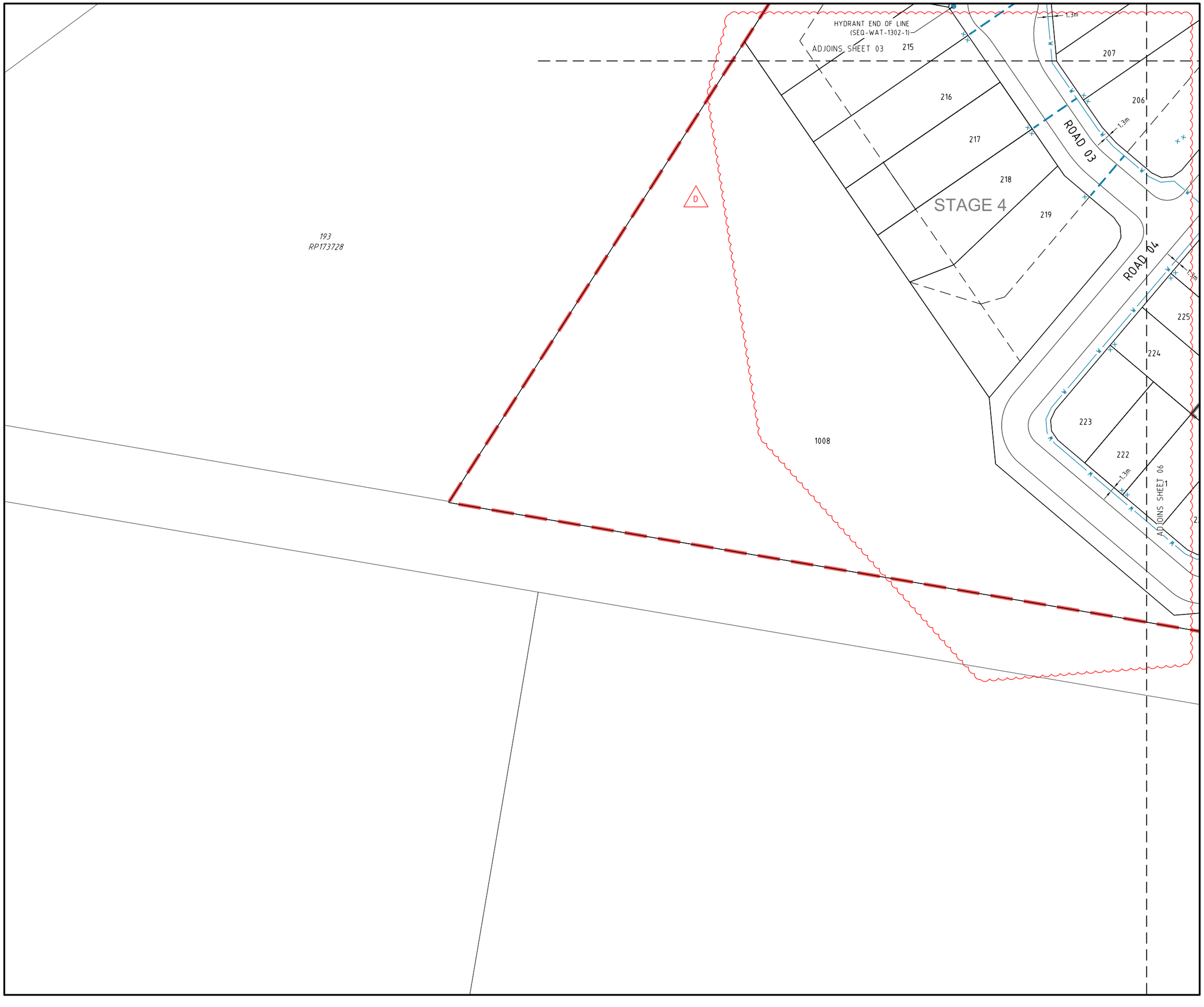

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MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

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Suite 9, 19 Short St
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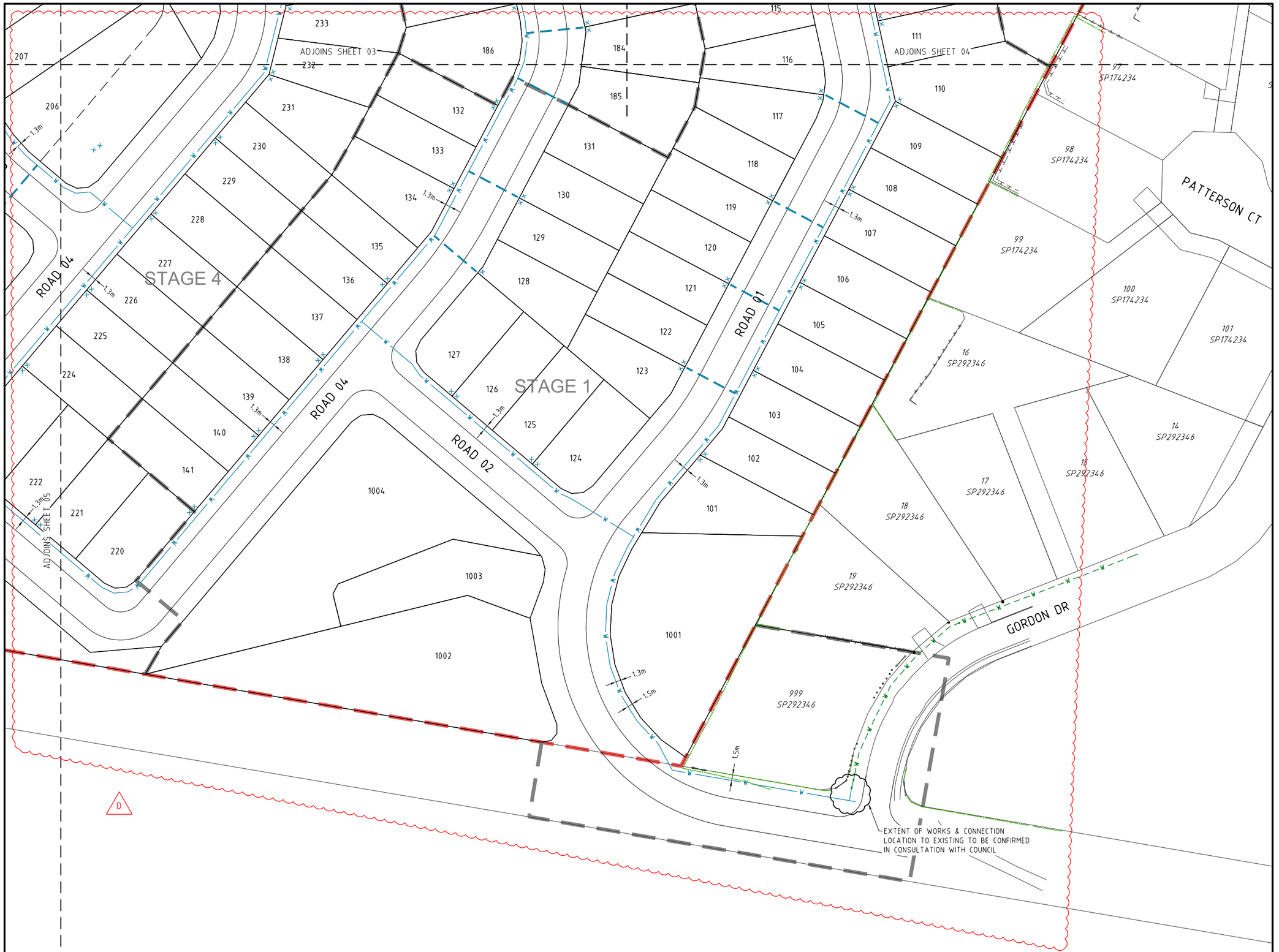

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Civil Engineering
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MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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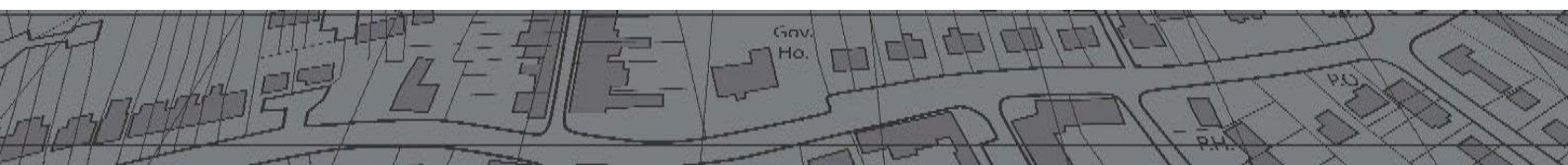
ATTACHMENT 7
Stormwater Management Plan



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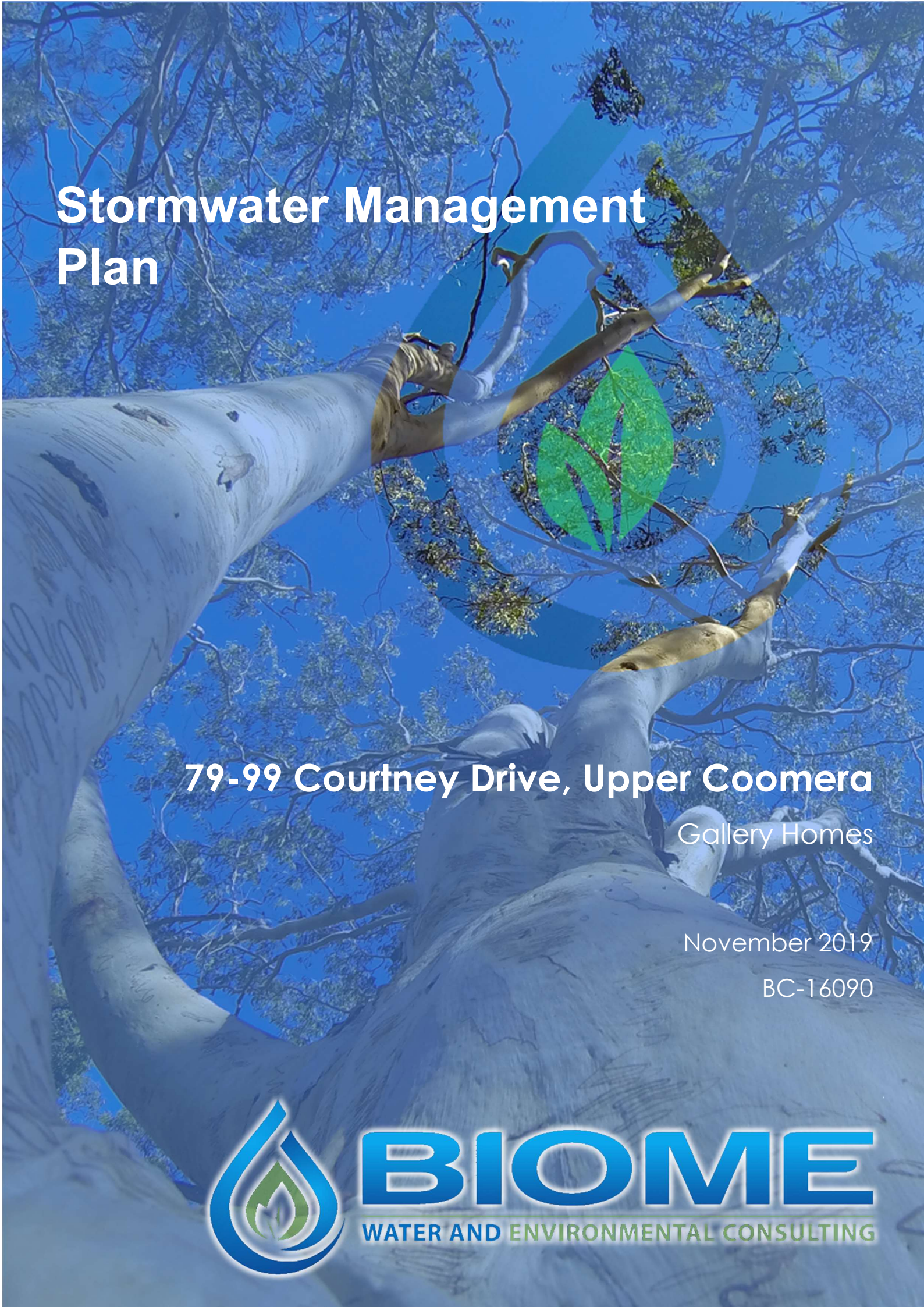

79-99 Courtney Drive, Upper Coomera

Gallery Homes

November 2019

BC-16090

BIOME

WATER AND ENVIRONMENTAL CONSULTING

Document Control

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Project Number	BC-16090
Report Title	Stormwater Management & Hydraulic Impact Assessment
Prepared by	Joe McDonald BEng(Civil), MIEAust Anna Kleinschmidt
Approved by	Brad Comley MSc, BAppSc, MEngPrac, NER, RPEQ.

Version Number	Date	Distribution
1	March 2019	Gallery Homes
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Biome Consulting Pty Ltd
ABN: 86 166 087 476

PO Box 3469, Australia Fair SOUTHPORT QLD 4215
Office: 5532 7779
Mobile: 0415 935 222
Email: admin@BIOMEconsulting.com.au
Internet: www.BIOMEconsulting.com.au

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Executive Summary

This conceptual stormwater management plan has been prepared so as to be considered as part of a Development Application for a Reconfiguration of Lot over Lots 188-192 on RP173728, at 79-99 Courtney Drive, Upper Coomera (hereafter referred to as 'the subject site').

The report has been prepared on behalf of Gallery Homes and presents a comprehensive review of available Stormwater Quality Improvement Devices (SQID) and stormwater Best Management Practices (BMP) to ensure that the proposed development adequately addresses the management of stormwater quantity and quality during both the construction and operational phases of the development.

This version of the report (Version 2) has been prepared in response to Items 28 and 29 of the Confirmation Notice and Information Request dated 12 July 2019 (Council Reference: COM/2019/82) and following several meetings with Council in relation to the mapped waterways and open space requirements. In particular, this report assesses a revised layout which has been modified to incorporate a naturalised channel design for the existing drainage feature that runs through the south western portion of the site.

In order to address the management of stormwater quantity and quality, a total of four (4) stormwater treatment basins have been proposed. Three (3) of these basins (Basins A, B and D) will be combined bioretention/detention basin for quality and quantity management. The remaining Basin C will only be required for treatment of pollutant loads, as catchment reductions in the post-development case have resulted in the reduction of peak discharge.

The results of xpstorm modelling indicate that the inclusion of the three (3) proposed detention basins will mitigate the expected increases in peak discharge at PD-A, PD-B, and PD-D during all modelled AEP events.

All internal catchments will be directed to bioretention measure for quality treatment. *MUSIC v6* modelling indicates that reduction target for TSS, TP, TN and gross pollutants of 80%, 60%, 45% and 90% respectively can be achieved for the rainfall data set simulated,

In order to simulate pre- and post-development flooding across the site the 1D - 2D hydrodynamic flood model TUFLOW has been utilised to route stormwater through the upper reaches of Yaun Creek and the other minor streams. Spatial analysis of the peak pre and post-development flooding indicates that the proposed earthworks required to create the subdivision will not cause any flood increase or nuisance to neighbouring properties.

The level of detail provided within this report is suitable for development assessment only and should not be relied upon for construction purposes. A Detailed Stormwater Management Plan containing detailed engineering designs will be needed to finalise the stormwater concepts presented in this report. Detailed design documentation should be prepared in conjunction with civil operational works.

This report has been reviewed by a Registered Professional Engineer of Queensland (RPEQ), and certification has been provided that if the design parameters set out in this report are included within the development:

- there should be no worsening in peak discharge as a result of the proposed development; and
- stormwater pollutant load reductions in accordance with best practice should be achieved.

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Appendix

Appendix A – Healthy Waters Code Response
Appendix B - Stormwater Management Design Drawings
Appendix C – Rational Method Validation

1 Introduction

This conceptual stormwater management plan has been prepared so as to be considered as part of a Development Application for a Reconfiguration of Lot over Lots 188-192 on RP173728, at 79-99 Courtney Drive, Upper Coomera (hereafter referred to as 'the subject site').

The report has been prepared on behalf of Gallery Homes and presents a comprehensive review of available Stormwater Quality Improvement Devices (SQID) and stormwater Best Management Practices (BMP) to ensure that the proposed development adequately addresses the management of stormwater quantity and quality during both the construction and operational phases of the development.

This version of the report (Version 2) has been prepared in response to Items 28 and 29 of the Confirmation Notice and Information Request dated 12 July 2019 (Council Reference: COM/2019/82) and following several meetings with Council in relation to the mapped waterways and open space requirements. In particular, this report assesses a revised layout which has been modified to incorporate a naturalised channel design for the existing drainage feature that runs through the south western portion of the site.

It is noted that the assessments relating to the 'existing' and 'pre-development' scenarios have not been altered from the original version (Version 1 dated May 2019) of the report.

The level of detail provided within this report is suitable for development assessment only and should not be relied upon for construction purposes. A Detailed Stormwater Management Plan containing detailed engineering designs will be needed to finalise the stormwater concepts presented in this report. Detailed design documentation should be prepared in conjunction with civil operational works.

1.1 Objectives

The objective of this report is to present practical conceptual stormwater designs which can be integrated into the development proposal so as to ensure that the development minimises potential impacts on downstream receiving environments during the operational phases of development. In addition, the report aims to address the requirements of the City of Gold Coast – Healthy Waters Code (Appendix A).

1.1.1 Operational Phase Objectives

The overarching objective for stormwater management during the operational phase of the development is to ensure that development does not cause an unacceptable impact or nuisance which could result in actionable damage to downstream properties and receiving environments. The following objectives are to be achieved.

Operational Phase Objective (Quantity)	Maintain a Lawful Point of Discharge (LPD) for all site catchments in accordance with the Queensland Urban Drainage Manual (2016).
Operational Phase Objective (Quality)	Stormwater discharged from the site achieves the specified load based reduction targets in accordance Queensland Water Quality Guidelines (2009). For the development site relevant targets are TSS 80%, TP 60%, and TN 45%.

2 Site Location

The subject site is located at 79-99 Courtney Drive, Upper Coomera on Lots 188-192 on RP173728 and is located within the City of Gold Coast Local Government Area. The site comprises of five allotments with a total land area of 18.849 ha. The size of each allotment is included within Table 2.1 with the location and extent of the site shown on Figure 2.1.

Table 2.1 Allotment Details

Street Number	Lot Plan Number	Lot Size (ha)
79	188 RP173728	3.079
89	189 RP173728	3.034
91	190 RP173728	3.095
97	191 RP173728	3.739
99	192 RP173728	5.902

Figure 2.1 Site Location (Google Earth, image date 2016)

3 Existing Case - Hydrological Assessment

xpstorm was utilised to assess the site's existing hydrology and generate hydrographs to represent the stormwater flows expected at the site's existing points of discharge (PD's). Modelling was based on existing catchment areas and surface characteristics. Peak discharge rates for nominated Annual Exceedance Probabilities (AEPs) were derived from the output hydrographs. The following sections detail the input parameters used in the *xpstorm* modelling. Catchments have been delineated on Drawing 201 – Appendix A.

3.1 Rainfall

The hydrologic analysis undertaken in this report will rely on Australian Rainfall and Runoff (ARR) temporal pattern and IFD data obtained for the site from the BOM (Table 3.1).

Table 3.1 Adopted Intensity Frequency Data (mm/hr)

Storm Duration	Annual Exceedance Probability (AEP)					
	0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
5 minute	140.00	176.00	204.00	234.00	276.00	308.00
10 minute	115.00	143.00	164.00	188.00	218.00	240.00
15 minute	97.30	121.00	139.00	158.00	183.00	201.00
20 minute	84.60	105.00	121.00	138.00	160.00	176.00
25 minute	75.20	93.40	108.00	123.00	143.00	158.00
30 minute	67.80	84.40	97.40	112.00	130.00	144.00
45 minute	53.10	66.50	77.10	88.90	105.00	117.00
60 minute	44.20	55.70	64.90	75.20	89.40	100.00
90 minute	34.00	43.20	50.80	59.30	71.30	80.90
120 minute	28.20	36.10	42.70	50.10	60.70	69.30
180 minute	21.70	28.20	33.50	39.70	48.50	55.70

3.2 Existing Case - External Catchments

Two (2) upstream catchments direct flows onto the subject site.

- Ext 1 - discharges flows onto the south western corner of the site as channel flow via a small gully; and
- Ext 2 - directs flows onto the subject site via channel flow. Catchment flows are conveyed across the south eastern corner of the site and to the east.

  NOTE: The conveyance requirements for this catchment through the subject site have been analysis as part of a 2D assessment within Section 7 of this report. As such no further reference is made to this catchment within following 1D hydrological section.

Table 3.2 below presents a summary of the external catchment characteristics.

Table 3.2 Existing Case – External Catchment Characteristic

Catchment ID		Area (ha)	Cover (%)
External	Ext-1	2.26	100 - Dense Forest

3.3 Existing Case - Internal Catchments

The subject site has been divided into four (4) internal catchment areas:

- A – discharges flows primarily as channel flow into Yaun Creek on the western edge of the site;
- B – flows are directed to the north and into Yaun Creek at the site's northern boundary;
- C – discharges catchment flows into the Mackellar Drive road reserve; and
- D – directs flows into a tributary of Yaun Creek at the site south eastern corner.

The characteristic of the site's catchments are detailed in Table 3.3 below and have been delineated on Drawing 201 – Appendix A.

Table 3.3 Existing Case – Catchment Characteristic

Catchment ID		Area (ha)	Cover (%)	Discharge Condition	PD ID
Internal	A	8.6	10 – Dense Forest 90 – Cleared pasture	Channel - Sheet	PD-A
	B	4.4	100 – Cleared pasture with isolated corpses	Sheet	PD-B
	C	2.9	100 – Cleared pasture with isolated corpses	Channel	PD-C
	D	1.94	100 – Cleared pasture with isolated corpses	Sheet – Channel	PD-D

3.4 Existing Case - *xpstorm* Runoff

The "Laurenson" routing method was applied to *xpstorm* for hydrological calculation and hydrograph generation. The contributing catchment was split into pervious (with 0% impervious fraction) and impervious (with 100% impervious fraction) areas. Adopted parameters for the Laurenson routing method include a Manning's roughness coefficient (n) for impervious and pervious areas respectively. Infiltration uniform losses have been applied to the hydrologic model.

The tables below contain the modelling parameters relied upon and present the resulting peak discharges expected for each catchment.

Table 3.4 *xpstorm* Catchment Details – Existing Case

Catchment ID		Impervious Area		Pervious Area	
		Area (ha)	Slope (%)	Area (ha)	Slope (%)
External	Ext-1	-	-	2.26	25
Internal	A	-	-	8.6	8.5
	B	-	-	4.4	11
	C	-	-	2.9	14
	D	-	-	1.94	16

Table 3.5 *xpstorm* Rainfall Multipliers Applied to Temporal Patterns (mm)

Storm Duration	Annual Exceedance Probability (AEP)					
	0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
5 minute	11.67	14.67	17.00	19.50	23.00	25.67
10 minute	19.17	23.83	27.33	31.33	36.33	40.00
15 minute	24.33	30.25	34.75	39.50	45.75	50.25
20 minute	28.20	35.00	40.33	46.00	53.33	58.67
25 minute	31.33	38.92	45.00	51.25	59.58	65.83
30 minute	33.90	42.20	48.70	56.00	65.00	72.00
45 minute	39.83	49.88	57.83	66.68	78.75	87.75
60 minute	44.20	55.70	64.90	75.20	89.40	100.00
90 minute	51.00	64.80	76.20	88.95	106.95	121.35
120 minute	56.40	72.20	85.40	100.20	121.40	138.60
180 minute	65.10	84.60	100.50	119.10	145.50	167.10

Table 3.6 *xpstorm* Adopted Initial and Continuing Losses – Existing Case

Impervious Area			Pervious Area			
IL (mm)	CL (mm/hr)	Manning's (n)	AEP	CL (mm/hr)	IL (mm)	Manning's (n)
0	0	0.014	0.393-0.049	2	15	0.037
			0.020-0.010	2	5	

Table 3.7 *xpstorm* Peak Discharge (m^3/s) – Existing Case

Point of Discharge	Annual Exceedance Probability (AEP)					
	0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
Ext-1	0.60	0.78	0.93	1.09	1.43	1.58
PD-A	1.70	2.55	3.36	4.10	4.53	5.05
PD-B	0.83	1.21	1.53	1.83	2.08	2.30
PD-C	0.65	0.90	1.08	1.28	1.56	1.75
PD-D*	0.51	0.70	0.82	1.01	1.15	1.29

*Peak discharge from Catchment D to PD-D. Does not include flows from Ext-2.

3.5 Existing Case - Model Validation (Rational Method)

For validation purposes, peak discharge values obtained for nominated storm events using xpstorm were compared to those calculated using Rational Method and are shown in Table 3.8 below. Rational calculations were prepared in accordance with QUDM 2013 Section 4, and are detailed within Appendix C.

Table 3.8 Peak Flow Validation *xpstorm* vs Rational – Existing Case

Catchment & Point of Discharge ID			*xpstorm* (m^3/s)	Rational (m^3/s)	Difference (%)
External	PD-A	Ext-1	1.58	1.52	3.8
Internal		A	3.97	4.76	-19.9
	PD-B		2.30	2.62	-13.9
	PD-C		1.75	1.82	-4.0
	PD-D		1.29	1.27	1.55

The peak inflows generated using both hydrological methods are within 20% of each other for the 0.01 AEP. The modelling is therefore considered to be appropriately validated.

4 Proposed Development

The development involves reconfiguring the existing site into 220 residential allotments (Figure 4.1). The development will also include:

- An internal road network with pedestrian footpath;
- Conservation areas (Environmental Reserve, public open space) to protect existing ecologically significant areas;
- A constructed naturalized waterway;
- Open space recreational areas;
- Four (4) stormwater treatment areas and six (6) drainage reserves; and
- Rehabilitated waterways incorporated into public open space

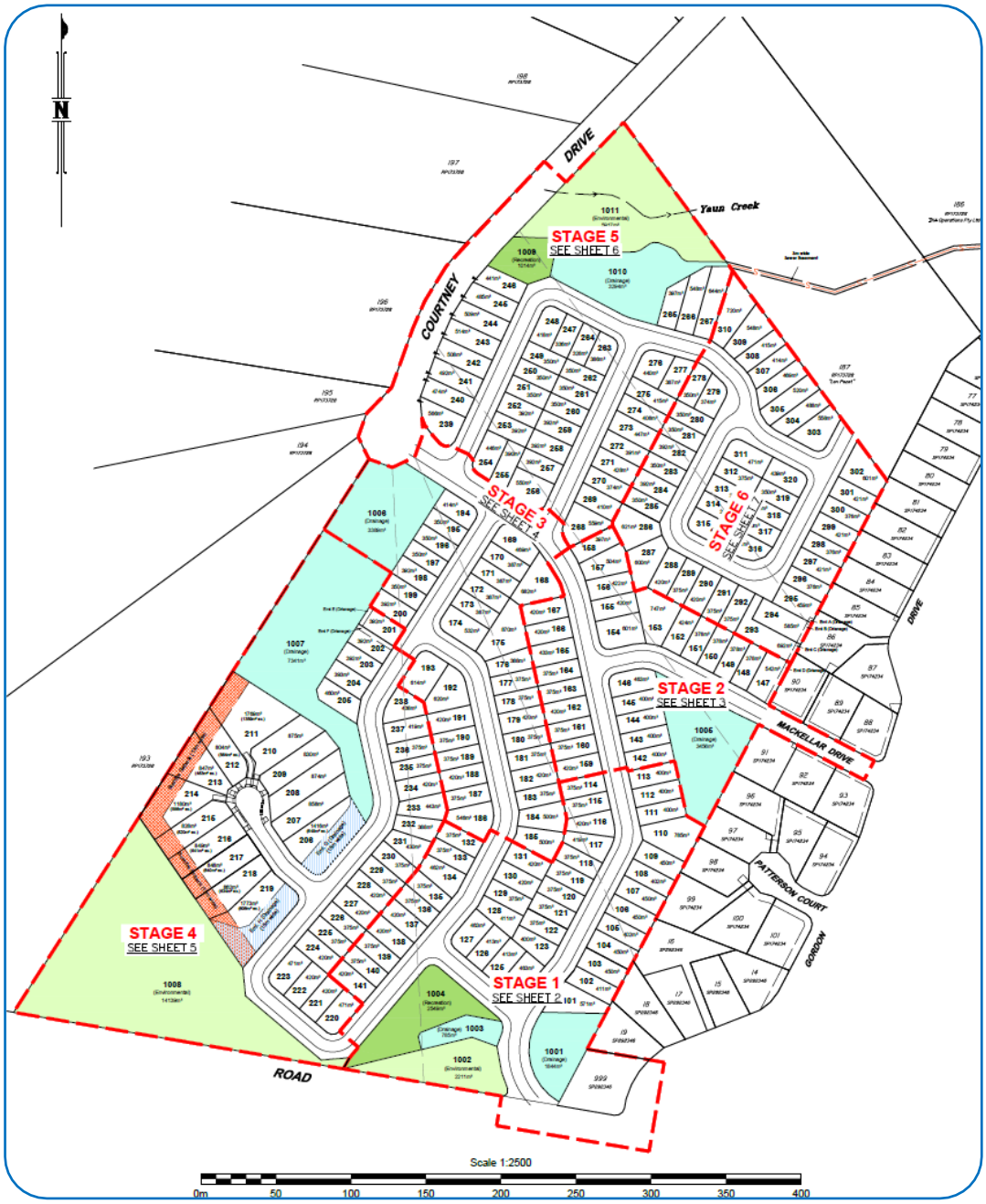


Figure 4.1 Proposed Development Layout (Bennett and Bennett)

5 Developed Case - Hydrological Assessment

xpstorm was utilised to assess the site's developed hydrology and generate hydrographs and peak discharge rates at each point of discharge (PD). The following sections detail the input parameters used in the *xpstorm* modelling. Catchments have been delineated on Drawing - 201 - Appendix A.

5.1 Developed Case - External Catchments

In the developed case the external catchment will remain unchanged (refer to Section 3.1 above). NOTE: The conveyance requirements for Ext-2 have been analysis as part of a 2D assessment within Section 8 of this report.

5.2 Developed Case - Internal Catchments

In the developed case the site will undergo substantial earthworks to profile the development area. Underground piped drainage will be installed to collect minor stormwater flows, with major flows conveyed via an internal road network. Six (6) major post development catchments have been delineated based on the preliminary civil designs by Mortons Urban Solutions. Catchment A has been further subdivided to recognise an area of environmental reserve that will be maintained (A1). The sites post development catchments are described as follows:

- A1 – Environmental Reserve which discharges flows primarily as channel flow into the natural channel/private waterway in A2a;
- A2a & A2b – residential allotments- discharges flows primarily as channel flow into Yaun Creek on the western edge of the site;
- B – residential allotments -flows are directed to the north and into Yaun Creek at the site's northern boundary;
- C – residential allotments -discharges catchment flows into the Mackellar Drive road reserve; and
- D – residential allotments - directs flows into a tributary of Yaun Creek at the site's south eastern corner.

The characteristic of the site's catchments are detailed in Table 5.1 below and have been delineated on Drawing 201 – Appendix A.

Table 5.1 Developed Case – Catchment Characteristic

Catchment ID		Area (ha)	Cover (%)	Discharge Condition	PD ID
Internal	A1	1.56	100 – Dense Forest	Channel	Into A2a
	A2a	3.89	100 – Res Dev	Weir – Pipe	PD-A
	A2b	3.17	100 – Res Dev	Weir – Pipe	PD-A
	B	5.20	100 – Res Dev	Weir – Pipe	PD-B
	C	2.48	100 – Res Dev	Pipe – Road	PD-C
	D	2.14	100 – Res Dev	Channel	PD-D

5.3 Developed Case - *xpstorm* Runoff

The "Laurenson" routing method was applied to *xpstorm* for hydrological calculation and hydrograph generation. The contributing catchment was split into pervious (with 0% impervious fraction) and impervious (with 100% impervious fraction) areas. Adopted parameters for the Laurenson routing method include a Manning's roughness coefficient (n) for impervious and pervious areas respectively. Infiltration uniform losses have been applied to the hydrologic model.

The tables below contain the modelling parameters relied upon and present the resulting peak discharges expected for each catchment. It is noted that areas with significantly different slopes (such as batter areas) have been modelled as separate sub catchments within the xpstorm hydrological node for the catchment.

Table 5.2 *xpstorm* Catchment Details – Developed Case

Catchment ID		Impervious Area				Pervious Area					
		Area (ha)	Slope (%)	Area (ha)	Slope (%)	Area (ha)	Slope (%)	Area (ha)	Slope (%)	Area (ha)	Slope (%)
External	Ext-1	-	-	-	-	2.26	25	-	-	-	-
Internal	A1	-	-	-	-	1.56	20	-	-	-	-
	A2a	1.90	5	-	-	1.27	5	0.45	25	0.28	8
	A2b	1.82	5	-	-	1.21	5	0.073	25	0.073	8
	B	1.97	6	-	-	2.96	6	0.28	20	-	-
	C	0.97	4	0.356	10	0.65	4	0.15	10	0.37	33
	D	0.84	4.5	0.10	6.8	0.56	4.5	0.28	15	0.71	17

Table 5.3 *xpstorm* Adopted Initial and Continuing Losses – Developed Case

Impervious Area			Pervious Area			
IL (mm)	CL (mm/hr)	Manning's (n)	AEP	CL (mm/hr)	IL (mm)	Manning's (n)
0	0	0.014	0.393-0.049	2	15	0.037
			0.020-0.010	2	5	

Table 5.4 *xpstorm* Peak Discharge (m^3/s)– Developed Case

Point of Discharge	Annual Exceedance Probability (AEP) – Peak Discharge					
	0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
Ext-1	0.60	0.78	0.93	1.09	1.43	1.58
PD-A	2.77	3.69	4.43	5.20	6.40	7.10
PD-B	1.35	1.73	2.10	2.48	2.90	3.30
PD-C	0.67	0.88	1.05	1.25	1.48	1.73
PD-D	0.57	0.76	0.90	1.06	1.51	1.67

5.3.1 Validation of Flows

Table 5.5 illustrates that the peak discharges generated using both methods are within 10% of each other for the 0.01 AEP. The modelling is therefore considered to be appropriately calibrated.

Table 5.5 Peak Flow Validation *xpstorm* vs Rational – Developed Case

Catchment & Point of Discharge ID			*xpstorm* (m^3/s)	Rational (m^3/s)	Difference (%)
External	PD-A	Ext-1	1.58	1.52	3.8
Internal		A1	1.09	1.05	3.67
		A2a	2.50	2.64	-5.6
		A2b	2.01	2.09	-4.0
	PD-B		3.30	3.56	-7.9
	PD-C		1.73	1.73	0.0
	PD-D		1.67	1.64	1.8

5.3.2 Peak Discharge Comparison - Existing- vs Developed (Unmitigated)

Table 5.6 presents a comparison of the peak discharges expected at each PD. Results indicate increases in peak discharge are expected a PD-A, PD-B, and PD-D. Decreases in peak discharge to PD-C for the 5-100 year ARI is expected due to catchment area and slope reductions. A slight increase of 0.02 m^3/s was estimated at PD-C during the 2 year ARI however as flows will be conveyed through a stormwater treatment measure prior to discharge it is expected that minor flows will be further reduced due to the mitigation effects of the basin.

Table 5.6 Peak Discharge Comparison (m^3/s) - Unmitigated

PD	Scenario	Contributing Catchment Area (ha)	Annual Exceedance Probability (AEP) – Peak Discharge					
			0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
A	Existing	10.86	1.70	2.55	3.36	4.10	4.53	5.05
	Developed (Unmitigated)	10.88	2.77	3.69	4.43	5.20	6.40	7.10
	Difference		**+1.07**	**+1.14**	**+1.07**	**+1.10**	**+1.87**	**+2.05**
B	Existing	4.40	0.83	1.21	1.53	1.83	2.08	2.30
	Developed (Unmitigated)	5.20	1.35	1.73	2.10	2.48	2.90	3.30
	Difference		**+0.52**	**+0.52**	**+0.57**	**+0.65**	**+0.83**	**+0.99**
C	Existing	2.89	0.65	0.90	1.08	1.28	1.56	1.75
	Developed (Unmitigated)	2.48	0.67	0.88	1.05	1.25	1.48	1.73
	Difference		**+0.02**	**-0.02**	**-0.03**	**-0.03**	**-0.08**	**-0.02**
D*	Existing	1.94	0.51	0.70	0.82	1.01	1.15	1.29
	Developed (Unmitigated)	1.83	0.57	0.76	0.90	1.06	1.51	1.67
	Difference		**+0.06**	**+0.06**	**+0.08**	**+0.05**	**+0.36**	**+0.38**

*Peak discharge from Catchment D to PD-D. Does not include flows from Ext-2.

6 Stormwater Management - Operational Phase

In order to ensure that the operational phase objectives outlined within Section 1.1 of this report can be achieved, a network of stormwater management measures are proposed for inclusion within the development.

To achieve these objectives, both external and internal flows will need to be adequately managed prior to discharge to the site's points of discharge.

6.1 Schematic Design Plan

With consideration given to the existing site characteristics, the proposed development configuration and the range of available stormwater management control measures, a set of conceptual design drawings have been prepared and are included as Appendix B. These drawings illustrate the layout and design requirements of each proposed mitigation measures.

6.1.1 External Drainage

- Ext-1 – Flows from this external catchment will continue to enter the subject site as per the pre-development case and into post-development Catchment A1 (Environmental Reserve). From the environmental reserve flows are to be conveyed through the development via a naturalised channel (located in Catchment A2a). The channel will discharge into a bunded portion of Basin A (denoted as 'by-pass pond' within the stormwater drawings contained in Appendix B) which is separate from the treatment area of the basin. This by-pass pond has been designed as a wet basin maintaining a depth of 1 m prior to discharge via an outlet headwall. Flows from the basin and pond will discharge along the site's western boundary at PD-A. The conveyance design for this catchment through the subject site has been included in Section 6.1.3 below. Additionally, the conveyance design has been assessed as part of a 2D assessment within Section 8 of this report
- Ext 2 - The conveyance requirements for this catchment through the subject site have been analysis as part of a 2D assessment within Section 8 of this report.

6.1.2 Internal Drainage

The site's internal catchments will be developed for residential allotments which will be graded so as to allow minor stormwater flows to be collected within inter-allotment and road piped drainage systems with higher flows conveyed with road reserves. It is noted that a portion of the high flows above the pipe network design from Catchment A2a will also be directed to the natural channel and conveyed to Basin A prior to discharge at PD-A. Allowances for these flows have been included within the channel design.

Four (4) stormwater treatment basins have been proposed for the management of stormwater. Basins A, B, and D will be combined bioretention/detention basin for quality and quantity management. Basin C will only be required for treatment of pollutant loads, as catchment reductions in the post-development case have resulted a reduction in peak discharge at PD-C.

6.1.3 Natural Waterway Design

As part of discussions held with Council Officers, it has been agreed that due to the degraded nature of the exiting natural drainage line, a fabricated naturalised waterway can be incorporated into the development to convey flows from the Environmental Reserve (denoted as Catchment A1) and the external catchment Ext 1 to Basin A prior to discharge at PD-A. The aim of the naturalised waterway design has been to:

- mimic a natural waterway form and structure to provide opportunities for the establishment of fauna habitat; and
- provide suitable hydraulic conveyance of external and internal flows whilst minimising scour and maximising environmental values.

A preliminary design and assessment of the proposed channel in terms of conveyance capacity has been undertaken below. Further detailed designs of the channel in terms of specific rock size and vegetation lining are to be completed in accordance with the Brisbane City Council Natural Channel Design Guidelines (2003) as part of future operational works application.

Figures 6.1 - 6.4 below presents preliminary sizing of the natural channel at four different sections based on Manning's equation. Layouts and typical sections showing the channel design and peak water depths during the 1% AEP event are contained in DWG - 314 of the stormwater drawing set (Refer to Appendix B).

The base width, batter slopes and rock lining have been designed so as to maintain a d*V of below 0.6 m^2/s.

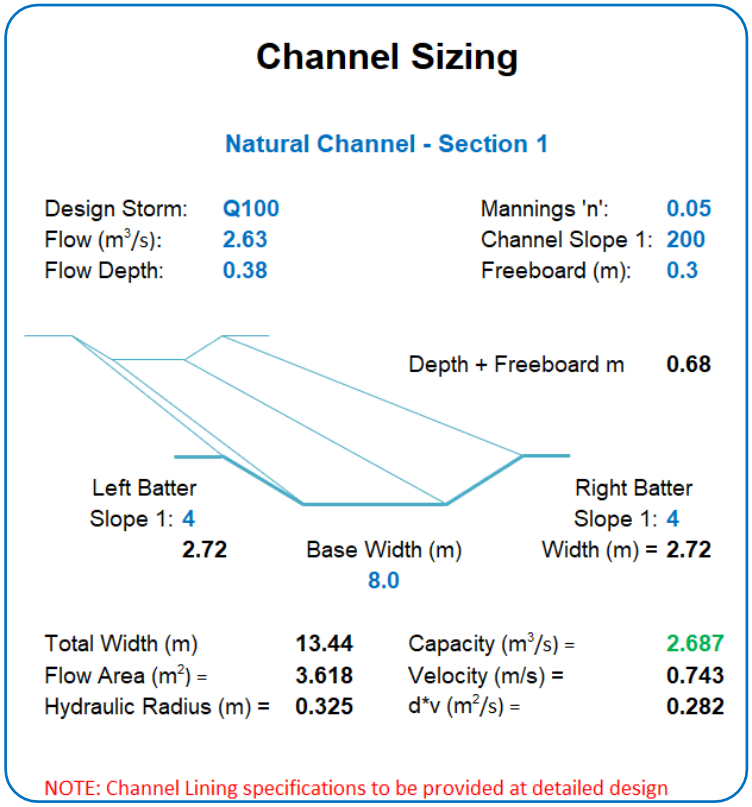


Figure 6.1 Natural Channel Section 1 – Manning's Assessment

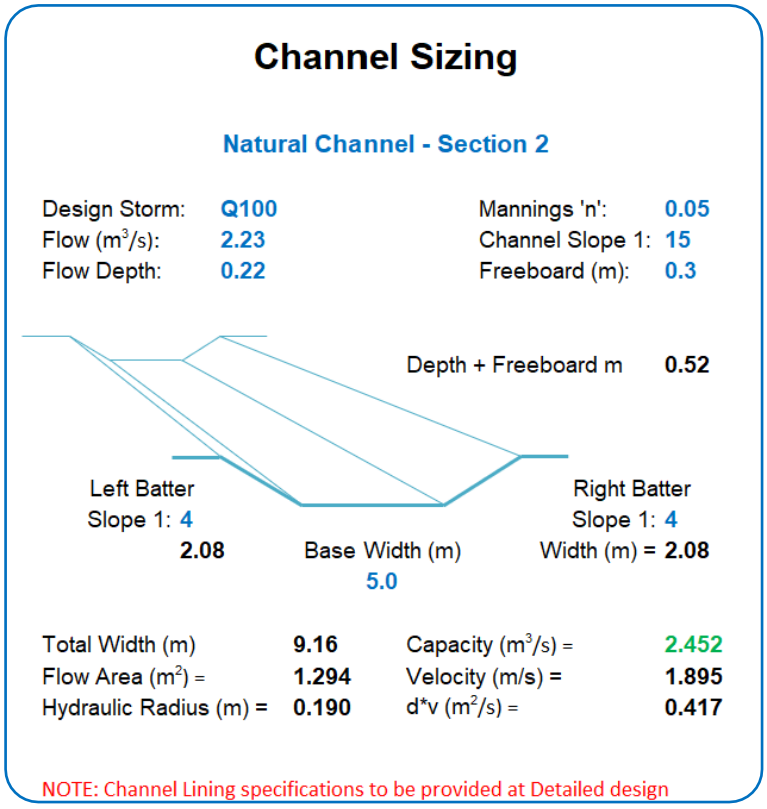


Figure 6.2 Natural Channel Section 2 – Manning's Assessment

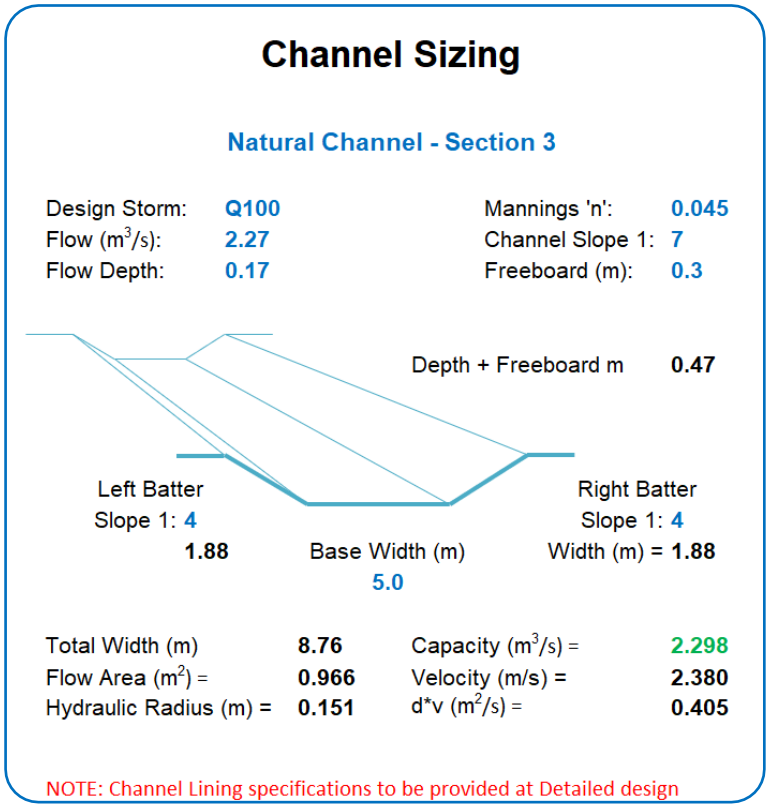


Figure 6.3 Natural Channel Section 3 – Manning's Assessment

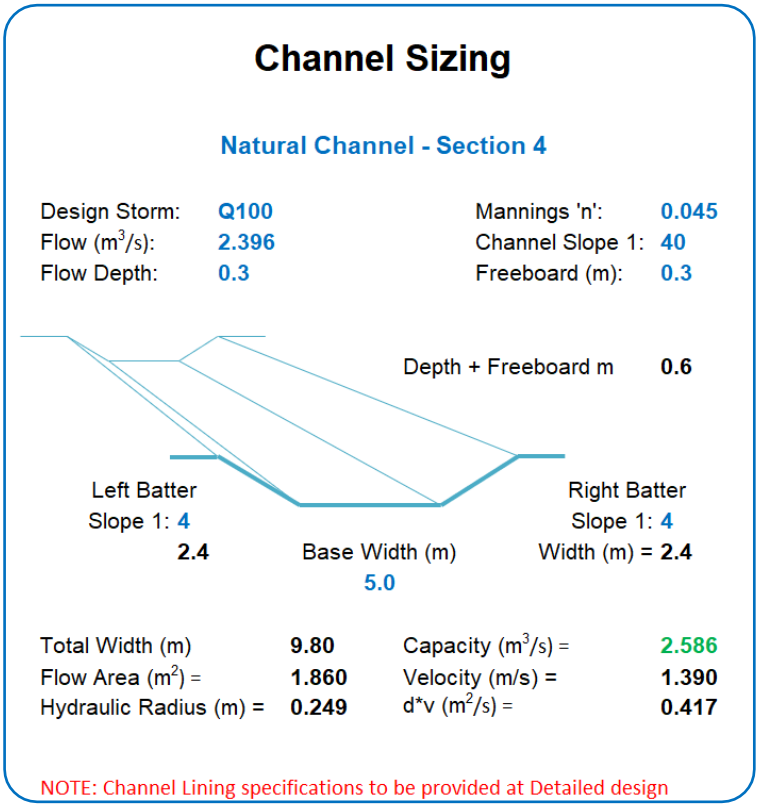


Figure 6.4 Natural Channel Section 4 – Manning's Assessment

6.1.4 Drainage Easements

There are four (4) easements nominated for drainage/conveyance purposes within the subject site. These can be seen on Drawing DWG-300 and DWG-314 (Appendix B) and include the following:

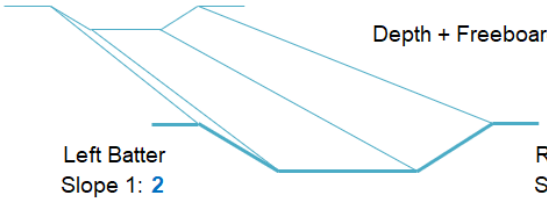
- Private Waterway. This waterway has been designed as a naturalised channel as described in the sections above for the conveyance of flows from Ext-1, A1, and high flows from Catchment A2a;
- Drainage Easement A2a. This easement has been designed as a grassed swale to collect and convey batter flows through lots 210-212 to the by-pass pond of Basin A;
- Lot 201. This easement is over the stormwater pipe which discharges low flows from catchment A2a to bioretention basin A2a. It is noted that high flows from this catchment will discharge directly to the natural channel; and
- Drainage Easement C which includes pipe and channel over lots 293, 294, and 146. This easement will convey flows to the existing stormwater infrastructure of Mackellar Drive to the east.

Figures 6.5 and 6.6 below presents preliminary sizing of the proposed channels within Drainage Easement A2a and C based on the Manning's equation. Further details of the proposed easements will be completed at detailed design.

Channel Sizing

Channel A2a (Batter)

Design Storm:	Q100	Mannings 'n':	0.05
Flow (m^3/s):	0.16	Channel Slope 1:	8.3
Flow Depth:	0.16	Freeboard (m):	0.15



Total Width (m)	1.53	Capacity (m^3/s) =	0.156
Flow Area (m^2) =	0.096	Velocity (m/s) =	1.619
Hydraulic Radius (m) =	0.096	d*v (m^2/s) =	0.254

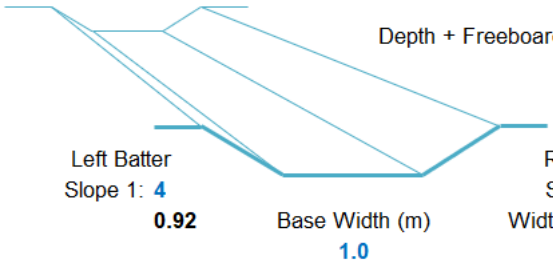
NOTE: Channel Lining specifications to be provided at Detailed design

Figure 6.5 Channel A2a– Manning's Assessment

Channel Sizing

Channel C (Drainage Easement)

Design Storm:	Q100	Mannings 'n':	0.045
Flow (m^3/s):	0.163	Channel Slope 1:	5
Flow Depth:	0.08	Freeboard (m):	0.15



Total Width (m)	2.84	Capacity (m^3/s) =	0.167
Flow Area (m^2) =	0.106	Velocity (m/s) =	1.584
Hydraulic Radius (m) =	0.064	d*v (m^2/s) =	0.127

NOTE: Channel Lining specifications to be provided at Detailed design

Figure 6.6 Channel C– Manning's Assessment

6.2 Quantity Control – Detention

In order to mitigate the increase in peak discharge expected at PD-A, PD-B and PD-D, detention is proposed within open detention basins. These basins will be located within open space to be dedicated to Council and will function to detain stormwater flows so as to ensure that there is no increase in discharge to downstream properties for all nominated AEP's.

NOTE: No detention is proposed within Catchment C as decreases in peak discharge are expected to PD-C as a result of catchment area and slope reductions in the development case.

6.2.1 *xpstorm* Modelling Paramaters

xpstorm has been relied upon to size the required detention measures and develop appropriate outlet configurations.

xpstorm requires a depth area relationship to be defined when modelling an onsite detention (OSD). An initial depth of 0.3 m has been applied within the modelling to reflect the bioretention extended detention requirements.

A summary of the total depth-area relationship applied to the storage node of the *xpstorm* model in the post-development (mitigated) scenario is contained in Table 6.1. The dimensions and proposed levels of the outlet structures used to mitigate the developed case peak discharge and achieve the required detention volume/s are detailed in Table 6.2.

Table 6.1 Depth Area Relationship

Detention ID	RL (m AHD)	Depth (m)	Surface Area (m^2)
Basin A*	44.50	0.00	1,111
	44.55	0.05	1,171
	44.60	0.10	1,232
	44.65	0.15	1,294
	44.70	0.20	1,356
	44.75	0.25	1,417
	44.80	0.30	1,480
	44.85	0.35	1,542
	44.90	0.40	1,605
	44.95	0.45	1,668
	45.00	0.50	1,731
	45.05	0.55	1,795
	45.10	0.60	1,858
	45.15	0.65	1,922
	45.20	0.70	1,987
	45.25	0.75	2,052
	45.30	0.80	2,117
	45.35	0.85	2,182
	45.40	0.90	2,248
	45.45	0.95	2,313
	45.50	1.00	2,380
	45.55	1.05	2,446
	45.60	1.10	2,513
	45.65	1.15	2,581
	45.70	1.20	2,649
	45.75	1.25	2,717

	45.80	1.30	2,786
	45.85	1.35	2,856
	45.90	1.40	2,927
	45.95	1.45	3,000
	46.00	1.50	3,505
Basin B	36.00	0.00	492
	36.05	0.05	517
	36.10	0.10	542
	36.15	0.15	567
	36.20	0.20	593
	36.25	0.25	619
	36.30	0.30	645
	36.35	0.35	672
	36.40	0.40	698
	36.45	0.45	763
	36.50	0.50	929
	36.55	0.55	962
	36.60	0.60	996
	36.65	0.65	1,030
	36.70	0.70	1,064
	36.75	0.75	1,098
	36.80	0.80	1,133
	36.85	0.85	1,168
	36.90	0.90	1,203
	36.95	0.95	1,239
	37.00	1.00	1,274
	37.05	1.05	1,310
	37.10	1.10	1,346
	37.15	1.15	1,383
	37.20	1.20	1,419
	37.25	1.25	1,456
	37.30	1.30	1,494
	37.35	1.35	1,531
	37.40	1.40	1,569
	37.45	1.45	1,607
	37.50	1.50	1,660
Basin D	57.00	0.00	147
	57.10	0.10	180
	57.20	0.20	215
	57.30	0.30	250
	57.40	0.40	286
	57.50	0.50	323
	57.60	0.60	361
	57.70	0.70	399
	57.80	0.80	438
	57.90	0.90	477
	58.00	1.00	515

*It is noted that for modelling purposes the depth vs area of Basin A has been split over two (2) storage nodes representing the pond area and the bioretention area which is separated via a 600mm bund.

Table 6.2 Outlet Structures

Detention ID	Pond Outlet	Outlet Riser & Pipe(s)	Weir
Basin A	2 x 525 mm dia RCP @ RL 44.5 m AHD	Pit A1: 1 x 600 x 900 mm inlet pit Crest @ RL 45.3 m AHD Outlet 1 x 525mm dia RCP @ RL 43.4 m AHD Pit A2: 1 x 600 x 900 mm inlet pit Crest @ RL 44.8 m AHD Outlet 1 x 375 mm dia RCP @ RL 43.4 m AHD	1 x 15 m Wide weir Crest @ RL 45.6 m AHD
Basin B	-	Pit B1: 1 x 600 x 900 mm inlet pit Crest @ RL 36.7 m AHD Outlet 1 x 450 mm dia RCP @ RL 34.9 m AHD Pit B2: 1 x 600 x 900 mm inlet pit Crest @ RL 36.3 m AHD Outlet 1 x 450 mm dia RCP @ RL 34.9 m AHD	1 x 12 m Wide weir, crest @ RL 37.05 m AHD
Basin D	-	Pit D: 1 x 600 x 900 mm inlet pit Crest @ RL 57.3 m AHD Outlet 1 x 375 mm dia RCP @ RL 56.0 m AHD	1 x 7 m Wide weir, crest @ RL 57.6 m AHD

6.2.2 Modelling Results

The results of xpstorm modelling indicate that the inclusion of the three (3) proposed detention basins will mitigate the expected increases in peak discharge at PD-A, PD-B, and PD-D during all modelled AEP events.

Table 6.3 presents a comparison between the expected peak discharge during nominated AEP events for the pre- and post-development mitigated cases. Figure 6.7, 6.8 and 6.9 illustrate a comparison of the outlet hydrographs at PD-A, PD-B and PD-D.

Table 6.3 Peak Discharge Comparison (m^3/s) – Mitigated

PD	Scenario	Contributing Catchment Area (ha)	Annual Exceedance Probability (AEP) – Peak Discharge					
			0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
A	Existing	10.86	1.70	2.55	3.36	4.10	4.53	5.05
	Developed (Mitigated)	10.88	1.64	2.02	2.46	2.98	3.70	4.39
	Difference		**-0.08**	**-0.23**	**-0.62**	**-0.94**	**-0.99**	**-1.27**
B	Existing	4.40	0.83	1.21	1.53	1.83	2.08	2.30
	Developed (Mitigated)	5.20	0.72	1.00	1.23	1.49	1.72	2.11
	Difference		**-0.11**	**-0.21**	**-0.31**	**-0.34**	**-0.35**	**-0.19**
D*	Existing	1.94	0.51	0.70	0.82	1.01	1.15	1.29
	Developed (Mitigated)	1.83	0.49	0.62	0.72	0.81	1.12	1.29
	Difference		**-0.03**	**-0.08**	**-0.10**	**-0.20**	**-0.03**	**0.00**

*Peak discharge from Catchment D to PD-D. Does not include flows from Ext-2

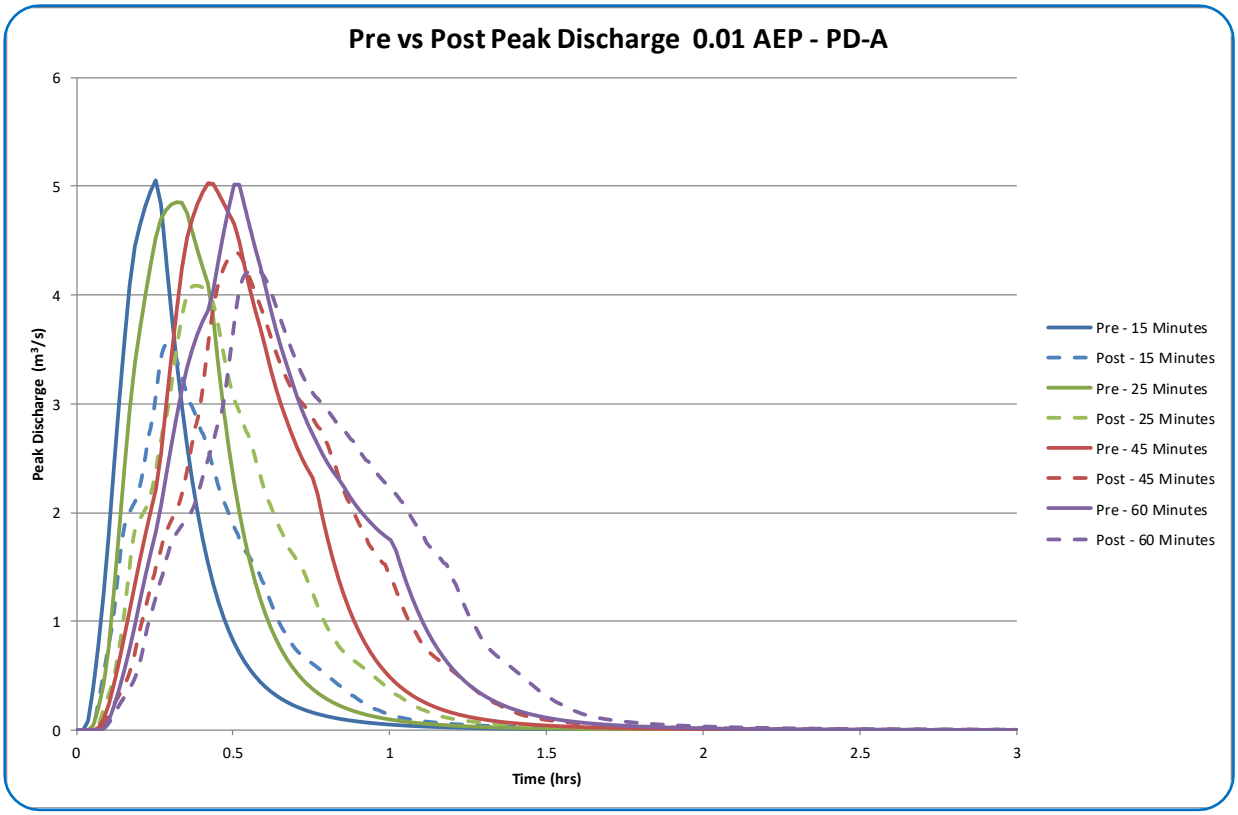


Figure 6.7 Comparison 0.01 AEP Hydrography PD-A

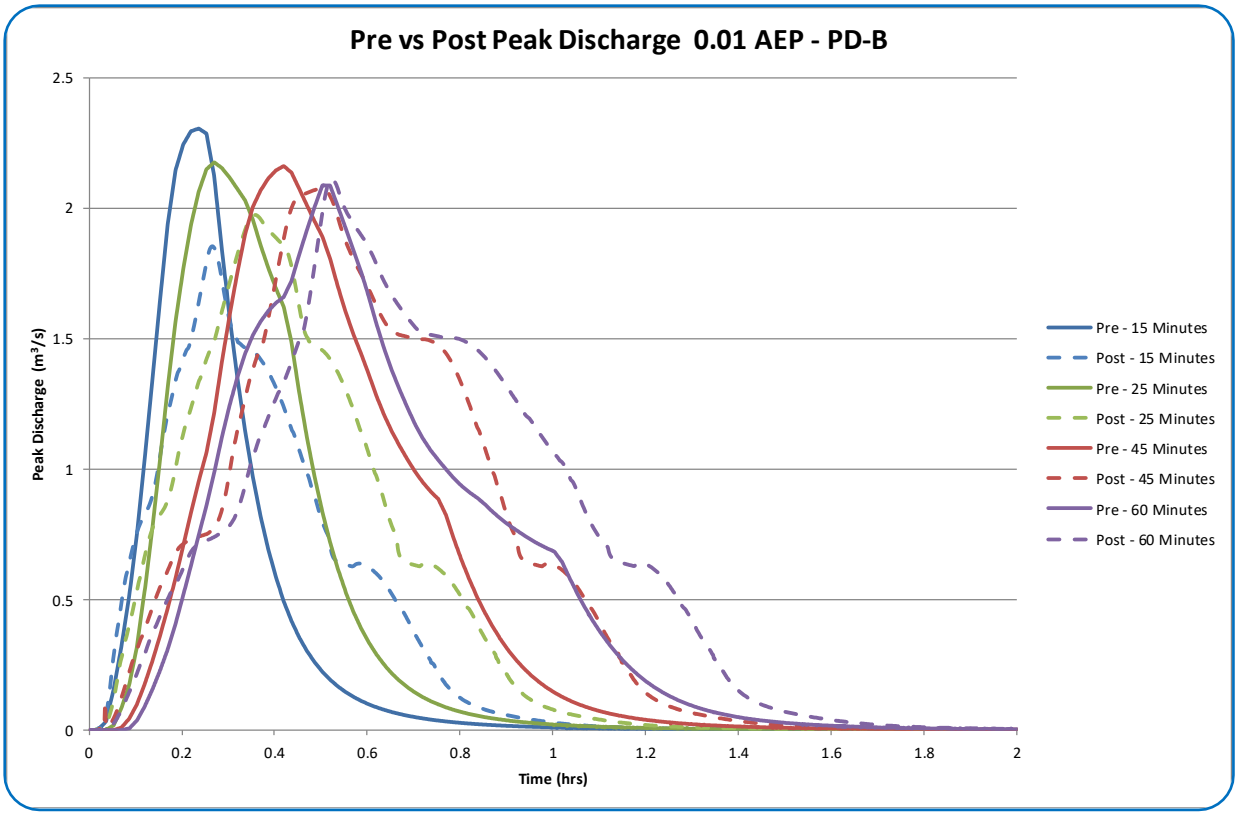


Figure 6.8 Comparison 0.01 AEP Hydrography PD-B

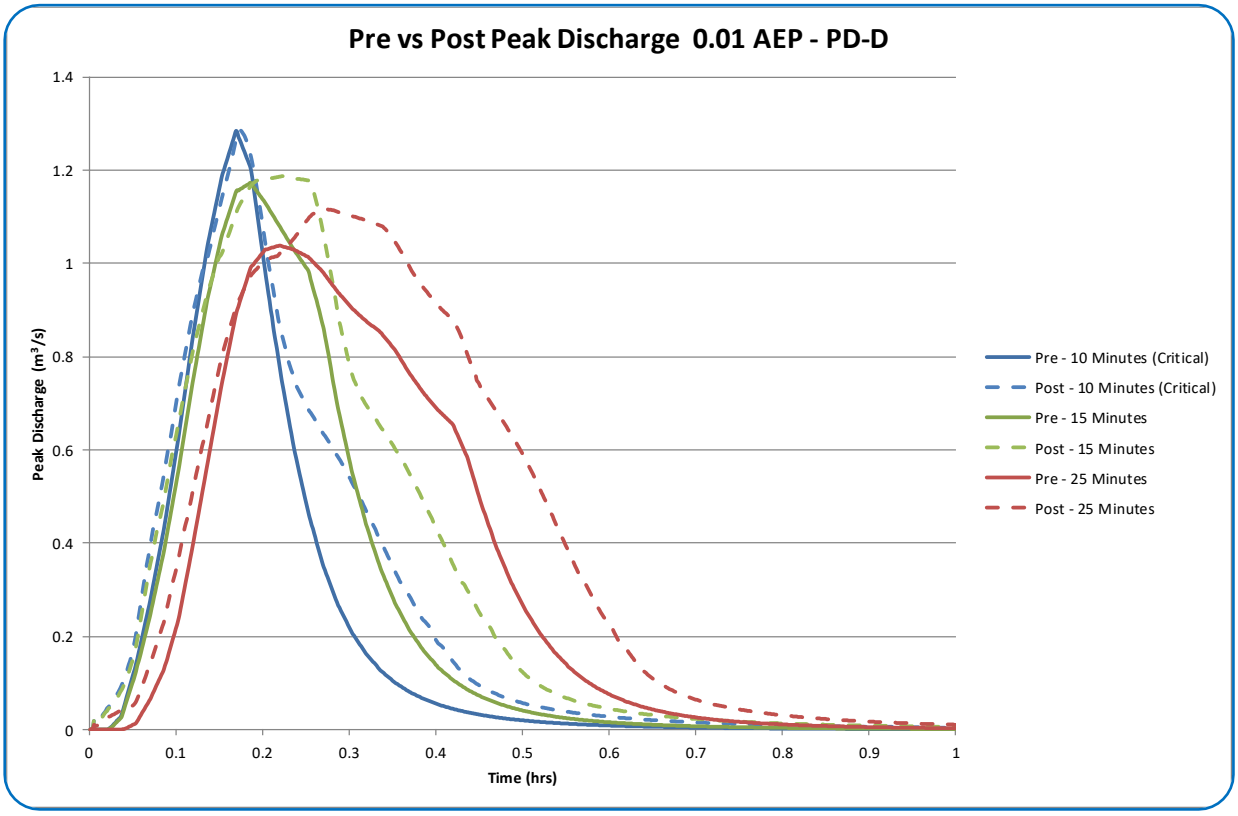


Figure 6.9 Comparison 0.01 AEP Hydrography PD-D

6.2.3 QUDM Minimum Design Safety Standards – Detention Depth

In accordance with the QUDM the depth of water in a detention basin is not to exceed 1.2 m during the 0.049 AEP and is to be limited to less than 1.5 m for the 0.01 AEP. A freeboard of 300 mm should also be achieved, along with a weir flow depth of no greater than 300 mm.

Table 6.4 presents the peak water levels, depths and volumes expected within the detention basins during both the 0.049 AEP and 0.01 AEP. Based on the *xpstorm* modelling of the proposed post-development scenario, the basin designs will not result in water depths outside the recommended design criteria with.

Table 6.4 Detention Storage Details, Depths and Volumes

	Basin A		Basin B		Basin D	
	0.049 (20 yr ARI)	0.01 (100 yr ARI)	0.049 (20 yr ARI)	0.01 (100 yr ARI)	0.049 (20 yr ARI)	0.01 (100 yr ARI)
Base Level (m AHD)	44.5	44.5	36.0	36.0	57.0	57.0
Top of Bund Level (m AHD)	46.0	46.0	37.5	37.5	58.0	58.0
Weir Level (m AHD)	45.6	45.6	37.1	37.1	57.6	57.6
Peak Water Surface (m AHD)	45.6	45.7	37.0	37.1	57.6	57.7
Peak Depth of Water (m)	1.1	1.2	1.0	1.1	0.6	0.7
Peak Volume (m^3)	1654	1966	690	853	77	104
Freeboard Achieved (m)	0.4	0.3	0.5	0.4	0.4	0.3
Depth of Weir Flow (m)	-	0.1	-	0.1	-	0.1

6.2.4 Sensitivity Analysis

In accordance with the requirements of QUDM Section 5.08.2, consideration has been given to the consequences of fully blocked outlets within each basin. Table 6.5 illustrates the expected peak water levels within each basin, should 50% blockage occur. In this event, water levels would increase and flows would be discharged over the high flow weir structures.

Table 6.5 Sensitivity Analysis Results for 0.01 AEP Event

Basin ID	Peak Water Level (m AHD)	Top of Bund (m AHD)	Depth of Weir Flow (m)
Basin A	45.80	46.0	0.20
Basin B	37.27	37.5	0.22
Basin D	57.74	58.0	0.14

Based on the proposed basin and weir configurations, peak water levels would not be expected to exceed the Top of Bund during the 0.01 AEP event for all three (3) basins. The expected maximum depth of flow over each weir has been modelled at less than 0.3 m.

6.2.5 QUDM Design Safety Standards – Inlet Grates

In accordance with Section 12.3 of the Queensland Urban Drainage Manual an initial safety risk assessment has been undertaken to determine the need for mitigation measures to reduce risks for any of the proposed inlet headwalls. These include the following structures:

- The culverts (4 x 300 mm x 1200 mm box culverts) underneath the internal road within Catchment A2a that convey flows from the natural channel underneath the internal road; and
- The culverts 2 x 525 mm which outlet through the Basin A bund.

This risk assessment has identified a cumulative score of 8 and 11 for the proposed box culverts and 2 x 525 mm stormwater structures respectively. In both scenarios Case 3 mitigation options are applicable in accordance with table 12.3.7 of QUDM.

Case 3 mitigation measures are described as:

> *Appropriate inlet screens should ideally be placed on stormwater inlets with openings that exceed a diameter of 300 mm, or a slot width of 125 mm wherever practical. However, the appropriate management of debris blockage issues and associated flooding risks could prevent the use of inlet screens in some cases. In such cases, consider the use of fencing (i.e. exclusion fencing or barrier fencing) to restrict access to the upstream channel.*
>
> *The placement of inlet screens on culverts and large stormwater pipes should generally only be considered as a last option if access to the upstream channel cannot be severely restricted and/or the safety risks associated with the culvert/pipe cannot be otherwise mitigated.*
>
> *Warning signs should be used liberally.*

Given the potential safety risk associated with the above conduits inlet screens have been recommended, and are to be designed in accordance with Section 12.5 of QUDM. Additionally, warning signages have been specified within the by-pass pond of Basin A (Refer to DWG-340 of the stormwater drawing set contained in Appendix B). Further assessment of the before mentioned structures and features to reduce safety risks will be provided as part of detailed design.

6.3 Lawful Point of Discharge

The criteria for determining a Lawful Point of Discharge (LPD) as specified within the Queensland Urban Drainage Manual (2016) is as follows:

(i) Will the proposed development alter the site's stormwater discharge characteristics in a manner that may substantially damage a third party property?

- If not, then no further steps are required to obtain tenure for a lawful point of discharge (assuming any previous circumstances and changes were lawful).
- If there is a reasonable risk of such damage then consider (ii) or (iii).

(ii) Is the location of the discharge from the development site under the lawful control of the local government or other statutory authority from whom permission to discharge has been received? This will include a park, watercourse, drainage or road reserve,

stormwater registered drainage easement, or land held by local government (including freehold land).

- If so, then no further steps are required to obtain tenure for a lawful point of discharge
- If not, then consider issue (iii). A land owner or regulator may require that the developer obtain an authority to discharge as described in (iii) in order for the stormwater to ultimately flow to a location described in (ii).

(iii) An authority to discharge over affected properties will be necessary. In descending order of certainty, an authority may be in the form of:

- Dedication of a drainage reserve or park;
- A registered easement for stormwater discharge/works; or
- Written approval.

The locations of the proposed points of discharge for each stormwater outlet are shown on Drawing DWG-200 – Appendix B. All the points of discharge have been aligned and designed so as to not result in any impacts that would substantially damage a third party property.

6.4 Quality Control – Pollutant Reduction

In accordance with the State Planning Policy for Healthy Waters and the Queensland Water Quality Guidelines (2009), treatment measures have been included to achieve the minimum mean annual load based reductions of 80% for Suspended Sediment; 60% for Total Phosphorus, 45% for Total Nitrogen; and 90% for Gross Pollutants.
The Model for Urban Stormwater Improvement Conceptualisation (*MUSIC v6*) has been used to estimate the potential pollutant loads generated by the development and to size the proposed treatment measures. The following sections outline the parameters relied upon within the *MUSIC v6* modelling.

6.4.1 Rainfall and Evapotranspiration Data

Rainfall and evapotranspiration data has been obtained from the Bureau of Meteorology (BOM) rainfall station and is included within Table 6.6 below.

Table 6.6 Meteorological and Rainfall Runoff Data Reporting

Station	40584 Hinze Dam
Period	1/01/1976 to 31/12/1985 (10 years)
Time step	6 minute
Mean annual rainfall (mm)	1371
Evapotranspiration	1539

6.4.2 Developed Case - Catchment Parameters

The developed site has been modelled as an Urban Residential Land use. Each internal catchment has been split into roof, road and ground level source nodes. Table 6.7 summarises the sub-catchment areas and Drawing DWG-210 – Appendix B presents the sub-catchment delineation. The pollutant export and runoff parameters for each sub catchment adopted is based on the data from the Water by Design *MUSIC v6* Modelling Guidelines (2010), as summarised in Table 6.8 and 6.9.

Table 6.7 *MUSIC v6* Sub-Catchment Areas

Catchment ID	Land Use	Area (ha)	Total Impervious (%)
Catchment A2a	Urban Residential - Road	0.72	60
	Urban Residential - Roof	0.80	100
	Urban Residential - Ground Level	1.63	20
Catchment A2b	Urban Residential - Road	0.78	60
	Urban Residential - Roof	0.97	100
	Urban Residential - Ground Level	1.00	20
Catchment B	Urban Residential - Road	1.45	60
	Urban Residential - Roof	1.70	100
	Urban Residential - Ground Level	1.50	20
Catchment C	Urban Residential - Road	0.45	60
	Urban Residential - Roof	0.80	100
	Urban Residential - Ground Level	1.04	20
Catchment D	Urban Residential - Road	0.47	60
	Urban Residential - Roof	0.47	100
	Urban Residential - Ground Level	0.69	20

Table 6.8 Rainfall Runoff Parameters

Parameter	All Nodes
Land use	Residential
Rainfall threshold (mm)	1
Soil storage capacity (mm)	500
Initial storage (% capacity)	10
Field capacity (mm)	200
Infiltration capacity coefficient a	211
Infiltration capacity exponent b	5.0
Initial depth (mm)	50
Daily recharge rate (%)	28
Daily baseflow rate (%)	27
Daily deep seepage rate (%)	0

Table 6.9 Pollutant Export Parameters

Flow Type	Surface Type	Total Suspended Solids (log mg/L)		Total Phosphorous (log mg/L)		Total Nitrogen (log mg/L)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Urban Residential							
Base Flow	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Road	1.00	0.34	-0.97	0.31	0.20	0.20
	Ground	1.00	0.34	-0.97	0.31	0.20	0.20
Storm Flow	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
	Road	2.43	0.39	-0.30	0.31	0.26	0.23
	Ground	2.18	0.39	-0.47	0.31	0.26	0.23

6.4.3 Treatment Measures

In order to determine the design requirements for the necessary stormwater treatment measures, key "Treatment Nodes" were added to the *MUSIC v6* model. The following sections outline the modelling parameters relied upon for each "Treatment Node".

Buffers & Grassed Channel

It is noted that there are two (2) minor areas within Catchment A2a and C (identified as 'untreated area' in the MUSIC Catchment Plan – DWG 210, Appendix B) which are unable to be directed to the proposed bioretention measures. These areas include a grassed batter within A2a, and four (4) lots within Catchment C. In order to treat these areas treatment has been proposed via grassed buffers (the batter and ground area from the four (4) lots in Catchment C) and a grassed swale that will form a drainage easement.

The buffer strip will reduce sediment loads by slowing stormwater flow and causing coarse sediments to fall out of suspension.

Key buffer design parameters include:

- Even distribution of flow onto the buffer;
- Avoiding rilling or channelled flows;
- Maintaining flow depths less than vegetation heights; and
- Minimising the slope of the buffer to below 5%.

Table 6.10 presents the buffer parameters relied upon for the purpose of MUSIC modelling.

Table 6.10 Buffer Parameters

Parameter	Parameter Settings
Upstream area buffered (%).	50
Buffer area (% upstream impervious area)	5
Exfiltration rate (mm/hr)	0

The drainage easement that runs along the rear of lots 294, 293 and the eastern boundary of lot 146 has been designed as a grassed channel to convey flows from a portion of these lots to Mackellar Drive . The channel will be vegetated (grassed) and therefore help to reduce sediment loads by slowing stormwater and causing sediments to fall out of suspension and as such has

been modelled as a grassed swale. Table 6.11 summaries the parameters used within the *MUSIC v6* modelling undertaken for the subject site.

Table 6.11 Grass Channel Parameters

Grass Swale Parameters	Parameter Settings
Length (m)	20
Bed Slope	1:5
Base Width (m)	0.3.
Top Width (m)	3
Depth (m)	0.30
Vegetation Height (m)	0.25
Exfiltration Rate (mm/hr)	0

Bioretention

It is proposed that bioretention measures be incorporated into the development layout to provide the necessary load-based reductions. Bioretention systems operate by capturing and retaining water in an extended ponding area (no more than 400 mm deep for a maximum of four (4) days to prevent anaerobic conditions, plant death and insect breeding), before filtering through a soil media. The devices remove pollutants via the following physical processes:

- Sedimentation in the extended detention storage;
- Filtration by filter media;
- Nutrient uptake by biofilms;
- Nutrient adsorption and pollutant decomposition by soil bacteria; and
- Adsorption of metals and nutrients by filter particles (Somes & Crosby, 2007).

In accordance with Water by Design Guidelines, Table 6.12 summarises the treatment node parameters used in the *MUSIC v6* modelling whilst Figure 6.10 provides typical design parameters for the proposed bioretention devices.

Table 6.12 Bioretention Parameters

Parameter	Bioretention A	Bioretention B	Bioretention C	Bioretention D
Surface area (m^2)	2 x 320	470	205	165
Extended detention depth (m)	0.3	0.3	0.3	0.3
Filter area (m^2)	2 x 290	420	175	140
Unlined filter media perimeter (m)	0.01	0.01	0.01	0.01
Saturated hydraulic conductivity (mm/hr)	200	200	200	200
Filter depth (m)	0.7	0.7	0.5	0.5
TN content of filter media (mg/kg)	400*	400*	400*	400*
Proportion of organic material in filter (%)	< 5	< 5	< 5	< 5
Orthophosphate content of filter media (mg/kg)	30*	30*	30*	30*
Is the base lined?	Yes	Yes	Yes	Yes
Effectiveness of plant TN removal	Effective	Effective	Effective	Effective
Overflow weir width (m)	Surface Area/10	Surface Area/10	Surface Area/10	Surface Area/10

Exfiltration rate (mm/hr)	0.00	0.00	0.00	0.00
If an exfiltration rate has been used, have node water balance losses been used in calculation of treatment train effectiveness?	N/A	N/A	N/A	N/A
If exfiltration rate has been used, is the exfiltration rate justified?	N/A	N/A	N/A	N/A
Underdrain present?	Yes	Yes	Yes	Yes
Submerged zone with carbon present?	No	No	No	No
Depth of submerged zone (m)	N/A	N/A	N/A	N/A
Confirmation that K and C* remain default?	Yes	Yes	Yes	Yes
Sediment Forebay Required (>2.5 ha contributing catchment)	Yes	Yes	No	No

*As per Healthy Land and Water Recommendations for *MUSIC v6* modelling

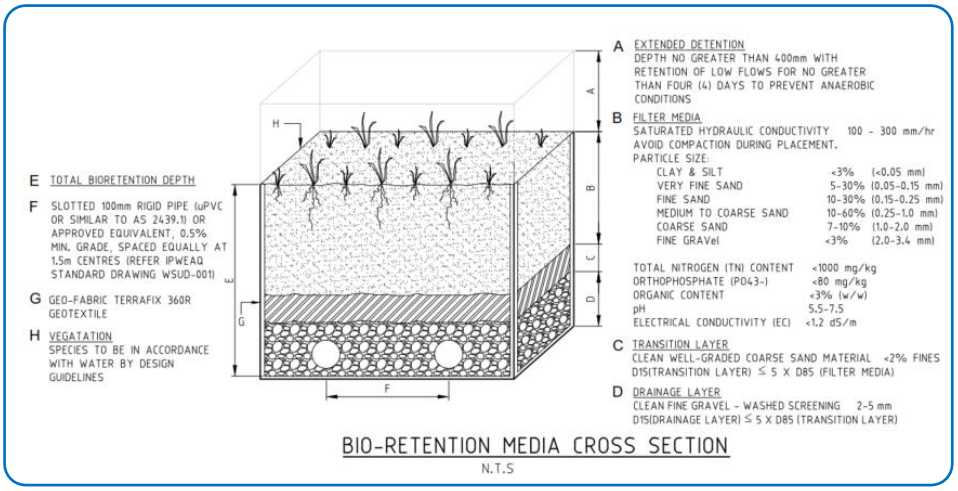


Figure 6.10 Bioretention specifications

Coarse Sediment Forebay

As the contributing catchment to bioretention basins A2a, A2b, B and C will greater than 2 ha a coarse sediment forebay will be installed at each piped discharge point into the bioretention basin. The forebay will limit sediment accumulation over the bioretention filter surface and reduce the potential for clogging. This will also help to reduce the frequency of maintenance required for the bioretention systems. Table 6.13 provides a summary of the sediment forebay calculations and requirements. The sediment forebays have been excluded from the *MUSIC v6* modelling. It is noted that basin A has two (2) inlet points.

Table 6.13 Sediment Forebay Parameters

Forebay ID	Contributing Catchment Area (ha)	Q_{3month} Inflow Rate (m^3/s)	Settling Velocity (m/s)	Area (m^2)	Depth (m)	Capture Efficiency (%)
A2a	2.97	0.33	0.1	40	0.15	80
A2b	2.86	0.31	0.1	36	0.15	80
B	4.79	0.51	0.1	58	0.15	80
C	2.29	0.25	0.1	30	0.15	80

6.4.4 Bioretention Basin Staged Construction and Establishment

In accordance with the Water by Design Construction and Establishment Guidelines: Swales Bioretention Systems and Wetlands (C & E Guidelines), inflow of sediment-laden runoff during the building stage is a major risk to the successful and long-term functioning of bioretention systems.

During the building phase of developments, sediment can seal the surface of the filter media, move into and clog the filter media and accumulate in the under-drainage. Within the C & E Guidelines, there are four (4) options recommended to overcome the challenges associated with delivering bioretention systems. These generally include the following options:

- Option 1: Surface Protection
- Option 2: Bypass flows and early establishment of vegetation;
- Option 3: Sediment basin and bioretention function; and
- Option 4: Leave as sediment basin.

Any of the above options will ensure adequate protection of the bioretention during the building phase and are suitable for implementation.

It is proposed that the Option 4 method for staged construction and establishment be implemented for the proposed development. This method will generally include the following:

- Earthworks and bulking out of basin;
- Install the hydraulic structures;
- Allow system to operate as a sediment basin during the building phase; and
- When 80-90% of building in the catchment is complete, the bioretention system can be cleaned and profiled, the under-drainage and bioretention media installed, and the vegetation planted and established.

For details of the procedure and order of construction for Option 4 method please refer to Section 3.10 (Steps 1-41) of the C& E Guidelines. If an alternative option is found to be more suitable for the site, construction methods and steps should be referenced from the C & E Guidelines.

It is noted that the methodologies of construction listed above are for the sole purpose of protection of the bioretention measures during the construction phase. It is expected that all active building/construction sites will be subject to independent Erosion and Sediment Control measures and plans.

Modelling Results

Results of the *MUSIC v6* modelling for the treatment train effectiveness are summarised in Table 6.14. The results indicate the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and gross pollutants respectively are achieved for the rainfall data set simulated at both assessment points. Screen captures of the *MUSIC v6* modelling results are included as Figures 6.11 to 6.13.

Table 6.14 Treatment Train Effectiveness

Catchment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction (kg/yr)	Reduction Achieved (%)	Water Quality Objective (%)
Northern	TSS	15,700	3,000	12,700	**80.9**	80
	TP	32.7	8.84	23.86	**73.0**	60
	TN	195	95.9	99.1	**50.9**	45
Southern	TSS	5,560	1,110	4,450	**80.0**	80
	TP	11.7	3.35	8.35	**71.3**	60
	TN	71.4	36.8	34.6	**48.5**	45
Combined	TSS	21,300	4,120	17,180	**80.7**	80
	TP	44.4	12.2	32.2	**72.5**	60
	TN	267	133	134	**50.3**	45

NOTE: All simulations have been run with pollutant export estimation set to “stochastic generation”.

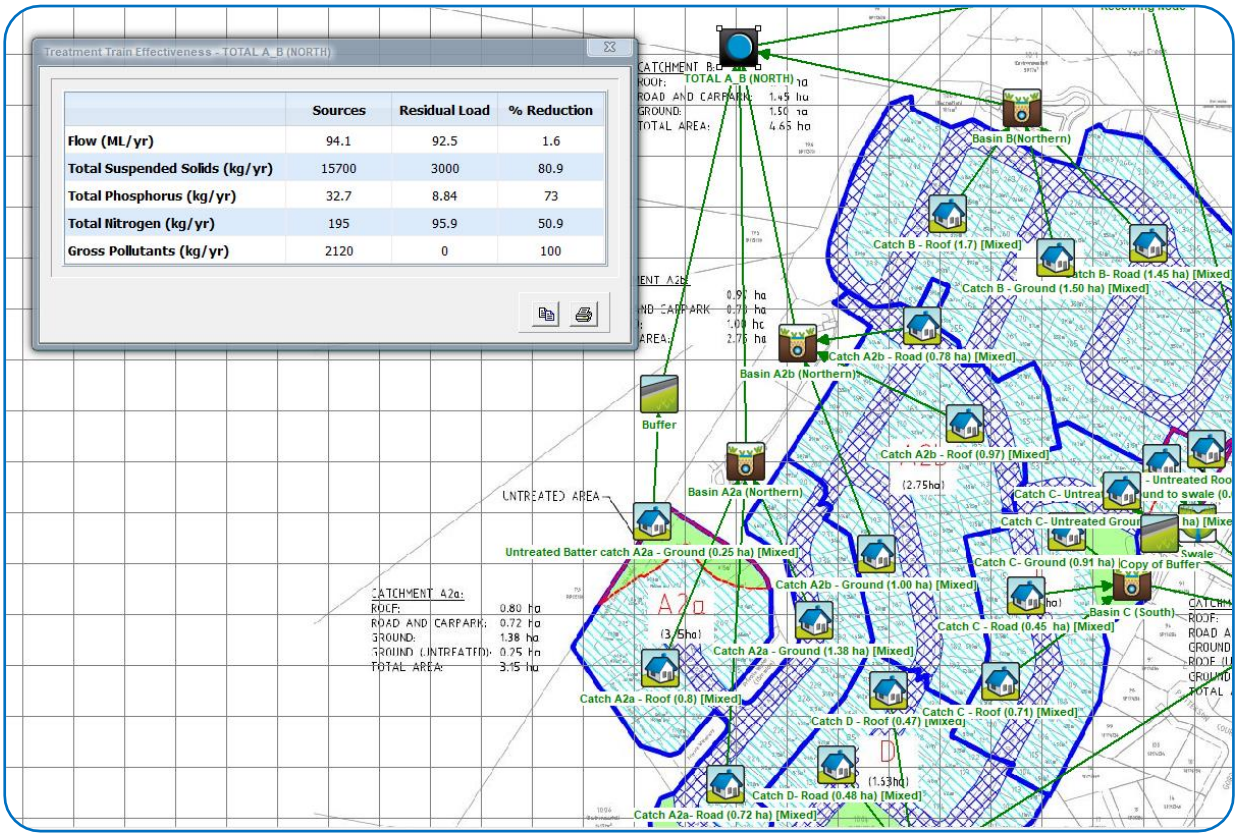


Figure 6.11 Screen Capture of MUSIC Modelling Results (Northern)

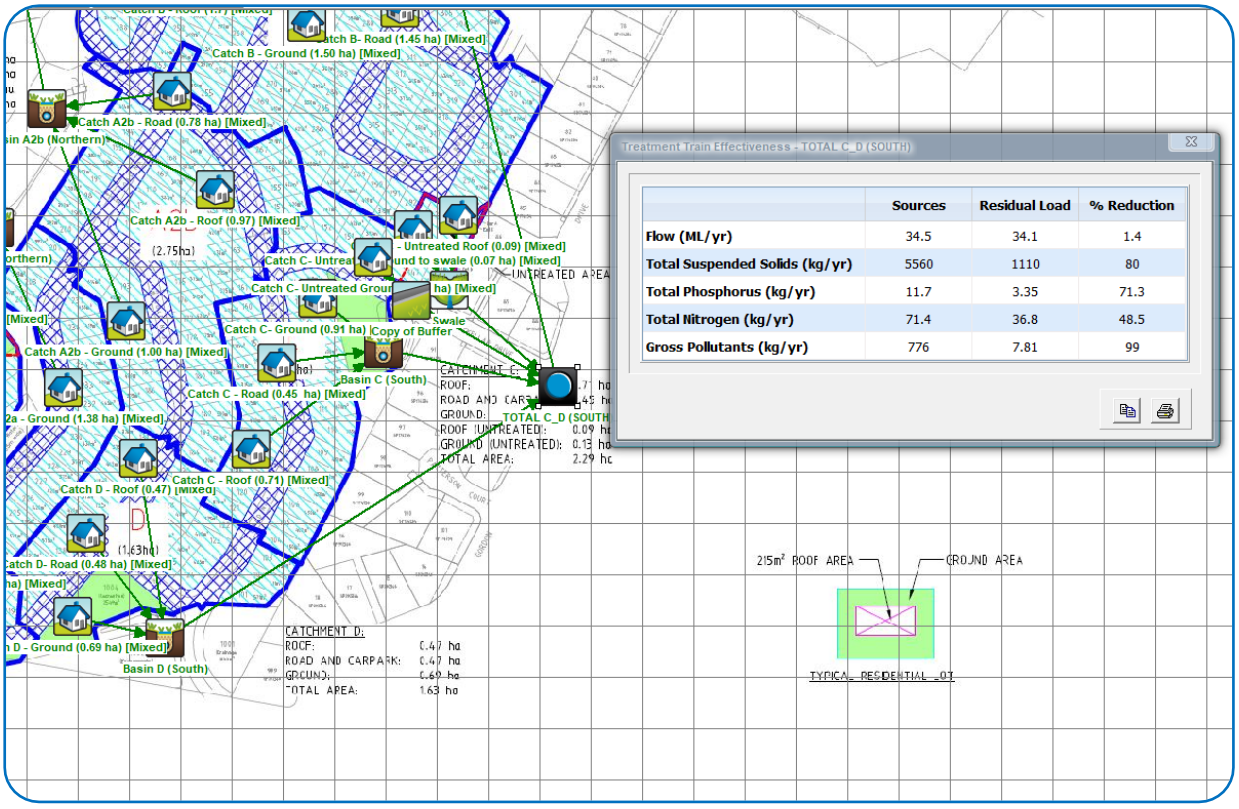


Figure 6.12 Screen Capture of MUSIC Modelling Results (Southern)

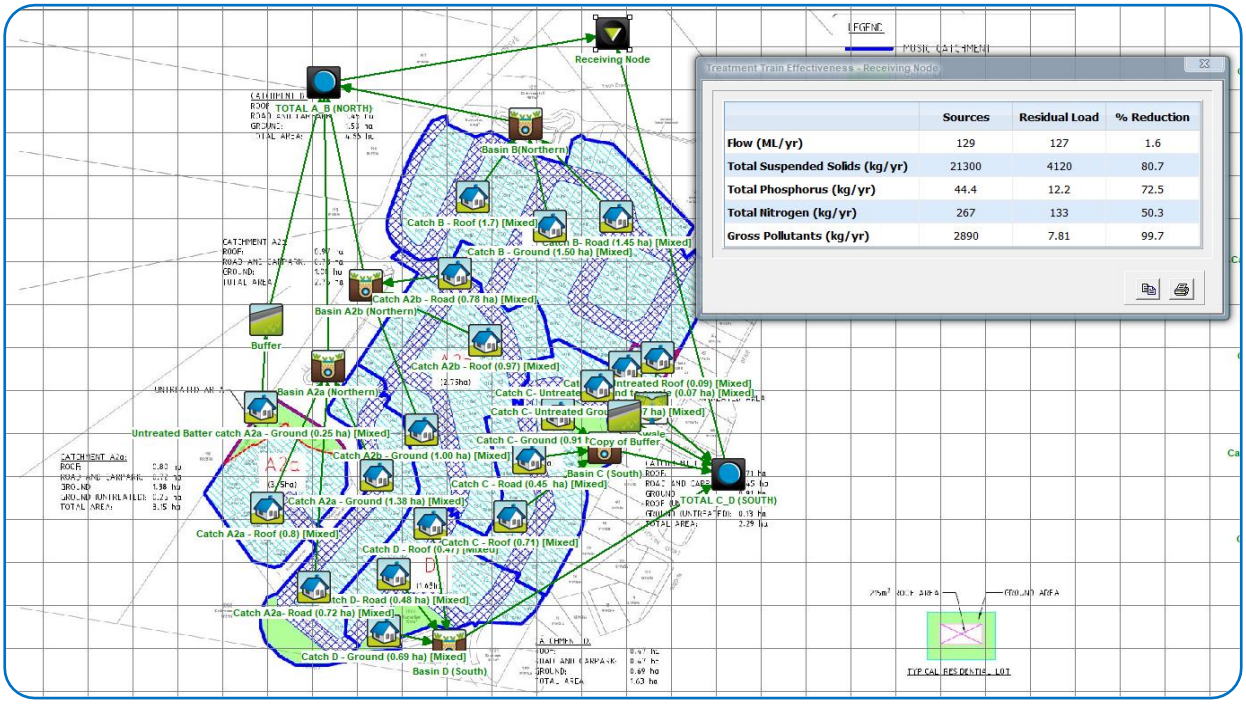


Figure 6.13 Screen Capture of MUSIC Modelling Results (Combined)

6.5 Water Quality Monitoring and Maintenance

In order to ensure that the stormwater management measures detailed within this management plan function correctly in the long term and to ensure that impacts to downstream receiving environments are mitigated, appropriate operational phase water maintenance and monitoring is to be undertaken. The following sections detail the minimum requirements for each specific control device.

6.5.1 Operational Phase Water Quality Monitoring

Monitoring during the operational phase will be undertaken to determine the impact of activities on the receiving waters. Surface water quality monitoring is to be undertaken at discharge points from the site. Samples should be collected for total suspended solids (TSS), pH, dissolved oxygen (DO), TP, TN and hydrocarbons. Sampling is to be performed in accordance with procedures set out in the Environmental Protection Authority's Water Quality Sampling Manual. A NATA registered laboratory is to be used to analyse the collected samples.

Table 6.15 specifies the parameters and sampling frequencies required. Results of the monitoring program are to be compiled monthly into an ongoing Water Quality Monitoring Report. A copy of the report and monitoring data is to be maintained at all times.

Table 6.15 Operational Phase Water Quality Parameters and Sampling Frequencies

Sampling Parameter	Sampling Frequency
Total Suspended Solids (TSS)	Water quality monitoring will be completed following a rainfall event of 25 mm or greater in any 24 hour period monthly for a minimum period of 12 months, or as specified by the Local Authority conditions of approval for the development.
pH	
Dissolved Oxygen (DO)	
TN	
TP	
Hydrocarbons	

Table 6.16 sets the water quality criteria for discharge water realised from the development site.

Table 6.16 Operational Phase Water Quality Discharge Criteria

Water Quality Parameter	Discharge Criteria
Total Suspended Solids (TSS)	No net deterioration of the downstream receiving environment as a result of discharge from the development.
Turbidity (NTU)	
pH	
DO	
TN	
TP	
Hydrocarbons	

6.6 Operational Phase Device Maintenance

In order for each of the proposed stormwater treatment devices to achieve the necessary pollutant removal efficiencies regular maintenance is necessary. Poorly maintained devices will result in under performance and in some instances may cause leaching of pollutants to downstream receiving environments. Based on the proposed treatment train Table 6.17 details appropriate maintenance regimes for each treatment device.

Table 6.17 Operational Phase Device Maintenance Requirements

Treatment Device	Maintenance Action
Grassed Swales	Routine inspection to identify obvious increased sediment deposition. Remove sediment when flow within the swale is impeded or smothering of vegetation occurs. If necessary reprofile swale and revegetate.
	Regular watering of vegetation until plants are established.
	Mowing of grass or slashing of vegetation to preserve the optimal design height.
	Removal and management of invasive weeds.
	Removal and replacement of dead and dying vegetation.
	Regular inspection and removal of litter and gross pollutants.
Bioretention	Routine inspection to identify obvious increased sediment deposition. Remove sediment when flow within the bioretention is impeded or smothering of vegetation occurs.
	Routine inspection of inlet and outlet pit to identify any areas of scour, litter build up or blockages.
	Tilling of the bioretention surface if there is evidence of clogging.
	Regular watering of vegetation until plants are established.
	Removal and management of invasive weeds.
	Removal and replacement of dead and dying vegetation.
	Regular inspection and removal of litter and gross pollutants.
	Resetting (i.e. complete reconstruction) of the bioretention will be required if the flow within the bioretention system is reduced by 25% due to an accumulation of sediment.
Detention Basin Area	Routine inspection to identify obvious increased sediment deposition. Remove sediment if there is any sign of smothering of vegetation. If necessary reprofile base and revegetate.
	Routine inspection of inlet and outlet structures to identify any areas of scour, litter build up or blockages.
	Regular watering of vegetation until plants are established.
	Removal and management of invasive weeds.
	Removal and replacement of dead and dying vegetation.
	Regular inspection and removal of litter and gross pollutants.
Inlet/Bypass Pond	Routine inspection to identify obvious increased sediment deposition. Remove sediment accumulation at inflow points. If sediment accumulation occurs within pond to a depth . 50% removal and reprofile base if necessary.
	Routine inspection of inlet and outlet structures to identify any areas of scour, litter build up or blockages.
	Regular watering of vegetation until plants are established.
	Removal and management of invasive weeds.
	Removal and replacement of dead and dying vegetation.
	Regular inspection and removal of litter and gross pollutants.

All material removed during maintenance, whether solid or liquid, is to be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

7 Hydraulic Assessment

The 1D - 2D hydrodynamic flood model TUFLOW has been utilised to route stormwater through the upper reaches of Yaun Creek and the other minor streams which cross the site. This modelling will confirm:

- The extent of flooding from Yaun Creek;
- The effect of the proposed earthworks on this flooding; and
- Sizes of infrastructure required to route flood flows through the site.

7.1.1 Modelling Procedure

To simulate the peak flow behaviour within the catchment and quantify peak flood depths, discharges, and flow velocities, hydraulic modelling using the 1D/2D hydrodynamic model *TUFLOW* was undertaken. This involved the insertion of inflow hydrographs into the model upstream of the site. The hydrographs have been calculated using *WBNM* software as described in the following sections. Pre-development and post-development scenarios have been modelled using LiDAR and proposed earthworks data respectively.

7.2 Hydrology – *WBNM*

WBNM hydrological software has been utilised to generate hydrographs to represent the contributing catchments. WBNM is a software package which calculates flood runoff from rainfall hyetographs, utilising sub-catchments and flow routings to estimate flood flows at various points within the catchment.

Hydrographs were generated for nominated Annual Exceedance Probability's (AEP)'s with peak discharges derived from the output hydrographs. The following sections detail the catchment parameters used in the *WBMN* modelling.

7.2.1 Design Rainfall

Rainfall data for this report has been based on site specific Intensity-Frequency-Duration (IFD) data acquired from the Bureau of Meteorology summarised in Figure 7.1.

Intensity-Frequency-Duration Table

Location: 27.875S 153.275E Issued: 21/6/2017

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

	Average Recurrence Interval						
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	125	158	193	212	239	275	301
6Mins	117	148	181	199	225	258	284
10Mins	96.0	122	149	164	186	214	235
20Mins	70.4	89.3	110	122	138	159	175
30Mins	57.4	72.9	90.1	99.8	113	131	144
1Hr	38.9	49.5	61.7	68.6	78.1	90.6	100
2Hrs	25.2	32.2	40.5	45.3	51.8	60.3	66.8
3Hrs	19.2	24.7	31.2	35.0	40.2	46.9	52.1
6Hrs	12.1	15.6	20.0	22.5	26.0	30.5	34.0
12Hrs	7.78	10.1	13.0	14.8	17.1	20.3	22.7
24Hrs	5.19	6.73	8.80	10.1	11.7	13.9	15.6
48Hrs	3.48	4.53	5.98	6.87	8.04	9.59	10.8
72Hrs	2.65	3.46	4.61	5.30	6.23	7.45	8.42

(Raw data: 50.05, 10.04, 3.48, 89.57, 19.77, 7.33, skew=0.08, F2=4.41, F50=17.18)

© Australian Government, Bureau of Meteorology

Figure 7.1 Adopted Intensity Frequency Data (mm/hr)

7.2.2 Temporal Patterns

Temporal patterns applied to the rainfall data have been extracted from Australian Rainfall and Runoff (1987) for Zone 3. Storm durations of 25, 60, 90, 120, 180, 360, 540, 720, 1440, and 1800 minutes have been analysed for each AEP.

7.2.3 Design Storm Events

This report has analysed a range of storm events which simulate the rainfall from hypothetical storms based on an Average Exceedance Probability (AEP). Table 7.1 lists each modelled AEP storm event and the corresponding Average Occurrence Interval (ARI) and description.

Table 7.1 Design Storm Events

Annual Exceedance Probability (AEP)	Average Occurrence Interval (ARI)	Storm Description
0.632	1 year	Storm rainfall total has a 63.2% probability of being exceeded in any one year
0.393	2 years	Storm rainfall total has a 39.3% probability of being exceeded in any one year
0.181	5 years	Storm rainfall total has a 18.1% probability of being exceeded in any one year
0.095	10 years	Storm rainfall total has a 9.5% probability of being exceeded in any one year
0.049	20 years	Storm rainfall total has a 4.9% probability of being exceeded in any one year
0.02	50 years	Storm rainfall total has a 2% probability of being exceeded in any one year
0.01	100 years	Storm rainfall total has a 1% probability of being exceeded in any one year

7.2.4 Land Uses

The land uses within each sub-catchment have been used to determine the impervious fraction relied upon in hydrological modelling. The land use parameters for this study are based upon the City of Gold Coast planning scheme assuming fully developed catchments. Table 7.2 below summarises the percentage impervious adopted for each land use type.

Table 7.2 Fraction Impervious

Land Use Type	Fraction Impervious (%)
Open Space	0
Low Density Urban	40
Rural	20

7.2.5 Infiltration Losses

Infiltration parameters applied to catchments simulate the volume of runoff lost into the soil as initial and continuing values. For the upstream catchment, values of 5 mm initial and 2.5 mm/hr continuing have been applied globally. These values are consistent with recommendations in *Australian Rainfall and Runoff (1987).*

7.2.6 *WBNM* Parameters

The *WBNM* parameters chosen for the hydrological modelling have been chosen in accordance with the *WBNM* documentation with reference to the specific characteristics of the catchment. These values control the sub-catchment lag and routing within each sub-catchment of the model and are listed in Table 7.3 below.

Table 7.3 WBNM Parameters

Parameter	Value
Catchment Lag Parameter	1.6
Impervious Lag Factor	0.1
Stream Lag Factor	1

7.2.7 Catchment Delineation

The hydrological assessment analysed the total catchment of Yaun Creek and delineated catchments based on:

- LiDAR survey obtained from the Department of Natural Resources and Mines; and
- land uses based on Council mapping and aerial photography.

A total catchment area of approximately 150 ha was delineated based on 22 sub-catchments. The area of each sub-catchment is shown within Table 7.4. Figure 7.2 illustrates the catchment location and extent.

Table 7.4 Catchment Characteristics

Catchment ID	Catchment Area (ha)	Fraction Impervious (%)
A	7.843	10
B	4.07	10
C	6.507	5
D	6.354	10
E	6.843	5
F	5.654	10
G	1.983	10
H	4.481	5
I	6.978	5
J	8.565	0
K	4.221	0
L	9.895	0
M	7.573	0
N	8.199	0
O	11.068	0
P	6.273	0
Q	10.525	0
R	9.664	0
S	7.116	0
T	5.426	5
U	4.05	0
V	5.715	0

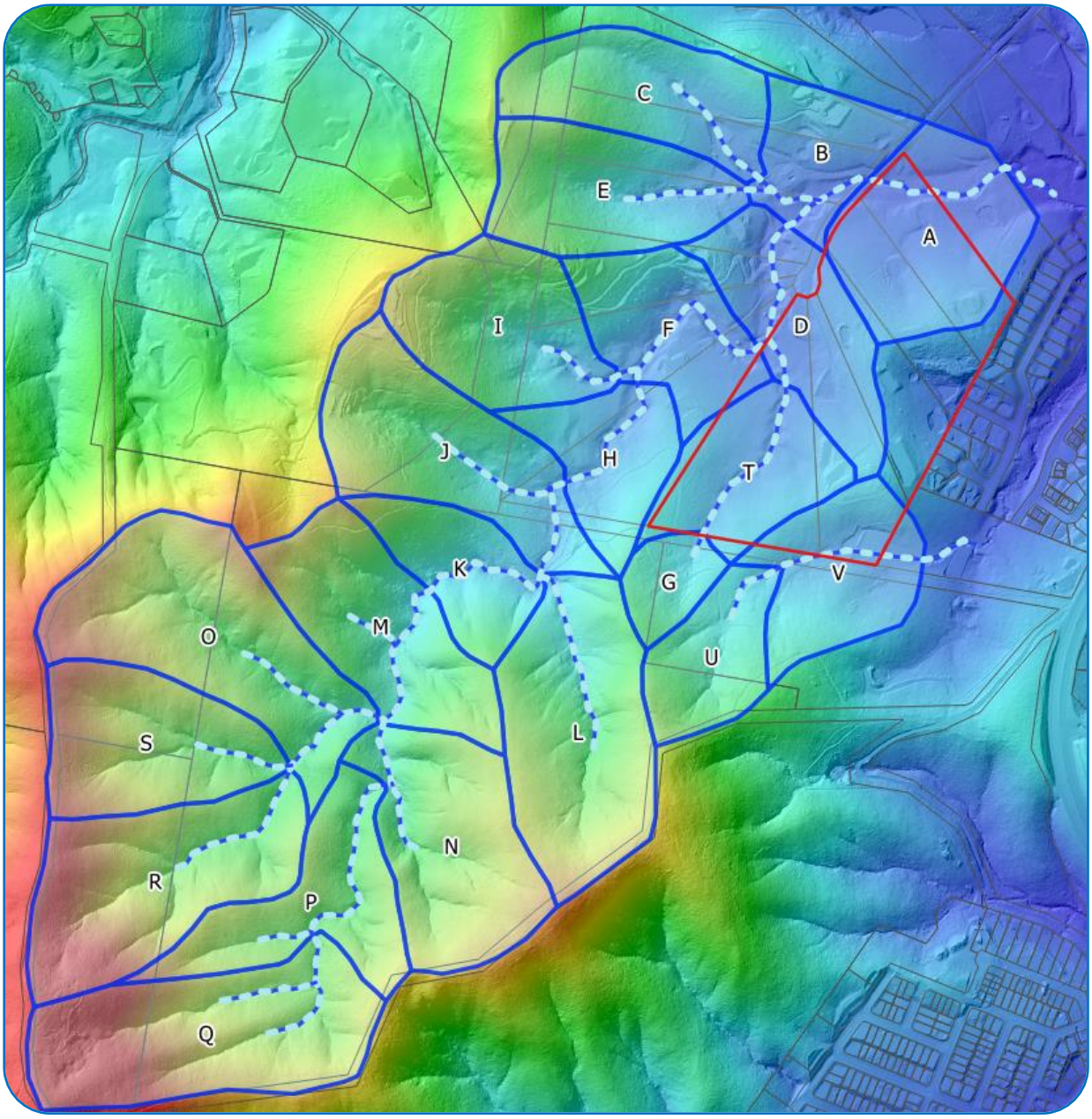


Figure 7.2 Catchment Plan

7.2.8 Critical Storm Duration

In order to determine the critical storm event for the Yaun Creek catchment, *WBNM* was relied upon to identify the storm duration that produced the highest peak flow immediately downstream of the site. Table 7.5 below presents the results of this assessment and concludes that the 90 minute duration storm is critical. Figure 7.3 presents the hydrographs for each duration.

Table 7.5 Critical Storm Durations

AEP	0.01 AEP Peak Flow (m^3/s)	Storm Duration (mins)
0.01	13.85	25
0.01	24.21	60
0.01	25.90	90
0.01	25.73	120
0.01	24.20	180
0.01	20.42	360
0.01	21.30	540
0.01	18.84	720
0.01	22.77	1440
0.01	17.85	1880

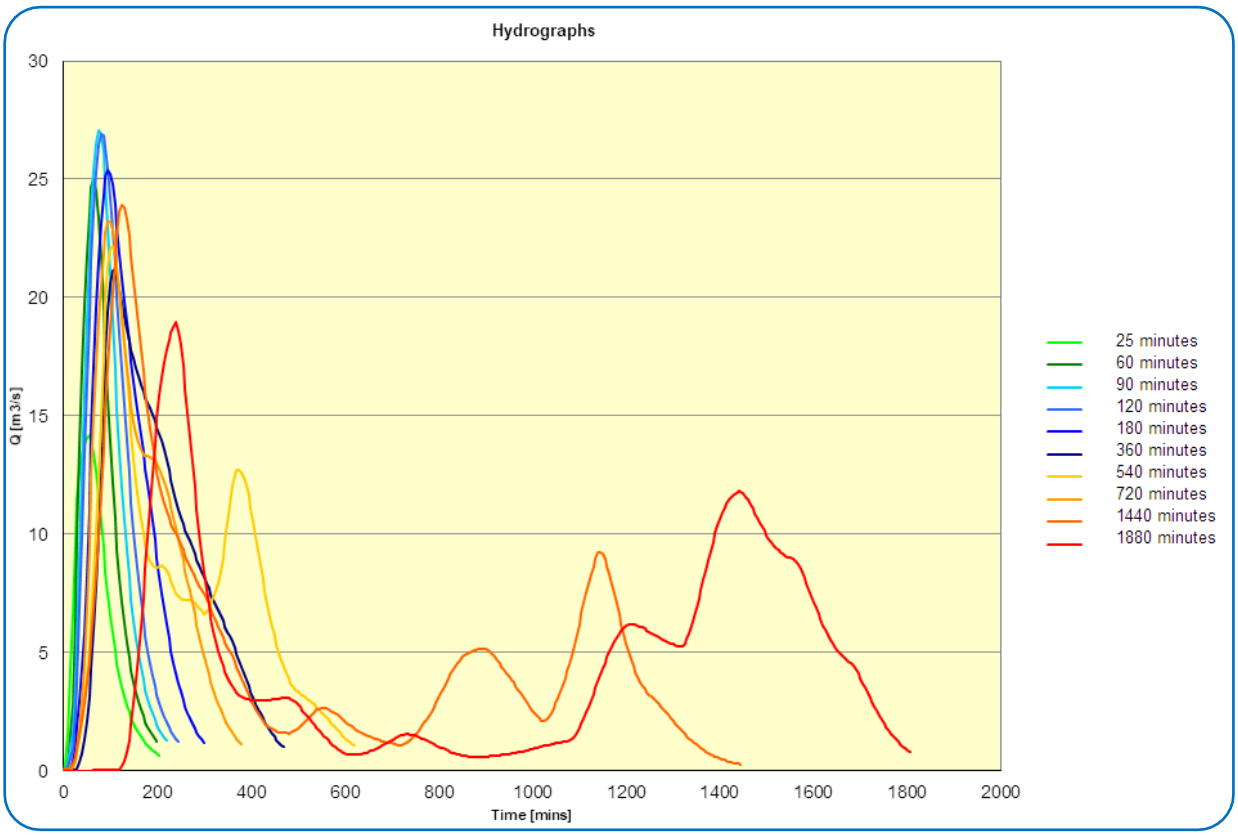


Figure 7.3 All Storm Duration Hydrographs – 0.01 AEP

7.2.9 Calculated Peak Flows

The expected inflow peak discharges generated for the critical storm event were extracted from the catchment hydrographs generated within *WBMN*. The peak result for each catchment are summarised within Table 7.6 below.

Table 7.6 *WBMN* Peak Catchment Discharge – 0.01 AEP

Catchment ID	Peak Flow (m^3/s)
A	2.819
B	1.586
C	2.316
D	2.351
E	2.419
F	2.123
G	0.83
H	1.67
I	2.461
J	2.799
K	1.529
L	3.154
M	2.526
N	2.7
O	3.457
P	2.153
Q	3.318
R	3.093
S	2.397
T	1.977
U	1.474
V	1.989

7.3 Hydraulics – *TUFLOW*

7.3.1 Digital Terrain Model (DTM)

The pre-development modelling scenario has relied upon LiDAR data of the site and contributing catchments. The post-development scenario utilises the preliminary civil design DTM provided by Mortons Urban Solutions. The proposed earthworks extends into the Yaun Creek inundation area on the western side of the site. The small catchment to the south of the site is to be routed through the site within a channel and culverts located midway through the channel underneath the internal road. The flowpath in the south-eastern corner of the site is to be piped under the proposed road.

7.3.2 Downstream Boundary Condition

The downstream boundaries of the model have been applied as free draining outlets. This arrangement is considered appropriate due to the relative steepness of the flowpaths and the absence of regional flooding in the vicinity.

7.3.3 Manning's Coefficient

Based on recommendations from; *Chow. V. T, (1959) Open Channel Hydraulics*, *Tweed Shire Council Development Design Specification D5 (V1.4),* the following Manning Coefficients were applied:

- Concrete/Road: 0.020
- Open water: 0.030
- Grassed areas: 0.050
- Light Vegetation : 0.060
- Dense Vegetation: 0.080

Figure 7.4 below presents the *TUFLOW* model layout.

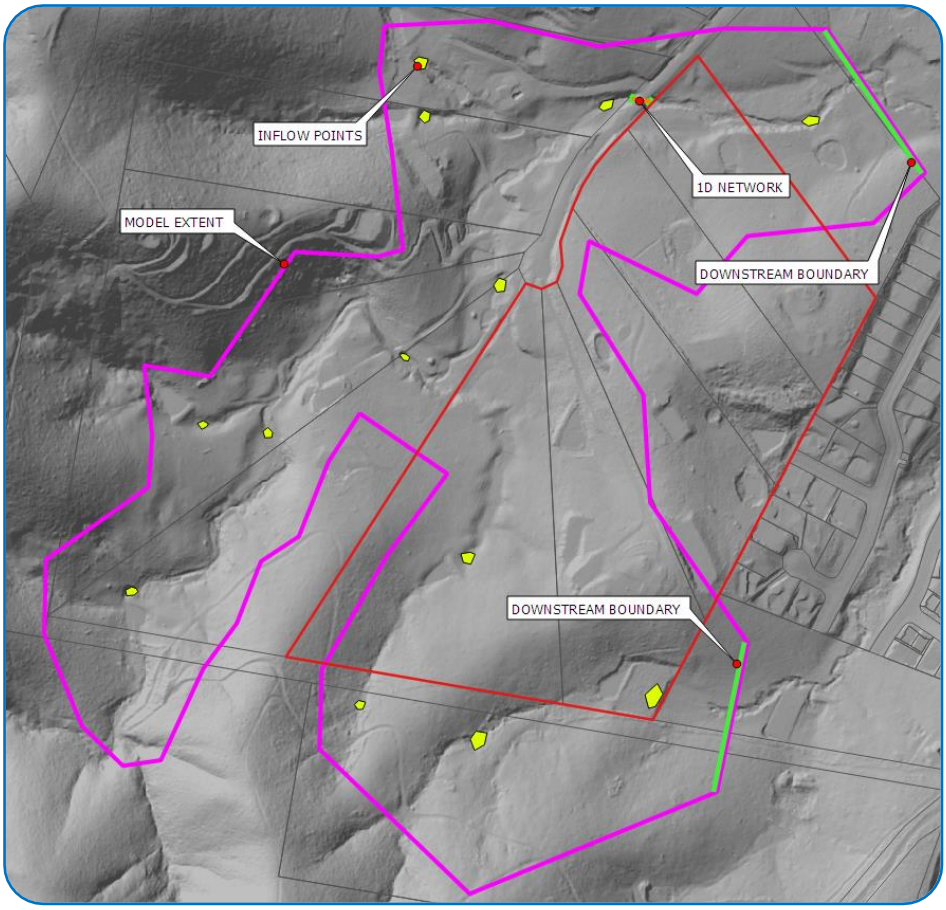


Figure 7.4 *TUFLOW* Model Layout

7.3.4 Hydraulic Model Simulation

Simulation of the adopted design storm events was undertaken based on:

- Applying the inflow hydrographs within the *TUFLOW* model; and
- Applying the appropriate downstream boundary condition to the hydraulic model.

Key model outputs describing flood behaviour include peak water levels, flows and velocities. Results of the hydraulic analysis have been presented in the following sections for the existing and design scenarios.

7.4 Modelling Results

The following sections provide a summary of the 2D modelling results for the pre and post-development scenarios.

7.4.1 Pre-Development Scenario

Pre-development flood depths and extents estimated by *TUFLOW* for the 0.01 AEP storm is presented in Figure 7.5 below. The existing flow regime can be described as follows:

- Yaun Creek briefly crosses the western edge of the site and then again in the northern corner downstream of Courtney Drive;
- Runoff from two external catchments to the south flow through the site; and
- Peak flood depths in Yaun Creek are approximately 3.6 m immediately upstream of Courtney Drive.

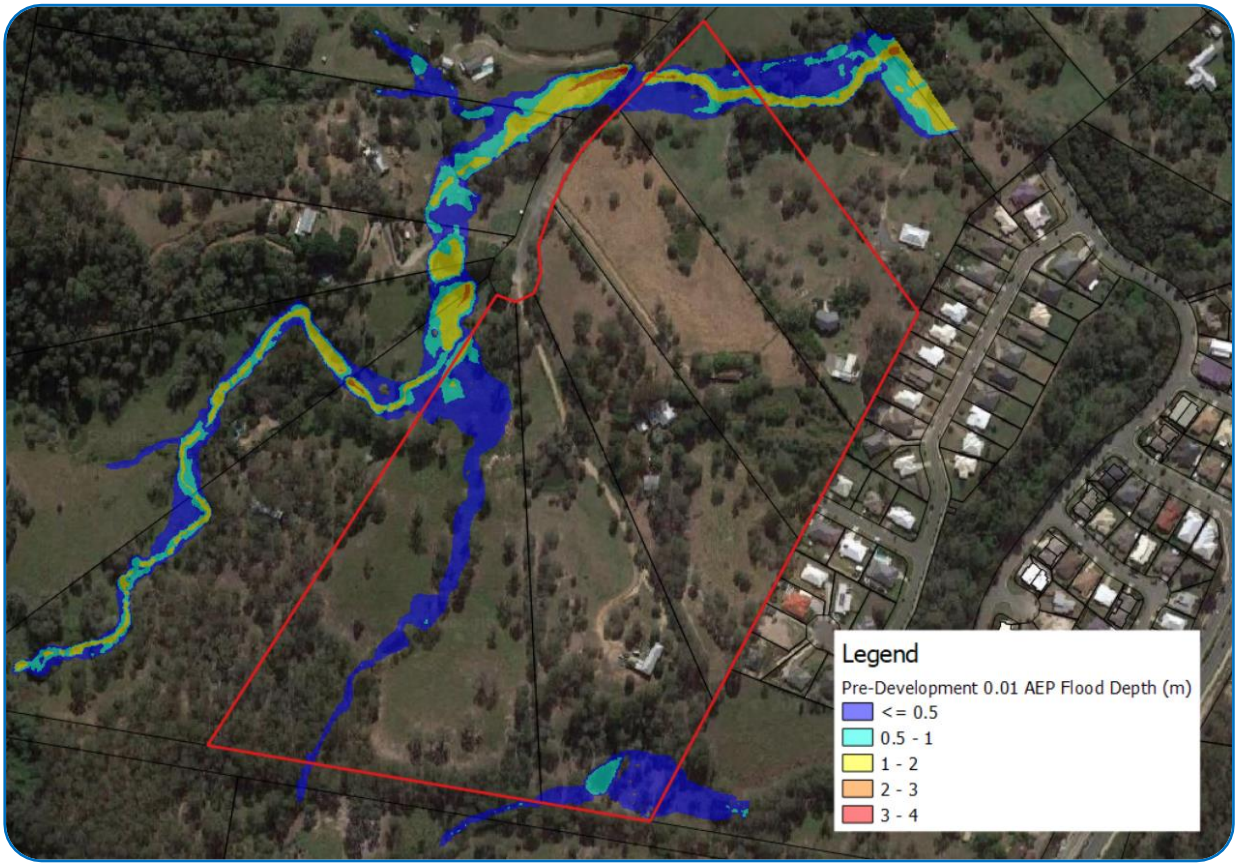


Figure 7.5 0.01 AEP Peak Flood Depth – Pre-Development

7.4.2 Post-Development Scenario

Post-development flood depths and extents estimated by *TUFLOW* for the 0.01 AEP storm are presented in Figure 7.6 below. Flow characterises in the post-development case can be summarised as follows:

- flow from Yaun Creek is in unimpeded by the proposed site earthworks;
- The south-western external catchment is routed through the site within a constructed channel with flows conveyed underneath the internal road via a set of four (4) 300mm x 1200mm box culverts located midway along the channel. The details of this overland flow are to be confirmed at the operational works design phase so as to ensure compliance with QUDM longitudinal flow requirements;
- The south eastern catchment is routed around the proposed development to the Council controlled park area; and
- Peak flood depths in Yaun Creek are approximately 3.6 m immediately upstream of Courtney Drive.

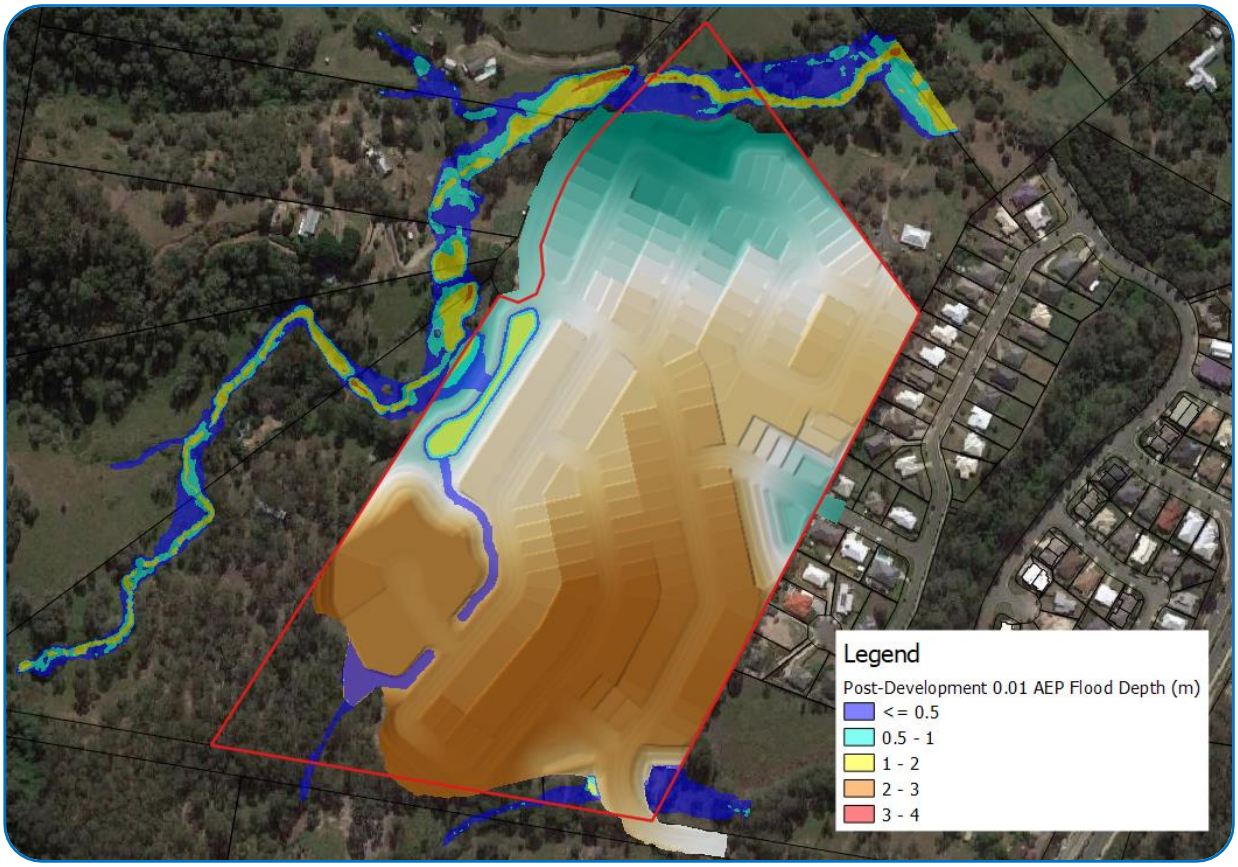


Figure 7.6 0.01 AEP Peak Flood Depth – Post-Development

7.5 Impact Assessment

In order to assess the impact of the proposed earthworks, a spatial analysis of the peak pre and post-development flood levels has been undertaken. The result of this analysis is presented in Figure 7.7 for 0.01 AEP storm event. These results indicate that the proposed earthworks will not cause any flood increase or nuisance to neighbouring properties.

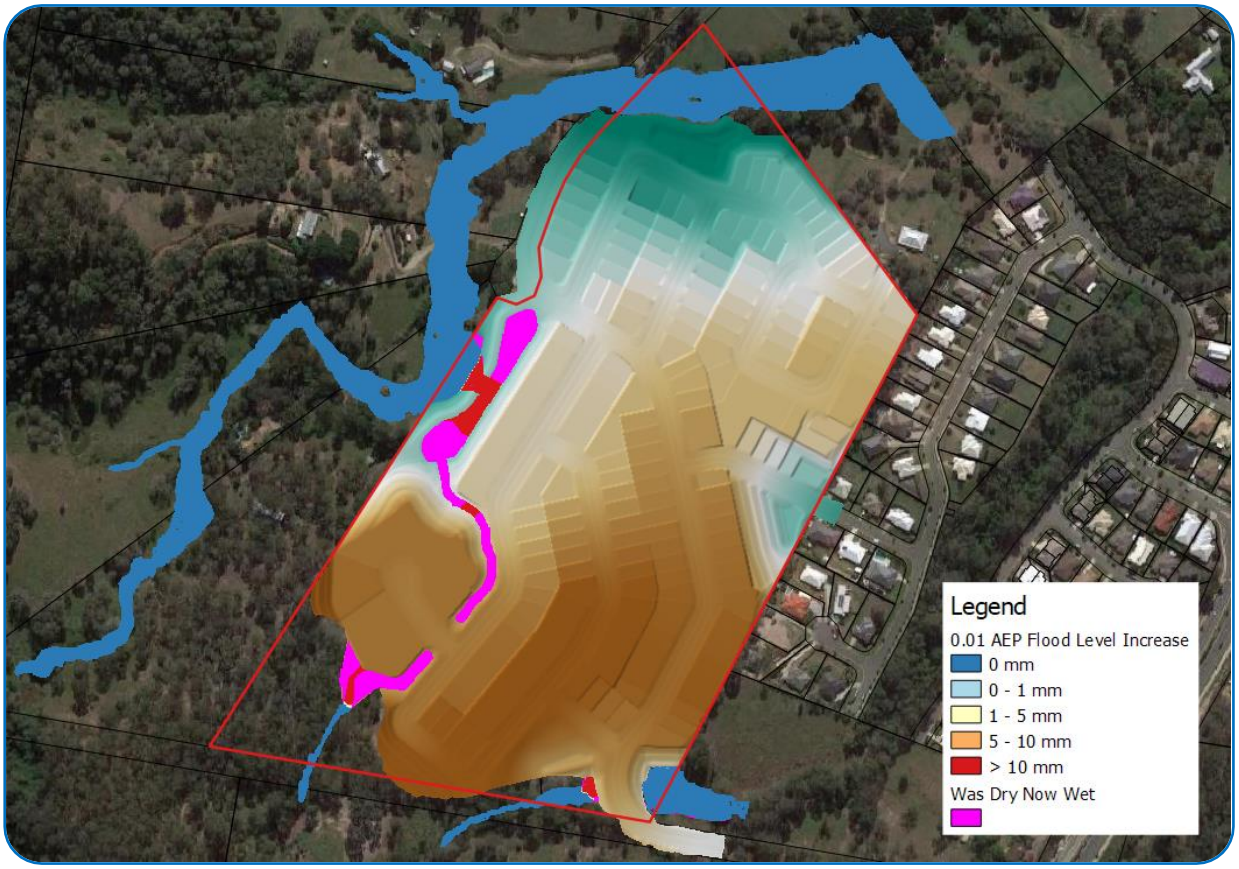


Figure 7.7 0.01 AEP Impact Plot

8 Conclusions

The report presents a comprehensive review of available Stormwater Quality Improvement Devices (SQID) and stormwater Best Management Practices (BMP) to ensure that the proposed development adequately addresses the management of stormwater quantity and quality during the operational phases of the development.

A total of four (4) stormwater treatment basins have been proposed. Three (3) of these basins (Basins A, B and D) will be combined bioretention/detention basin for quality and quantity management. The remaining Basin C, will only be required for treatment of pollutant loads, as catchment reductions in the post-development case have resulted a the reduction of peak discharge.

The results of xpstorm modelling indicate that the inclusion of the three (3) proposed detention basins will mitigate the expected increases in peak discharge at PD-A, PD-B, and PD-D during all modelled AEP events.

All internal catchment will be directed to bioretention measure for quality treatment. MUSIC v6 modelling indicates that reduction target for TSS, TP, TN and gross pollutants of 80%, 60%, 45% and 90% respectively can be achieved for the rainfall data set simulated,

In order to simulate pre- and post-development flooding across the site the 1D - 2D hydrodynamic flood model TUFLOW has been utilised to route stormwater through the upper reaches of Yaun Creek and the other minor streams.

Spatial analysis of the peak pre and post-development flooding indicates that the proposed earthworks required to create the subdivision will not cause any flood increase or nuisance to neighbouring properties.

The level of detail provided within this report is suitable for development assessment only and should not be relied upon for construction purposes. A Detailed Stormwater Management Plan containing detailed engineering designs will be needed to finalise the stormwater concepts presented in this report. Detailed design documentation should be prepared in conjunction with civil operational works.

This report has been reviewed by a Registered Professional Engineer of Queensland (RPEQ), and certification has been provided that if the design parameters set out in this report are included within the development:

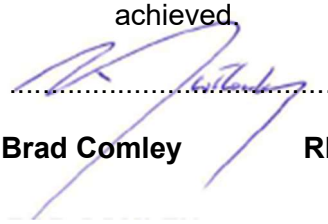
- there should be no worsening in peak discharge as a result of the proposed development; and
- stormwater pollutant load reductions in accordance with best practice should be achieved.

9 RPEQ Certification

I am aware that Council may rely upon the contents and findings of this assessment for the purposes of development assessment. In my opinion, the Council can rely upon the information contained within the report and there are no reservations or qualifications in respect to the information other than set out in the report.

I confirm that if the design parameters set out in this report are included within the development:

- there should be no worsening in peak discharge, as a result of the proposed development that would result in actionable damage to downstream properties; and
- stormwater pollutant load reductions in accordance with best practice should be achieved.



..... 01 November 2019.....

Brad Comley **RPEQ 17706** **DATE**

10 References

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Appendix A

Healthy Waters Code

City Plan code template

This code template supports the preparation of a development application against either the acceptable outcome(s) or performance outcome(s) contained in the code. Development assessment rules are outlined in **Section 5.3.3** of the City Plan.

Please note:

For assessment against the overall outcomes, refer to the appropriate code.

Impact assessable development requires assessment against the strategic framework prior to using this template.

9.4.5 Healthy waters code

9.4.5.1 Application

This code applies to assessing material change of use or reconfiguring a lot for development where indicated within **Part 5 Tables of assessment** unless either of the following circumstances apply:

(1) No increase in impervious area is required onsite for the development.

(2) A stormwater quality and quantity management plan previously approved by the Council has been fully implemented within the existing development layout.

Note: Where a development proposal meets either (1) and (2) above, this code is not applicable.

When using this code, reference should be made to **Section 5.3.2** and, where applicable, **Section 5.3.3,** in **Part 5**.

9.4.5.2 Purpose

(1) The purpose of the Healthy waters code is to protect the quality of the city's waters from the impacts of development.

(2) The purpose of the code will be achieved through the following overall outcomes:

(a) Urban stormwater quality management, wastewater management, and management of waters are based on the following principles:

(i) Development and construction activities are conducted in accordance with design objectives to achieve the water quality objectives, as specified in the *Environmental Protection (Water) Policy 2009*.

(ii) The ongoing management of urban stormwater quality incorporates design objectives that reflect the regional climate and the site's landscape characteristics.

(iii) Development is undertaken in accordance with best practice environmental management.

(iv) Development avoids adverse impacts on the City of Gold Coast's waters or, where this is not feasible, adverse impacts are minimised.

(b) Water resource catchments are protected from contamination by chemicals.

(c) The drainage capacity of the Woongoolba Flood Mitigation Scheme Area for rainfall events up to 1 in 10 year 72 hours is maintained (contained within the Scheme drains within a 4 day period) and this capacity is not be eroded due to cumulative impact of development.

9.4.5.3 Criteria for assessment

Table 9.4.5-2: Healthy waters code – for assessable development

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome
Stormwater quality		
PO1 Development appropriately manages stormwater quality to: (a) protect natural ecosystems; (b) integrate stormwater treatment into the urban landscape; (c) protect water quality; (d) reduce runoff and peak flows; and (e) meet the water quality objectives and environmental values for Queensland waters. **Note: Water quality objectives and environmental values for Queensland waters are contained within *Schedule 1* of the *Environmental Protection (Water) Policy 2009*. Water quality objectives are locally specific and vary between and within river catchments.**	**AO1.1** Where development is: (a) for a dwelling house, dual occupancy or multiple dwelling on a lot less than 5000m²; or (b) light industry or business activity on a lot less than 2500m², it complies with the 'Deemed to comply' requirements detailed in the **Stormwater quality management guidelines** in **SC6.9 City Plan policy – Land development guidelines**.	**N/A**
	AO1.2 Where development is: (a) for a dwelling house, dual occupancy or multiple dwelling on a lot equal to or more than 5000m² but less than 1.25 ha; or (b) light industry or business activity on a lot equal to or more than 2500m² but less than 1.25 ha; (c) it complies with the 'Deemed to comply' requirements detailed in the **Stormwater quality management guidelines** in **SC6.9 City Plan policy – Land development guidelines**.	**N/A**

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? **If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome**
	AO1.3 Where development is not listed in AO1 a Stormwater Quality Management Plan is prepared by a suitably-qualified person in accordance with the **Stormwater quality management guidelines** in **SC6.9 City Plan policy – Land development guidelines**.	**COMPLIES WITH AO1.3** This Stormwater Management Plan has been prepared by a suitably-qualified person and is in accordance with the Stormwater quality management guidelines in SC6.9 City Plan policy – Land development guidelines.
Stormwater quantity		
PO2 Stormwater quantity management outcomes demonstrate no adverse impact on stormwater flooding or the drainage of properties external to the subject site.	**AO2** A stormwater quantity management plan is prepared by a suitably qualified person and demonstrates: (a) achievable stormwater quantity control measures for discharge during both the construction and operational phases of development designed in accordance with the *Queensland Urban Drainage Manual (QUDM)* unless subject to specific requirements of **SC6.9 City Plan policy – Land development guidelines**; (b) on-site detention systems that are designed to restrict peak outflows for Q2, Q5, Q10, Q20 Q50 and Q100 to pre-development conditions.	**COMPLIES WITH AO2** This Stormwater Management Plan has been prepared by a suitably-qualified person in accordance with the QUDM and includes on-site detention systems designed to restrict peak outflows for Q2, Q5, Q10, Q20 Q50 and Q100 to pre-development conditions.
Woongoolba Flood Mitigation Scheme Catchment Area		
PO3	**AO3** No acceptable outcome provided.	**N/A**

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome
In the Woongoolba Flood Mitigation Scheme Catchment Area, shown on the **Water catchments and dual reticulation overlay map**, peak outflow and its timing for Q2, Q5 and Q10 for rainfall events up to 72 hours does not change as a result of development.		
Protection of natural flows (discharge)		
PO4 Construction and operational activities avoid or minimise adverse impacts of altered stormwater quality and quantity.	**AO4** Development achieves the Frequent Flow Management and Waterway Stability Management design objectives as stated within *Chapter 2 – Section 2.4.2 of the Urban Stormwater Quality Planning Guidelines 2010*. **Note: A site Stormwater Quality and Quantity Management Report prepared by a suitably qualified person is Council's preferred method required to be submitted to Council to address Acceptable outcome AO6.** **The intent in the above guidelines (*Urban Stormwater Quality Planning Guidelines 2010*) can be achieved by adopting Water Sensitive Urban Design (WSUD) concepts within the development.**	**COMPLIES WITH AO4** This Stormwater Management Plan has been prepared by a suitably-qualified person and adopts Water Sensitive Urban Design (WSUD) concepts within the development to manage stormwater quality and quantity.
Wastewater management		
PO5 Development does not discharge wastewater to receiving waters or areas external to the site unless demonstrated to be the best-practice environmental management for that site and takes into consideration:	**AO5** Where the development involves the discharge of wastewater, a Wastewater Management Plan (WWMP) is prepared, demonstrating compliance with the performance outcome, by a suitably qualified person	**N/A**

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome
(a) the applicable water quality objectives for the receiving waters; and (b) the potential adverse impact on ecosystem health of receiving waters.	and submitted to the Council, detailing all of the following: (a) wastewater type; (b) climatic conditions; (c) water quality objectives; (d) best-practice environmental management; (e) waste management hierarchy; and (f) the WWMP provides for the management of wastewater in accordance with a wastewater management hierarchy that: (i) avoids wastewater discharge to waterways; or (ii) if wastewater discharge to the environment cannot practicably be avoided wastewater discharge to waterways is minimised through re-use, recycling, recovery and treatment for disposal to sewer, surface water and groundwater.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	
Erosion and sediment control (ESC)			
PO6 Development does not cause erosion or allow sediments to leave the site.	**AO6** An **Erosion hazard assessment** completed in accordance with the criteria in **Table 9.4.5-3** is undertaken to establish the level of risk for soil erosion and sediment pollution to the environment. **Where the Erosion hazard assessment has a risk score less than or equal to 10:** A deemed to comply report is prepared by a suitably qualified person for Council approval, including conceptual location and design drawings of each treatment measure in plan and section views, in accordance with the *Best Practice Erosion and Sediment Control: International Erosion Control Association, (IECA) 2008, Australasia Chapter 2008.* **Where the Erosion hazard assessment has a risk score greater than 10:** A conceptual erosion and sediment control plan (ESCP) is prepared by a suitably qualified person for Council approval in accordance with the *Best Practice Erosion and Sediment Control: International Erosion Control Association, (IECA) 2008, Australasia Chapter 2008*.	**COMPLIES VIA CONDITIONS** It is considered reasonable that conditions be placed on the development approval to ensure that am Erosion and Sediment Control plan is developed in conjunction with the OPW for Change to Ground Level.	

Appendix B

Stormwater Management Design Drawings

VERSION: B
DATE : 01.11.19

CONCEPTUAL STORMWATER MANAGEMENT DRAWING SET

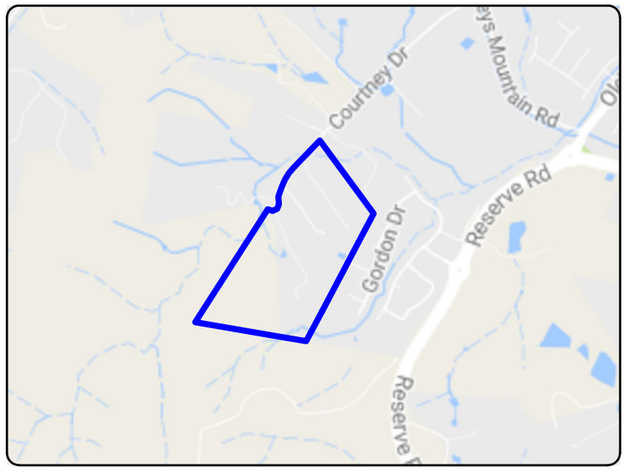
Courtney Drive

for

Gallery Homes Pty Ltd

Project No: BC-16090

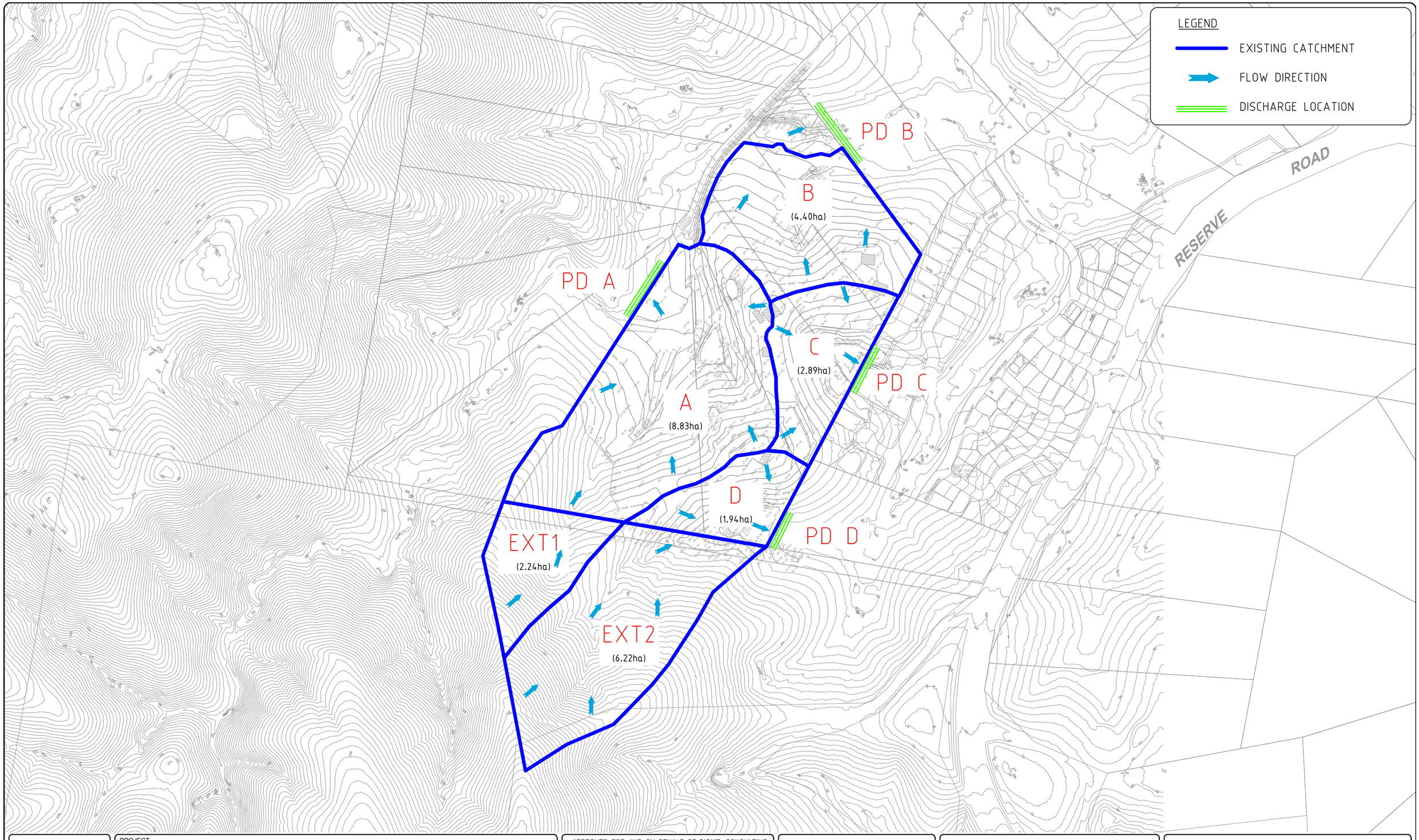
November 2019



Site Location

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
DWG-100	LOCALITY AND DRAWING INDEX PLAN
DWG-200	EXISTING CATCHMENT PLAN
DWG-201	DEVELOPED CATCHMENT PLAN
DWG-210	MUSIC CATCHMENT PLAN
DWG-300	OPERATIONAL CONTROL PLAN
DWG-310	BASIN A LAYOUT AND CROSS SECTION
DWG-311	BASIN B LAYOUT AND CROSS SECTION
DWG-312	BASIN C LAYOUT AND CROSS SECTION
DWG-313	BASIN D LAYOUT AND CROSS SECTION
DWG-314	WATERWAY & DRAINAGE EASEMENT LAYOUT AND CROSS SECTIONS
DWG-320	BASIN A - INLET AND OUTLET DETAILS
DWG-321	BASIN B - INLET AND OUTLET DETAILS
DWG-322	BASIN C - INLET AND OUTLET DETAILS
DWG-323	BASIN D - INLET AND OUTLET DETAILS
DWG-330	BIORETENTION - FILTER MEDIUM DETAILS
DWG-340	BASIN A - DEPTH INDICATOR AND DEEP WARNING SIGNAGE

BIOME Consulting Pty Ltd
Unit 30201, Southport Central Tower 3,
9 Lawson St, Southport QLD 4215
PO Box 3469, Australia Fair, Southport
O 07 5532 7779
M 0415 935 222
E brad@BIOMEconsulting.com.au
W www.BIOMEconsulting.com.au
ABN 86 166 087 476



DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-200

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
EXISTING CATCHMENT PLAN

CLIENT
GALLERY HOMES PTY LTD

ADDRESS:
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TP / HN	AK	BC	A3	1:5000

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ORIGINAL SCALE BEFORE REDUCTION
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1 : 5000 (FULL SIZE) (metres)

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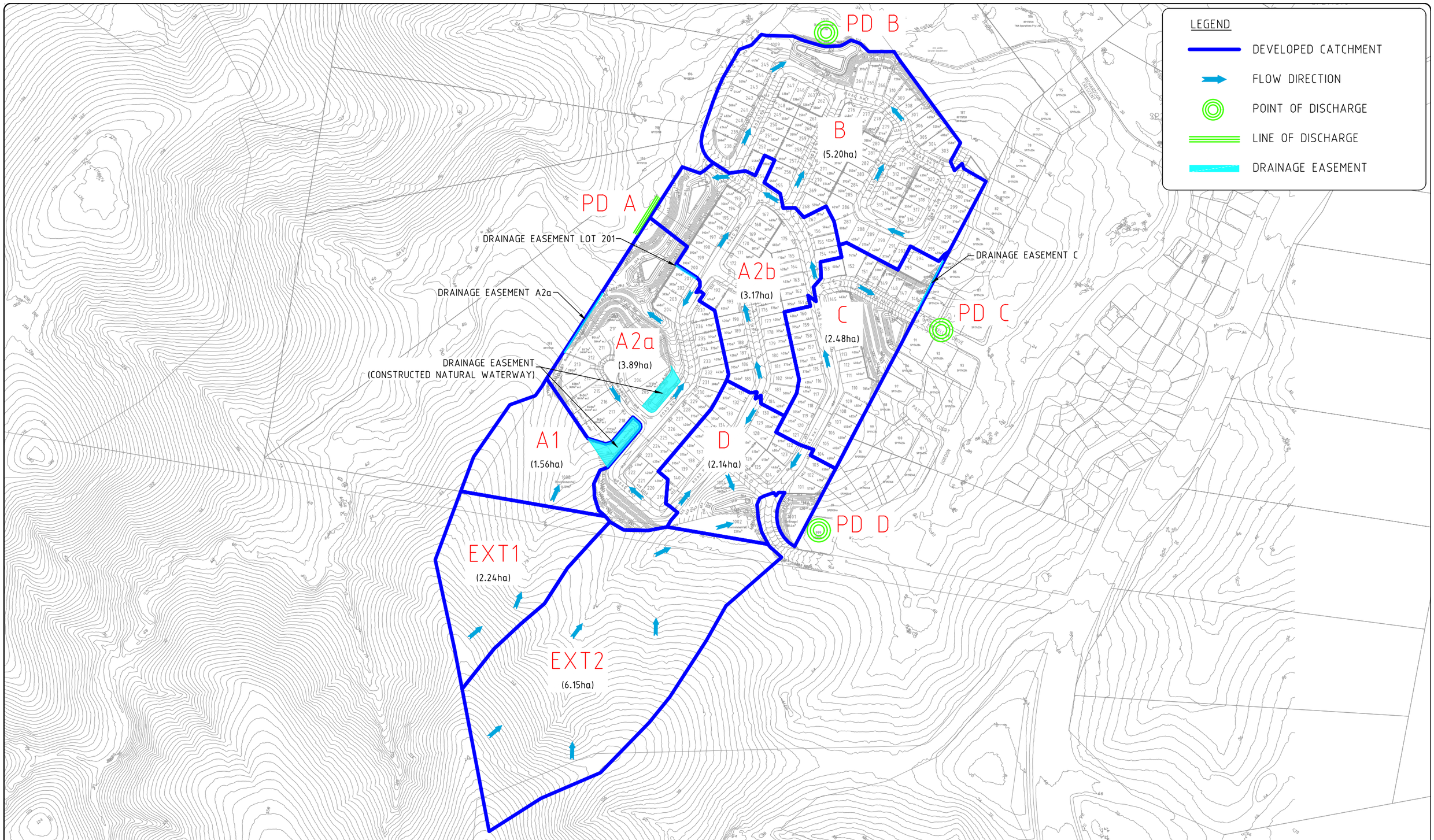

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-201

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
DEVELOPED CATCHMENT PLAN

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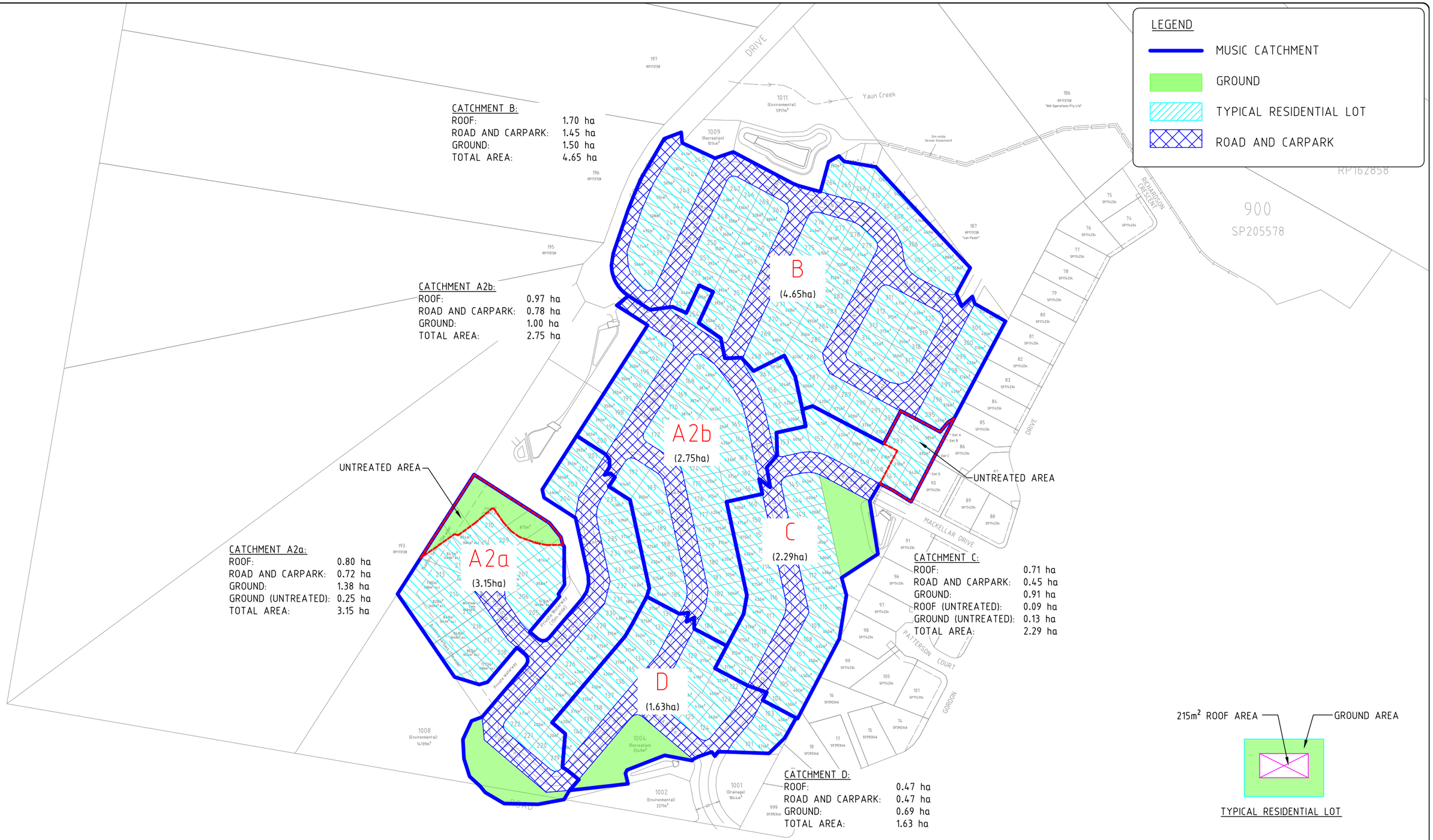

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PROJECT No. :
BC-16090

DRAWING No. :
DWG-210

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
MUSIC CATCHMENT PLAN

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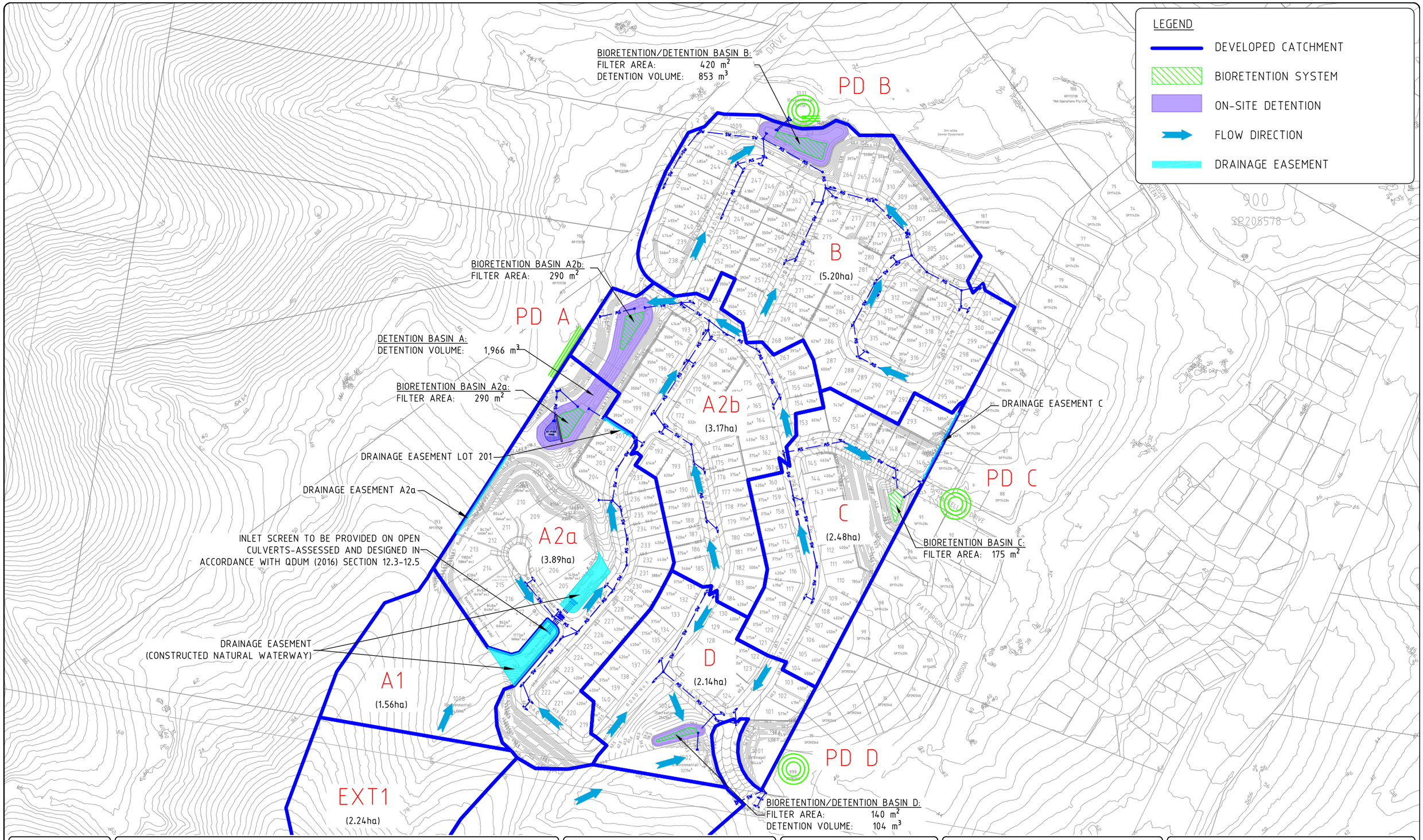

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PROJECT No. :
BC-16090

DRAWING No. :
DWG-300

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
OPERATIONAL CONTROL PLAN

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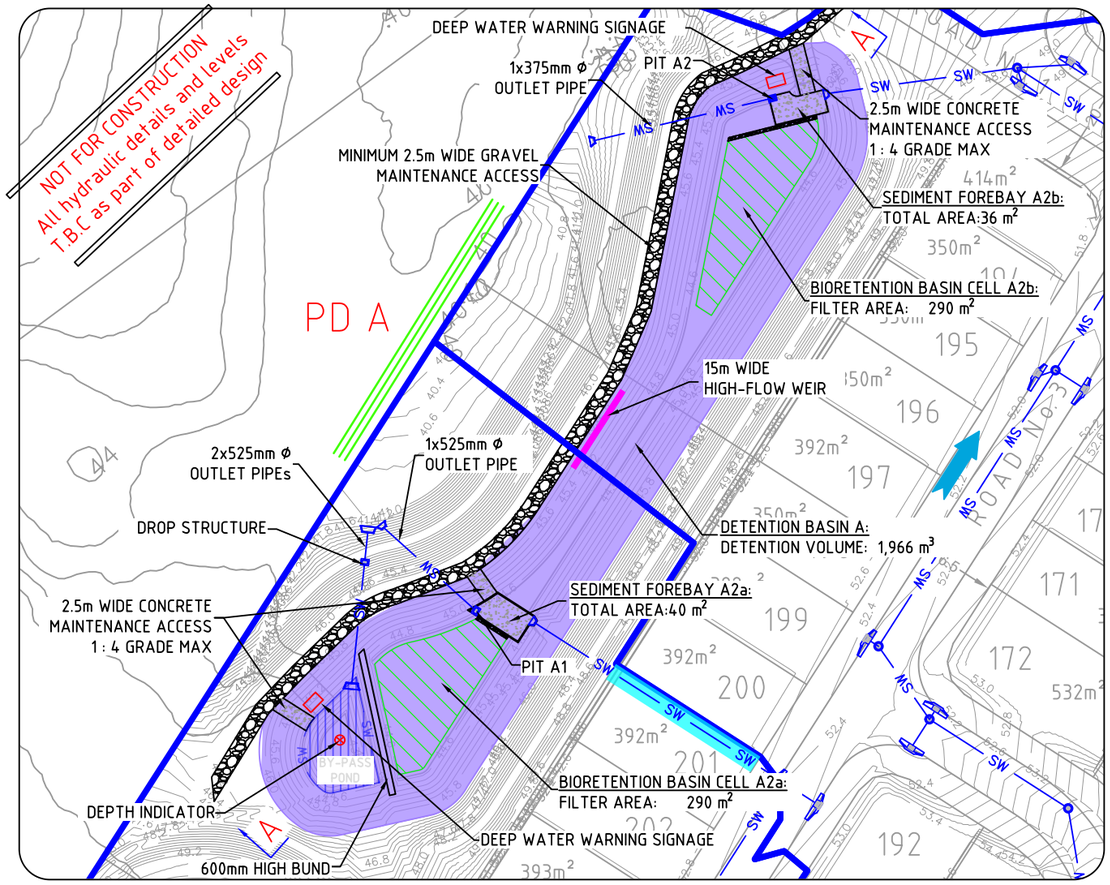

BASIN A PLAN VIEW

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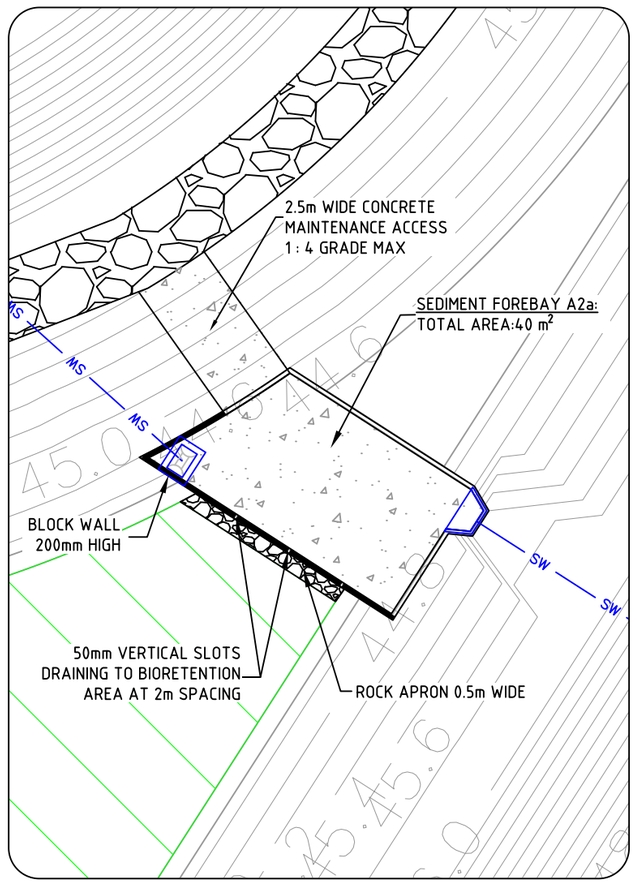
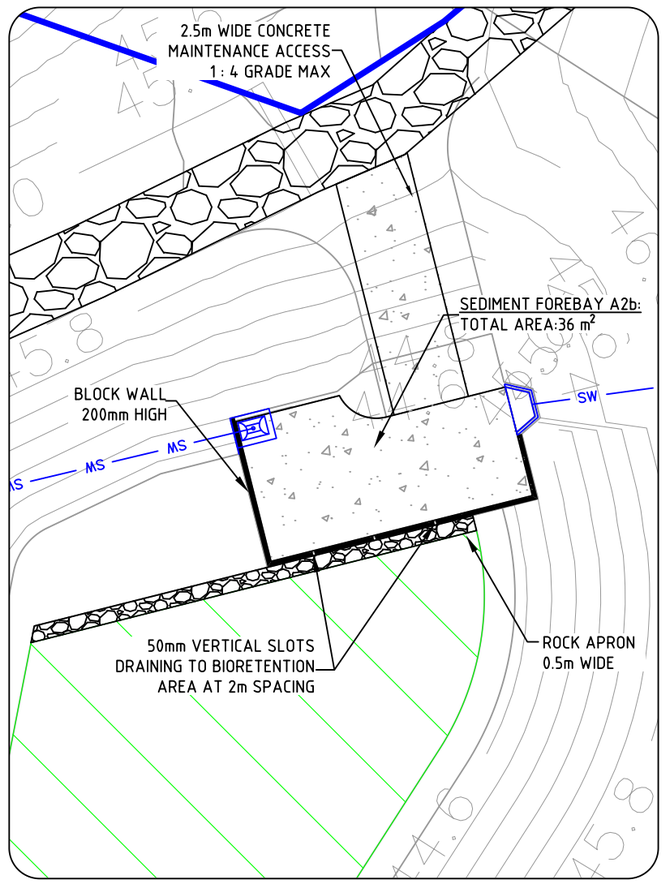


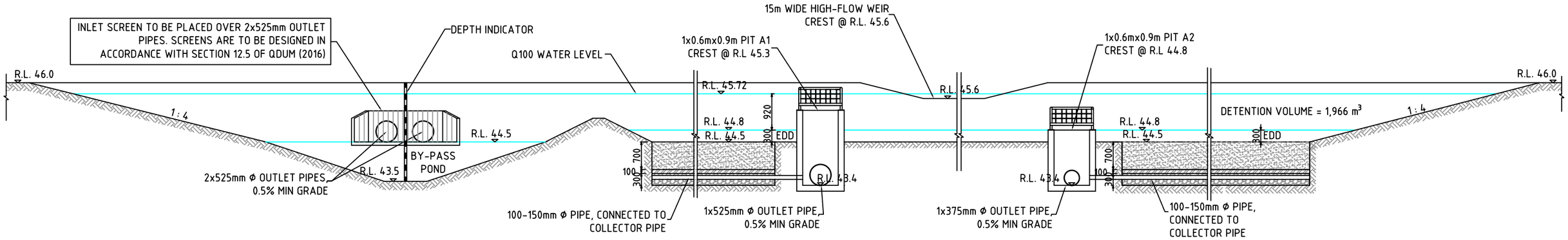
SEDIMENT FOREBAY A2a PLAN VIEW

1:200



SEDIMENT FOREBAY A2b PLAN VIEW

1:200



BASIN A CROSS SECTION A - A

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1 : 100 (FULL SIZE) (metres)

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-310

REVISION No. :
B

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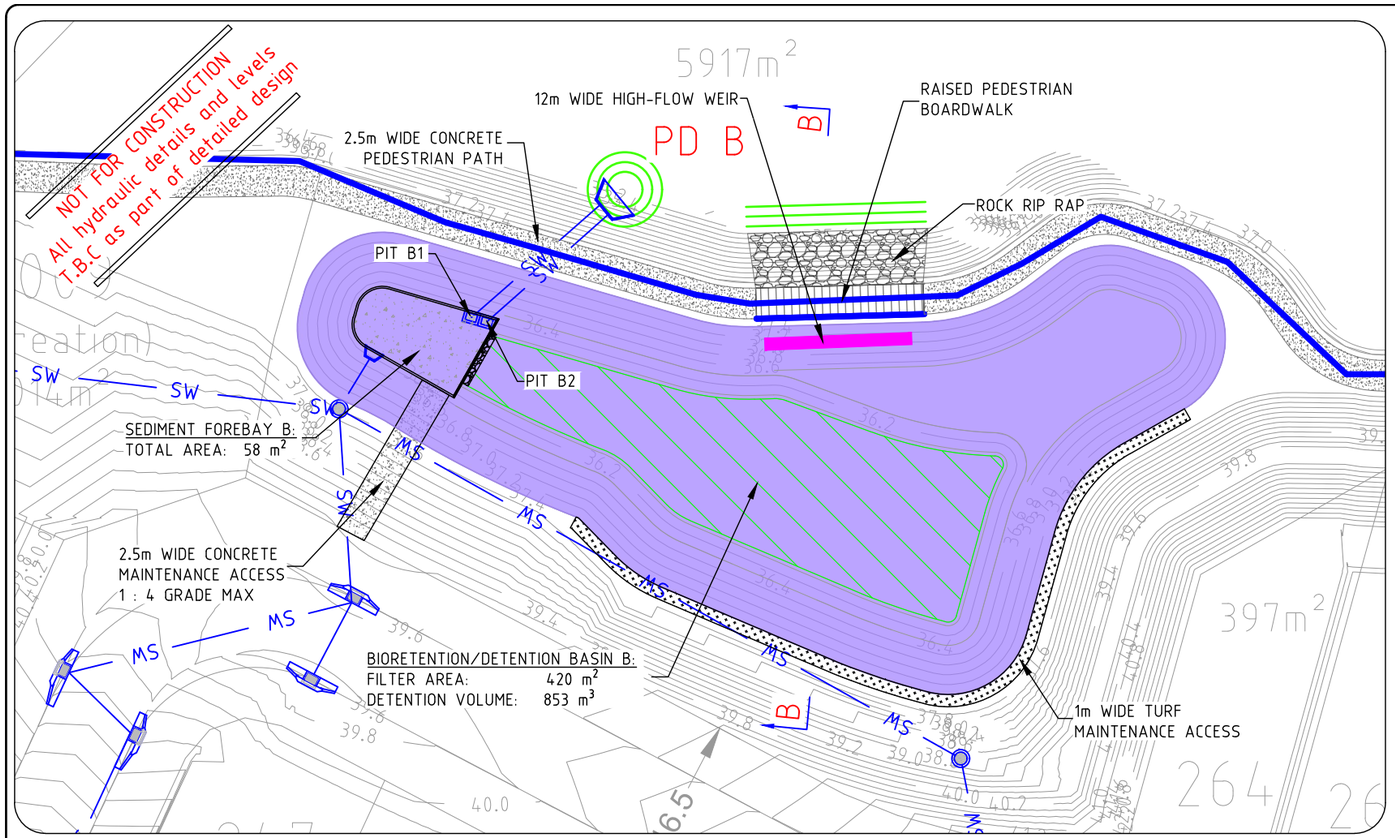

BASIN B PLAN VIEW

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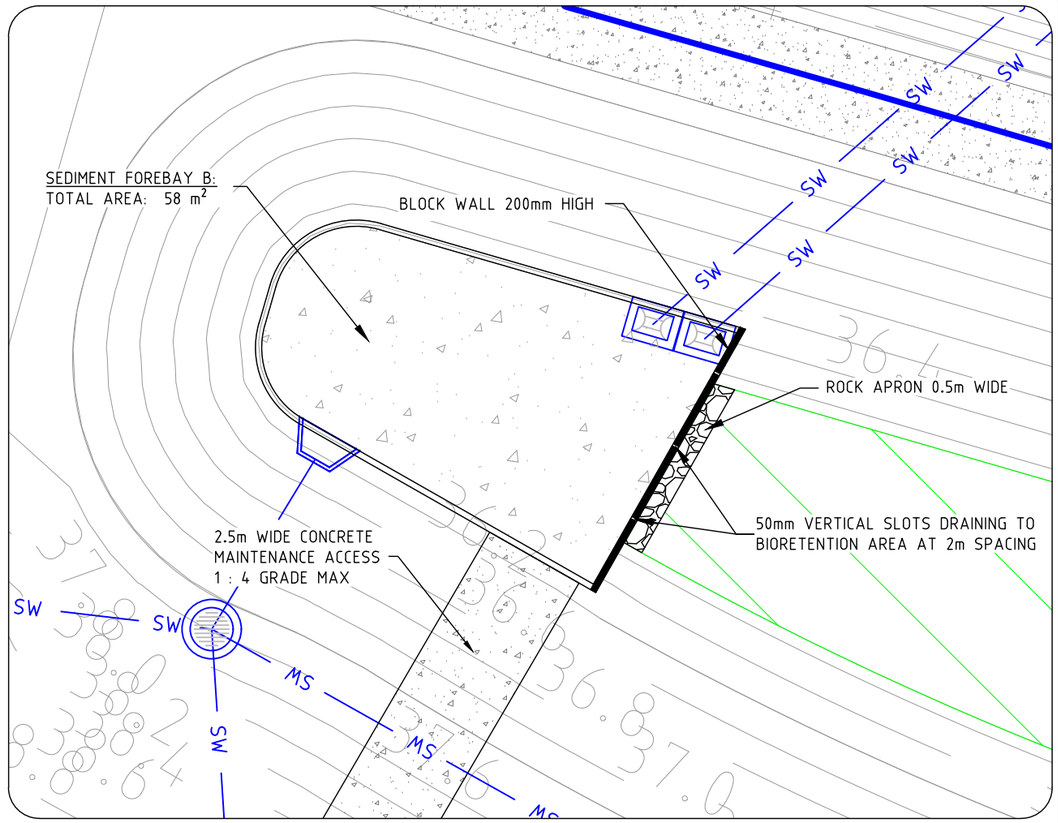
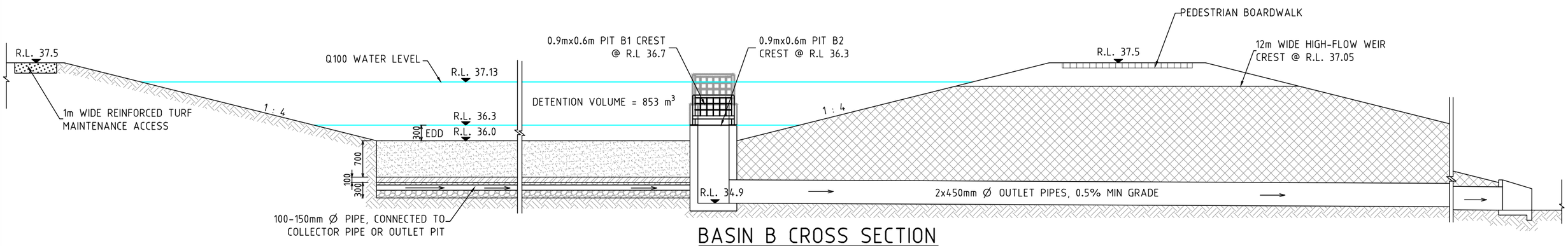


SEDIMENT FOREBAY B PLAN VIEW

1:150



BASIN B CROSS SECTION

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1 : 75 (FULL SIZE) (metres)

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-311

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN B LAYOUT AND CROSS SECTION

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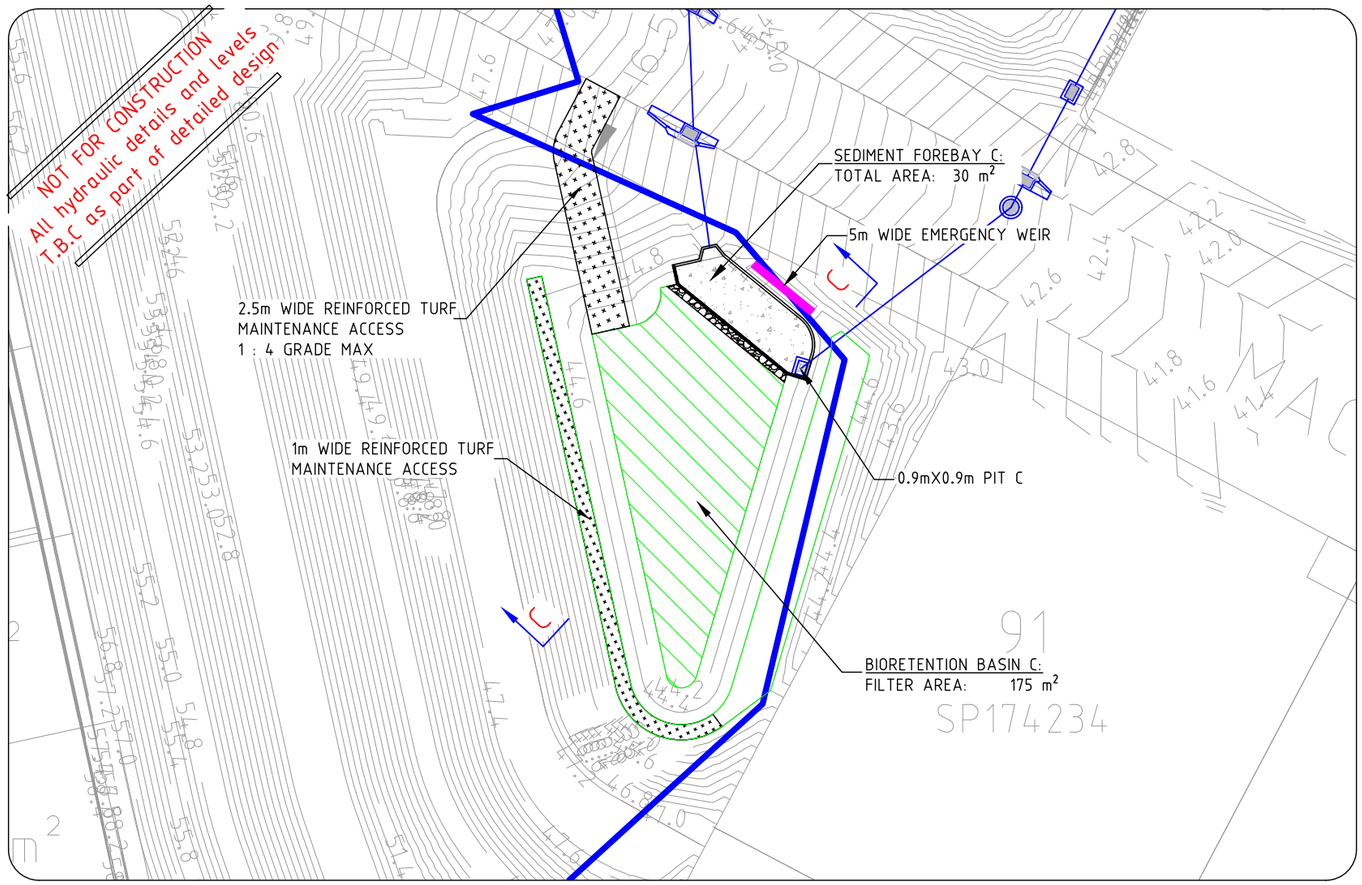
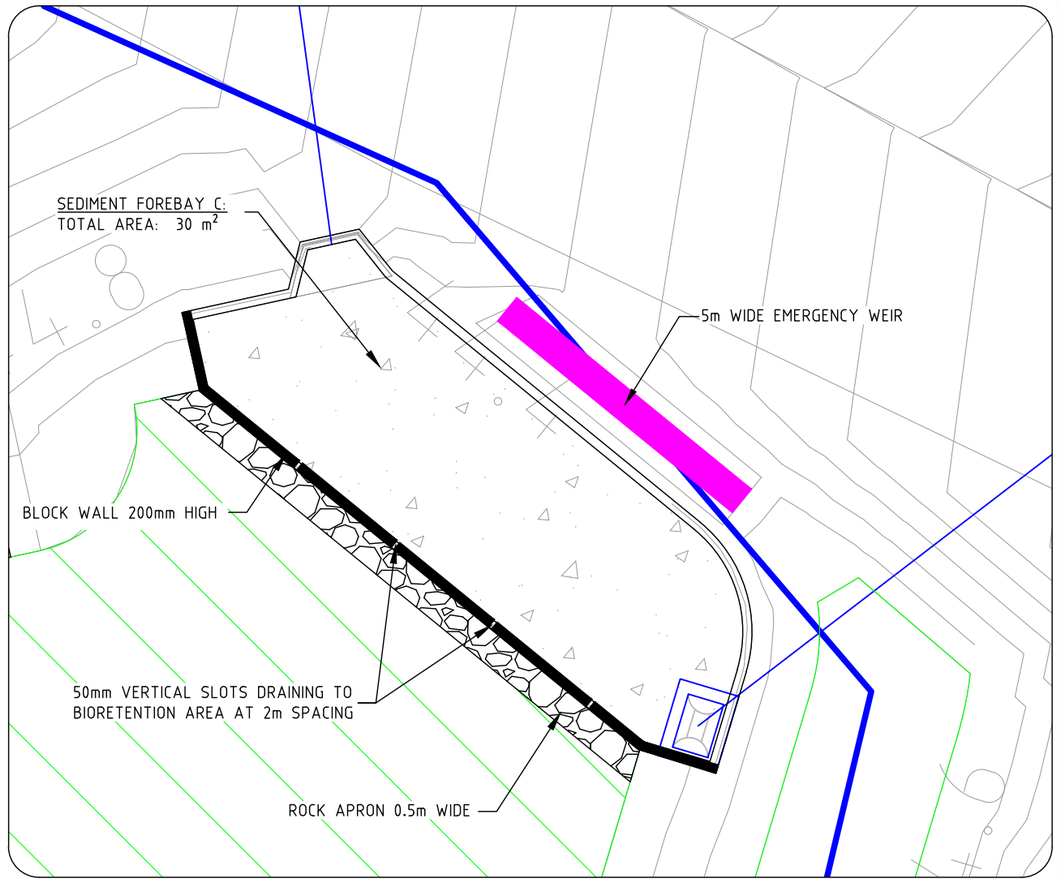
NOT FOR CONSTRUCTION
All hydraulic details and levels T.B.C as part of detailed design



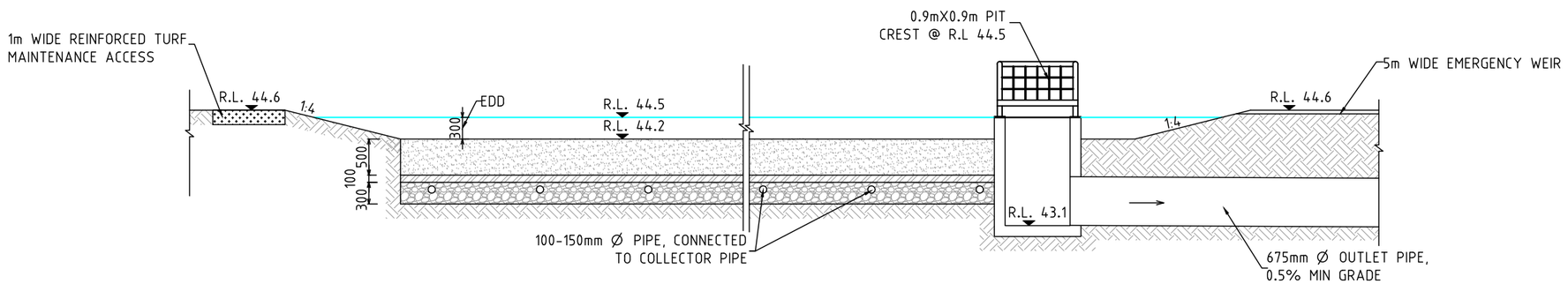
BASIN C PLAN VIEW

SCALE: 1/250



SEDIMENT FOREBAY C PLAN VIEW

SCALE: 1/100



BASIN C CROSS SECTION C - C

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1 : 75 (FULL SIZE) (metres)

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-312

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN C LAYOUT AND CROSS SECTION

CLIENT
GALLERY HOMES PTY LTD

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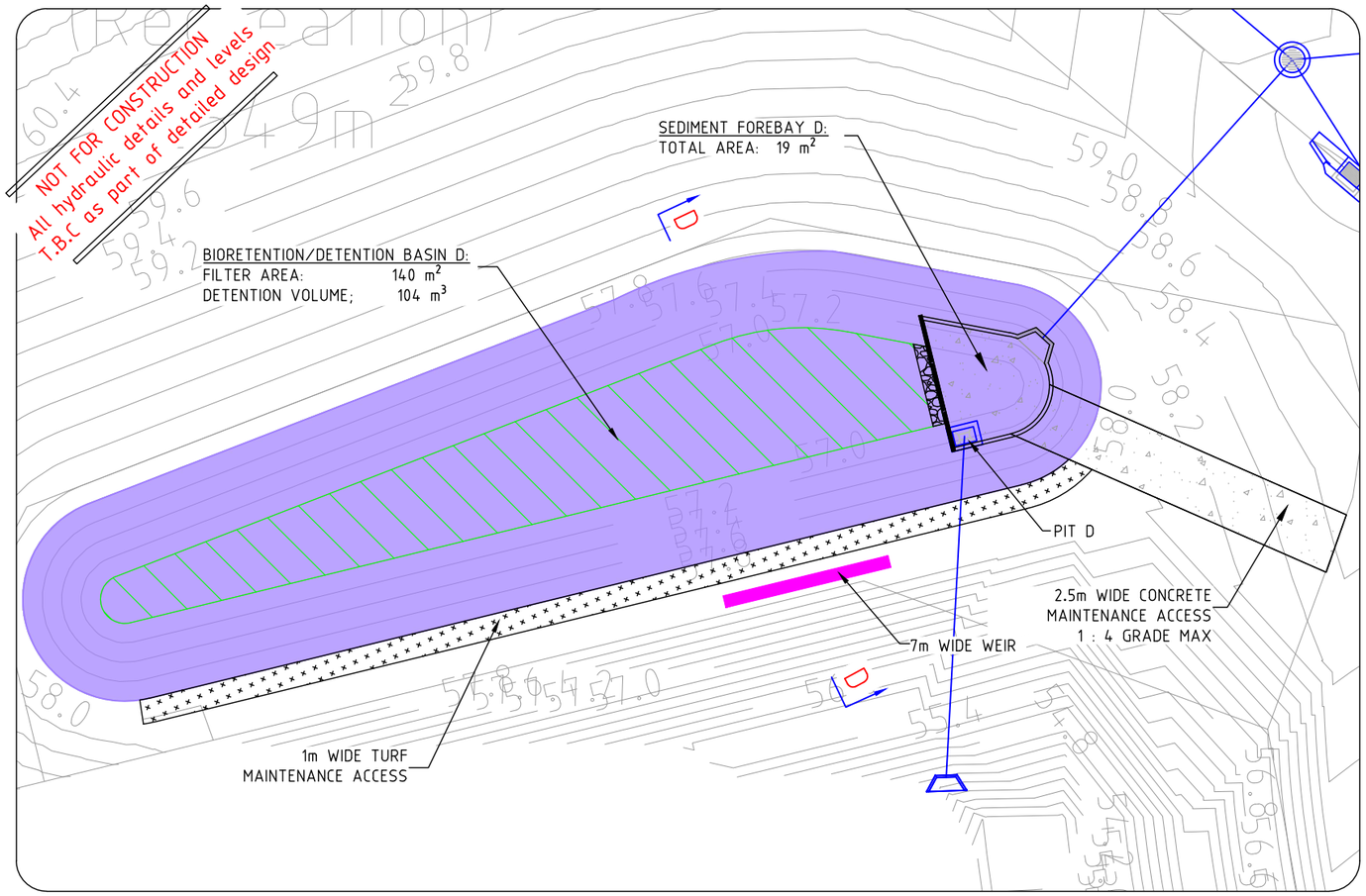
All hydraulic details and levels T.B.C as part of detailed design



BASIN D PLAN VIEW

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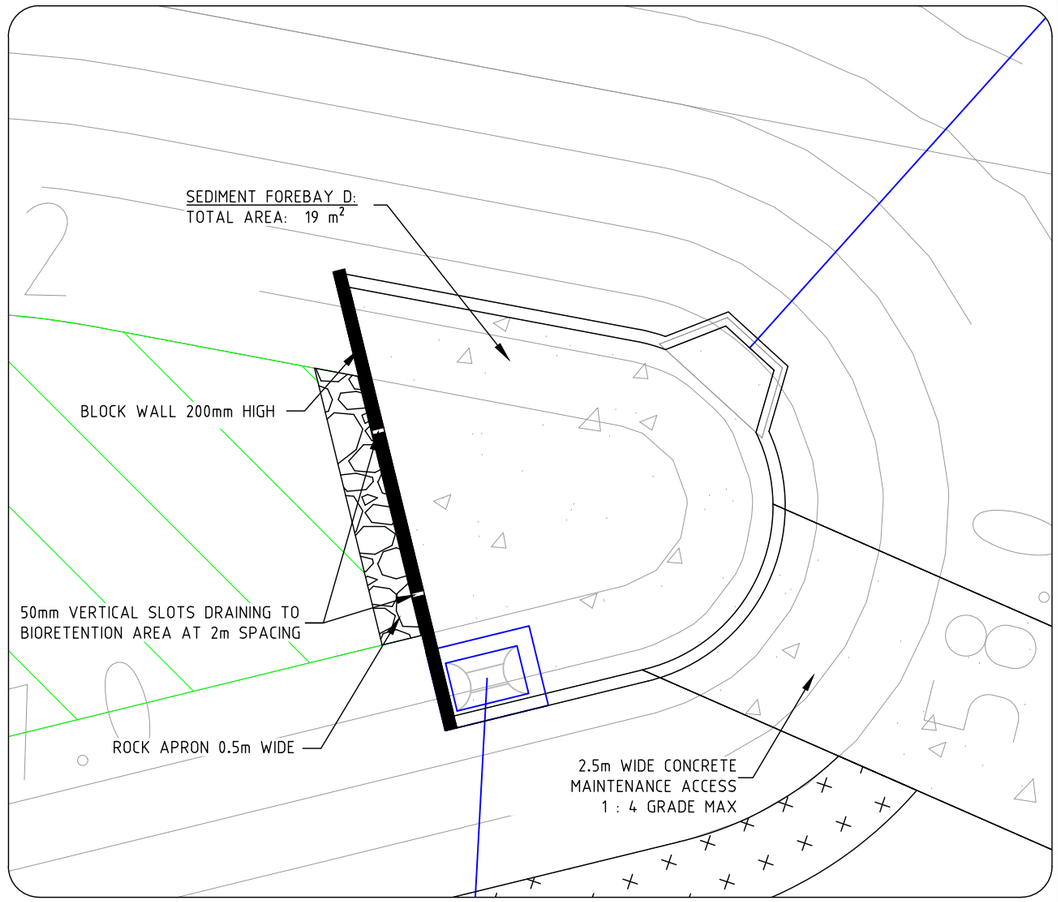
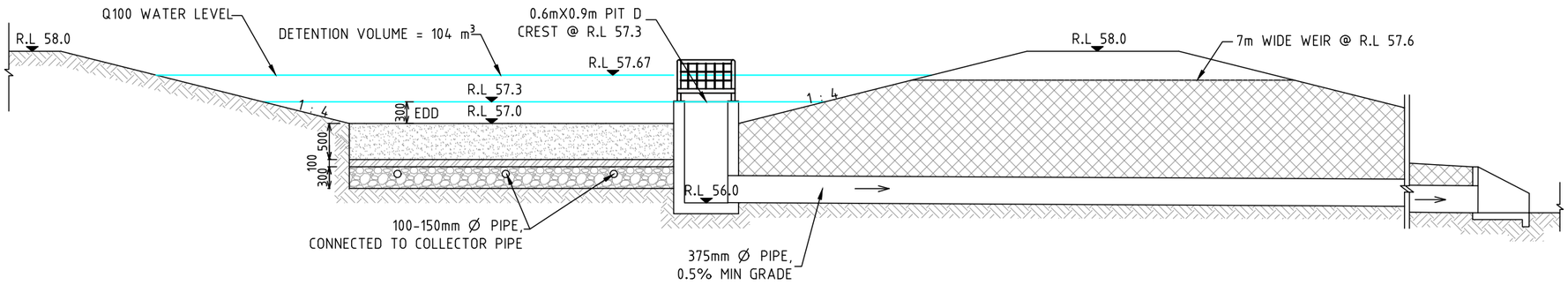


SEDIMENT FOREBAY D PLAN VIEW

SCALE: 1/75



BASIN D CROSS SECTION

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1 : 75 (FULL SIZE) (metres)

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-313

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN D - LAYOUT AND CROSS SECTION

CLIENT
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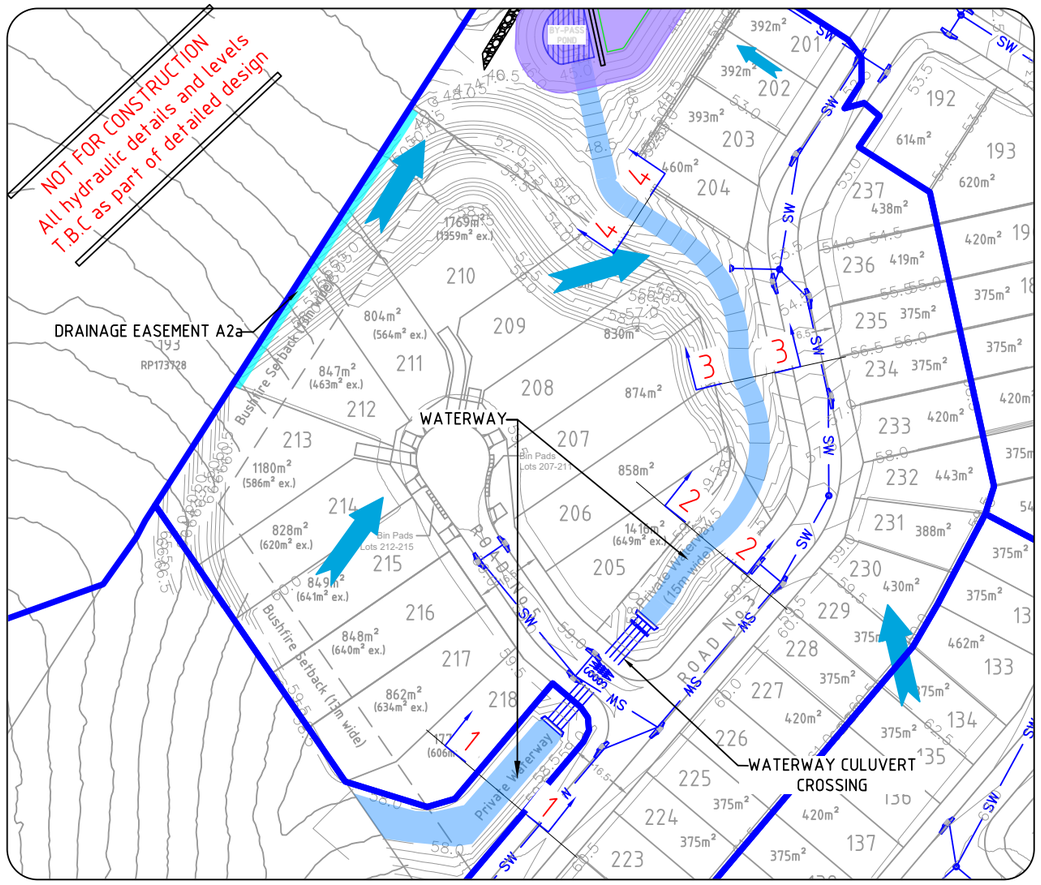

WATERWAY & CHANNEL A2a PLAN VIEW

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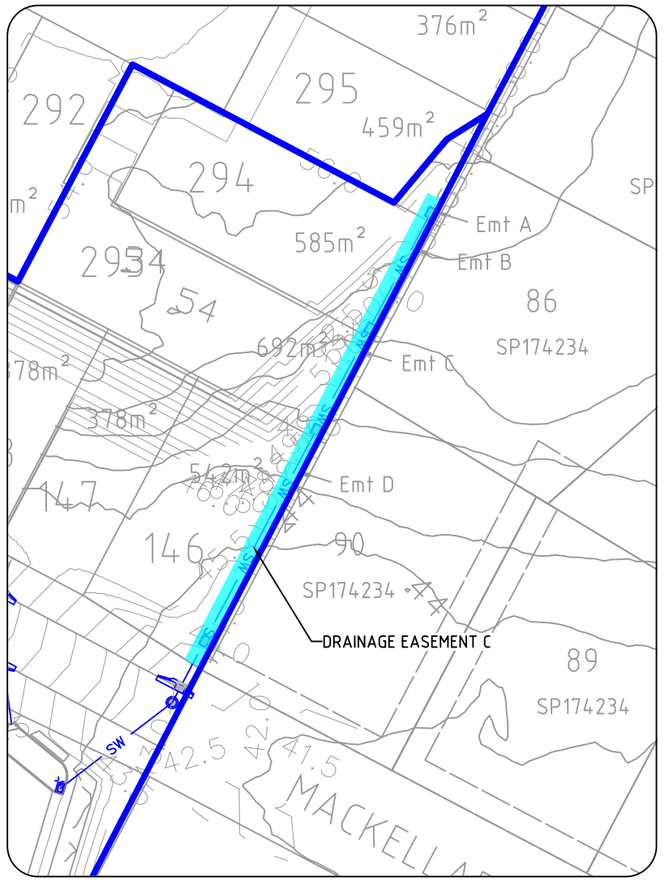
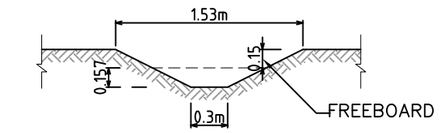


CHANNEL C PLAN VIEW

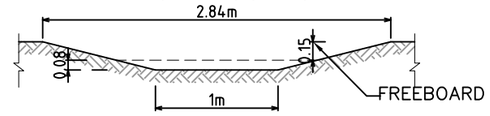
SCALE 1:750



DRAINAGE EASEMENT A2a CROSS SECTION

0.5 0 0.5 1.0 1.5 2.0 2.5

1 : 50 (FULL SIZE) (metres)

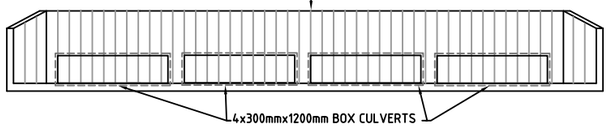


DRAINAGE EASEMENT C CROSS SECTION

0.5 0 0.5 1.0 1.5 2.0 2.5

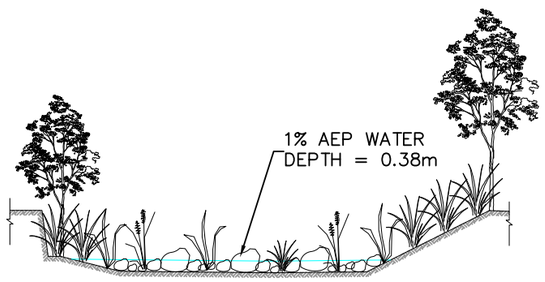
1 : 50 (FULL SIZE) (metres)

INLET SCREEN TO BE PLACED OVER 2x525mm OUTLET PIPES. SCREENS ARE TO BE DESIGNED IN ACCORDANCE WITH SECTION 12.5 OF QDUM (2016)



WATERWAY CULVERT CROSSING CROSS SECTION

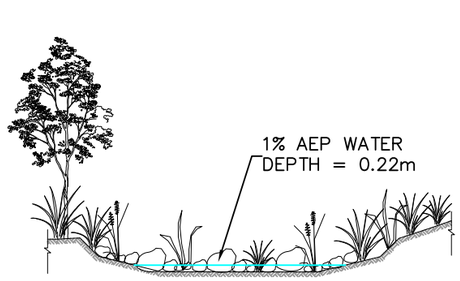
N.T.S.



WATERWAY SECTION 1 - 1

2 0 2 4 6 8 10

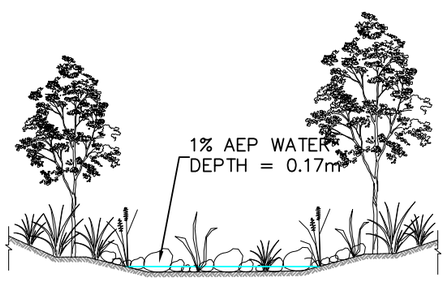
1 : 200 (FULL SIZE) (metres)



WATERWAY SECTION 2 - 2

2 0 2 4 6 8 10

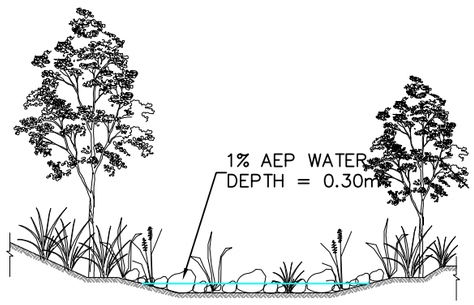
1 : 200 (FULL SIZE) (metres)



WATERWAY SECTION 3 - 3

2 0 2 4 6 8 10

1 : 200 (FULL SIZE) (metres)



WATERWAY SECTION 4 - 4

2 0 2 4 6 8 10

1 : 200 (FULL SIZE) (metres)

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-314

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
WATERWAY & DRAINAGE EASEMENT - LAYOUT & CROSS SECTIONS

CLIENT
GALLERY HOMES PTY LTD

ADDRESS:
COURTNEY DRIVE, UPPER COOMERA, QLD

DRAFTED BY :	*DESIGNED BY :*	*CHECKED BY:*	*PAPER SIZE :*	*SCALE :*
TP / KP	AK	BC	A3	1:150

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ACN 166 087 476
RPEQ No. :

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.04.19
B	WATERWAY ADDED – IRR		01.11.19

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M 0415 935 222
E brad@BIOMEconsulting.com.au
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ORIGINAL SCALE BEFORE REDUCTION

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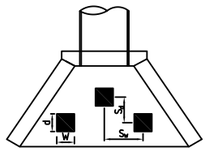
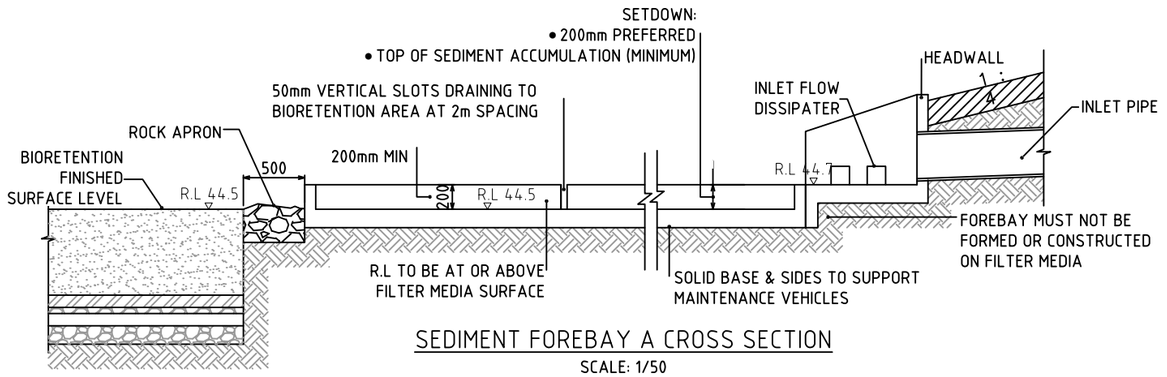


NOTE: ENERGY DISSIPATER LAYOUT TO BE DESIGNED AS PER BRISBANE CITY COUNCIL'S STORMWATER OUTLETS IN PARKS AND WATERWAYS

INLET SCOUR PROTECTION DETAILS

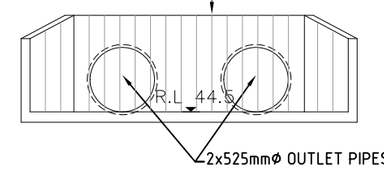
N.T.S



SEDIMENT FOREBAY A CROSS SECTION

SCALE: 1/50

INLET SCREEN TO BE PLACED OVER 2x525mm OUTLET PIPES. SCREENS ARE TO BE DESIGNED IN ACCORDANCE WITH SECTION 12.5 OF QDUM (2016)

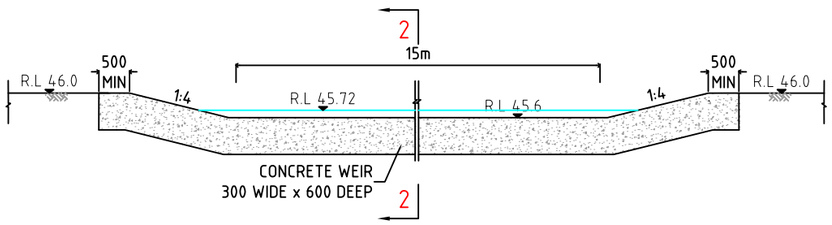


HEADWALL

(2x525mm OUTLET PIPES)

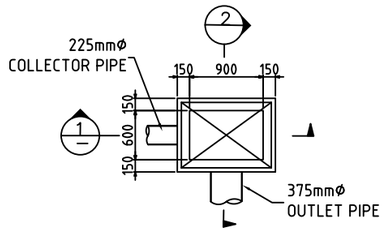
SCALE: 1/50

INLET DETAILS



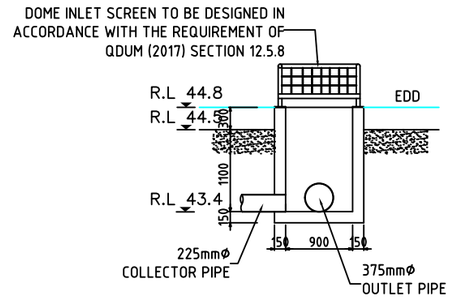
WEIR DETAIL SECTION 1-1

SCALE: 1/100



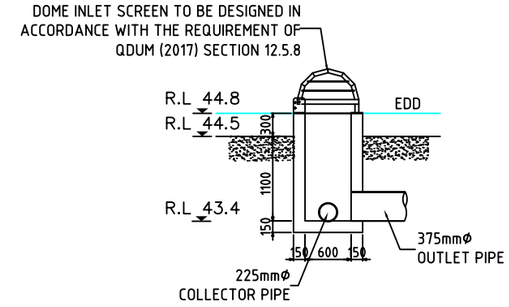
OVERFLOW STRUCTURE PLAN - PIT A1

SCALE: 1/75



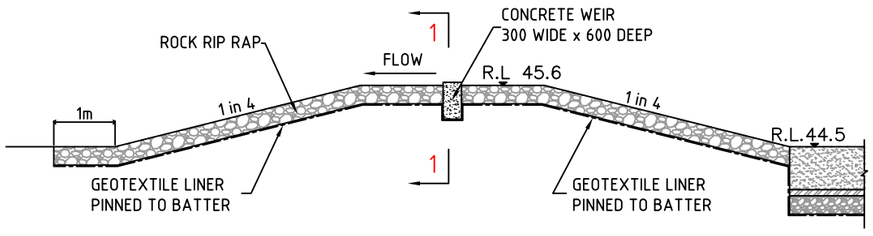
SECTION 1 - 1

SCALE: 1/75



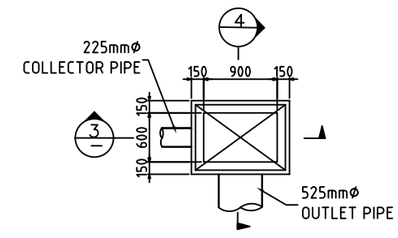
SECTION 2 - 2

SCALE: 1/75



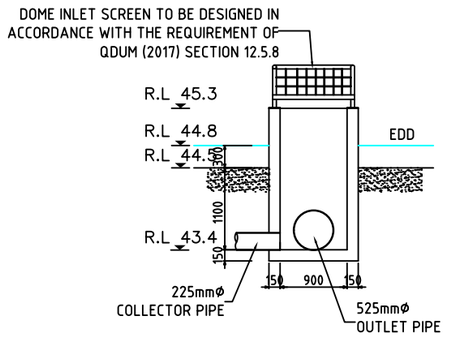
WEIR CROSS SECTION 2-2

SCALE: 1/100



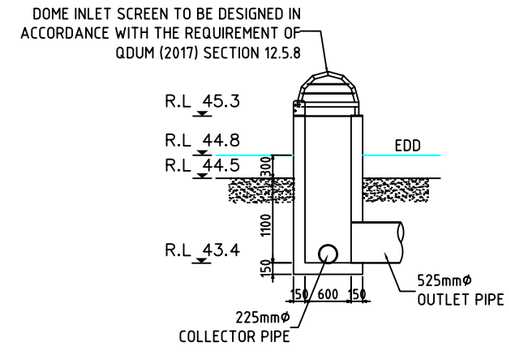
OVERFLOW STRUCTURE PLAN - PIT A2

SCALE: 1/75



SECTION 3 - 3

SCALE: 1/75



SECTION 4 - 4

SCALE: 1/75

OUTLET DETAILS

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-320

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN A - INLET & OUTLET DETAILS

CLIENT
GALLERY HOMES PTY LTD

ADDRESS:
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M 0415 935 222
E brad@BIOMEconsulting.com.au
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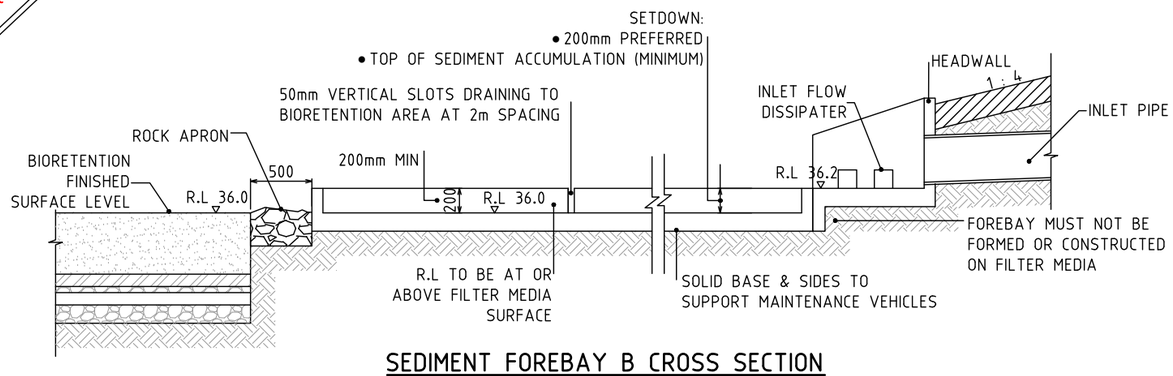
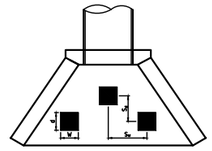


SEDIMENT FOREBAY B CROSS SECTION

SCALE: 1/50

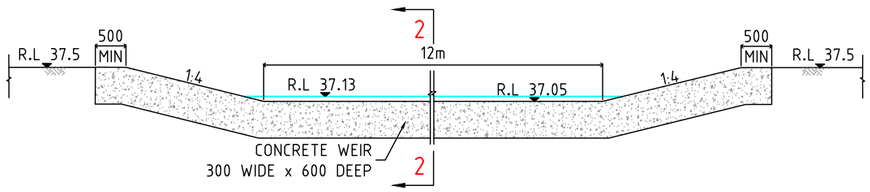


NOTE: ENERGY DISSIPATER LAYOUT TO BE DESIGNED AS PER BRISBANE CITY COUNCIL'S STORMWATER OUTLETS IN PARKS AND WATERWAYS

INLET SCOUR PROTECTION DETAILS

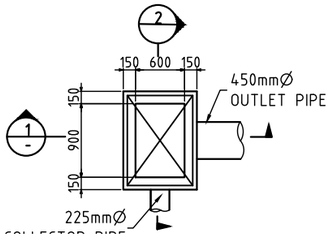
N.T.S

INLET DETAILS



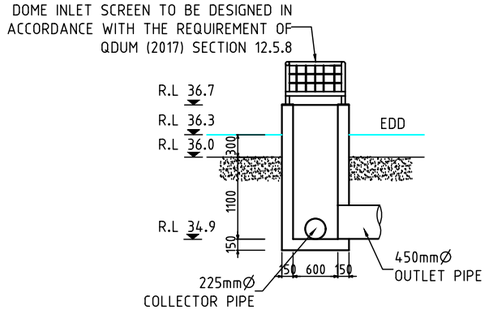
WEIR DETAIL SECTION 1-1

SCALE: 1/100



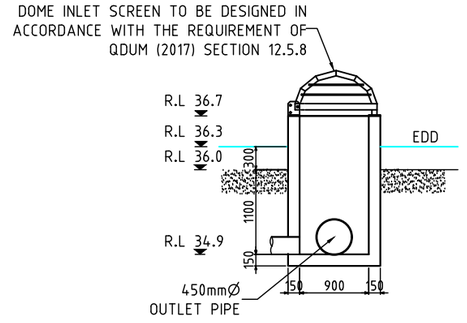
OVERFLOW STRUCTURE PLAN - PIT B1

SCALE: 1/75



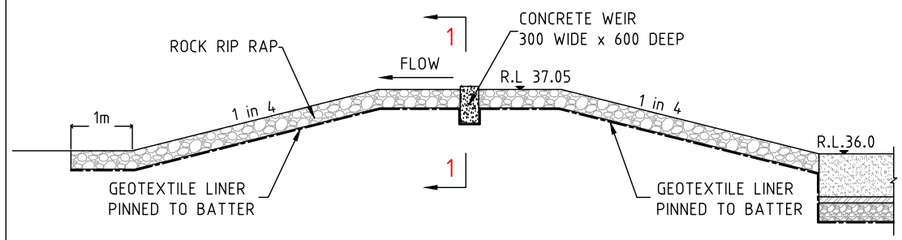
SECTION 1 - 1

SCALE: 1/75



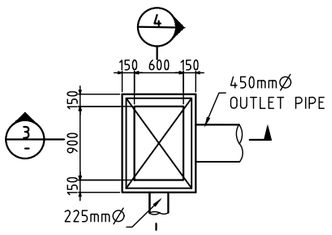
SECTION 2 - 2

SCALE: 1/75



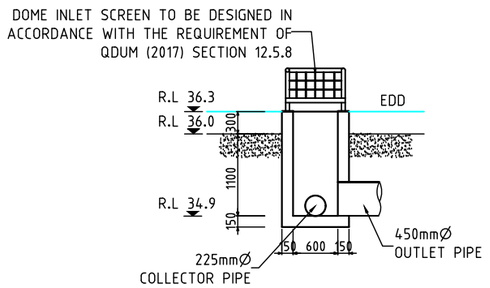
WEIR CROSS SECTION 2-2

SCALE: 1/100



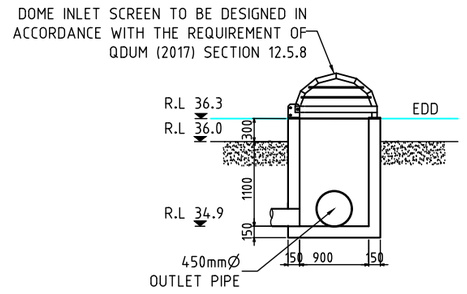
OVERFLOW STRUCTURE PLAN - PIT B2

SCALE: 1/75



SECTION 3 - 3

SCALE: 1/75



SECTION 4 - 4

SCALE: 1/75

OUTLET DETAILS

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-321

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN B - INLET AND OUTLET DETAILS

CLIENT
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ADDRESS:
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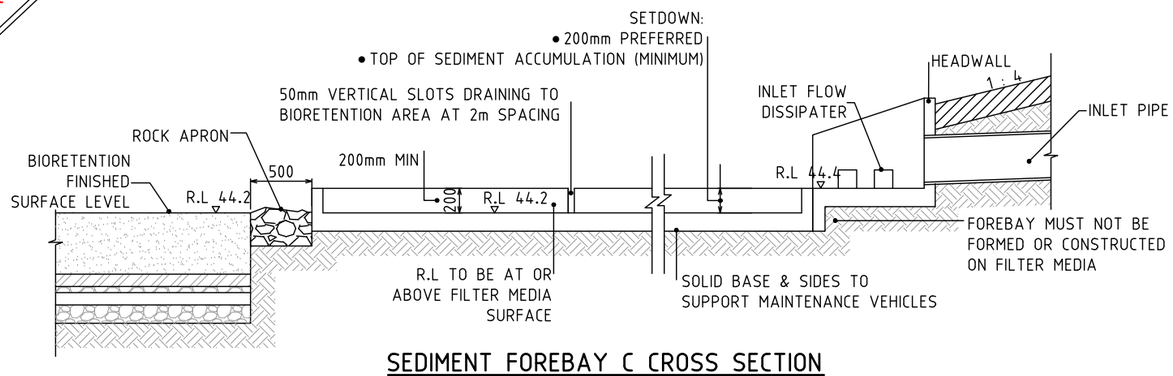
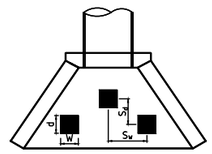


SEDIMENT FOREBAY C CROSS SECTION

SCALE: 1/50

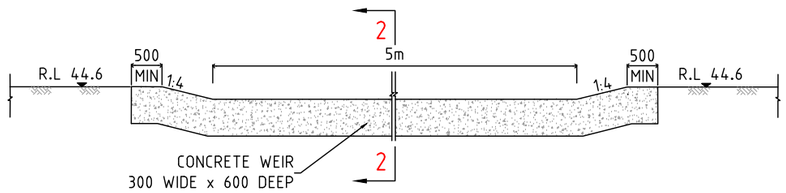


NOTE: ENERGY DISSIPATER LAYOUT TO BE DESIGNED AS PER BRISBANE CITY COUNCIL'S STORMWATER OUTLETS IN PARKS AND WATERWAYS

INLET SCOUR PROTECTION DETAILS

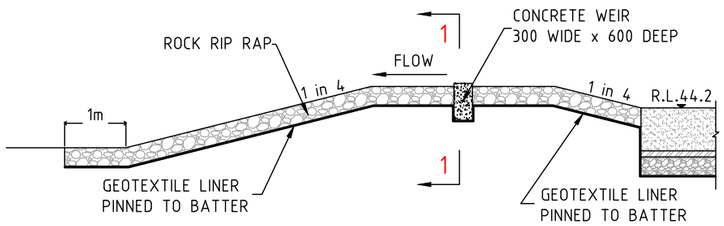
N.T.S

INLET DETAILS



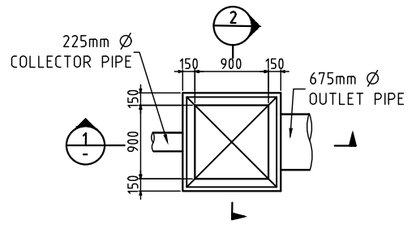
WEIR DETAIL SECTION 1-1

SCALE: 1/100



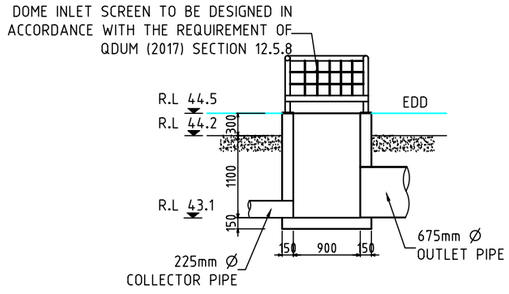
WEIR CROSS SECTION 2-2

SCALE: 1/100



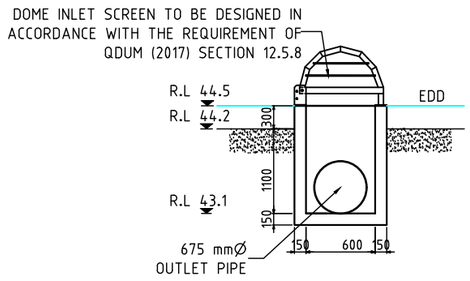
OVERFLOW STRUCTURE PLAN - PIT C

SCALE: 1/75



SECTION 1 - 1

SCALE: 1/75



SECTION 2 - 2

SCALE: 1/75

OUTLET DETAILS

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-322

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN C - INLET AND OUTLET DETAILS

CLIENT
GALLERY HOMES PTY LTD

ADDRESS:
COURTNEY DRIVE, UPPER COOMERA, QLD

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VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.04.19
B	WATERWAY ADDED – IRR		01.11.19

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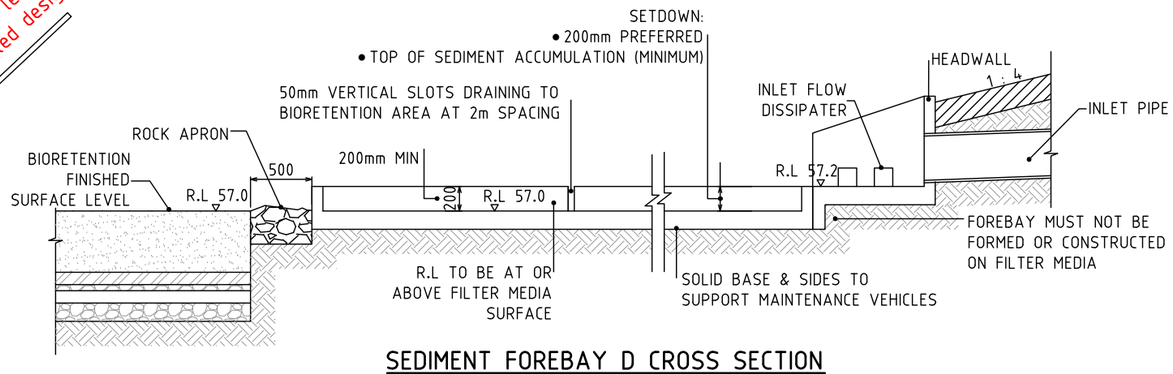
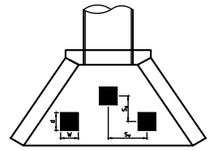


SEDIMENT FOREBAY D CROSS SECTION

SCALE: 1/50

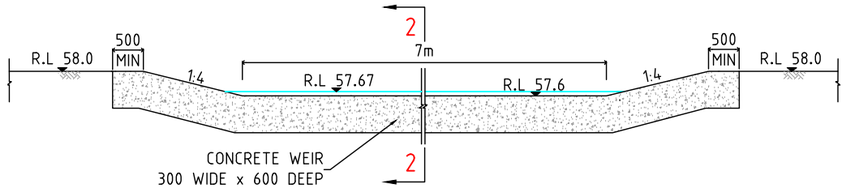


NOTE: ENERGY DISSIPATER LAYOUT TO BE DESIGNED AS PER BRISBANE CITY COUNCIL'S STORMWATER OUTLETS IN PARKS AND WATERWAYS

INLET SCOUR PROTECTION DETAILS

N.T.S

INLET DETAILS



WEIR DETAIL SECTION 1-1

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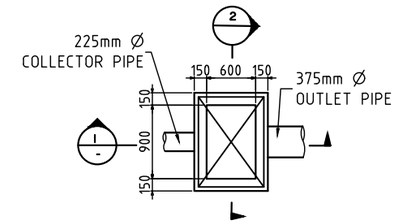

OVERFLOW STRUCTURE PLAN - PIT D

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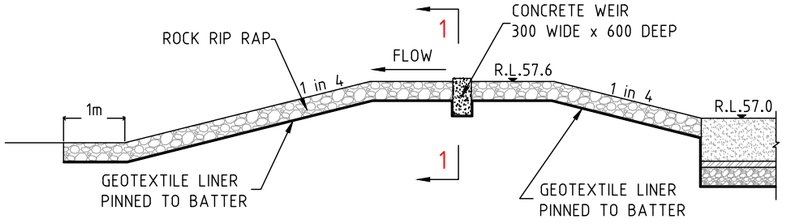

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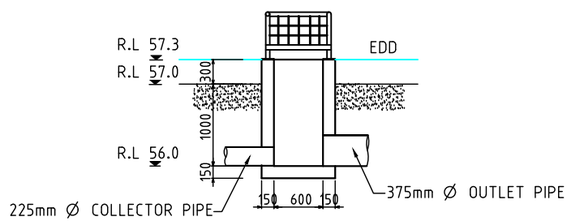

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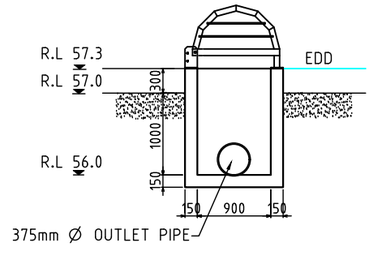

SECTION 2 - 2

SCALE: 1/75

OUTLET DETAILS

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-323

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN D - INLET SCOUR PROTECTION DETAILS

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ADDRESS:
COURTNEY DRIVE, UPPER COOMERA, QLD

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PO Box 3469, Australia Fair, Southport
M 0415 935 222
E brad@BIOMEconsulting.com.au
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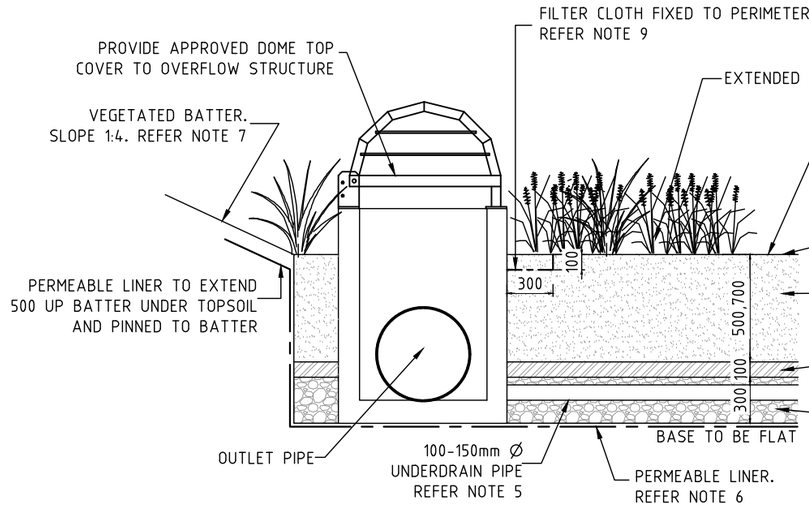
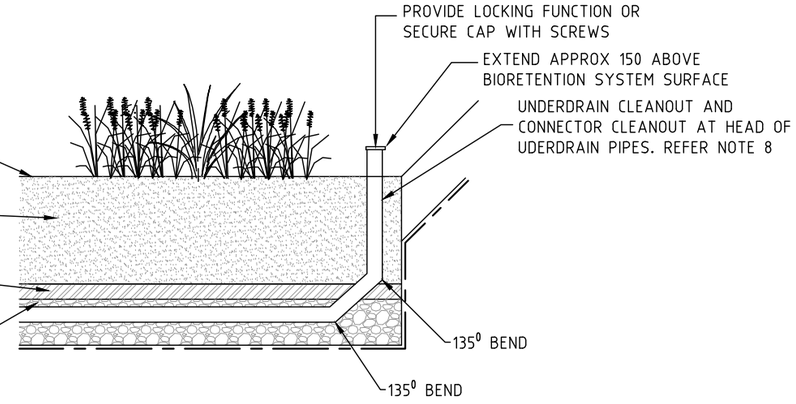
All hydraulic details and levels T.B.C as part of detailed design



BIORETENTION MEDIA (TYPE 3-CONVENTIONAL) CROSS SECTION

N.T.S



BIORETENTION BASIN SUBSOIL DRAIN CLEANOUT (TYPE 3-CONVENTIONAL)

N.T.S

NOTES (IN ACCORDANCE WITH IPWEAQ STANDARD DRAWINGS DS-070 AND DS-073):

1. BIORETENTION SYSTEM SURFACE. SURFACE LEVEL IS TOP OF FILTER MEDIA. SURFACE TO BE PLANTED AS PER PROJECT DRAWINGS AND THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).
2. FILTER MEDIA SPECIFICATION SHALL BE IN ACCORDANCE WITH THE 'ADOPTION GUIDELINES FOR STORMWATER BIOFILTRATION SYSTEMS (CRC FOR WATER SENSITIVE CITIES) AND THE BIORETENTION TECHNICAL DESIGN GUIDELINES (WATER BY DESIGN). BIORETENTION HYDRAULIC CONDUCTIVITY SHALL BE IN ACCORDANCE WITH PRACTICE NOTE 1: IN SITU MEASUREMENT OF HYDRAULIC CONDUCTIVITY' (FAWB). THE NUMBER OF SAMPLES TO BE TESTED SHALL BE IN ACCORDANCE WITH THE 'CONSTRUCTION AND ESTABLISHMENT GUIDELINES - SWALES, BIORETENTION SYSTEMS AND WETLANDS' (WATER BY DESIGN).
3. CONSTRUCTION TOLERANCES SHALL BE IN ACCORDANCE WITH THE 'CONSTRUCTION AND ESTABLISHMENT GUIDELINES -SWALES, BIORETENTION SYSTEMS AND WETLANDS' (WATER BY DESIGN)
4. TRANSITION LAYER AND DRAINAGE LAYER. DEPTHS AND SPECIFICATION TO BE IN ACCORDANCE WITH THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN)
5. UNDERDRAIN. SLOTTED RIGID PIPE LAID FLAT. PIPE SHOULD NOT BE INSTALLED WITH A FILTER SOCK SURROUNDING PIPE. UNDERDRAIN PIPES SHALL BE SEALED INTO PITS USING GROUT OR OTHER APPROVED WATERTIGHT SEAL.
6. PERMEABLE LINER. NON-WOVEN GEOTEXTILE FILTER CLOTH TO BASE AND SIDES OF BIORETENTION SYSTEM. FILTER CLOTH NOT TO BE PLACED BETWEEN ANY FILTER LAYERS. PERMEABLE LINER AS PER 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN)
7. VEGETATED BATTER. SLOPE AND PLANTING TO BE IN ACCORDANCE WITH 'BIORETENTION TECHNICAL DESIGN GUIDELINES' (WATER BY DESIGN).
8. INSPECTION/CLEANOUT POINT. VERTICAL SOLID PIPE SECTION ATTACHED TO THE END OF EACH UNDERDRAIN IN ACCORDANCE WITH THE 'BIORETENTION TECHNICAL DESIGN GUIDELINES'(WATER BY DESIGN)
9. FILTER CLOTH TO BE FIXED TO PERIMETER OF PIT TO AVOID RUNNELLING OF WATER BETWEEN PIT AND SOIL INTERFACE. BEGIN FILTER CLOTH 100 ABOVE SURFACE. EXTEND TO 100 BELOW SURFACE. CONTINUE 300 HORIZONTALLY INTO FILTER MEDIA.
10. FOR GENERAL DESIGN AND CONSTRUCTION NOTES REFER TO DS-078
11. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-330

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BIORETENTION – FILTER MEDIUM DETAILS

CLIENT
GALLERY HOMES PTY LTD

ADDRESS:
COURTNEY DRIVE, UPPER COOMERA, QLD

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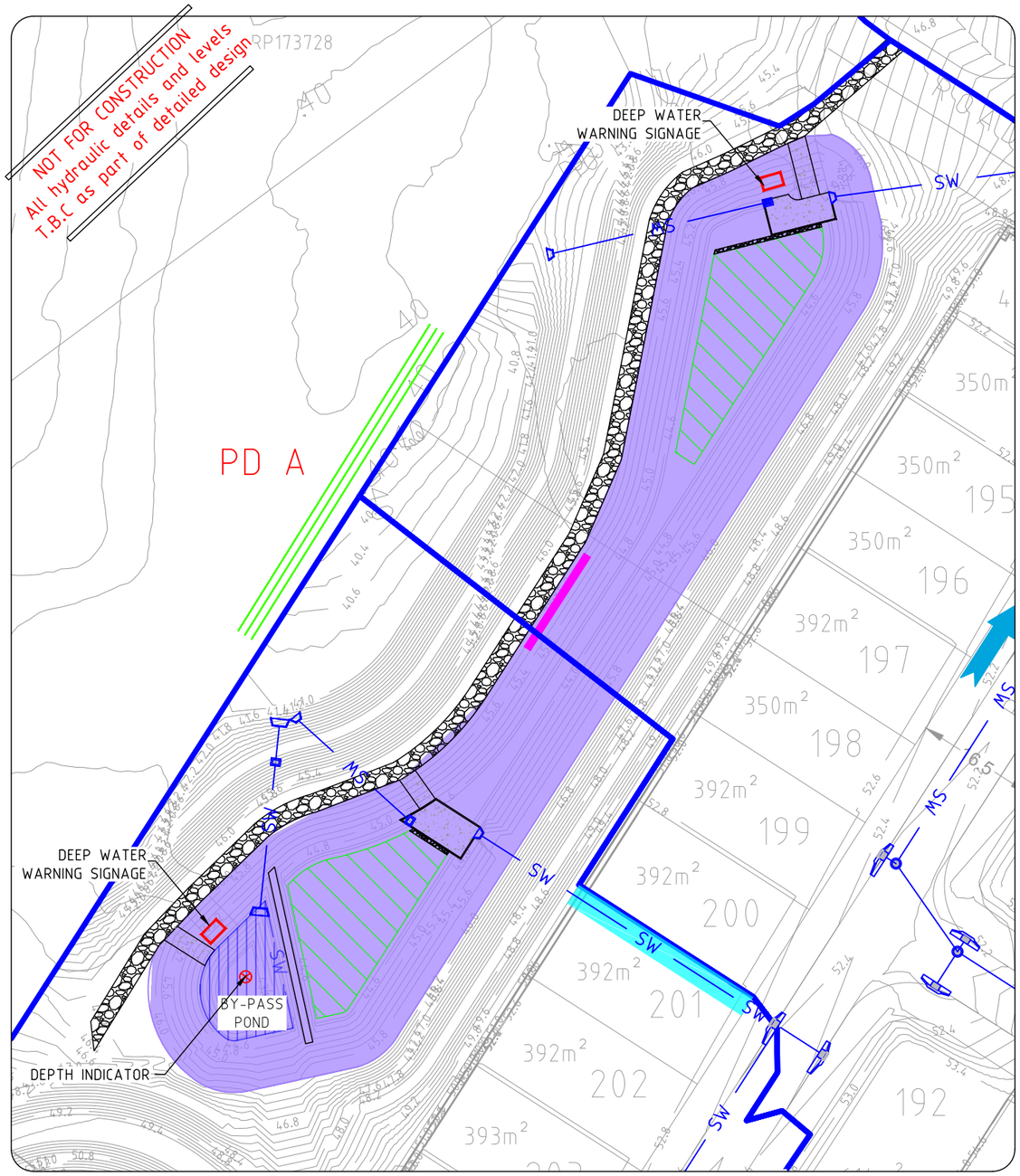

PLAN VIEW

10 0 10 20 30 40

1 : 750 (FULL SIZE) (metres)

DEEP WATER WARNING SIGNAGE

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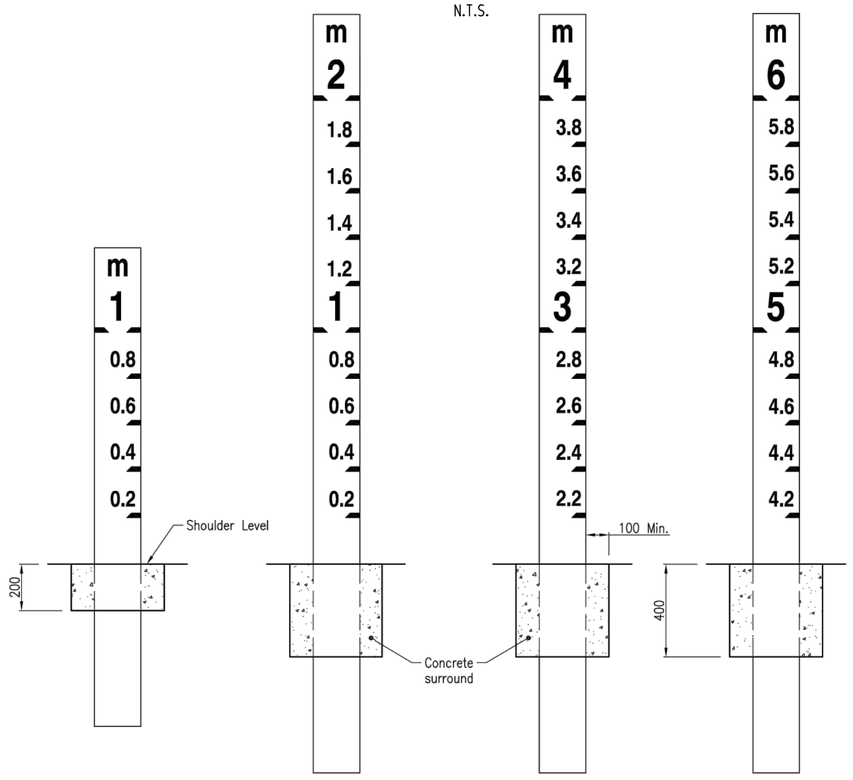

DEPTH INDICATORS

N.T.S.

NOTE:

FLOOD DEPTH INDICATORS:

1. DEPTH INDICATORS ARE TO HAVE A ZERO LEVEL RELATIVE TO THE LOWEST POINT IN THE BASIN FLOOR SO AS TO CLEARLY SHOW CURRENT WATER DEPTHS
2. G9-22-2 AND G9-22-3 INDICATORS TO BE ERECTED ON PROGRESSIVELY HIGHER GROUND WHERE FLOOD DEPTHS ARE IN EXCESS OF 1.5m OR 3.5m RESPECTIVELY.

CONCRETE SURROUND:

3. TO BE CLASS N20/20 AND PROVIDE 100mm MINIMUM COVER ALL ROUND.
4. DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

DATE
01.11.19

PROJECT No. :
BC-16090

DRAWING No. :
DWG-340

REVISION No. :
B

PROJECT
PROPOSED SUBDIVISION

DRAWING TITLE
BASIN A - DEPTH INDICATOR AND DEEP WARNING SIGNAGE

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ADDRESS:
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Appendix C

Rational Method Model Validation

The Rational Method has been relied upon to validate the flows reported within *xpstorm* for both the pre and post development cases. In accordance with QUDM 2013 Section 4, the Rational Method provides a simple means of estimating peak discharge and is therefore considered suitable for validation purposes. Equation 4.2 from QUDM has been relied upon.

$$Q_y = (C_y \cdot {}^{t}I_y \cdot A)/360$$

where:

Q_y	=	peak flow rate (m^3/s) for annual exceedance probability (AEP) of 1 in '*y*' years
C_y	=	coefficient of discharge for AEP of 1 in '*y*' years
A	=	area of catchment (ha)
${}^{t}I_i$	=	average rainfall intensity (mm/h) for a design duration of '*t*' hours and an AEP of 1 in '*y*' years
t	=	the nominal design storm duration as defined by the time of concentration (t)

Coefficient of Discharge

Based on the infiltration characteristics of the internal and external catchments, the following discharge coefficients have been calculated using the method presented within Book 8 of Australian Rainfall and Runoff (1998) and based on Equation 4.4 from QUDM (2013).

$$C_y = F_y \cdot C_{10}$$

where:

C_y	=	coefficient of discharge for AEP of 1 in '*y*' years
F_y	=	frequency factor for AEP of 1 in '*y*' years
C_{10}	=	10 year discharge coefficient value for Tables 4.5.3 and 4.5.4 of QUDM

Based on Table SC6.9.2-7, Runoff Coefficient vs Development Category of the City Of Gold Coast Land Development Guidelines, C_{10} values have been determined for each catchment and the coefficient of discharge values for the nominated AEP's for the existing and developed catchment condition are shown in Tables C.1 and C.2, respectively.

Table C.1 Coefficient of Discharge – Existing Case

Catchment & Point of Discharge ID			C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
External	PD-A	Ext-1	0.68	0.76	0.8	0.84	0.92	0.96
Internal		A	0.68	0.76	0.8	0.84	0.92	0.96
	PD-B		0.68	0.76	0.8	0.84	0.92	0.96
	PD-C		0.68	0.76	0.8	0.84	0.92	0.96
	PD-D		0.68	0.76	0.8	0.84	0.92	0.96

Table C.2 Coefficient of Discharge – Developed Case

Catchment & Point of Discharge ID			C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
External	PD-A	Ext-1	0.68	0.76	0.8	0.84	0.92	0.96
Internal	PD-A	A1	0.68	0.76	0.80	0.84	0.92	0.96
	PD-A	A2a	0.72	0.81	0.85	0.89	0.98	1.00
	PD-A	A2b	0.72	0.81	0.85	0.89	0.98	1.00
	PD-B		0.72	0.81	0.85	0.89	0.98	1.00
	PD-C		0.72	0.81	0.85	0.89	0.98	1.00
	PD-D		0.72	0.81	0.85	0.89	0.98	1.00

Time of Concentration

The time of concentration (t_c) for each catchment was calculated in accordance with Section 4.6 of QUDM. A standard inlet time of concentration of 5 min has been adopted within developed catchments from Table 4.6.2 of QUDM (2013).

The time of concentration (t_c) for the initial flow length within the undeveloped catchments was estimated using Friend's Equation for overland flow (QUDM Section 4.6.6).

$$t_c = (107nL^{0.333})/S^{0.2}$$

where:

t_c	=	Time of concentration (min)
n	=	Horton's roughness value
L	=	Overland sheetflow path length (m)
S	=	Slope (%)

For channel flows, times where estimated using approximate stream velocities as provided within QUDM Table 4.6.6 and based an average catchment surface slope.

Table C.3 and C.4 below present the parameters relied upon to calculate the time of concentration (t_c) to the discharge point of each catchment for the existing and developed case, respectively.

Table C.3 t_c Parameters Remaining Flow Length – Existing Case

Parameter	External	Internal			
	Ext-1	A	B	C	D
Standard Inlet Time					
t_c (min)	-	-	-	-	-
Sheet Flow					
Flow Length (m)	50	50	50	50	50
Horton's Roughness Value	0.04	0.04	0.04	0.04	0.04
Slope (%)	25	8	11	14	16
t_c (min)	8.3	10.4	9.7	9.3	9.0
Channel Flow					
Flow Length (m)	150	341	217	111	78
Velocity (m/s)	3	1.5	1.5	1.5	3
Slope (%)	25	8	11	14	16
t_c (min)	0.83	3.79	2.41	1.23	0.43
TOTAL t_c (min)	**9.11**	**14.18**	**12.16**	**10.52**	**9.48**

Table C.4 Time of Concentration - Developed Case

Parameter	External	Internal					
	Ext-1	A1	A2a	A2b	B	C	D
Standard Inlet Time							
t_c (min)	-	-	5	5	5	5	5
Sheet Flow							
Flow Length (m)	50	50	-	-	-	-	-
Horton's Roughness Value	0.04	0.04	-	-	-	-	-
Slope (%)	25	20	-	-	-	-	-
t_c (min)	8.3	8.6	-	-	-	-	-
Channel Flow							
Flow Length (m)	150	65					
Velocity (m/s)	3	3					
Slope (%)	25	30					
t_c (min)	0.83	0.36					
Pipe Flow							
Flow Length (m)	-	-	280	320	270	250	140
Velocity (m/s)	-	-	1	1	1	1	1
Slope (%)	-	-	1	1	1	1	1
t_c (min)	-	-	4.67	5.33	4.50	4.17	2.33
TOTAL t_c (min)	**9.11**	**9.01**	**9.67**	**10.33**	**9.50**	**9.17**	**7.33**

Rainfall Intensity

Based on the calculated t_c for each catchment, Intensity-Frequency-Duration data (IFD) has been obtained from the Bureau of Meteorology for nominated AEP's and the existing and developed cases are presented in Tables C.5 and C.6, respectively.

Table C.5 Rainfall Intensity (mm/h) – Existing Case

Catchment & Point of Discharge ID			I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
External	PD-A	Ext-1	119.45	148.87	171.12	196.19	228.32	252.10
Internal		A	100.20	124.61	143.10	162.92	188.74	207.40
	PD-B		107.35	133.50	153.20	175.04	202.88	223.15
	PD-C		113.16	140.71	161.40	184.88	214.36	235.94
	PD-D		117.60	14643	168.16	192.78	224.03	247.07

Table C.6 Rainfall Intensity (mm/h)– Developed Case

Catchment & Point of Discharge ID			I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
External	PD-A	Ext-1	119.45	148.87	171.12	196.19	228.32	252.10
Internal		A1	95.7	120.0	149.5	171.9	197.1	229.5
		A2a	93.0	116.7	145.2	166.6	191.0	221.8
		A2b	90.8	113.8	141.5	162.4	186.0	215.7
	PD-B		93.7	117.5	146.3	168.0	192.6	223.8
	PD-C		95.1	119.2	148.5	170.6	195.6	227.6
	PD-D		102.5	128.4	160.6	185.4	212.6	249.0

Peak Discharge

Based on the above parameters, estimates of the expected peak discharge generated at the site's existing discharge locations for nominated AEP's have been calculated, and are presented in Tables C.7 and C.8 below.

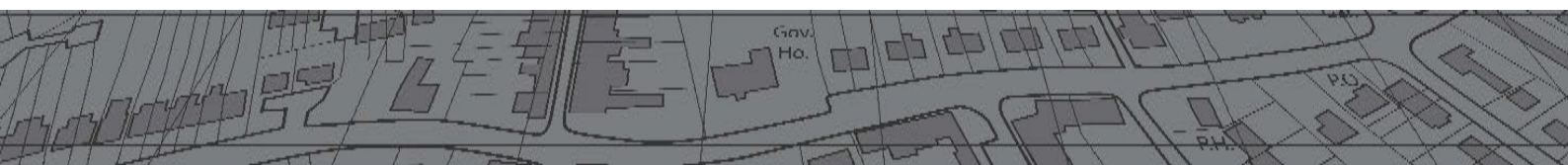
Table C.7 Peak Discharge (m^3/s) – Existing Case

Catchment & Point of Discharge ID			0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
External	PD-A	Ext-1	0.509	0.709	0.858	1.033	1.317	1.517
Internal	PD-A	A	1.628	2.263	2.735	3.270	4.149	4.757
	PD-B		0.893	1.241	1.499	1.798	2.283	2.620
	PD-C		0.617	0.857	1.035	1.245	1.581	1.816
	PD-D		0.430	0.598	0.723	0.870	1.108	1.275

Table C.8 Peak Discharge (m^3/s) – Developed Case

Catchment & Point of Discharge ID			0.393 (2 yr ARI)	0.181 (5 yr ARI)	0.095 (10 yr ARI)	0.049 (20 yr ARI)	0.02 (50 yr ARI)	0.01 (100 yr ARI)
External	PD-A	Ext-1	0.51	0.71	0.86	1.03	1.32	1.521
Internal	PD-A	A1	0.35	0.49	0.60	0.72	0.91	1.05
	PD-A	A2a	0.91	1.27	1.53	1.84	2.34	2.64
	PD-A	A2b	0.72	1.01	1.22	1.46	1.86	2.09
	PD-B		1.23	1.71	2.06	2.48	3.16	3.56
	PD-C		0.59	0.83	1.00	1.20	1.53	1.73
	PD-D		0.55	0.77	0.94	1.13	1.45	1.64

ATTACHMENT 8
Bushfire Management Plan



Wollemi Eco-Logical

Environmental Project Management | Bushfire Assessment | Vegetation Management

Bushfire Management Plan

79-99 Courtney Drive, Upper Coomera

Lots 188-192 on RP173728

Gold Coast City Council, Qld

Prepared by:

Wollemi Eco-Logical Pty Ltd
PO BOX 123
WAMURAN QLD 4512

Project Reference: **19220**

Version / Date: **V6 / 1 November 2019**

Prepared for:

Gallery Homes
PO Box 855
Sanctuary Cove Qld. 4212

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It should be noted that the recommendations within this BMP have been formulated based on site conditions at the time of writing and utilising current best-practise hazard and impact assessment methodologies, and have been developed to reduce the potential severity of impacts on the proposed development in the event of a bushfire emergency rather than prevent impacts altogether. No guarantee is provided or assumed that the area will not be affected by bushfire at some time.

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1.0 INTRODUCTION

Wollemi Eco-Logical has been commissioned to undertake a Site Specific Bushfire Hazard Assessment and to prepare a Bushfire Management Plan for a proposed development on the subject site (**Figure 1**).

This report aims to assess the Bushfire Hazard and risk to the proposed development with regard to the *Queensland State Government Single State Planning Policy - Part E* (SPP 2017), and the *Gold Coast City Council, Bushfire Hazard Overlay Code (8.2.3),* and the *Australian Standard – Construction in Bushfire Prone Areas (AS3959-2018).* These documents detail both the State and Council interest in Bushfire Hazard with regard to determining suitability of development applications.

Subsequently, this report references currently available best-practice Bushfire Hazard Assessment and Risk Mitigation Methodologies, from the following sources: Vegetation Hazard Classification & Potential Fire-line Intensity for Queensland sourced from 'A new methodology for state-wide mapping of bushfire prone areas in Queensland'. CSIRO, Australia. (2014); Bushfire Attack Level (BAL), Building setback requirements and Construction Standards as per the Australian Standard AS 3959- 2018 - *Construction of buildings in bushfire prone areas*. These methodologies are used in conjunction with GCCC Planning Scheme requirements to ensure appropriate assessment and mitigation of potential bushfire hazard is undertaken.

Vegetation composition and extent, slope and industry standard Fuel Load calculations will be used to determine the Potential Bushfire Hazard acting on the proposed development. Once determined, Bushfire Risk Mitigation Measures are detailed in order to demonstrate compliance with Councils Planning Scheme performance outcome to ensure the safety of people and property in the event of a bushfire emergency.

This BMP has been prepared by a suitably qualified Bushfire Consultant with over 20 years relevant experience in Environmental Management & Bushfire Planning and Design experience specific to South East Queensland.

1.1 Subject Site

Address:	79-99 Courtney Drive, Upper Coomera
Titles:	Lots 188-192 on RP173728
Local Government:	Gold Coast City Council
Total Area:	18,849ha
Zoning:	Rural Residential - Emerging Community
Topography:	The site is undulating, predominantly sloping downslope from the south and eastern property boundaries to the north through northwest at up to 5 degrees, with a downslope to the south-eastern site extent.
Current Use:	Rural Residential land uses.

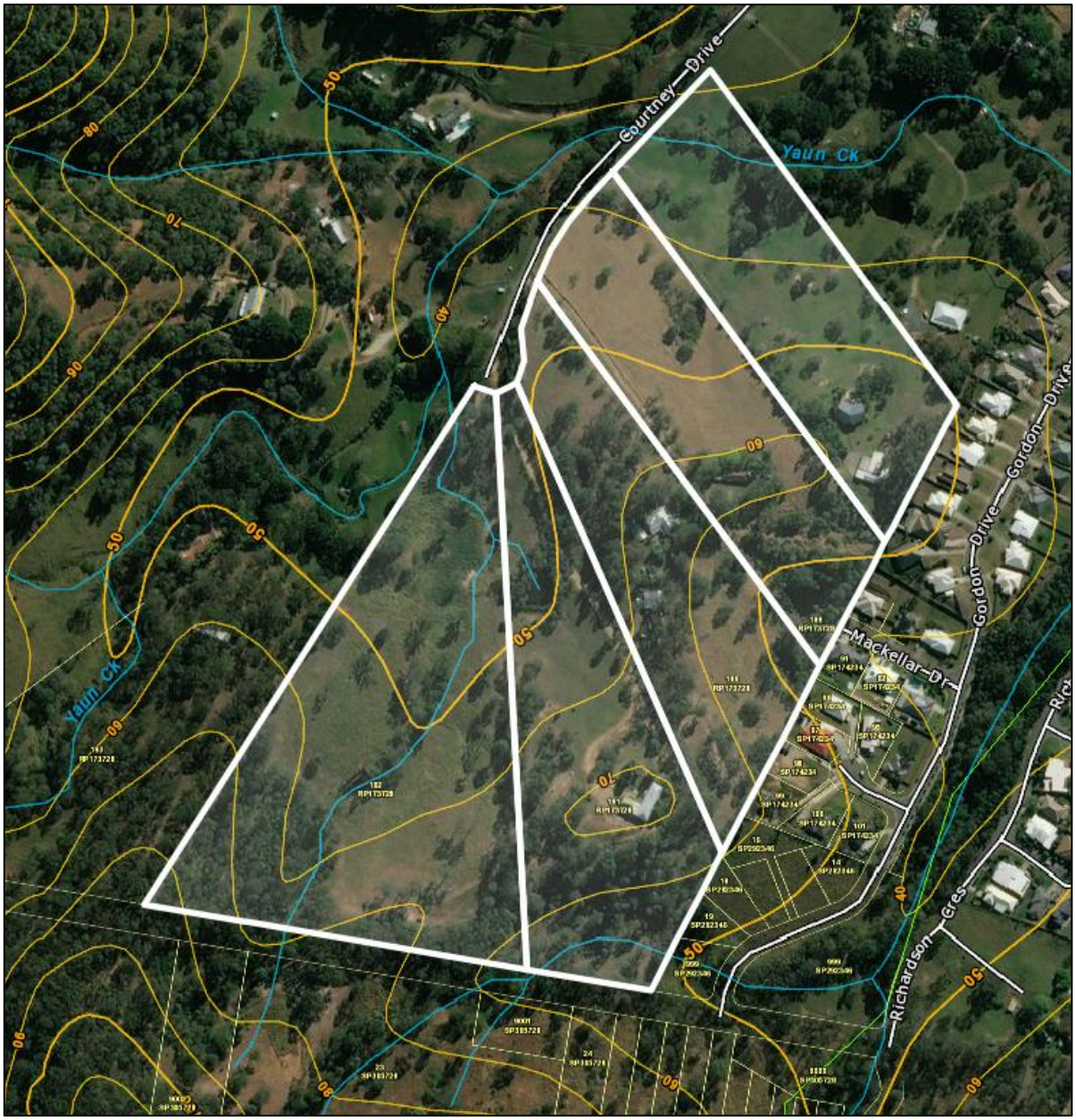


Figure 1: Subject Site

1.2 Proposed Development

It is understood a new 220 Residential Lot subdivision (5 into 220) is proposed to be constructed on the subject site. The proposed development layout is represented in **Figure 2**.

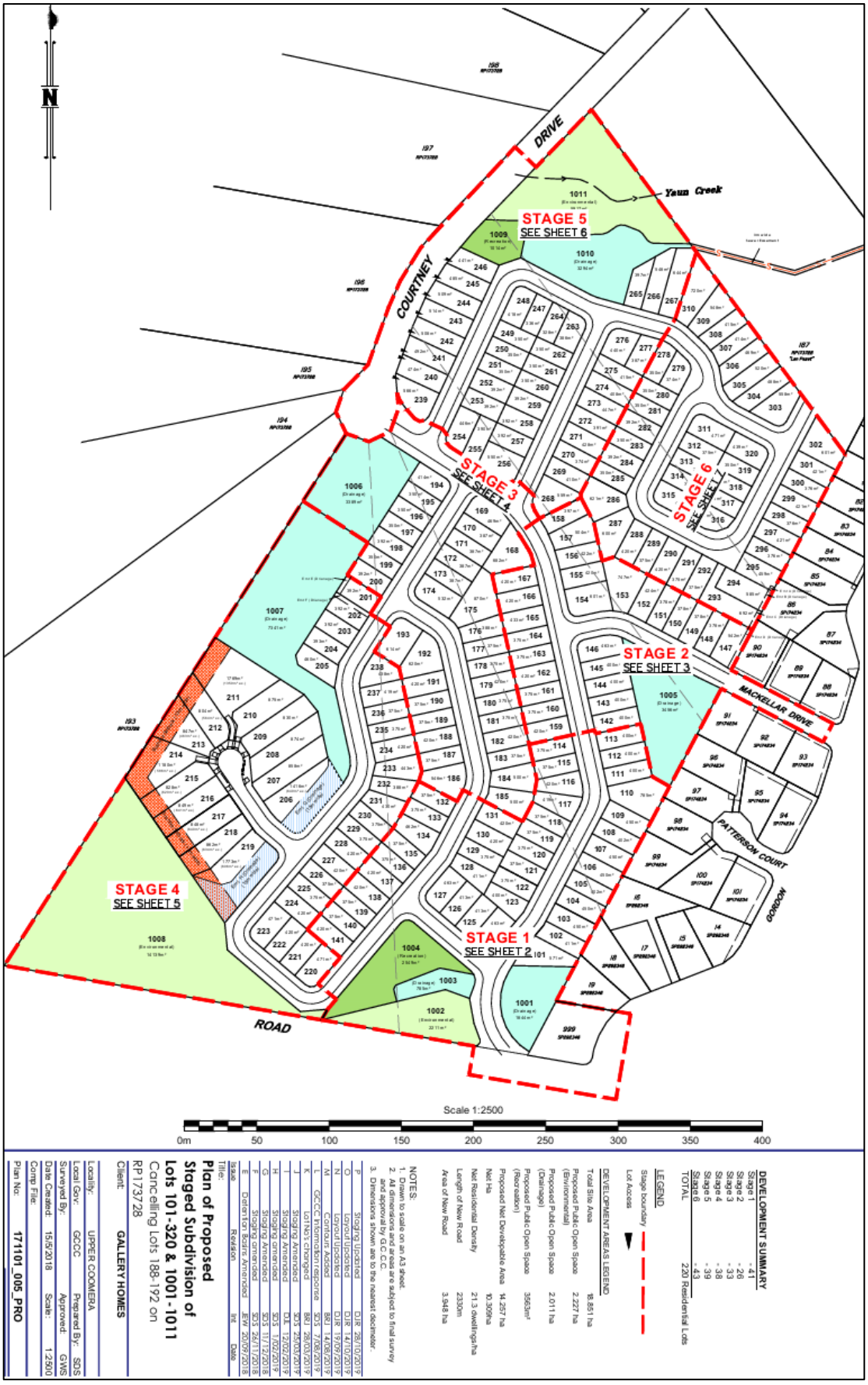


Figure 2: Proposed Development Layout

2.0 Bushfire Hazard Assessment

The prevalence of Bushfire in the landscape is dependent on vegetation type and fuel load available to sustain a bushfire. Bushfire intensity and rate of spread are influenced by fuel load, (including type and extent of vegetation), topography and to a lesser extent aspect. Land uses surrounding potentially hazardous vegetation, and consequently the connectivity of vegetation communities, all influence the potential for a bushfire to develop and be sustained.

2.1 Current Bushfire Hazard Mapping

On review of current State Bushfire Hazard Overlay Mapping, as maintained by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) the site is mapped as being within a Potential Bushfire Hazard area (**Figure 3**).

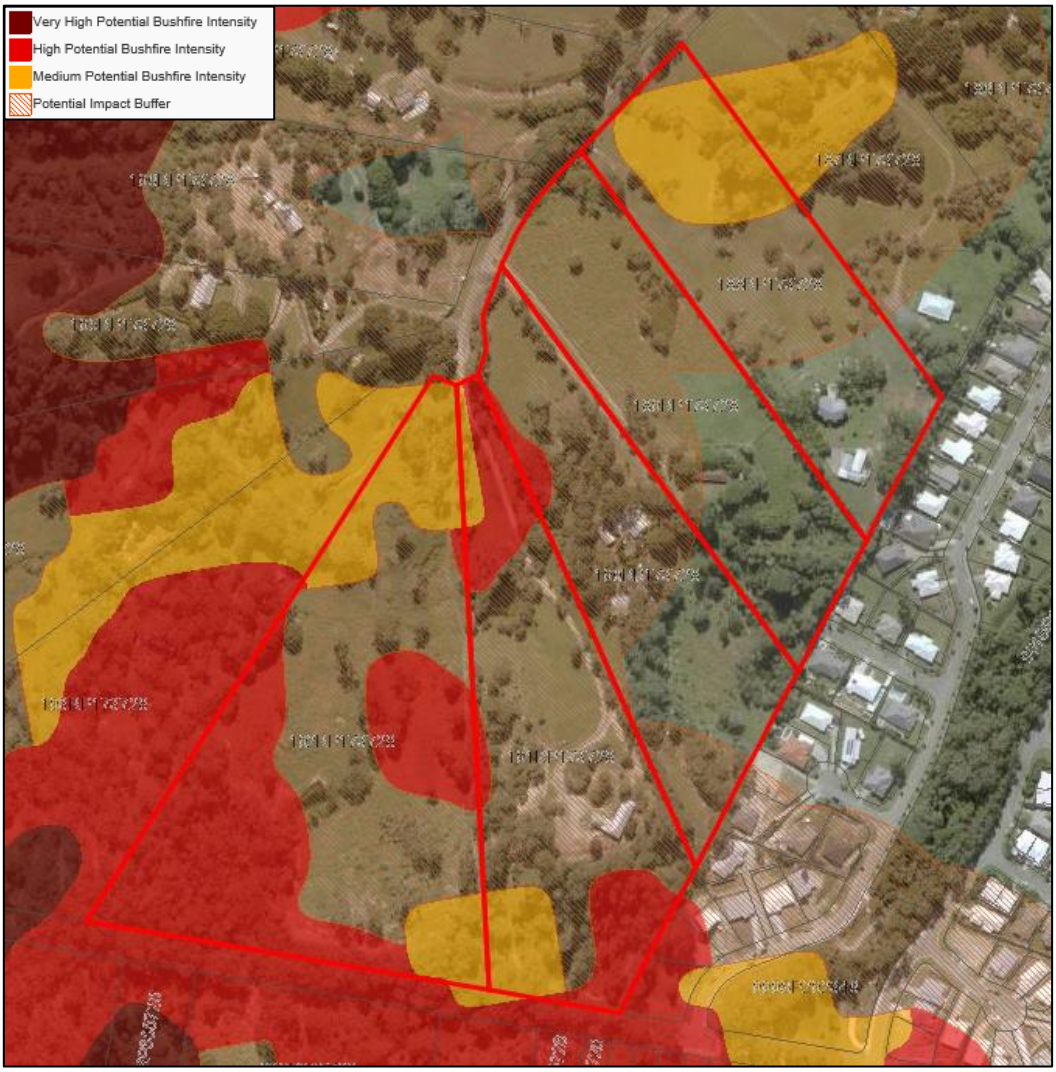


Figure 3: State Bushfire Hazard Overlay Mapping

It is noted that Council Bushfire Hazard Overlay Mapping is consistent with current State mapping as represented in Figure 3. To verify the Bushfire Hazard mapping, a Site-Specific Bushfire Hazard Assessment is triggered, and is addressed below.

2.2 On-Site Hazard Assessment

This Site Specific Bushfire Hazard Assessment references: Vegetation Hazard Classification & Potential Fire-line Intensity for Queensland sourced from *A new methodology for state-wide mapping of bushfire prone areas in Queensland*. CSIRO, Australia. (2014)[1]; Bushfire Attack Level (BAL), Building setback requirements and Construction Standards as per the Australian Standard AS 3959- 2018 - *Construction of buildings in bushfire prone areas*[2]; and Bushfire Risk Mitigation Measures in compliance with current industry best-practice assessment methodologies. Vegetation composition and extent, slope and industry standard Fuel Load calculations will be used to determine the Potential Bushfire Hazard acting on the proposed development. Additionally, this BMP will address the requirements of the proposed development against *Gold Coast City Council, Bushfire Hazard Overlay Code (8.2.3)* with regard to the proposed development.

Two key features of the landscape strongly contribute towards the behaviour of bushfires:

1. Vegetation community structure/composition
   The structure and composition of vegetation communities determine the rate at which dry fuel accumulates. Some vegetation communities protect fuel from drying out in all but extreme bushfire seasons, making the vegetation susceptible to very destructive bushfires, whilst other vegetation communities may expose fuels to drying and therefore be frequently available for burning.
2. Slope
   As a general rule, bushfire intensity and the rate of spread of bushfires rises in proportion to slope, with bushfires burning faster uphill and slower downhill. Studies have shown that the speed and intensity of fires moving up slopes generally doubles every 10 degrees of slope. Steeper slopes also increase the difficulty of constructing ring roads and firebreaks and limit the access for emergency crews.

Several investigative tools were utilised to determine the site specific bushfire hazard risk including:

[1] This methodology updates the calculations apparent in the Australian Standard AS3959: 2018 based on current fire weather modelling and includes 43 detailed Vegetation Hazard Classes, in addition to the 20 broad Hazard categories used to update State-wide Mapping.

[2] The Australian Standard AS3959: 2018 defines Fire Danger Index as the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression, according to various combinations of air temperature, relative humidity, wind speed and both the long and short term drought effects.

- A review of local aerial photography;
- A review of site and local topography;
- Review of site development plan;
- A review of DERM Regional Ecosystem Mapping; and
- An inspection of the site.

The risk assessment comprised an analysis of the site and the surrounding lands (i.e. within 100m) to determine characteristic bushfire risk based on Vegetation Hazard Classifications for vegetation within 100m of the site.

2.2.1 Site Inspection & Findings

A site inspection was completed on the 31st August 2017 to verify the bushfire hazard mapping over the site and surrounds. All vegetated areas of the site and within 100m of the proposed development site were assessed during the site investigations.

A summary of the findings of the site inspection is provided:

1. Site access is via Courtney Drive, a formed public bitumen road bordering the northwest of the majority of the site. Courtney Drive is accessed from the east via Reserve Road, a major arterial road, linking the pacific Motorway in the east.
2. The site is located in a Rural Residential setting, with established dwellings and rural land uses on site and to the west, south and north. Extensive emerging residential development is located immediately to the east of the site, and further afield to the northeast.
3. Site topography is undulating with the lots 188 – 192 generally sloping upslope from Courtney Drive to the southern and eastern extents of the property boundaries (respectively) at up to 5 degrees. Lot 188 contains an overland flow path through the north-western portions of the lots and subsequently slopes downhill from Courtney drive to the northeast in this locality. Adjacent properties to the south of Lots 191 and 192 slope upslope to the south. Adjacent properties to the east slope downslope at approximately 7 degrees, and properties on the western side of Courtney Drive slope up to the southwest through west to northwest respectively.
4. Regulated Vegetation as maintained by Qld Department of Natural Resources & Mines (DNRM), maps a small area adjacent the south-western boundary of Lot 192 as containing Regional Ecosystem (RE) 12.11.5 (dominate), described as '*Corymbia citriodora subsp. variegata, Eucalyptus siderophloia, E. major open forest on metamorphics ± interbedded volcanics*' (Refer **Figure 5**).

   Site assessment generally confirmed the vegetation present in this locality (southwest) to be reflective of the described RE, all-be-it fragmented and with variable foliage projective cover. The remainder of site vegetation consisted of: small patches of fragmented native vegetation, consisting of limited dominant species (i.e. mature Eucalypt sp.) and relatively high percentage of acacia; scattered trees and shrubs

(predominantly Eucalypt and acacia); dominant, predominantly maintained grazing land throughout; ornamentals and exotics associated with existing residences, and exotic species, predominantly lantana, and introduced grasses.

5. Adjacent vegetation to the north consists predominantly of managed grazing land, with scattered trees, and ornamentals as associated with an established residential dwelling and rural residential land use.
6. Adjacent vegetation to the east is limited to scattered trees, ornamentals and maintained grass as associated with established, and under construction, residential dwellings.
7. Adjacent vegetation to the south consists of a narrow (east/west) strip of Eucalypt species in the road reserve, with patches of native and regenerating vegetation and predominantly unmanaged grazing land further south.
8. Adjacent vegetation to the west within 100m is consistent with site vegetation, being scattered trees and shrubs over maintained grazing land, and ornamental associated with residential land uses.

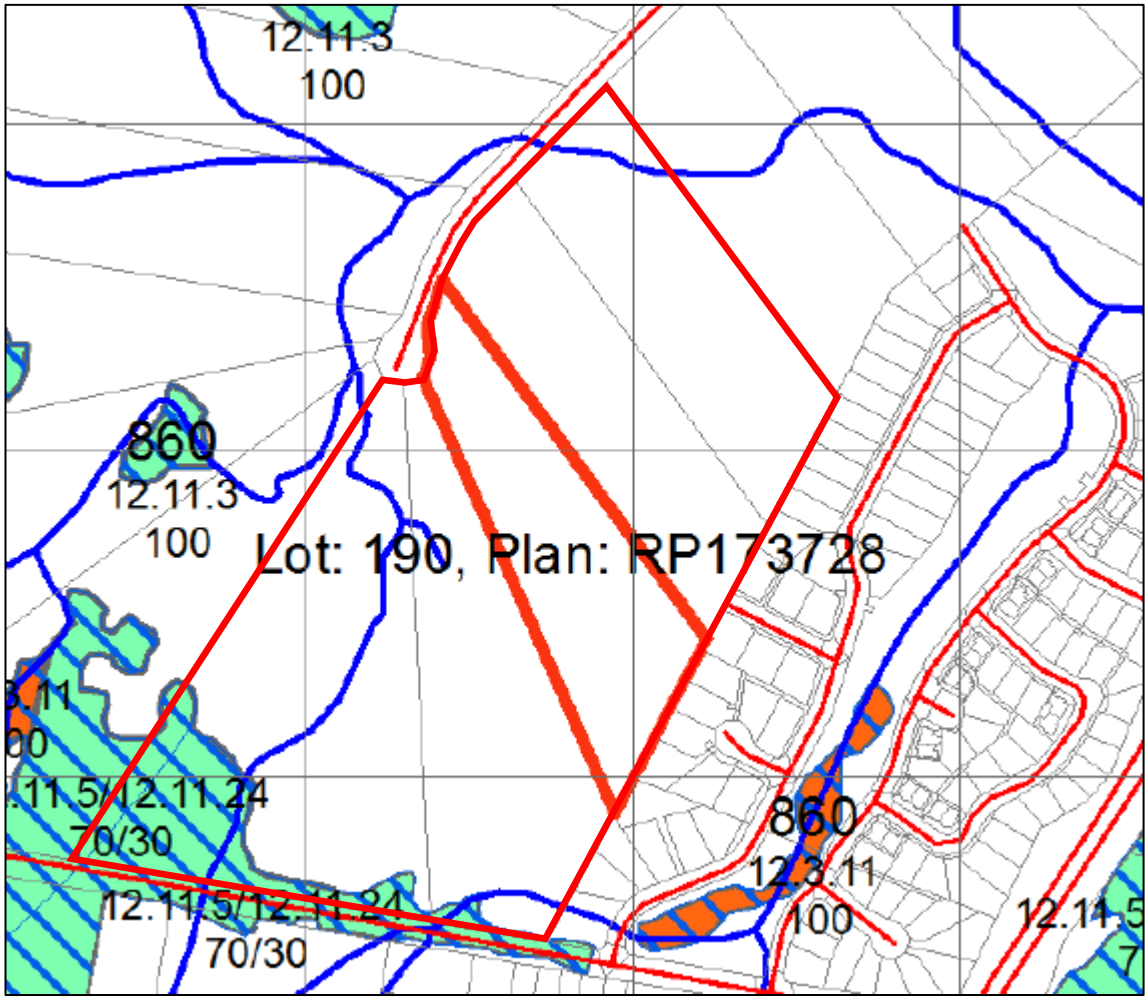


Figure 5: Regional Ecosystem Mapping

2.2.2 Vegetation Classification

The structure and composition of vegetation communities determine the rate at which dry fuel accumulates. Some vegetation communities protect fuel from drying out in all but extreme bushfire seasons, making the vegetation susceptible to very destructive bushfires, whilst other vegetation communities may expose fuels to drying and therefore be frequently available for burning.

Vegetation communities surrounding the proposed development were referenced against mapped RE's in the general vicinity, and Vegetation Hazard Classifications and Potential Fire-line Intensity calculations as detailed in the CSIRO (2014) report. Potential Fuel Load calculations were undertaken on site to validate vegetation classifications and subsequently potential bushfire hazard to the proposed development.

Vegetation ecotones result in varying fuel load availability. Subsequently, vegetation communities have been referenced against predominant vegetation with highest fuel loads. Observed vegetation communities are described in **Table 1**. It is understood that the majority of site vegetation within the proposed development footprint and associated site infrastructure will be removed for the purpose of the development. Note: Retention of individual trees and small patches of vegetation within the development site as per the proposed site layout is considered in the following determinations.

Table 1 Vegetation Hazard Classifications

Direction of Bushfire Hazard	Vegetation Description (Sub-Unit – if relevant)	DNRM Regional Ecosystem (ref. RE)	Vegetation Hazard Class (CSIRO, 2014)	Potential Fuel Load (t/ha)	Potential Fire-line Intensity (kw/m)	Potential Bushfire Hazard
North: Existing Lot 187SP173728	Grazing land, small patch of vegetation, scattered trees (SU1)	NA	Class 12: Mixture of Rural Classes – Mainly Grassland	8t/ha (calculated)	1,984	LOW
East: All proposed Lots	Managed vegetation associated with established residential development (SU2)	NA	Class 16: Mixture of Urban Classes	5t/ha (5 deg.)	1,094	LOW
South to Southeast: Existing Lots 191 & 192 on SP173728)	Narrow strip of Eucalypt species with patches of native vegetation and predominantly unmanaged grazing land. (SU3)	NA	Class 12: Mixture of Rural Classes – Mainly Grassland	10t/ha (calculated)	3,100	LOW
Southwest: Existing Lot 192 SP173728	Eucalypt Forest (SU4)	12.11.5	Class 10.1 Spotted gum dominated open forests	20.8t/ha	14,370	Medium
West: Existing Lot 192 SP173728	Fragmented Eucalypt Forest (SU5)	12.11.5	Class 10.1 Spotted gum dominated open forests	20.8t/ha	14,370	Medium

West: Existing Lots 188 &191SP17372 & northwest of Lot 192 SP17372	Managed Grazing land, scattered trees, rural residential land uses (SU6)	NA	Class 12: Mixture of Rural Classes – Mainly Grassland	5t/ha	830	LOW

Vegetation Hazard classification as described in **Table 1**, are visually represented in **Figure 6.**

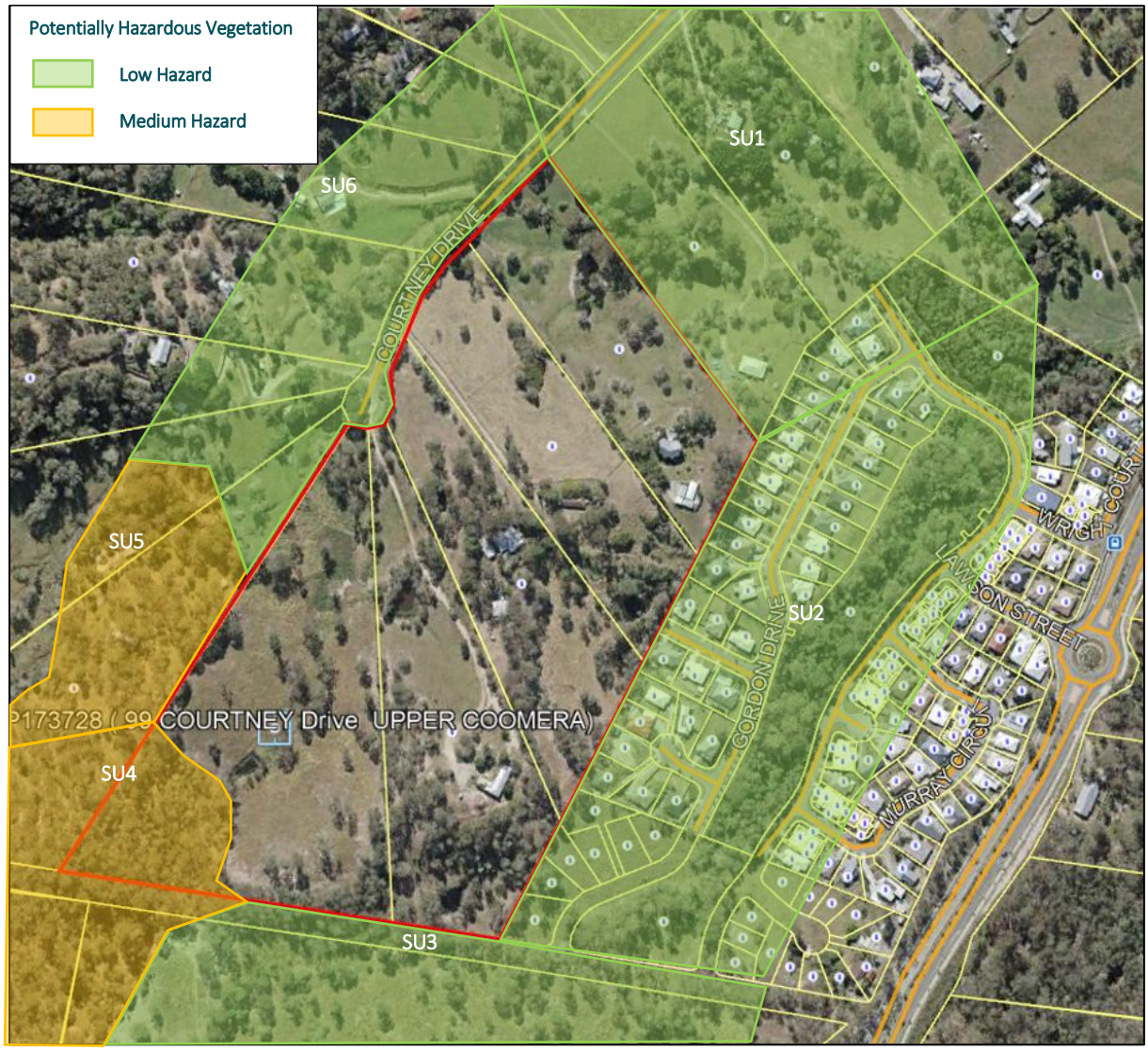


Figure 6: Vegetation Hazard Classification

2.2.3 Potentially Hazardous Vegetation

Based on the above assessment, vegetation posing a Medium Potential Bushfire Hazard to the proposed development is present to the Southwest to West of current Lot 192SP173728. These vegetation communities have the potential to carry moderate fuel loads and subsequently present a potential Bushfire Hazard to the proposed development.

Vegetation in the immediate vicinity of the proposed development and in all other directions has been classified as having a Low Potential Bushfire Hazard to the proposed development. However, it is noted that determined low threat vegetation within 100m of designated bushfire hazard area, will require assessment against the Australian Standard for *Construction of buildings in bushfire prone area (AS3959-2018)* to ensure compliance. This is particularly relevant for Lots within 100m of proposed rehabilitation activities.

The following section details Bushfire Risk Mitigation measures to be implemented on the site to address the Bushfire Hazard and compliance requirements acting on the proposed development.

3.0 Bushfire Risk Mitigation Measures

The following section describes Bushfire Risk Mitigation measures, recommended to be utilised at the subject site to reduce the risk of Bushfire impacting on people and property.

The scope of proposed Bushfire Risk Mitigation Measures have been drawn from the following sources:

- the *Queensland State Government Single State Planning Policy* - Part E (SPP 2017);
- the *Gold Coast City Council, Bushfire Hazard Overlay Code (8.2.3)*; and
- the Australian Standard (AS 3959- 2018) - *Construction of buildings in bushfire prone areas*.

The intent of the above legislation is to protect people and premises in the event of a bushfire emergency, through achieving acceptable Performance Outcomes for the development given the identified bushfire hazard. Performance Outcomes are generally achieved by appropriate separation of a development from bushfire hazard, appropriate access for fire-fighting vehicles, and appropriate construction standards of buildings. Additional factors are detailed where considered appropriate.

3.1 Asset Protection Zones

Asset protection zones (APZ's) provide a defensive tool to assist in the reduction of potential bushfire impact to people and property situated in bushfire prone areas. APZ's are the most strategically valuable defence against radiant heat and flame, and to a lesser extent, embers.

Whilst APZ's should prevent buildings from being subjected to direct contact from flames, and reduced levels of radiant heat in the event of a bushfire, building construction standards will also be key to ensuring the performance of buildings subjected to ember attack. Bushfire Attack Level for the proposed development is determined in **Section 3.2**.

Based on the above Bushfire Hazard Assessment, APZ's may be required adjacent the proposed development. These are detailed in the following section.

3.1.1 Performance Outcomes

APZ and setback distances have not been prescribed in the SPP 2017. The SPP refers to provision of appropriate defendable space between dwellings and medium or above Bushfire Hazard. The *Gold Coast City Council, Bushfire Hazard Overlay Code* does not prescribe separation distances from potentially hazardous vegetation, aside from fire trail provisions for development adjacent bushfire hazard areas (refer **Section 3.5** below). Consequently, the required setbacks (APZ's) detailed in the AS3959-2018, with regard to building construction standards are considered appropriate to mitigate the identified bushfire hazard to the proposed development and consequently meeting the intent of the GCCC Planning Scheme Performance Outcome and the SPP as a result.

Subsequently, the **Table 2** details the requirements for setbacks for the proposed development, in order to comply with the performance outcomes of the Australian Standard (AS3939-2018) and specified Building Construction Standards, with regard to the Medium Potential Bushfire Hazard acting on the site from the west to southwest of the site.

N.B. Where '*Exclusions for Low Threat Vegetation'* criteria as per the AS3959-2018 are applicable, relevant vegetation will be classified as Low Threat for the purpose of BAL determination.

APZ's have been determined for individual proposed lots, potentially exposed to Bushfire Hazard, with regard to minimum known setbacks to individual Lots, and Building Setback Provisions within proposed Lots. It is noted that Asset Protection Zones have been proposed within the proposed Lots 211-219, as represented in Figure 2, and as requested by Council in Information request dated 12th July 2019.

It should be noted that planning provisions in Queensland specify BAL-29 construction standards are considered the maximum acceptable requirement for new residential subdivision developments. Consequently, this will be used to inform the following APZ's and BAL determinations for the proposed development.

Table 2: Australian Standard Asset Protection Zones

Direction of Bushfire Hazard	Classification of Vegetation AS3959-2018	Effective Slope (deg.)	Setback to Hazard	Required Setback to achieve (≤ BAL-40)	Required Setback to achieve (≤ BAL-29)	Required Setback to achieve (≤ BAL-19)	Required Setback to achieve (≤ BAL-12.5)
North of proposed Lots: 246-248, 263-264, 265-267	Woodland (env. Area)	<5	>20m	≥6m	≥9m	≥13m	≥19m
North of proposed Lots: 265-267	Woodland (env. Area)	<5	>9m	≥6m	≥9m	≥13m	≥19m
Northwest of proposed Lots: 306-310	Woodland (env. Area)	<5	>13m	≥6m	≥9m	≥13m	≥19m
North of proposed Lots: 302-310	Low Threat	NA	NA	NA	NA	NA	NA
East of proposed Lots: 101-113, 142-147, 293-302	Low Threat	NA	NA	NA	NA	NA	NA
South of proposed Lots: 101, 124-127,	Woodland (env. Area)	<5	>20	≥6m	≥9m	≥13m	≥19m
South of proposed Lots: 214-219	Forest	0	>13m	≥10m	≥13m	≥20m	≥28m
South of proposed Lot: 220-223	Forest	0	>16.5m	≥10m	≥13m	≥20m	≥28m
West of proposed Lots: 211-214	Forest	0	>13m	≥10m	≥13m	≥20m	≥28m
West of proposed Lots: 194-205	Woodland	<5	>30m	≥6m	≥9m	≥13m	≥19m
West of proposed Lots: 239-246	Low Threat	NA	NA	NA	NA	NA	NA

Based on the above assessment, and achievement of the specified setbacks to assessable vegetation for individual buildings, the proposed development is considered appropriately positioned to achieve maximum BAL ratings of BAL-29. These recommended setback requirements, in compliance with the Australian Standard (AS3959-2018), are considered appropriate to inform APZ requirements for the proposed development, and no additional setbacks are required.

It is noted that vegetation treatments within recreational areas, and drainage easements is understood to maintain a low potential bushfire hazard in these areas. Environmental Areas covering Lots 1002 and 1011 are understood to seek to re-establish be woodland vegetation communities, and the above classification has been undertaken on this premise.

N.B. acceptable treatment of vegetation within the APZ's is detailed in ***Section 3.3*** – *Landscaping & Vegetation Management*.

3.2 Bushfire Attack Level - Construction Standards

The Building Code of Australia (BCA) requires all Class 1-3 and Class 10a buildings associated with a dwelling, to be constructed in accordance with the Australian Standard 3959 (2018) - *Construction of buildings in bushfire-prone areas* (AS 3959-2018). This standard provides minimum construction standards for new dwellings in designated Bushfire Prone Areas.

The construction standards are intended to improve the performance of buildings subjected to burning debris, radiant heat or flame contact. The AS3959- 2018 methodology prescribes Bushfire Attack Levels (BAL's) to the facades of proposed buildings to which corresponding construction safety standards are applied. AS3959-2018 defines Bushfire Attack Levels as:

> *'A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, which is the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire.'*

3.2.1 Bushfire Attack Level Determination

In accordance with the Australian Standard – *Construction of Buildings in Bushfire-prone Areas* (AS 3959, 2018), an assessment of the required construction standards for the proposed development of has been undertaken (**Table 2**). Subsequently, the required BAL's for construction within individual Lots of the proposed development are represented in **Figure 7**.

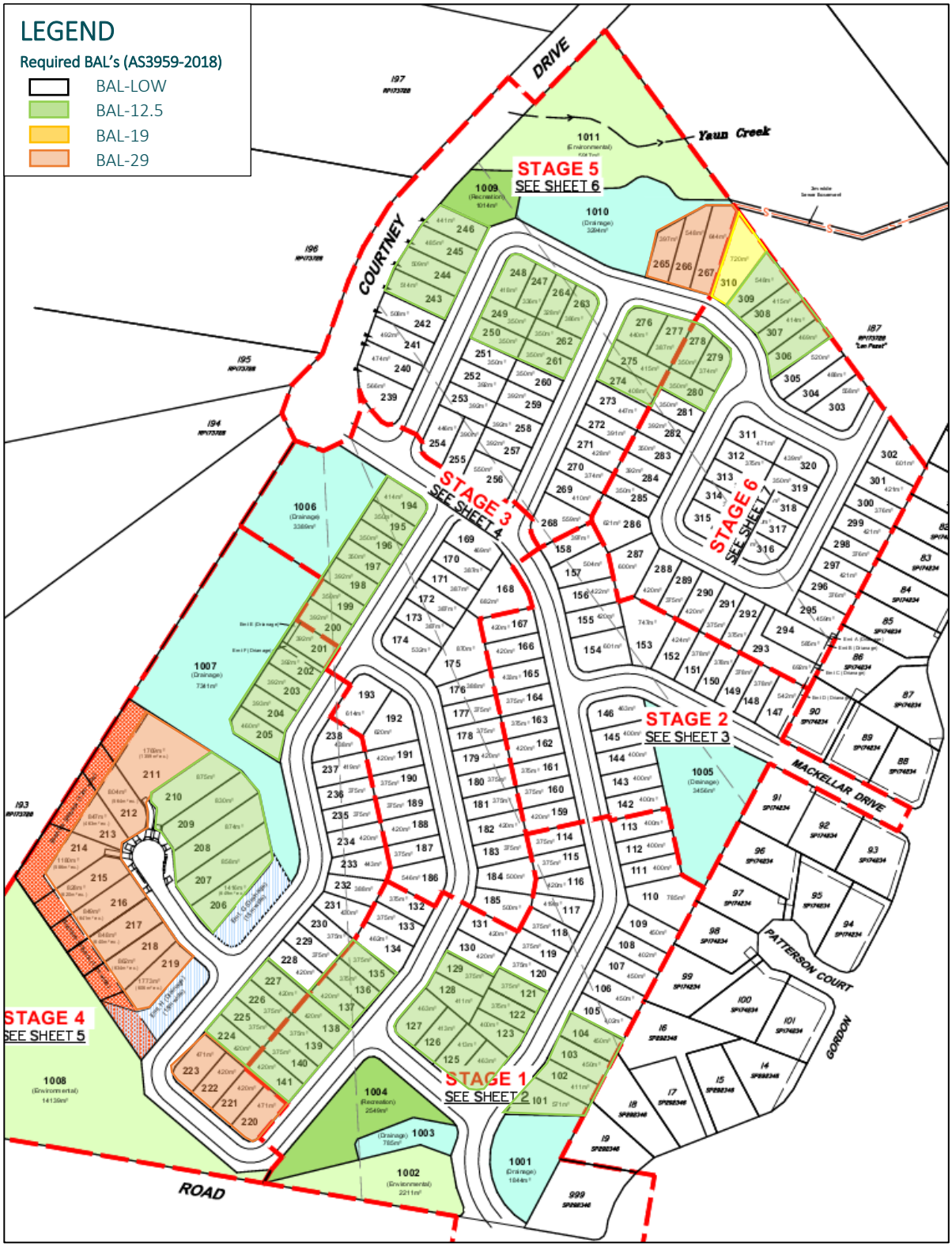


Figure 7: Bushfire Attack Level Requirements

Based on this assessment, the following Bushfire Attack Levels for individual Lots are applicable:

- **BAL-29**: Lots 211-223, 265-267 (refer Sections 3 & 7 in the AS3959-2018);
- **BAL-19**: Lot 310 (refer Sections 3 & 6 in the AS3959-2018);
- **BAL-12.5:** Lots 101-104, 121-129, 135-141, 194-205, 206-210, 224-227, 243-250, 261-264, 274-280, 306-309, (refer Sections 3 & 5 in the in the AS3959-2018);
- **BAL-LOW**: Lots 105-120, 130-134, 142-193, 211-220, 228-242, 251-260, 268-273, 281-305, (no specific construction requirements – refer Section 4 in the in the AS3959-2018);

Relevant Building Construction Standards, as detailed in the Australian Standard – Construction of Buildings in Bushfire-prone Areas (AS 3959, 2018), should be applied. The nominated construction standards should be reviewed by an experienced consultant/designer at the time of detailed building design. Should the proposed site layout or vegetation setbacks change, this may alter the determination of the required BAL.

It is recommended that Individual Lots undertake individual BAL assessments at the time of detailed design to inform specific BAL requirements for each structure.

3.3 Landscaping and Vegetation Management

The landscaping and ongoing management of vegetation in areas susceptible to Bushfire Hazard is an important tool to mitigate bushfire risk. Previously detailed APZ's/setback requirements should prevent buildings from being subjected to direct contact from flames, and reduced levels of radiant heat in the event of a bushfire. Please Note: Final Building footprint locations, and vegetation setbacks able to be achieved, will dictate final BAL ratings for individual dwellings of the proposed development.

The proposed development layout has considered potential bushfire hazard from the southwest to west and has revised preliminary designs to minimise vegetation clearing of the subject site where practical. Previously detailed bushfire hazard and setback recommendations have been made, particularly with regard to the establishment of appropriate setbacks to hazardous vegetation.

Landscaping and vegetation retention adjacent proposed buildings should consider the following guidelines:

- Immediately adjacent proposed buildings should either be fully cleared and regularly maintained (i.e. lawn) or retain trees as clumps or islands and provide a tree canopy cover of less than 15% and tree canopies should be located greater than 2 metres from any part of the roofline of a building. Any trees should have lower limbs removed up to a height of 2 metres above the ground.
- Any landscaping performed on site shall maintain the APZ effectively free of available fuel. Landscaping plants may be used in this area so long as they are selected for their low combustibility, by virtue of high moisture content, low volatile oil content, high leaf mineral levels, large fleshy leaves, and absence of shedding bark. They should be

placed so as to not provide either vertical or horizontal connectedness of plant material, and avoid overhanging rooflines or contact with flammable parts of buildings. Any planted trees should be of species which grow to over 2m, to maintain separation between lower canopy and the ground.

- Turf is to be maintained regularly to reduce the potential for long grass to fuel an advancing fire toward buildings.
- Revegetation activities in covenant areas particularly to the north and east of the site should utilise low volatility, locally endemic rainforest species where appropriate to ensure future fuel load potential is minimised.

3.4 Emergency Access & Egress

New developments in bushfire prone areas should be serviced by safe access/exit points for both residents and emergency services personnel in the event of an emergency. Development should avoid entrapment potential, provide safe and effective access for emergency services vehicles and safe evacuation routes for occupants.

The *GCCC Bushfire Hazard* Overlay Code (PO6) prescribes '*vehicular access is designed to mitigate against bushfire hazard by ensuring adequate access for* (a fire-fighting and other emergency vehicles, and (b) the evacuation of residents and emergency personnel, during a bushfire event.'

The proposed development layout contains perimeter roads, where possible, to separate the majority of the proposed lots from potential sources of bushfire hazard. Proposed Lots 211-219 have been designed with APZ within the Lots boundaries, at Councils request. All Lots have direct access to proposed public roadways, and importantly in directions away from bushfire hazard and into Low potential bushfire hazard areas. Site access includes the existing established public road network to Courtney Drive to the northwest and proposed Mackellar Drive to the east and unnamed road to the southeast of the site.

Importantly, multiple access and egress routes are provided internally into designated Low Hazard areas. Consequently, it is considered that current access and egress is appropriate, for the proposed development.

3.5 Fire Trails

The *GCCC Bushfire Hazard* Overlay Code (PO9) prescribes '*in a bushfire hazard area, fire trails must be provided to: enable access for fire fighters, residents and equipment; contribute to bushfire radiation zones; mitigate against bushfire hazard; and to allow access for hazard reduction management programs*'.

The proposed development has been designed to exclude Fire Trails as requested by Council in Information Requested dated 12th July 2019. The proposed design layout appropriately separates proposed Lots from potential bushfire hazard by perimeter roads where possible.

Asset protections zones within Proposed Lots 211-219 is deemed appropriate to separate proposed dwellings from potential bushfire hazard, with regard to achievement of BAL construction standards as detailed in this report.

3.6 Water Availability for Fire-Fighting Purposes

All development within bushfire hazard areas require adequate water supply for fire-fighting purposes in the event of a bushfire emergency. The *GCCC Bushfire Hazard* Overlay Code (PO10) prescribes 'a reliable reticulated water supply that has sufficient flow and pressure characteristics for fire-fighting purposes at all times' be achieved.

It is understood the proposed development site will be on a reticulated water supply and it is subsequently understood the indicated pressure and flow of 10L/Sec at 200 kPa (as per AO10.2) will be achieved on site. Verification of this via the utility provider is recommended.

3.7 Open Space Management

The *GCCC Bushfire Hazard* Overlay Code (PO8) prescribes '*for areas to be dedicated to Council as open space, management strategies to mitigate bushfire risk must be identified*.'

It is understood the Public Open Space (and drainage areas) are proposed, as represented in Figure 2, and it is understood these areas, where relevant will be dedicated to Council as part of the proposed development (refer **Town Planning Report for confirmation and full detail**). Open Space areas with potential to contain potentially hazardous vegetation are limited to the southwest, southern and northern extents of the subject site, with the southwest containing forest vegetation, and the south and northern creek corridors understood to be rehabilitated with woodland vegetation communities.

Due to the extent and nature of the vegetation, specific bushfire management strategies are limited to the following:

- Maintaining a foliar separation to proposed development to ensure the above determined BAL ratings and APZ setbacks remain relevant into the future. In essence, ensuring separation distances used to determine BAL ratings are maintained free of potentially hazardous vegetation and fuel load accumulation.

3.8 Advice to New Residents

The *GCCC Bushfire Hazard* Overlay Code (PO16) prescribes *'…new residents/occupants of a development in a bushfire hazard area are informed about: (a) the potential bushfire hazard on their site; (b) their responsibilities for fire management; (c) the measures required for ongoing fire mitigation; and (d) emergency procedures during a bushfire or on bad weather days*.'

Consequently, it is recommended that a copy of this Bushfire Management Plan, complete with a Queensland Fire and Emergency Services (QFES) cover sheet be provided to each resident/occupant of Lots where BAL ratings of **BAL-12.5** and above have been determined (refer Section 3.2.1).

Residents and occupants should be made aware of QFES website (www.ruralfire.qld.gov.au) for further information on bushfire preparation.

4.0 Recommendations and Conclusions

This report details the assessment of Bushfire Hazard and risk mitigation measures acting on the proposed development, with consideration to the requirements of: the *Queensland State Government Single State Planning Policy - Part E* (SPP 2017); the *GCCC Bushfire Hazard* Overlay Code; and the Australian Standard (AS 3959- 2018) - *Construction of buildings in bushfire prone areas*.

This assessment has confirmed that vegetation posing a Medium Potential Bushfire Hazard to the proposed development is present to the Southwest to West of current Lot 192SP173728. These vegetation communities have the potential to carry moderate fuel loads and subsequently present a potential Bushfire Hazard to the proposed development.

Vegetation in the immediate vicinity of the proposed development and in all other directions has been classified as having a Low Potential Bushfire Hazard to the proposed development. However, it is noted that determined low threat vegetation within 100m of designated bushfire hazard area, will require assessment against the Australian Standard for *Construction of buildings in bushfire prone area (AS3959-2018)* to ensure compliance. This is particularly relevant for Lots within 100m of proposed rehabilitation activities.

The following Bushfire Risk Mitigation Measures, as detailed above, are considered appropriate to substantially mitigate the Bushfire Hazard acting on the proposed development:

- Asset Protection Zone (APZ) / setbacks widths have been determined for areas of the proposed development (refer Section 3.1). With the achievement of setbacks consistent with applicable BAL ratings, no additional setbacks are considered required
- BAL determination and Construction Standard requirements have been determined for the proposed development, with a maximum BAL-29 considered achievable. Highest applicable BAL ratings for individual Lots have been detailed, with recommendations for individual BAL ratings to be undertaken at the time of detailed dwelling design for bushfire prone Lots (refer Section 3.2).
- Vegetation management within the site, including within setbacks and APZ's have been detailed to ensure low fuel availability and reduced connectivity to buildings. It is further recommended that revegetation activities within 20m of proposed Lots, be undertaken utilising low volatility species where appropriate (refer Section 3.3).
- Emergency Access & Egress of the proposed development has been detailed and is considered appropriate for the Bushfire Hazard acting on the site (refer Section 3.4).
- Fire Trail provisions within the development footprint have been discussed in order to comply with the *GCCC Bushfire Hazard* Overlay Code (PO9). In accordance with Councils request, no Fire Trails are proposed on public space (refer Section 3.5). Asset protections zones within Proposed Lots 211-219 is deemed appropriate to separate proposed dwellings from potential bushfire hazard, with regard to achievement of BAL construction standards as detailed in this report.

- Water Availability for Fire-fighting Purposes as per Councils Planning Scheme has been detailed (refer Section 3.6).
- Open Space Management recommendations have been made to assist Council to manage the potential bushfire hazard posed to the proposed development by Open Space land dedicated to Council (refer Section 3.7). and
- Advice to new residents/occupants by way of a copy of this Bushfire Management Plan, complete with a Queensland Fire and Emergency Services (QFES) cover sheet be provided to each resident/occupant for their information. This is applicable to Lots where BAL ratings of **BAL-12.5** and above have been determined (refer Section 3.2.1).

  Residents and occupants should also be made aware of QFES website (www.ruralfire.qld.gov.au) for further information on bushfire preparation (refer Section 3.8)

With the achievement of the Bushfire Risk Mitigation Measures as detailed in this report, the proposed development is considered to be compliant with the specifications and intent of the *Queensland State Government Single State Planning Policy - Part E* (SPP 2017), and the *Gold Coast City Council, Bushfire Hazard Overlay Code (8.2.3),* and the *Australian Standard – Construction in Bushfire Prone Areas (AS3959-2018).*

This assessment has been undertaken based on vegetative condition and bushfire hazards identified on and adjacent the subject site in November 2019.

It should be noted that the recommendations within this BMP have been formulated based on site conditions at the time of writing and utilising current best-practise hazard and impact assessment methodologies, and have been developed to reduce the potential severity of impacts on the proposed development in the event of a bushfire emergency rather than prevent impacts altogether. No guarantee is provided or assumed that the area will not be affected by bushfire at some time.

Site occupants should seek advice from the local fire authority every 5 years (as a minimum) to ensure the subject recommendations remain appropriate as site conditions and hazard assessment methodologies may change over time.

Bushfires are an intrinsic part of Australia's environment, are often unpredictable, and have potentially extremely serious consequences. All Queenslanders should be familiar with the official Bushfire Warnings system and have a completed Bushfire Survival Plan. Print ready guides for preparing a Bushfire Survival Plan and to assist in the interpretation of the official Bushfire Warnings system are available for download from the Rural Fire Service Queensland website – https://ruralfire.qld.gov.au/bushfires/.

There are three formal Bushfire Warning levels:

Advice

Monitor conditions and review your bushfire survival plan.

Watch and act

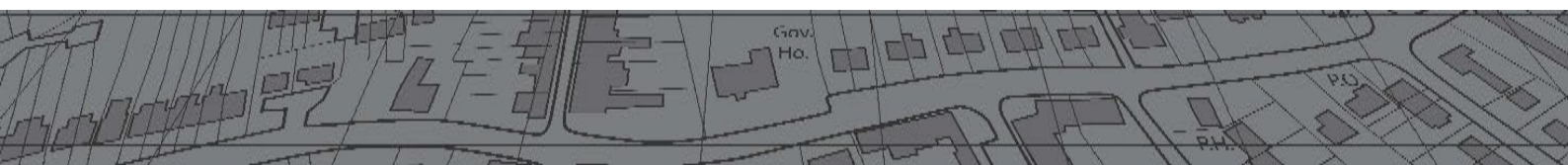
Conditions are changing. Start taking action and follow your bushfire survival plan.

Emergency Warnings

You are in danger. Act on your bushfire survival plan now.

ATTACHMENT 9

Water Supply & Sewerage Network Hydraulic Analysis



H2ONE

79-99 Courtney Drive
Upper Coomera Qld 4209

Water Supply and Sewerage Network
Hydraulic Analysis

FINAL Report V5 - 4 November, 2019

H2One Pty Ltd

Water, Sewer and Stormwater Engineering Specialists

H2One Pty Ltd

ABN 20 130 354 764

P 07 5503 0044

E info@H2One.com.au

W h2one.com.au

Reviewed by RPEQ	Reg. No.	Signed	Date
Joshua May	18064		4 November, 2019

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1 INTRODUCTION

1.1 Background

A residential sub-division on 79 to 99 Courtney Drive, Upper Coomera QLD 4209, lots 188-192 on RP173728, is currently in the planning phase of the Development Application (DA) process. The site has an estimated land area of 18.9 hectares and will comprise of 220 residential freehold allotments. The development is located within the Upper Coomera development area.

To support the DA, City of Gold Coast (CoGC) has requested the following works to be submitted, with respect to water supply and sewerage infrastructure.

- A hydraulic modelling assessment of the proposed internal networks, including staging layout and preparation of reticulation schematic plans, to ensure adequate service will be achieved throughout the sub-division.
- A network capacity assessment to determine if the site's additional loading will impact CoGC's existing systems and trigger the need for infrastructure upgrades. Note CoGC completed a sewer modelling study in May, 2017, identifying infrastructure upgrades to service the Upper Coomera development area along Courtney Drive (refer Appendix 1). This study formed the basis for any potential infrastructure upgrades triggered by the subject site.

Morton Urban Solutions Pty Ltd developed a water supply and sewerage reticulation layout plan and service strategy for the proposed development on 79 to 99 Courtney Drive, Upper Coomera (refer to Appendices to 2 and 3 for further details). With the adoption of these service plans, H2One Pty Ltd was engaged to undertake the above assessments requested by CoGC, in accordance with the *South East Queensland Water Supply and Sewerage Design and Construction Code* (SEQ WS&S D&C Code) (2013). The outcomes of the study are presented in this report.

1.2 Objectives

The main objectives of the project were as follows.

1. Estimate potable water supply and sewerage demands for the proposed development.
2. With the adoption of CoGC's Local Government Infrastructure Plan (LGIP) hydraulic models, introduce proposed water supply and sewerage infrastructure as per Morton Urban Solutions' service strategy and reticulation schematic plans (refer Appendix 3), and complete a hydraulic analysis to determine if the proposed networks will perform within CoGC's Design Standards.
3. Assess the capacity of CoGC's existing water supply and sewerage networks to determine infrastructure upgrades necessary to achieve the minimum Design Standards, where system performance failures have occurred due to the additional loading of the new development.
4. Issue an RPEQ certified hydraulic assessment report outlining outcomes of the assessment.

1.3 Sewer Catchment System

The development site is located within the SPS PA1 sewerage catchment, at the southern extremity of Courtney Drive. The proposed service strategy consists of constructing a DN225 trunk gravity sewer line along Courtney Drive, which will traverse east through neighbouring properties and connect into the existing DN300 along Richardson Crescent. Two additional connections are proposed on the existing DN150 gravity mains along Mackellar Drive and Gordon Drive.

The development's sewage outfall will be conveyed north-east via DN300, DN375 and DN450 gravity mains along Reserve Road and Clydesdale Drive, and discharge to SPS PA1, approximately 3.3 km east of the subject site. SPS PA1 boosts flow to a downstream catchment (PA9) where wastewater is ultimately transferred to the Pimpama Sewage Treatment Plant (STP).

SPS PA1 currently services an estimated 12,000 EP, which is projected to increase to a maximum of 17,000 EP at the Ultimate planning horizon (2066).

Refer to Appendices 2, 3 and 4 for an overview of the development site and relevant service strategy.

1.4 Water Supply Zone

The development site is proposed to be serviced by the Upper Coomera High Level Zone (HLZ), which is supplied by the Upper Coomera tank (UC03), via a trunk system of DN375, DN300, DN225 and DN200 mains along Skyridge Drive, Heatherdale Drive, Torrington Street and Wimmera Crescent.

The proposed service strategy was discussed with CoGC and consists of constructing a DN200 main, extending from the newly constructed DN200 main running south to north along the existing fire trail from Wimmera Crescent, to Stage 35 of the Highland Reserve development (refer Appendix 5 for further details).

The Upper Coomera tank (UC03) is located to the south-west of the site approximately 4.0 km along the pipe alignment, and is situated at a ground level of RL 97 m AHD. The Upper Coomera tank currently services 3,800 EP, which is estimated to increase to a maximum of 5,600 EP at the ultimate planning horizon.

Refer to Appendices 2, 3 and 6 for an overview of the development site and relevant service strategy.

1.5 Demand Assessment

A demand assessment of the development was undertaken to determine the approximate potable water and sewage demands attributed to the proposed land use type and density. This was calculated using the CoGC's adopted Equivalent Tenement (ET) unit rates and average "per capita" demand for potable water and sewage (220 L/EP/day and 210 L/EP/day respectively).

Table 1 shows a summary of the development's demand estimation.

Table 1. Estimated demands for the proposed development

Site Land Use and Density	Demand Rate	ET	EP	Water (kL/day)	Sewage (kL/day)
220 x res. allotments	1 ET / Lot	220.0	600.6	132.1	126.1

Note: Based on 2.73 ET to EP conversion

Prior to the analysis, the demands presented in Table 2 below were introduced to the sewer hydraulic model to account for planned development within the PA1 catchment. These figures were advised by CoGC and consider existing LGIP demands already present in the model.

Table 2. Development demands (EP) introduced to the sewer hydraulic model

Address	Sewer Node ID	2016 to 2066
155 Baileys Mountain Rd, Upper Coomera	S111-00177M	212.3

2 METHODOLOGY

2.1 Desired Standards of Service

The CoGC Design Standards from the *South East Queensland Water Supply and Sewerage Design and Construction Code* (2013) were adopted for the study. A summary of relevant provisions is presented in Table 3 below.

Table 3. SEQ WS&S D&C Code provisions relevant to the analysis

	Provision	Specification
Sewerage	ET to EP conversion factor	2.73
	Average Dry Weather Flow (ADWF)	210 L/EP/day
	Peak Wet Weather Flow (PWWF)	5 x ADWF
	Single pump capacity	C1 x ADWF (L/s) where; C1 = 3.5 to 5.0 C1 = 15 x (EP)$^{-0.1587}$
	Pump station operational storage (m^3)	0.9 x Q / N where; Q = Single pump capacity (L/s) N = Number of pump starts per hour, where N = 12 for duty pump motor < 100 kW N = 8 for duty pump motor 100 – 200 kW N = 5 for duty pump motor > 200 kW
	Pump station emergency storage (m^3)	4 hours ADWF
	Total pump station capacity (L/s)	PWWF
	Minimum gravity pipe grade	DN150 - 1:100 for first 10 allotments, 1:150 for following allotments DN225 - 1:300
	Minimum ground cover	0.6 m in allotment or pathway 0.9 m in roadway
	Maximum manhole spacing	90 m
	Maximum depth of gravity flow (proposed system)	75% pipe diameter
	Maximum depth of gravity flow (existing system)	1.0 m below manhole level
Water Supply	ET to EP conversion factor	2.73
	Average Day Demand	220 L/EP/day
	Maximum pipe velocity (m/s)	2.5 m/s
	Standard flow minimum network pressure and background demand	22m at the property boundary at PH demand
	Residential fire flow minimum network pressure and background demand	12m at 2/3 PH demand Positive pressure at PH demand Reservoir at Minimum Operating Level (15%)
	Fire flows	Residential - 15L/s
	Hazen Williams pipe friction co-efficient	<= 150 diameter, 100 151 to 300 diameter, 110

2.2 Sewer Hydraulic Assessment

The methodology adopted for the sewerage hydraulic modelling assessment is as follows.

2.2.1 Internal Reticulation Layout and Service Strategy

1. CoGC's InfoWater SWMM LGIP hydraulic model (*PI_LGIP_2014*) was adopted for the study.
2. The development's sewer pipe layout was introduced to the base model as a background layer and model elements drawn manually. The following data was subsequently introduced to the model.

a. Nominal pipe diameters and minimum pipe grades.

b. Manhole invert levels and minimum ground cover, based on ground contours from the proposed finished surface levels presented in Appendix 3.

c. Lot demands (EP) based on closest proximity to nodes.

3. A hydraulic analysis was undertaken on the development's internal pipe layout and service strategy, where pipe sizes and grades were systematically adjusted to achieve relevant design requirements.

2.2.2 CoGC Network Capacity Assessment

4. The pump capacity of SPS PA1 was assessed by comparing the PWWF required to service the catchment, pre- and post-development, to available pump capacities presented in CoGC's LGIP report.

   If the combined pump capacity was above the catchment's PWWF, relevant design standards were achieved. If it was below the PWWF, upgrades were investigated until compliance was attained.

5. The wet well operational storage of SPS PA1 was subsequently evaluated by comparing the required operational storage capacity, post-development, against wet well volumes between duty pump start/stop levels.

   If the wet well's operational storage volume was above the minimum requirement, compliance was achieved. If it was below the minimum requirement, upgrades were investigated until design standards were achieved.

6. The flow depth of gravity mains was assessed from the proposed connection points to SPS PA1, at post-development PWWF. To avoid surcharging from unrelated issues downstream, pumps were deactivated from the model and gravity mains discharged directly to a wet well outlet.

   If flow depths could not be maintained within CoGC specifications, pipe augmentations were investigated until design standards were achieved.

7. The emergency storage for the SPS PA1 catchment was assessed by determining the available ADWF network volume between 300 mm below the overflow level (RL 3.04 m - 300 mm) and pump duty start level (RL -2.13 m AHD). This was achieved by calculating the "empty" volume of the network and subtracting the post-development ADWF volume already present in the network.

   The available emergency storage was compared against the 4 hour ADWF requirement. If the available storage was above the minimum requirement, compliance was achieved. If it was below the minimum requirement, compliance was not achieved and storage augmentations were investigated.

8. Modelling results were verified and findings reported.

2.3 Water Supply Hydraulic Assessment

The methodology adopted for the water supply hydraulic modelling assessment is as follows.

2.3.1 Internal Reticulation Layout and Service Strategy

1. CoGC's InfoWater LGIP hydraulic model (*Northern v102_WSSIP_2019*) was adopted for the study.

2. The development's water pipe layout was introduced to the base model as a background layer and model elements drawn manually. The following data was subsequently introduced to the model.
    a. Nominal pipe diameters and relevant Hazen Williams pipe roughness.
    b. Node/hydrant elevation based on ground contours from the proposed finished surface levels presented in Appendix 3.
    c. Lot demands (EP) and diurnal patterns based on closest proximity to nodes/hydrants.
    d. Residential (15 L/s) fire flow allocation applied to all hydrants.

    Note the *MD_WSSIO19_YEAR_2016* scenario was adopted for this component of the study, as it presented the lowest network pressures across all planning horizons.
3. A standard flow and fire flow hydraulic analysis was undertaken on the development's internal pipe layout and service strategy, at each development stage. Where required, pipe sizes were systematically increased and/or alignments adjusted to achieve relevant design requirements.

2.3.2 CoGC Network Capacity Assessment

4. A detailed 3 x consecutive Maximum Day (MD) demand standard flow analysis was undertaken on the Upper Coomera HLZ tank, property connection point/s and surrounding network, for both pre- and post-development scenarios. Any deficiencies in the network were investigated and appropriate solutions determined.
5. Residential (15 L/s) and commercial (30 L/s) fire flow allocation was applied to the surrounding network as per the CoGC's Infowater allocation. Hydrants surrounding the site were allocated 15 L/s fire flow, due to the site's significant residential usage.
6. A detailed fire flow analysis was undertaken on the nearest hydrants directly servicing the site and all hydrants within the surrounding network. This was completed for both pre- and post-development scenarios, with a 1 x MD event and supply tanks at MOL (15%). Any deficiencies in the network were investigated and appropriate solutions determined.
7. Modelling results were verified and deliverables prepared.

3 RESULTS

3.1 Sewer Internal Reticulation and Service Strategy

As per the methodology described in Section 2.2 of this report, a hydraulic analysis was undertaken on the proposed service strategy and internal sewer pipe reticulation, as per the layout plan provided by Morton Urban Solutions Pty Ltd.

The proposed pipe infrastructure presented sufficient grade, capacity and ground cover to service the subject site. The sewer hydraulic model pipe layout and raw modelling results is presented in Appendices 7 and 8, respectively. A summary of the proposed pipe network is presented in Table 4.

Table 4. Summary of infrastructure for the proposed sewer service strategy

Description	Location	Diameter (DN)	Length (m)
Sewer reticulation pipe	Within the development site	150	3,150
Sewer trunk pipe	Courtney Drive	225	705

The proposed DN225 trunk gravity main will service majority of the Upper Coomera Precinct, therefore pipe sizing was undertaken to accommodate the estimated PWWF from both the subject site and external development. Based on the upper limit of the zoned densities, as per CoGC's City Plan Major Update 2 and 3, and a service level limit of RL 65 m AHD, a PWWF of 18 L/s was estimated for the allotments that are likely to connect to the DN225 trunk main (refer Appendix 9 for detailed calculations and schematics).

At 75% d/D flow depth and minimum grade (1:300), a DN225 gravity main provides approximately 23.6 L/s flow rate, therefore the proposed gravity main will have sufficient capacity to incorporate sewage loading from the subject site and relevant external development. It is recommended however that pipe sizing be confirmed at the Operational Works phase of the application process, to ensure sufficient capacity is available as town planning and densities from approved DA's progress.

3.2 Sewer Capacity Assessment

3.2.1 Pumps

A pump capacity assessment was undertaken on SPS PA1 as per the methodology described in Section 2.2 of this report. Refer to Table 5 below for a summary of results.

Table 5. Combined pump flow capacity results (post-development)

Planning Horizon	Capacity Available (kL)	Capacity Required (kL)	Difference (kL)
2016	256.2	155.9	+100.3
2066	256.2	214.3	+41.9

The above results demonstrate that there is sufficient capacity at SPS PA1 to incorporate the site's additional loading across all planning horizons. A pump capacity upgrade is therefore not required.

3.2.2 Wet Well

An assessment on the operational storage capacity of the SPS PA1 wet well was undertaken with the inclusion of the development's estimated loading. Refer to Table 6 below for a summary of results and Appendix 10 for detailed calculations.

Table 6. Operational storage capacity results (post-development)

Planning Horizon	Storage Available (kL)	Storage Required (kL)	Difference (kL)
2016	15.6	8.2	+7.4
2066	15.6	11.3	+4.3

Table 6 shows that the introduction of the site's demand did not adversely impact the operating volume of the SPS PA1 wet well. A storage capacity upgrade is therefore not required.

3.2.3 Gravity Mains

As per the methodology described in Section 2.0 of this report, gravity pipe flow depths were assessed against the CoGC's minimum requirement (1.0 m below manhole level), from the connection points to SPS PA1.

The analysis identified sufficient capacity to incorporate the site's additional loading up to the 2036 planning horizon. However, the 2066 planning horizon demonstrated insufficient pipe capacity at two locations downstream of the site. This necessitated approximately 210 m of DN300 parallel pipe augmentations to achieve the minimum Design Standards at the 2066 planning horizon (pipe ID's MS-PA1-19L1AUG, MS-PA1-20L1AUG, S111-02136ML1AUG, S111-02135ML1AUG and S111-02134ML1AUG). This augmentation was determined in conjunction with the overall pipe augmentation strategy from CoGC's Upper Coomera development area regional planning study (refer Appendix 1).

Refer to Appendix 10 for detailed results and Appendix 11 for the recommended gravity main upgrades.

3.2.4 Emergency Storage

An emergency storage capacity assessment was undertaken on the SPS PA1 catchment, with the inclusion of the additional ADWF from the proposed development (1.5 L/s). Refer to Table 7 below for a summary of results and Appendix 10 for detailed calculations.

Table 7. Emergency storage capacity results (post-development)

Planning Horizon	Storage Available (kL)	Storage Required (kL)	Difference (kL)
2016	514.3	404.8	+109.5
2036	514.3	410.0	+104.2
2066	510.4	539.2	-28.8

Table 7 shows that the SPS PA1 catchment has sufficient emergency storage to incorporate the development's loading up to 2036 planning horizon. The 2066 planning horizon presented insufficient capacity and will therefore require a 28.8 kL storage upgrade to satisfy CoGC's Design Standards.

The subject site is estimated to have contributed 74% towards the storage upgrade, with the remaining component attributed to the approved development at 155 Baileys Mountain Road, Upper Coomera. For the development approval process, it is recommended that CoGC only considers the component of the augmentation attributed to the subject site.

3.3 Water Supply Internal Reticulation and Service Strategy

As per the methodology described in Section 2.3 of this report, a standard flow and fire flow hydraulic analysis was undertaken on the development's internal water supply network, as per the pipe layout provided by Morton Urban Solutions Pty Ltd.

The proposed pipe network presented a minimum pressure of 37.5 m for peak hour standard flow (J168) and 19.2 m for 2/3 peak hour fire flow (J154) respectively. This achieved CoGC's minimum Design Standard for both standard flow and 2/3 peak hour fire flow

The maximum service pressure was observed at 63.7 m at node J128, based on a ground level of RL 40.0 m. This exceeded CoGC's "target maximum allowable" pressure of 55 m, however was below the "maximum pressure" requirement of 80 m. The existing Coomera HLZ network was also largely observed at pressures exceeding the 55 m target pressure. For these reasons, the resolution of excess pressure was not investigated.

The water supply hydraulic model pipe layout and raw modelling results is presented in Appendices 12-14. A summary of the proposed pipe infrastructure is presented in Table 8.

Table 8. Summary of infrastructure for the proposed water supply service strategy

Description	Location	Diameter (DN)	Length (m)
Water supply reticulation pipe	Within the development site	100	1950
Water supply reticulation pipe	Within the development site	150	470
Water supply reticulation pipe	Entrance to development site	200	65

Note: The 65 m of DN200 is the approximate pipe length to connect to the newly constructed DN200 main located at the south-east corner of the subject site.

3.4 Water Supply Capacity Assessment

3.4.1 Standard Flow and Fire Flow

As per the methodology described in Section 2.3 of this report, a post-development standard flow and fire flow network analysis was undertaken on all planning horizons. A summary of results is presented in Tables 9 and 10 below.

Table 9. Standard flow network modelling results (post-development)

	Planning Horizon					
Provision	**2016**	**2021**	**2026**	**2031**	**2036**	**2066**
Connection point (*CD_1_HY*) min. pressure (m)	42.6	42.0	42.0	42.0	42.0	42.7
Network min. pressure (m)	23.7	23.6	23.3	23.3	23.3	23.5
Network min. pressure node ID	HE_11100514189_WTHY					
Network no. failures	0	0	0	0	0	0
Tank min. water level (%)	70%	70%	70%	70%	70%	70%
Max. pipe velocity (m/s)	2.5	2.8	2.7	2.7	2.7	2.5

The above results demonstrate that the network performed within CoGC's standard flow requirements across all planning horizons. Infrastructure upgrades related to standard flow are not required to service the development.

Refer to Appendix 15 for the modelling results pre- and post-development.

Table 10. Fire flow network modelling results (post-development)

Scenario		Planning Horizon					
		2016	2021	2026	2031	2036	2051
Peak Hour	Site hydrant *(CD_1_HY)* min. pressure (m)	29.2	28.4	28.6	28.6	28.6	29.6
	Network hydrants min. pressure (m)	13.5	13.3	28.6	13.2	13.2	13.5
	Network hydrant min. pressure node ID	HE_11100010870_WTHY					
	Network hydrants no. failures	0	0	0	0	0	0
2/3 Peak Hour	Site hydrant *(CD_1_HY)* min. pressure (m)	32.4	32.0	32.1	32.1	32.1	32.7
	Network hydrants min. pressure (m)	14.6	14.4	32.1	14.4	14.4	14.6
	Network hydrant min. pressure node ID	HE_11100010870_WTHY					
	Network hydrants no. failures	0	0	0	0	0	0

Note: Results based on supply reservoirs operating at MOL (15%), peak hour at 7 am and 2/3 peak hour at 7 pm

The above results demonstrate that the network performed within CoGC's fire flow requirements across all planning horizons. Infrastructure upgrades related to standard flow are not required to service the development.

No water supply infrastructure upgrades are therefore required for standard flow and fire flow service. Refer to Appendix 15 for the modelling results pre- and post-development.

4 CONCLUSION

A residential sub-division on 79 to 99 Courtney Drive, Upper Coomera QLD is currently in the planning phase of the Development Application (DA) process. The site has an estimated land area of 18.9 hectares and will comprise of 220 residential freehold allotments. The development is located within the Upper Coomera development area.

To support the DA, City of Gold Coast (CoGC) has requested the following works to be submitted, with respect to water supply and sewerage infrastructure.

- A hydraulic modelling assessment of the proposed internal networks and preparation of reticulation schematic plans, to ensure adequate service will be achieved throughout the sub-division.
- A network capacity assessment to determine if the site's additional loading will impact CoGC's existing systems and trigger the need for infrastructure upgrades.

The hydraulic analysis completed by H2One identified the following outcomes.

- The proposed internal pipe layouts and service strategies achieved CoGC's Design Standards, for both water and sewer.
- CoGC's water supply network has sufficient capacity to incorporate the proposed development and infrastructure upgrades are therefore not required.
- CoGC's sewer network has sufficient capacity to incorporate the proposed development up to the 2036 planning horizon. However, the 2066 planning horizon required the following infrastructure upgrades to service the site's additional loading.
  - 210 m of DN300 parallel gravity mains (refer Appendix 11 for layout plan).
  - 28.8 kL of emergency storage. Note the subject site is estimated to have contributed 74% towards this upgrade, with the remaining component attributed to the approved development at 155 Baileys Mountain Road, Upper Coomera.

It is therefore recommended that CoGC approves the recommended water supply and sewer service strategies presented in Appendix 3, with consideration to the infrastructure upgrades presented above.

Detailed modelling results and layout plans can be observed in Appendices 1 through 15.

5 REFERENCE LIST

CoGC. (2013). *SEQ Water Supply and Sewerage Design and Construction Code*. Gold Coast: City of Gold Coast

CoGC. (2014). *Water Supply and Sewerage Infrastructure Plan 2014, Pimpama Sewerage Catchment Hydraulic Modelling Report 2014*. Gold Coast: City of Gold Coast

CoGC. (2016). *Network Modifications, Extension and Connections Policy Procedure.* Gold Coast: City of Gold Coast

6 APPENDICES

Appendix 1. CoGC Upper Coomera development area hydraulic analysis

CITY OF GOLDCOAST.

Briefing notes

To: Kim Evans

Copy: Mark Hunting, Kanthavanam Subramaniam, Anton Adina

From: Swapan Sikder

Action by:

Subject: Upper Coomera Development Sewerage Network Capacity Assessment

Date: 27/03/2017

File no:

Doc #: 60875128

1. Introduction

The Upper Coomera development area is located in Upper Coomera on both sides of Courtney Drive and on the north-west side of Reserve Road as shown in Figure 1.1 and Figure 1.2. The development area falls within the sewerage pump station catchment (SPS) PA1 which is located within the Pimpama Sewerage Catchment.

Figure 1.1: Upper Coomera Development

Figure 1.2: Upper Coomera Development Area within PA1 Pump Station catchment

The IDM_2013 EPs for the development area was updated based on the increase in densities, which was then used for modelling analysis. Only 2066 planning horizon was modelled to identify required augmentations due to increasing EPs within the development area.

2. Objectives

The objectives of the study were to:

- Assess the capacity of the existing gravity mains, rising mains, pumps, operational volume and emergency storage for the SPS PA1.
- Determine infrastructure upgrades necessary to achieve Council's minimum design standards, where system performance failures have occurred due to the additional sewage loadings from the development area.
- Prepare a sewer network capacity assessment report.

3. Demand Assessment

The IDM_2013 EPs were verified in September 2015 as part of Detailed Planning investigation for PA1 emergency storage requirements. These EPs were used in all assessments in this report. The EPs within the development area and SPS PA1 catchment are shown in Table 3.1. In Tables 3.1 and 3.2, additional EPs from the proposed development were added to verified EPs within the SPS PA1 catchment from 2021 planning horizon.

Table 3.1: Total EPs within the development area and SPS PA1 catchment 'without' and 'with' the proposed development

	Without Proposed Development						With Proposed Development					
	2016	2021	2026	2031	2036	2066	2016	2021	2026	2031	2036	2066
Development lots	0	0	0	0	0	0	0	1,850	1,850	1,850	1,850	1,850
PA1	10,051	10,473	10,852	11,212	11,388	15,213	10,051	12,323	12,702	13,062	13,238	17,063

Table 3.2 shows the Peak Wet Weather Flow (PWWF) within the development area and SPS PA1 catchment.

Table 3.2: Peak Wet Weather Flow (L/s) to PA1

	Without Proposed Development						With Proposed Development					
	2016	2021	2026	2031	2036	2066	2016	2021	2026	2031	2036	2066
Development lots	0	0	0	0	0	0	0	22.5	22.5	22.5	22.5	22.5
PA1	122.1	127.3	131.9	136.3	138.4	184.9	122.1	149.8	154.4	158.7	160.9	207.4

4. Desired Standards of Service

The design standards of the "South East Queensland Water Supply and Sewerage Design and Construction Code" 2013 (SEQ Code) were utilised for the assessment. A summary of the most relevant requirements is provided in Table 4.1 below.

Table 4.1: SEQ Code provisions relevant to sewerage network analysis

Parameters	Specification
Average Dry Weather Flow (ADWF)	210 L/EP/day
Peak Wet Weather Flow (PWWF)	5 x ADWF
Single Pump Capacity (L/s)	C1 x ADWF where; C1 = 3.5 to 5.0, C1 = 15 x (EP) $^{-0.1587}$
Pump station operational storage (m^3)	0.9 x Q/N where; Q = Single pump (duty) capacity (L/s) N – Number of pump starts per hour, where N = 12 for duty pump motor < 100 kW N = 8 for duty pump motor 100 – 200 kW N = 5 for duty pump motor > 200 kW
Pump station emergency storage (m^3)	4 hours ADWF
Total pump station capacity (L/s)	PWWF
Maximum depth of gravity flow (proposed system)	75% pipe full
Maximum depth of gravity flow (existing system)	1.0 m below manhole lid level.
Maximum rising main flow velocity (m/s)	3.0
Minimum rising main flow velocity (m/s)	0.75

5. Sewerage Network Modelling

The methodology adopted for the sewerage network analysis is as follows:

- Gold Coast Water and Waste's (GCWW) latest Local Government Infrastructure Planning (LGIP) InfoSWMM Pimpama sewerage catchment network model (PI_LGIP_2014) was adopted for the analysis of 2066 planning horizon. The development area's updated demand was placed into the model at relevant manholes for 2066 planning horizon.

- An analysis was carried out for SPS PA1 upstream and further downstream network to identify pumps capacities.

- The new operational volume and emergency storage volume requirements were calculated using Table 4.1 loadings and compared with available volumes.

- Rising main capacity was assessed for existing and future pumps capacity requirements.

- The flow depth of gravity mains were assessed with Table 4.1 loadings within the SPS PA1 catchment. If the flow depths could not be maintained within the Council Specifications, augmentations were proposed to meet the requirements.

- Modelling results were then verified and findings reported.

6. Sewerage Network Capacity Assessment without the Proposed Development

6.1 Gravity Sewers

As per the methodology described in section 5, existing gravity sewer flow depths were assessed against the Council's minimum requirement (1.0 m below manhole lid level) from the development area to SPS PA1.

Modelling analysis results indicate that the existing gravity sewers from the proposed development connection manhole SAP ID: 000000009000149097 up to SPS PA1 would be adequate for 2066 PWWF demand without the proposed development load (Figure 6.1). It can be seen that five gravity sections between manholes 000000009000221749 and 000000009000225835, and two gravity sections between manholes 000000009000144477 and 000000009000024658 would have exceeded pipe capacity but not breach Council's maximum depth of gravity flow criteria (1m below manhole lid level).

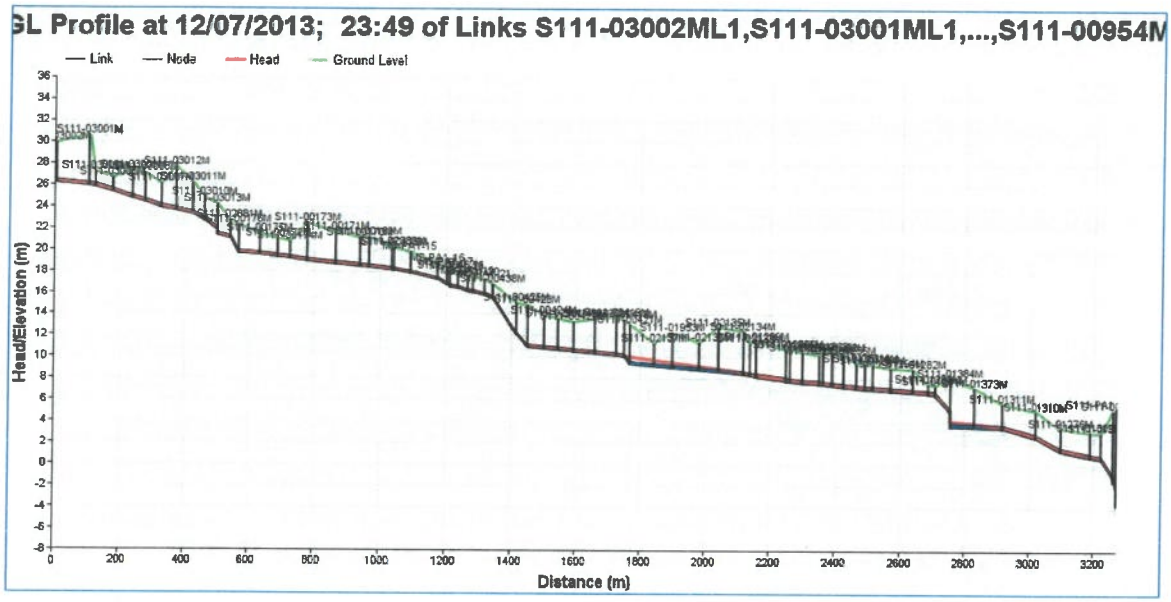

Figure 6.1: Longitudinal profile of existing gravity sewers from proposed development connection manhole 000000009000149097 up to SPS PA1 for 2066 planning horizon (without proposed development)

6.2 Pump Capacity

The single and dual pumps capacities of existing PA1 pumps are 180 L/s and 260 L/s, respectively. The 2066 PWWF inflow to PA1 is 185 L/s. There is no surcharge at immediate upstream gravity pipes of the station (Figure 6.1).

Hence existing PA1 pumps capacities are adequate until 2066.

6.3 Rising Main

SPS PA1 discharges through 375 mm diameter rising main. In 2066, the velocity in the rising main would be 1.6 m/s for single pump operation and 2.4 m/s for dual pumps operation, which would satisfy both maximum and minimum rising main velocity criteria in the SEQ Code.

Hence existing PA1 rising main would be adequate until 2066.

6.4 Operational Volume

The available operating wet well volume of PA1 is 13.2 m^3. The required operational volume for PA1 is 13.5 m^3 for existing pumps. Since PA1 pump capacity would not be required to be upgraded up to 2066, then the existing operational volume would not need to be changed.

Hence existing PA1 operational volume is sufficient until 2066.

6.5 Emergency Storage

Available current emergency storage volume of PA1 is 278 m^3, which is not adequate for any planning horizon. Additional emergency storage volume is proposed to be constructed in two stages:

Stage 1 – construction of additional 128 m^3 storage by 2017
Stage 2 – construction of additional 134 m^3 storage by 2032.

The spare capacity of emergency storage (after upgrade) at PA1 is shown in Table 6.1.

Table 6.1: Emergency storage requirements (kL) for SPS PA1

Parameter	Emergency Storage Volume (kL)					
	2016	2021	2026	2031	2036	2066
Available storage	278	406	406	406	540	536
Required storage	352	367	380	392	399	532
Spare Capacity	-74	39	26	14	141	4

Hence available PA1 emergency storage volume would be adequate up to 2066.

7. Sewerage Network Assessment with Proposed Development Demand

7.1 Gravity Sewers

The existing gravity sewers from the proposed development connection manhole 000000009000149097 up to SPS PA1 would not be adequate for 2066 PWWF demand with the proposed development load (Figure 7.1).

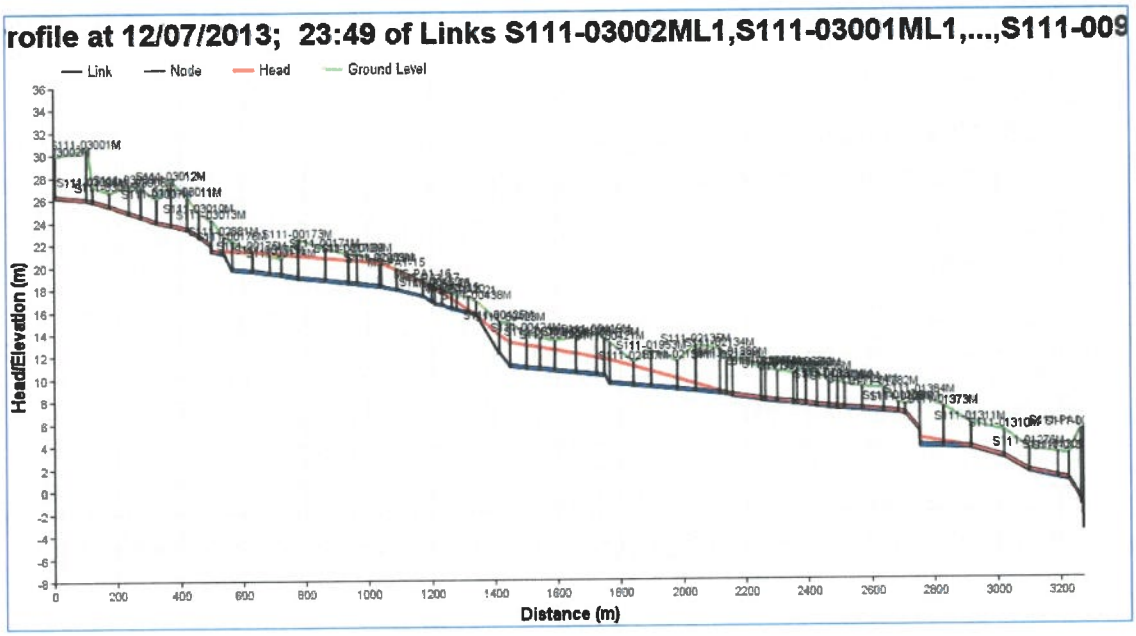

Figure 7.1: Longitudinal profile of existing gravity sewers from proposed development connection manhole 000000009000149097 up to SPS PA1 for 2066 planning horizon (with the proposed development)

As seen from above Figure 7.1, several gravity sewer sections do not have adequate capacity to deliver 2066 PWWF and spills would occur at 5 manholes.

Further modelling and analysis has identified that following gravity sections (Table 7.1 and Figure 7.2) will need to be augmented with additional 300 mm diameter pipes to satisfy SEQ design criteria of 75% depth of flow for new sewers.

Table 7.1: Existing Gravity Sections Requiring Augmentation to accommodate the Proposed Development

Pipe SAP ID	Length (m)	Existing Main Diameter (mm)	Required Additional Main Diameter (mm)
000000009000221835	85.5	225	300
000000009000140434	26.7	225	300
000000009000221864	6.9	225	300
000000009000221870	21.7	225	300
000000009000105682	29.2	225	300
000000009000140311	13.8	225	300
000000009000140318	35.4	225	300
000000009000105695	23.5	225	300
000000009000221746	78.0	300	300
000000009000146844	57.5	300	300
000000009000146291	85.9	300	300
000000009000146840	60.0	300	300
000000009000027992	79.9	300	300
000000009000225832	18.6	300	300
Total	**622.3**		

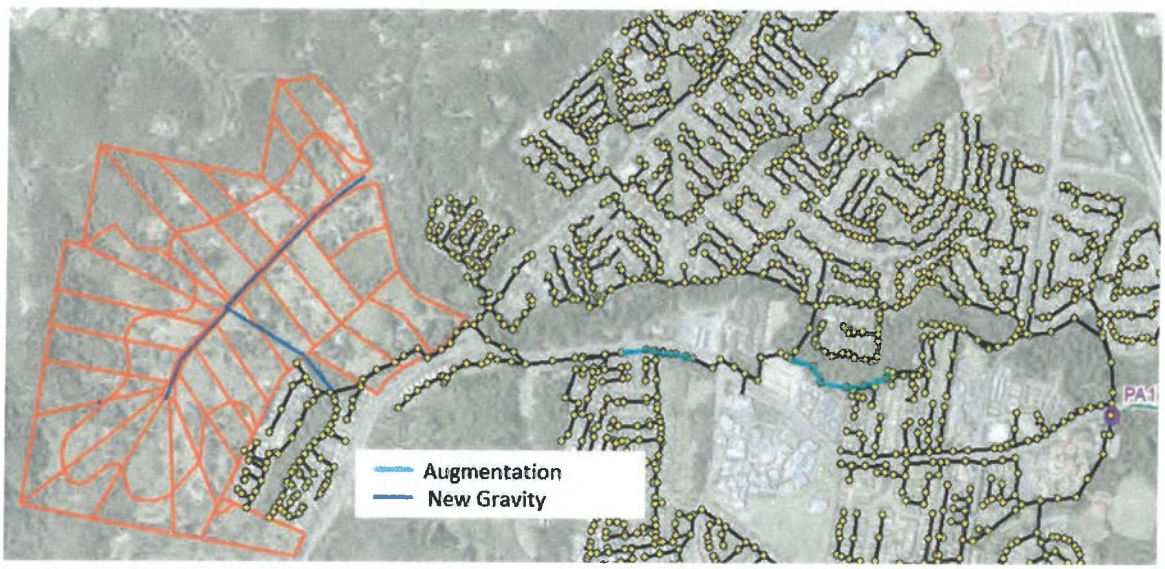

Figure 7.2: Required gravity sewers augmentation between development connection manhole 000000009000149097 and SPS PA1 (2066 Planning Horizon)

After augmenting the gravity sections as mentioned in Table 7.1 and Figure 7.2, the network to deliver 2066 PWWF including the development load would be adequate as shown in Fig 7.3.

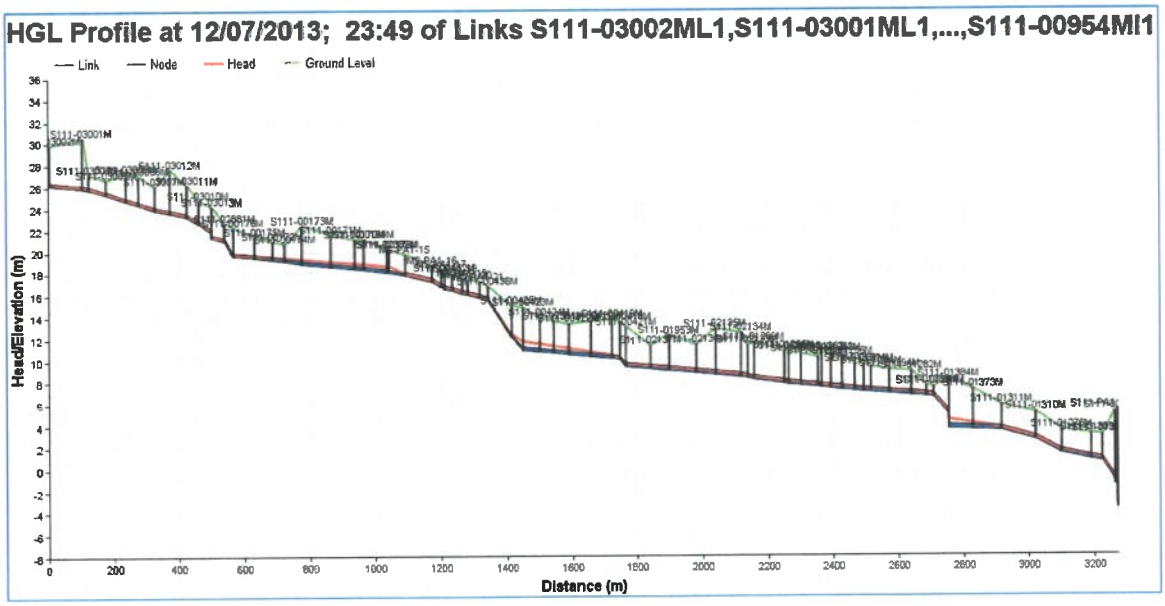

Figure 7.3: Longitudinal profile of gravity sewers from proposed development connection manhole 000000009000149097 up to SPS PA1 with augmentations and the proposed development (2066)

7.2 Pump Capacity

PWWF inflow to PA1 with additional demand from the proposed development would be 207.4 L/s in 2066. Since the dual pump capacity of existing PA1pumps is 260 L/s, the PA1 pump capacity would be adequate until 2066 including the proposed development.

Hence existing PA1 pumps would not be required to be upgraded to accommodate the proposed development.

7.3 Rising Main

Since PA1 pumps would not be required to be upgraded to cater for the proposed development, PA1 rising velocity would not change and be below 3 m/s as mentioned in section 6.3.

Hence the existing PA1 rising main would be adequate until 2066 with the proposed development.

7.4 Operational Volume

Since PA1 pumps would not be required to be upgraded to cater for the proposed development, the required operational volume would not change.

Hence existing PA1 operational volume is adequate until 2066 with the proposed development.

7.5 Emergency Storage

Since existing storage volume within PA1 catchment is not adequate for any planning horizon, additional storage volumes would be constructed to cater the demand from verified EPs. Table 6.2 shows the required emergency storage with proposed development.

Table 6.2: Emergency storage requirements (kL) for SPS PA1

Parameter	Emergency Storage Volume (kL)					
	2016	2021	2026	2031	2036	2066
Available storage	278	406	406	406	540	536
Required storage	352	431	445	457	463	597
Spare Capacity	-74	-25	-39	-51	+77	-61

The proposed development would require an additional emergency storage volume of 61 kL and available storage volume does not have adequate capacity to service this development.

Hence additional 61 kL of emergency storage would have to be constructed before development connection to service the proposed development up to 2066 planning horizon.

8. Summary of Augmentations

The following augmentations in Table 8.1 were identified to connect the proposed Upper Coomera developments to the Council's sewerage network. This is due to increase in densities in the proposed developments area.

Table 8.1: Required Augmentations within PA1 sewerage catchment

SPS Catchment	Infrastructure Augmentations	Infrastructure Size	Augmentation Year
PA1	Gravity Sewers	623 m length of DN300 – Existing gravity sewer augmentations 1370 m length of DN225 – New gravity sewers within Proposed Development 20 new manholes – Within Proposed Development	Before development connection
	Emergency Storage	61 m^3	Before development connection

9. Costing

Table 9.1 shows the total capital cost for the proposed augmentations. Cardno unit rates (2013) were used for the cost estimates. Adjustments were made for current year (2017). The overheads (20%) and contingencies (30%) were applied to base cost to calculate the total cost.

Table 9.1: Cost for Required Augmentations

SPS Catchment	Infrastructure Augmentations	Total Cost ($)
PA1	Gravity Sewer Main – Existing gravity sewer mains augmentation	[redacted]
	New gravity sewer mains in the development area	[redacted]
	New Manholes in the development area	
	Emergency Storage	[redacted]
Sub total		[redacted]
	Overheads @ 20%	[redacted]
Total		[redacted]
	Contingency @ 30%	[redacted]
Grand Total (2012 Dollars)		[redacted]
Grand Total (Adjusted to 2017 Dollars)		[redacted]

Note that pipe solution is adopted for emergency storage cost calculation.

10. Conclusions

The Upper Coomera development area would trigger the following augmentations requirements within PA1 sewerage catchment:

- Additional 243 m length of 300 mm gravity sewers from manhole 000000009000105826 to manhole 000000009000140368.
- Additional 380 m length of 300 mm gravity sewers from manhole 000000009000221749 to manhole 000000009000225830.
- New 1370 m length of 225 mm gravity sewers within the proposed development area.
- New 20 manholes within the proposed development area.
- Additional 61 kL of emergency storage at SPS PA1.
- Total capital cost of augmentations within PA1 catchment is [redacted].

Appendix 2. Proposed development layout

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PO Box 5021, GCMC QLD 9726
Ph: (07) 5631 8000
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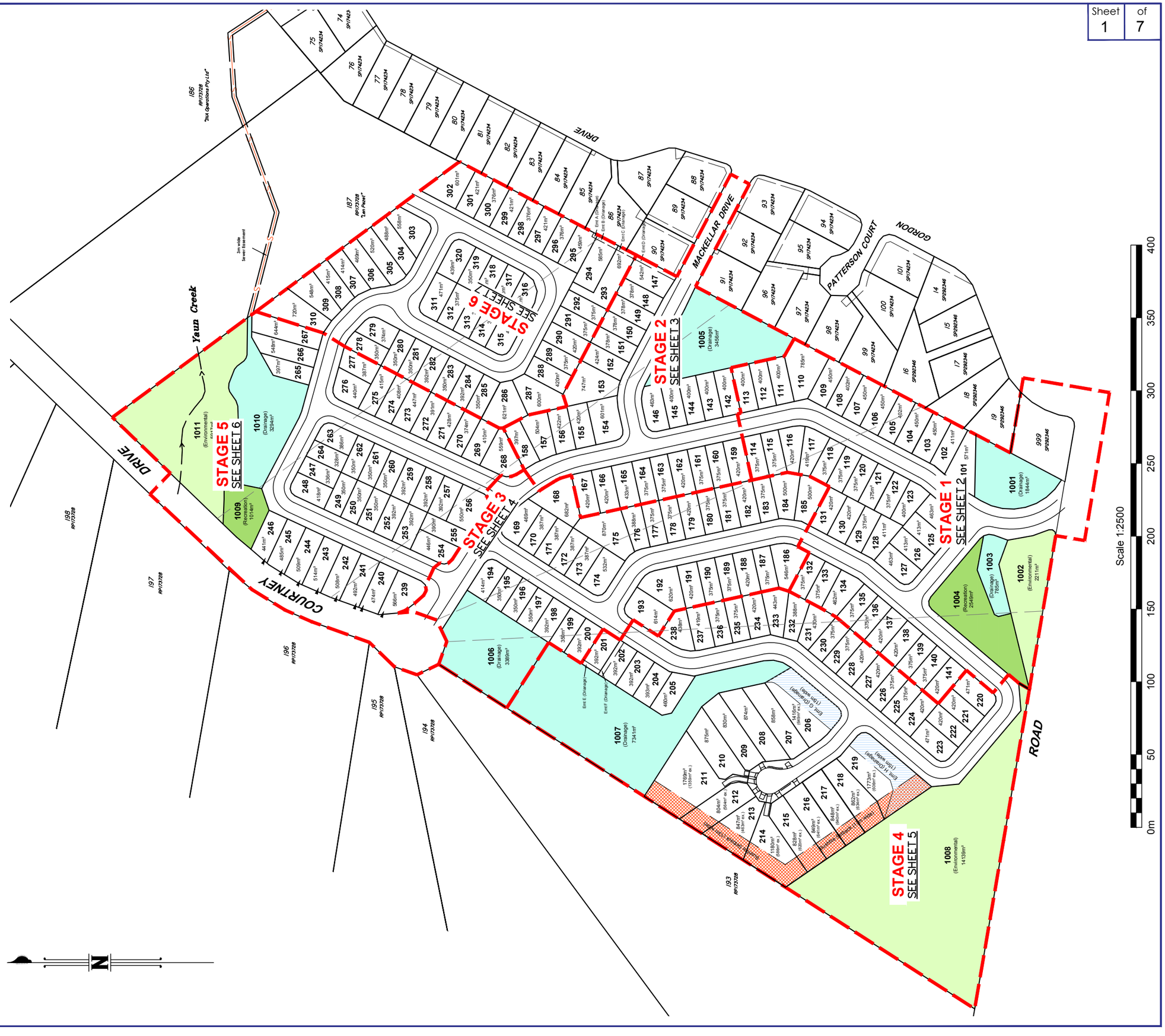

DEVELOPMENT SUMMARY

Stage 1	- 41
Stage 2	- 26
Stage 3	- 33
Stage 4	- 38
Stage 5	- 39
Stage 6	- 43
TOTAL	220 Residential Lots

LEGEND

Stage boundary

Lot Access

DEVELOPMENT AREAS LEGEND

Total Site Area	18.851 ha
Proposed Public Open Space (Environmental)	2.227 ha
Proposed Public Open Space (Drainage)	2.011 ha
Proposed Public Open Space (Recreation)	3563m²
Proposed Net Developable Area	14.257 ha
Net Ha	10.309ha
Net Residential Density	21.3 dwellings/ha
Length of New Road	2330m
Area of New Road	3.948 ha

NOTES:
1. Drawn to scale on an A3 sheet.
2. All dimensions and areas are subject to final survey and approval by G.C.C.C.
3. Dimensions shown are to the nearest decimeter.

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P	Staging Updated	DJR	28/10/2019
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G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:2500
Comp File:			
Plan No:	**171101_005_PRO**		

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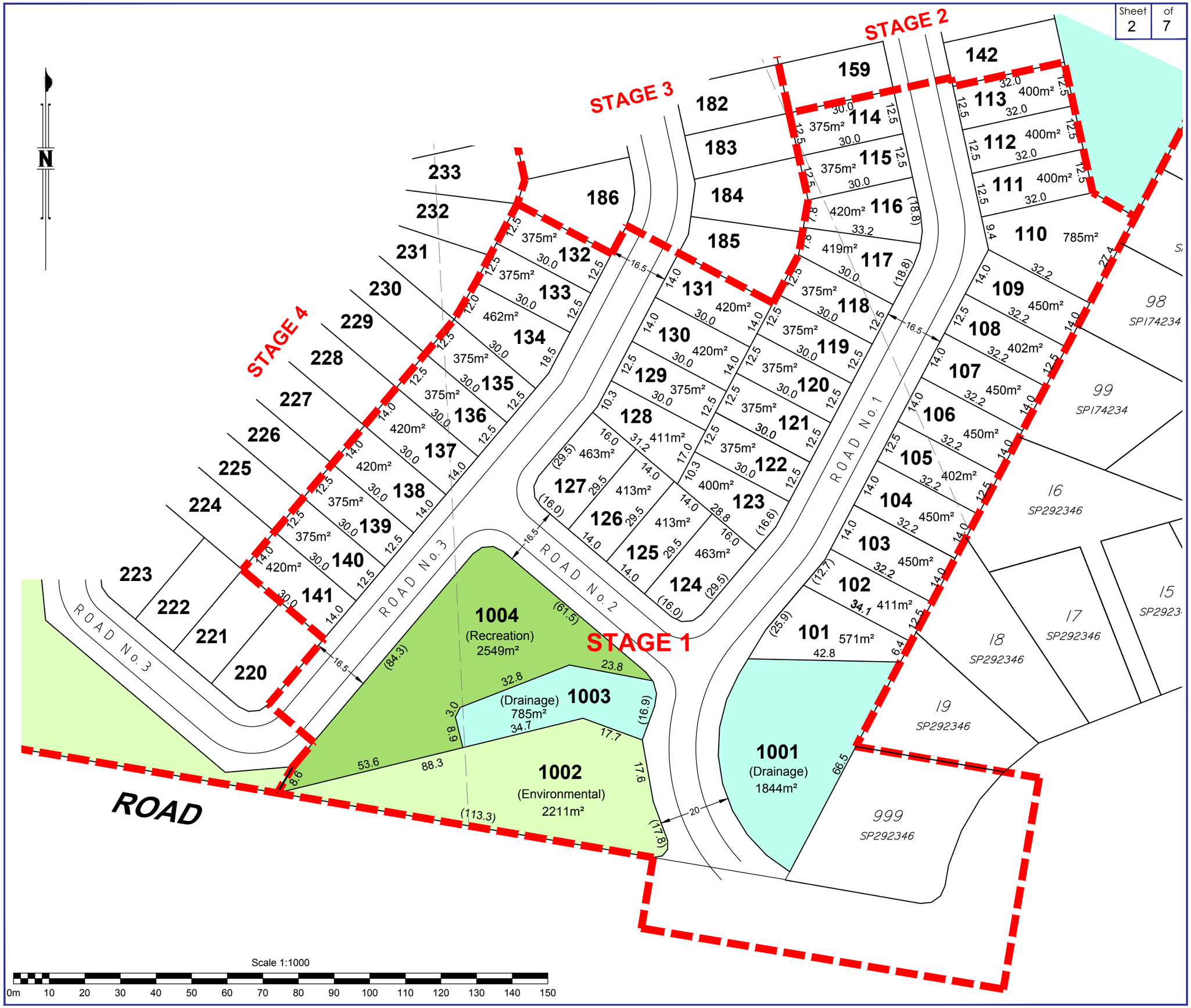

DEVELOPMENT SUMMARY

Stage 1

No of Lots	41
Total Stage Area	3.282ha
Total Recreation Area	2549m²
Total Drainage Area	2629m²
Total Environmental Area	2211m²
Total Development Area	2.544ha
Total Length of New Road	480m
Area of New Road	8201m²

LEGEND

Stage boundary

Lot Access

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Surveyed By:		Approved:	GWS
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Comp File:			
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Scale 1:1000

0m 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

DEVELOPMENT SUMMARY

Stage 2

No of Lots	26
Total Stage Area	1.909ha
Total Drainage Area	3456m²
Total Development Area	1.563 ha
Total Length of New Road	270 m
Area of New Road	4388 m²

LEGEND

Stage boundary

Lot Access

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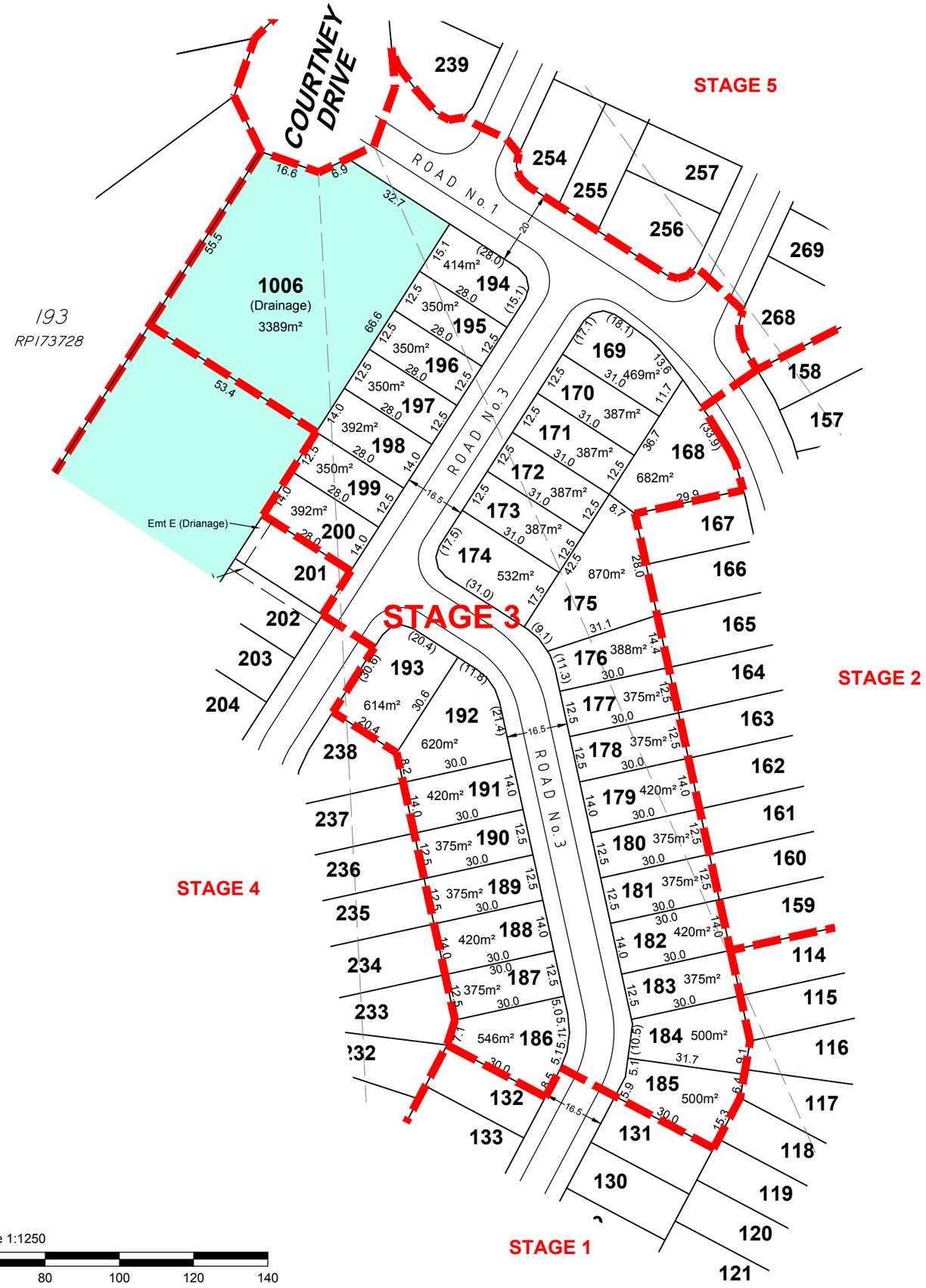

Scale 1:1250

0m 20 40 60 80 100 120 140

N

DEVELOPMENT SUMMARY

Stage 3

No of Lots	33
Total Stage Area	2.480ha
Total Drainage Area	3389m²
Total Development Area	2.141 ha
Total Length of New Road	400 m
Area of New Road	6929m²

LEGEND

Stage boundary

Lot Access

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DEVELOPMENT SUMMARY

Stage 4

No of Lots	38
Total Stage Area	5.325 ha
Total Drainage Area	7341m²
Total Environmental Area	1.414ha
Total Development Area	3.177ha
Total Length of New Road	430 m
Area of New Road	7296m²

LEGEND

Stage boundary

Lot Access

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Yaun Creek

187 RP173728 "Len Pezet"

DRIVE

COURTNEY

197 RP173728

196 RP173728

ROAD No.7

ROAD No.6

ROAD No.1

ROAD No.3

STAGE 5

STAGE 6

STAGE 2

STAGE 3

1011 (Environmental) 5917m²

1010 (Drainage) 3294m²

1009 (Recreation) 1014m²

1006

Lots 239–310, 157–171, 194–198

N

Scale 1:1000

0m 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

DEVELOPMENT SUMMARY

Stage 5

No of Lots	39
Total Stage Area	3.297ha
Total Recreation Area	1014m²
Total Drainage Area	3294m²
Total Environmental Area	5917m²
Total Development Area	2.275ha
Total Length of New Road	360m
Area of New Road	5988m²

LEGEND

Stage boundary

Lot Access

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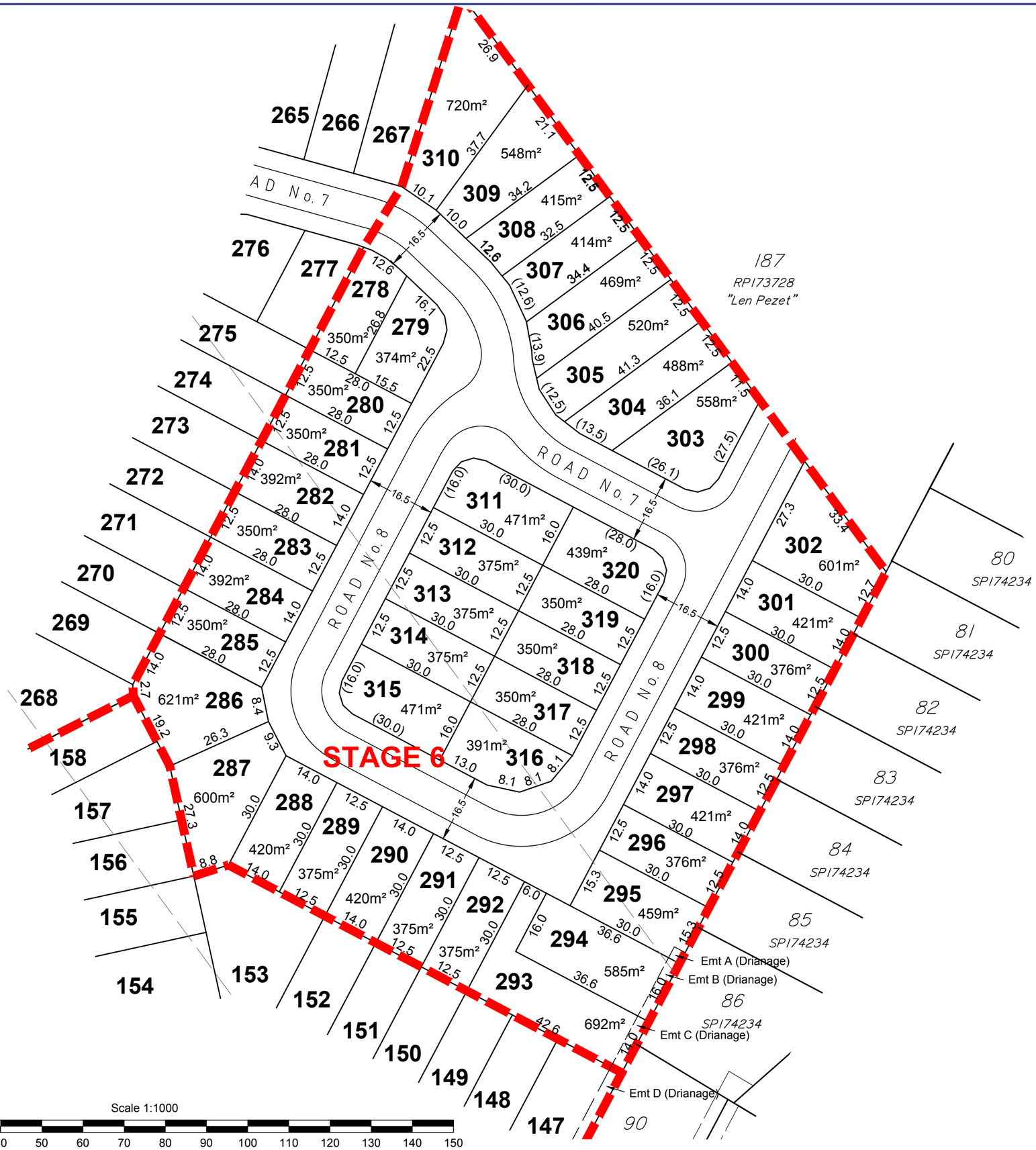


DEVELOPMENT SUMMARY
Stage 6

No of Lots	43
Total Site Area	2.558 ha
Total Development Area	2.558 ha
Total Length of New Road	390m
Area of New Road	6683m²

LEGEND
Stage boundary
Lot Access

NOTES:
1. Drawn to scale on an A3 sheet.
2. All dimensions and areas are subject to final survey and approval by G.C.C.C.
3. Dimensions shown are to the nearest decimeter.

Issue	Revision	Int	Date
P	Staging Updated	DJR	28/10/2019
O	Layout Updated	DJR	14/10/2019
N	Layout Updated	DJR	19/09/2019
M	Contours Added	BRJ	14/08/2019
L	GCCC Information response	SDS	7/08/2019
K	Lot No's changed	BRJ	28/03/2019
J	Staging Amended	SDS	25/03/2019
I	Staging Amended	DJL	12/02/2019
H	Staging amended	SDS	1/02/2019
G	Staging Amended	SDS	11/12/2018
F	Staging amended	SDS	26/11/2018
E	Detention Basins Amended	JEW	20/09/2018

Title:

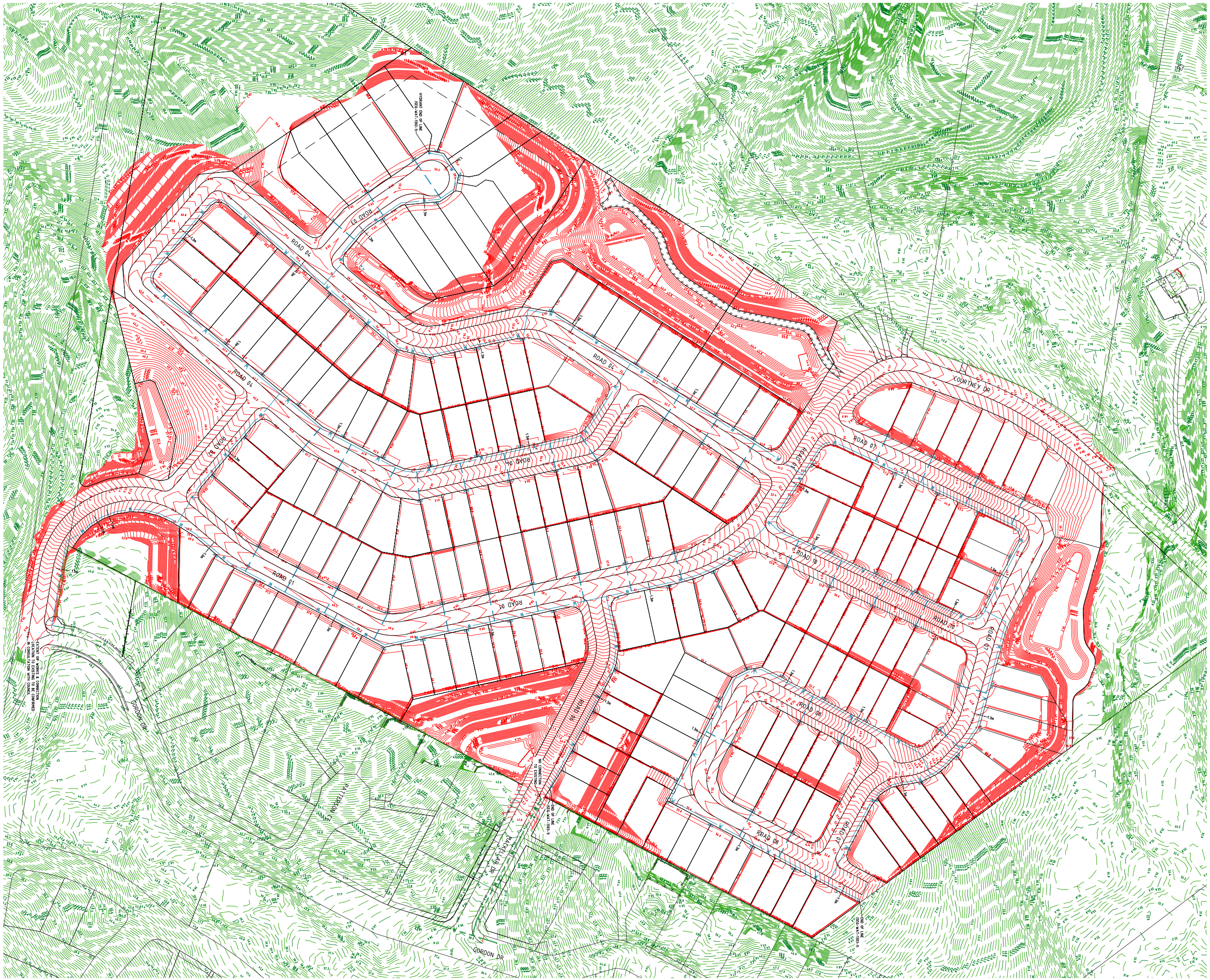
Plan of Proposed Staged Subdivision of Lots 101-320 & 1001-1011

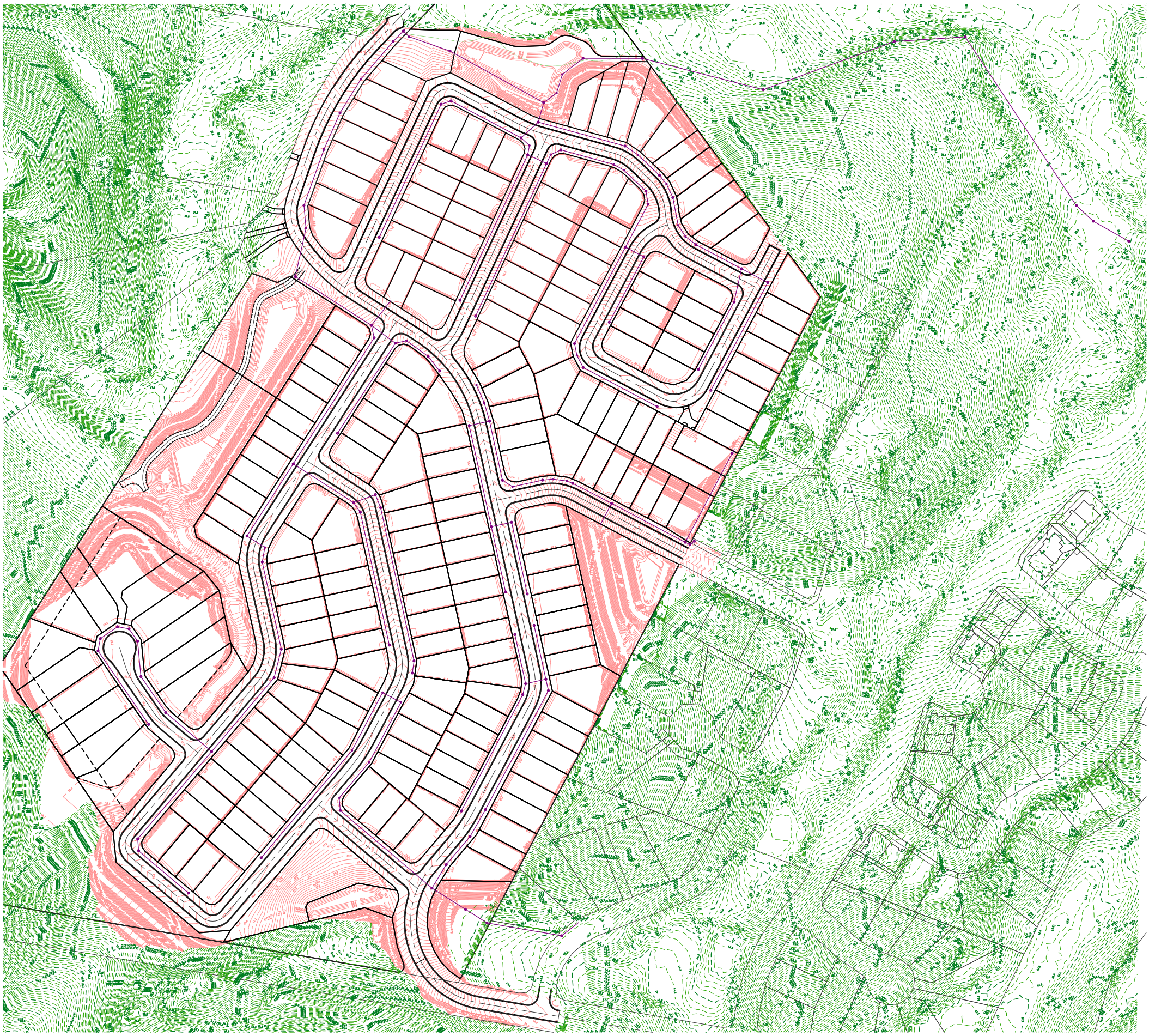
Cancelling Lots 188-192 on RP173728

Client:	**GALLERY HOMES**		
Locality:	UPPER COOMERA		
Local Gov:	GCCC	Prepared By:	SDS
Surveyed By:		Approved:	GWS
Date Created:	15/5/2018	Scale:	1:1000
Comp File:			
Plan No:	**171101_005_PRO**		

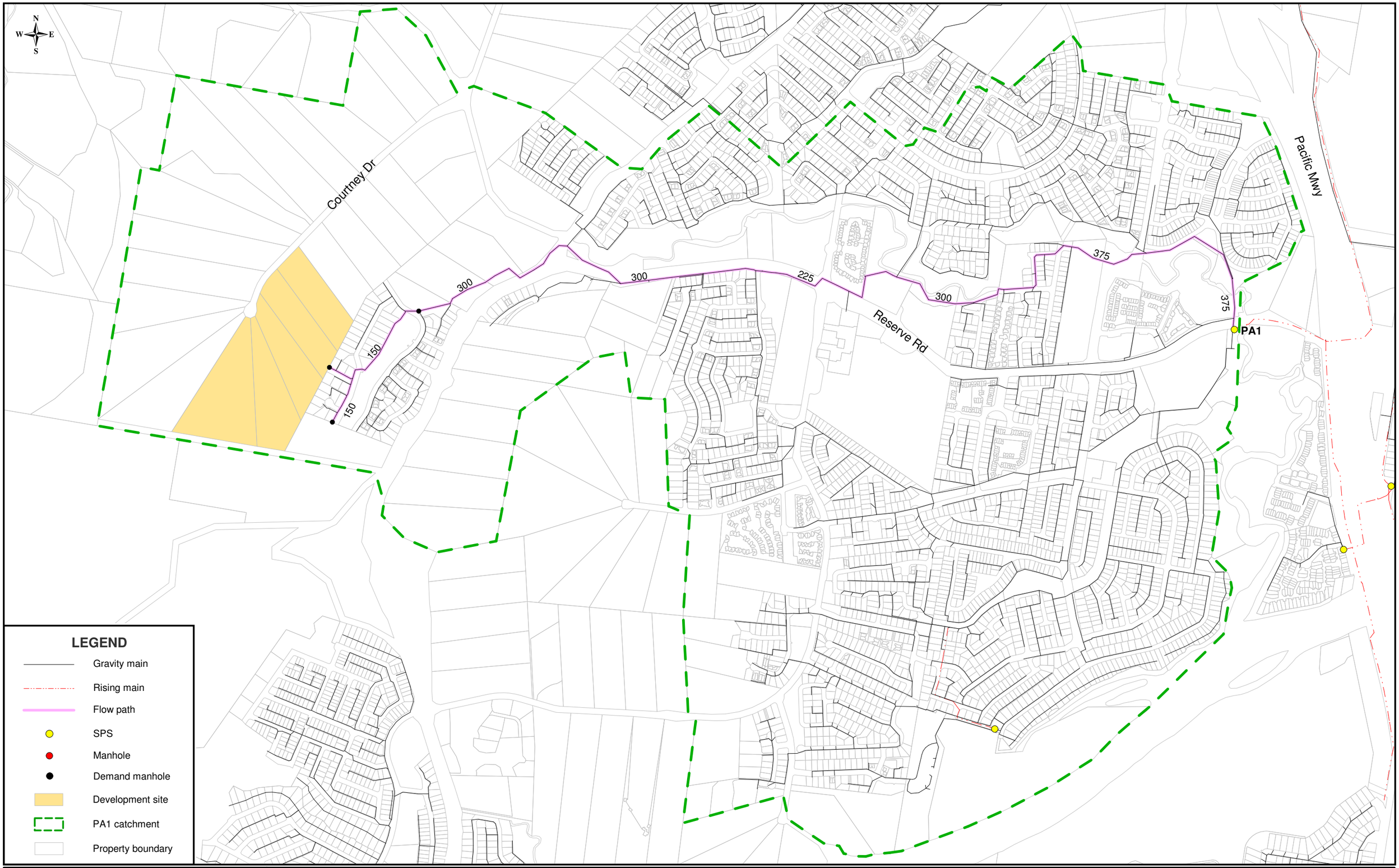
A3

Appendix 3. Proposed water supply and sewerage reticulation layout plans


ROAD 01
ROAD 02
ROAD 03
ROAD 04
ROAD 05
ROAD 06
ROAD 07
ROAD 08
ROAD 09
ROAD 10
COURTNEY DR
GORDON DR
HYDRANT END OF LINE
EXTENT OF WORKS & CONNECTION TO EXISTING ROAD TO BE CONFIRMED IN CONSULTATION WITH COUNCIL



Appendix 4. Development site and SPS PA1 sewer catchment



LEGEND

- Gravity main
- Rising main
- Flow path
- SPS
- Manhole
- Demand manhole
- Development site
- PA1 catchment
- Property boundary

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PO Box 290
IPSWICH QLD 4305

P: 07 5463 9538
E: info@H2One.com.au
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DESIGNED:	D Colledge
DRAWN:	D Colledge
CHECKED:	J May
APPROVED:	J May
CLIENT PM:	
H2ONE PM:	J May

NOTE: DESIGN NOT TO BE AMENDED WITHOUT H2ONE PTY LTD ACCEPTANCE

No.	REVISION	APPROVED
C	REVISED ISSUE - 17 APR 2019	
B	REVISED ISSUE - 21 SEP 2018	
A	ORIGINAL ISSUE - 15 MAY 2018	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:

0 200 400

Metres

SURVEYED BY / DATE: | SURVEY CHECKED:

H2ONE REFERENCES

PROJECT NO: 1804245

FILE REFERENCE:

CAD FILE:

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CITY OF GOLD COAST
PO BOX 5042, GCMC QLD 9729

79-99 Courtney Dr Upper Coomera QLD 4209 Water Supply and Sewerage Hydraulic Analysis

Appendix 4. Development site and SPS PA1 sewer catchment

ORIGINAL ISSUE DATE: MAY, 2018

DATE SCANNED:

DRG No: | REV:

Appendix 5. Proposed water supply service strategy discussed with CoGC

RE: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

JOHNSON Mark <MJOHNSON@goldcoast.qld.gov.au>

Wed 7/08/2019 2:27 PM

To: David Colledge <davidcolledge@H2One.com.au>
Cc: Joshua May <JoshuaMay@H2One.com.au>; SAHA Uttam <USAHA@goldcoast.qld.gov.au>

2 attachments (3 MB)
116415_36F-signed.pdf; 116415_37D -signed.pdf;

David,

Following on from our previous dialog, an option to consider and investigate further, is the possibility for the development proposal to be supplied from the Upper Coomera Reservoir (UC03), with Bottom Elevation of 97m compared with Peanba Reservoir (CP01) bottom elevation of 84m.

Directly south of 97 & 99 Courtney drive, a DN200mm dia water main was constructed from Wimmera Cres, along the existing fire trail to service stage 35 of the Highland Reserve development. I've provide a screen shot outlining in red (design attached), the approximate location of the water main, please note the newly constructed water main as highlighted, is yet to be accepted on-maintenance by the City. However the water main is likely to be accepted, prior to commencement of works for your development.

Regards,

Mark Johnson

Executive Coordinator
Development Services
Gold Coast Water and Waste
City of Gold Coast

T: (07)5582 8939 **M:** 0466 370 787
PO Box 5042 Gold Coast Mail Centre Qld 9726
cityofgoldcoast.com.au

CITY OF GOLDCOAST.

From: David Colledge [mailto:davidcolledge@H2One.com.au]
Sent: Wednesday, 7 August 2019 12:28 PM
To: JOHNSON Mark
Cc: Joshua May
Subject: Re: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

Hi Mark,

Just touching base to see how the water servicing options for above site are going? If you'd like to discuss over the phone feel free to contact myself on the details below.

Thanks

David Colledge
Water and Sewer Network Modeller
H2One Pty Ltd
P +61 (0)7 5463 9538
M +61 (0)408 859 594
W H2One.com.au

PO Box 290, Ipswich QLD 4305

H2ONE

From: JOHNSON Mark <MJOHNSON@goldcoast.qld.gov.au>
Sent: Friday, 2 August 2019 1:47 PM
To: Joshua May <JoshuaMay@H2One.com.au>; SAHA Uttam <USAHA@goldcoast.qld.gov.au>
Cc: Development Assessment <GCWDA@goldcoast.qld.gov.au>; JOSEPH Dominic <DJOSEPH@goldcoast.qld.gov.au>; JAHAN Syeda <SJAHAN@goldcoast.qld.gov.au>; Ashley Nankervis <ashley.n@galleryhomes.com.au>; Nicole Webb <nwebb@zoneplanning.com.au>; David Colledge <davidcolledge@H2One.com.au>
Subject: RE: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

David,

We are currently investigating other alternate solutions to service the development and will require some more time, to ensure all other possible solutions have been investigated. Please note, Consideration of a booster zone would be our last course of action, should an alternative viable option cannot be achieved. As discussed, we will try to have some information/options provided to you by next COB Wednesday.

Should further information be required, please don't hesitate to contact me.

Regards,

Mark Johnson

Executive Coordinator
Development Services
Gold Coast Water and Waste
City of Gold Coast

T: (07)5582 8939 **M:** 0466 370 787
PO Box 5042 Gold Coast Mail Centre Qld 9726
cityofgoldcoast.com.au

CITY OF GOLDCOAST.

From: Joshua May [mailto:JoshuaMay@H2One.com.au]
Sent: Thursday, 1 August 2019 1:28 PM
To: JOHNSON Mark; SAHA Uttam
Cc: Development Assessment; JOSEPH Dominic; JAHAN Syeda; Ashley Nankervis; Nicole Webb; David Colledge
Subject: Re: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA
Importance: High

This email originates from outside of the City of Gold Coast. If suspicious send it to spam@goldcoast.qld.gov.au

Hi Mark and Uttam,

Thanks for the information below.

The team and I have reviewed/discussed the field pressure logging results and proposed RL 55 m service limit. This will have a major impact on the design of the development, as excavation to reduce the existing levels to RL 60 m is already excessive. In addition, majority of the lots are in excess of the RL 55 m benchmark (refer attached).

Therefore, to meet the minimum design standards the only possible solution is a High Level Zone (HLZ) VSD booster pump set. *Could you please advise what's involved to seek approval for this service strategy?* A response at your earliest convenience would be appreciated.

Feel free to call David or myself if you'd like to discuss.

Thanks

Joshua May
BEng (hon) RPEQ
Principal Water and Sewer Engineer

H2One Pty Ltd
P +61 (0)7 5463 9538
M +61 (0)423 264 390
W H2One.com.au

PO Box 290, Ipswich QLD 4305

From: SAHA Uttam <USAHA@goldcoast.qld.gov.au>
Sent: Tuesday, 30 July 2019 2:18 PM
To: Joshua May <JoshuaMay@H2One.com.au>; David Colledge <davidcolledge@H2One.com.au>
Cc: Development Assessment <GCWDA@goldcoast.qld.gov.au>; JOSEPH Dominic <DJOSEPH@goldcoast.qld.gov.au>; JOHNSON Mark <MJOHNSON@goldcoast.qld.gov.au>; JAHAN Syeda <SJAHAN@goldcoast.qld.gov.au>
Subject: RE: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

Hi David,

With reference to my email (date: 20/06/19) below and attached IR Item 31, the following are the summary of our telephone conversation this morning.

- As the theoretical modelling identified that the existing networks are border line to meet the servicing standards of above development, we have monitored the pressure at three locations of proposed connection points to validate the concern. If above development were approved without this validation, the GCWW would be at risk to maintain the servicing standards.
- Refer to Table below for the minimum and maximum pressures recorded from the loggers. Based on the recorded logger data, the minimum HGL for three connections becomes 81m. It is to be noted that this HGL is representative of 2019 AD scenario. The servicing pressure for the entire network would drop in the future due to competing demand growth. As a result, HGL value at the Courtney Drive's three connections would drop further below 81m in the future. This has not accounted the consideration of MDMM and MD scenario. As per SEQ Code, the servicing standards should be assessed based on 2066 MD scenario.
- Considering above reason, 55m finished elevation can be serviced for above development in the current state of network as outlined in my previous email.

Loggers data were collected between 07/06/19 and 18/06/19 for the three connections. As requested, I am providing the loggers' raw data as well as attached Excel spreadsheet.

I understand that you will be sending the loggers data to the developer to convince them. I hope that above information clarifies your query.

Regards Uttam

From: JOSEPH Dominic
Sent: Tuesday, 30 July 2019 9:05 AM
To: 'JoshuaMay@H2One.com.au'
Cc: SAHA Uttam; Development Assessment
Subject: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

Hi Joshua,

How are you?

Below are comments provided by Uttam.

Can you please review and respond to his queries below. Thank you.

Kind Regards

Dominic Joseph
Senior Development Engineer
Water and Waste
City of Gold Coast

T: (07)5582 8707
PO Box 5042 Gold Coast Mail Centre Qld 9729
cityofgoldcoast.com.au

From: SAHA Uttam
Sent: Thursday, 20 June 2019 9:22 AM
To: JOHNSON Mark; JOSEPH Dominic; DARWIN Nick
Cc: JAHAN Syeda; CACHO Michael; SUBRAMANIAM Subra; HUNTING Mark
Subject: Water & Sewer capacity for COM/2019/82 - 79-99 Courtney Drive, UPPER COOMERA

Hi Mark and Dominic,

With reference to our recent meeting, I had concern whether the existing water network can support above development approval. We have monitored the pressure at three locations of proposed connection points to validate the concern.

My understanding initial connection to existing mains in Gordon Dr for Stage 1 and Mackellar Drive for Stage 2. Another connection is likely along Courtney Drive & Baileys Mountain Rd.

The following are the interpretation based on logger data and modelling:

- Figure 4 shows the location of three loggers at Gordon Dr, Mackellar Dr and Reserve Rd (some hydrants near Baileys Mountain Rd roundabout are buried). The Reserve Rd monitored pressure should be considered as representative of Baileys Mountain Rd connection.
- As can be seen from Table 1, the model based HGL over predicts the HGL by 6m as compared to actual field data. Therefore, logger data is adopted to calculate the minimum elevation that can be serviced for the Courtney Dr development.
- The pressure reducing valve (PRV9003) located at the corner of Days Rd and Old Coach Rd was removed physically. Therefore, the supply to the Courtney Dr is coming from the Peanba potable water reservoir (TWL = 94m, bottom level of reservoir = 84m). The minimum HGL of ~81m obtained from pressure data is possibly the lowest level can be achieved from the system in its current state.
- Considering 22m minimum servicing standard, the possible servicing elevation becomes 59m (=81-22). There should be head loss through Courtney Dr reticulation network. So, 55m finished elevation can be serviced now in the current state of network. It is to be noted that the servicing pressure/ HGL would drop in the future.
- The elevations for some part of the lots (#79, #89, #91, #97, #99) are well above 55m. Therefore, developer has to satisfy the servicing connection requirement.

Conclusion: The existing networks in their current state are not adequate to service the entire lots. The developer has to demonstrate how it can be achieved.

Recommendation: Send this email to the consultant to manage the expectation of above development.

Regards Uttam

Table 1: Statistical pressure record and model based data

				Model based minimum HGL (m) in 2021AD
	minimum	maximum	average	
Pressure (m) at Reserve Rd (source: Figure 2-a)	50.43	60.88	55.08	
HGL (m) at Reserve Rd (elevation = 31.3m)	81.73	92.18	86.38	87.4
Pressure (m) at Gordon Rd (source: Figure 1-a)	32.48	46.83	38.33	
HGL (m) at Gordon Dr (elevation = 49m)	81.48	95.83	87.33	87.3
Pressure (m) at Mackellar Dr (source: Figure 3-a)	40.58	54.87	46.28	
HGL (m) at Mackellar Dr (elevation = 41m)	81.58	95.87	87.28	87.3

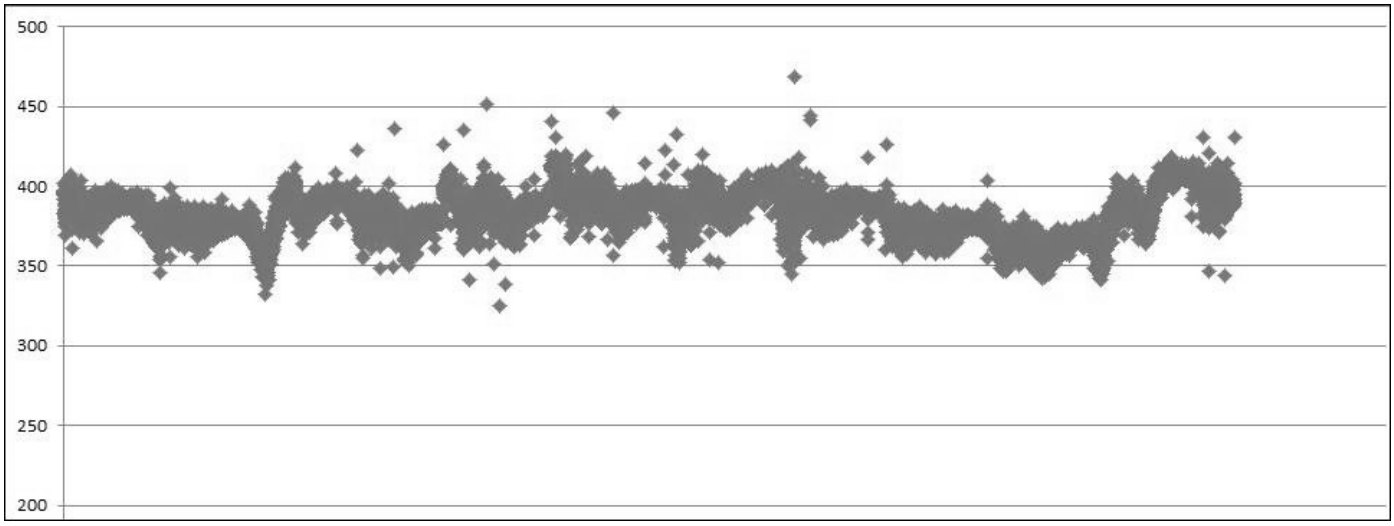


Figure 1-a: Logger's pressure record in kPa (between 07/06/19 and 18/06/19) at the end hydrant of Gordon Drive DN150 water main

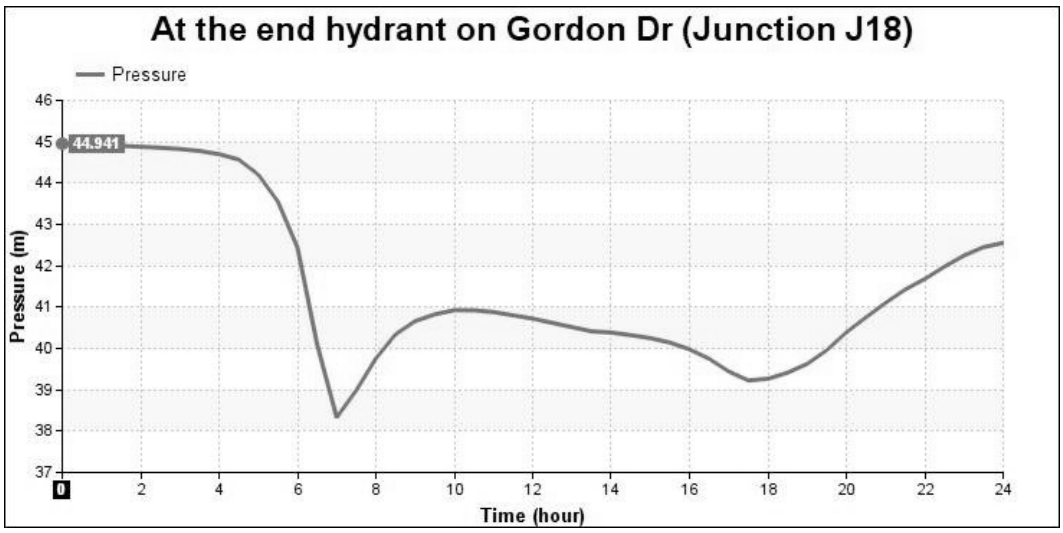


Figure 1-b: Model (version 99; 2021 AD) based pressure (in meter) data at the end hydrant of Gordon Drive DN150 water main

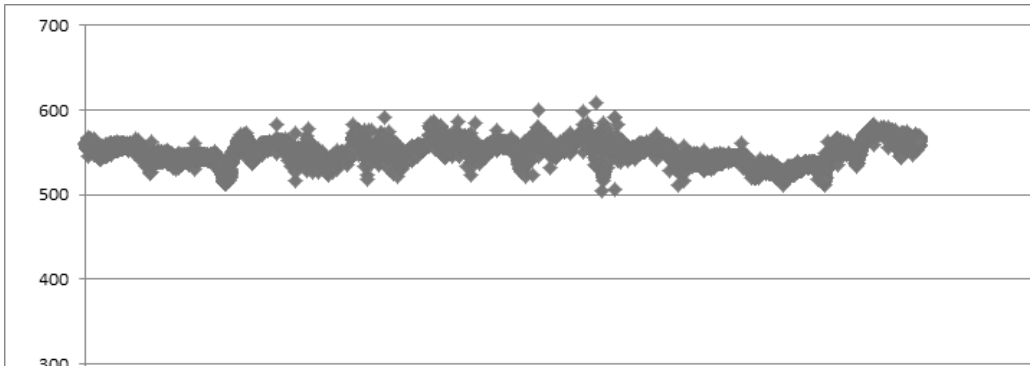


Figure 2-a: Logger's pressure record in kPa (between 07/06/19 and 18/06/19) at the hydrant on Reserve Rd DN200 water main

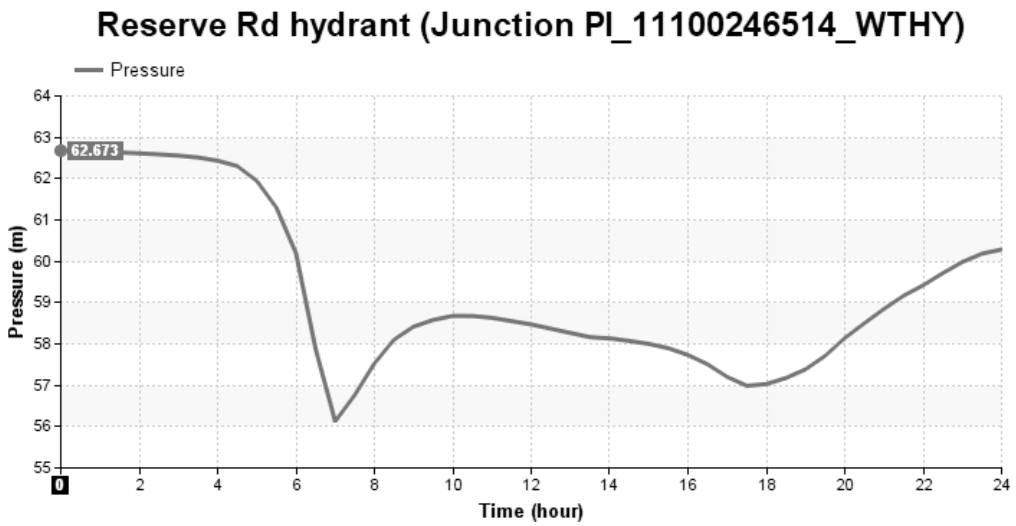


Figure 2-b: Model (version 99; 2021 AD) based pressure (in meter) data at the hydrant on Reserve Rd DN200 water main

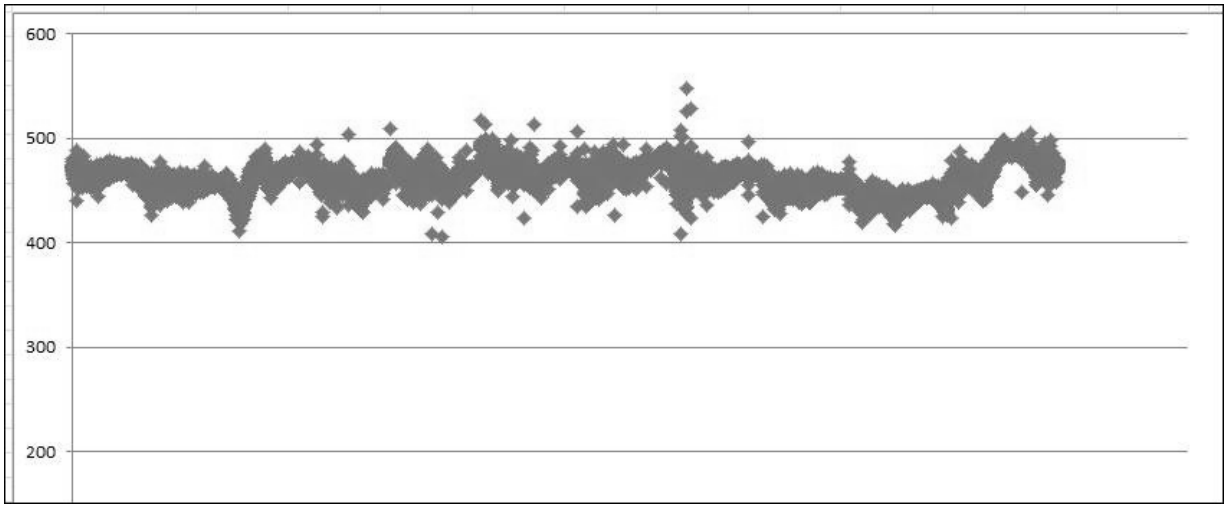


Figure 3-a: Logger's pressure record in kPa (between 07/06/19 and 18/06/19) at the hydrant on Mackellar Dr DN100 water main

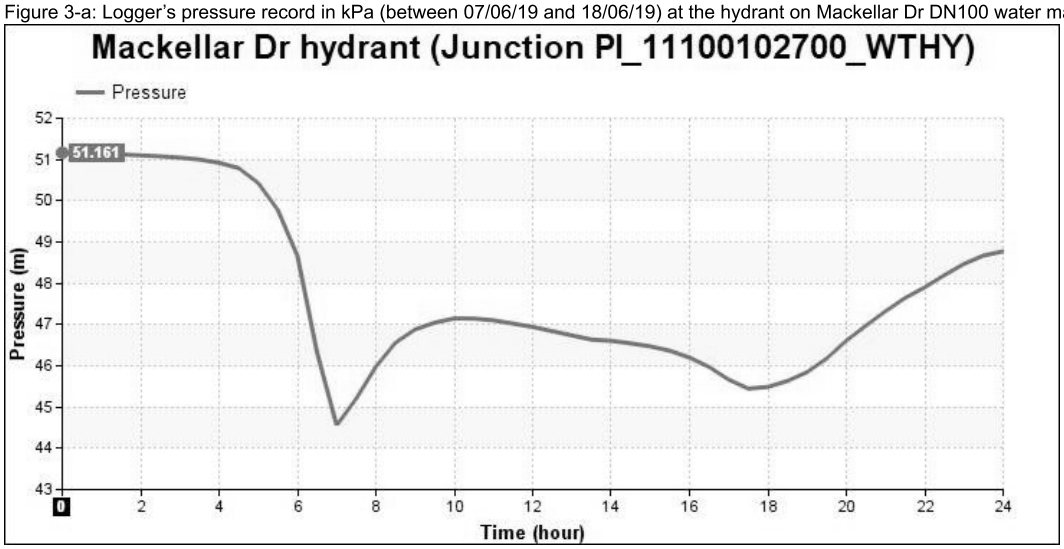


Figure 3-b: Model (version 99; 2021 AD) based pressure (in meter) data at the hydrant on Mackellar Dr DN100 water main

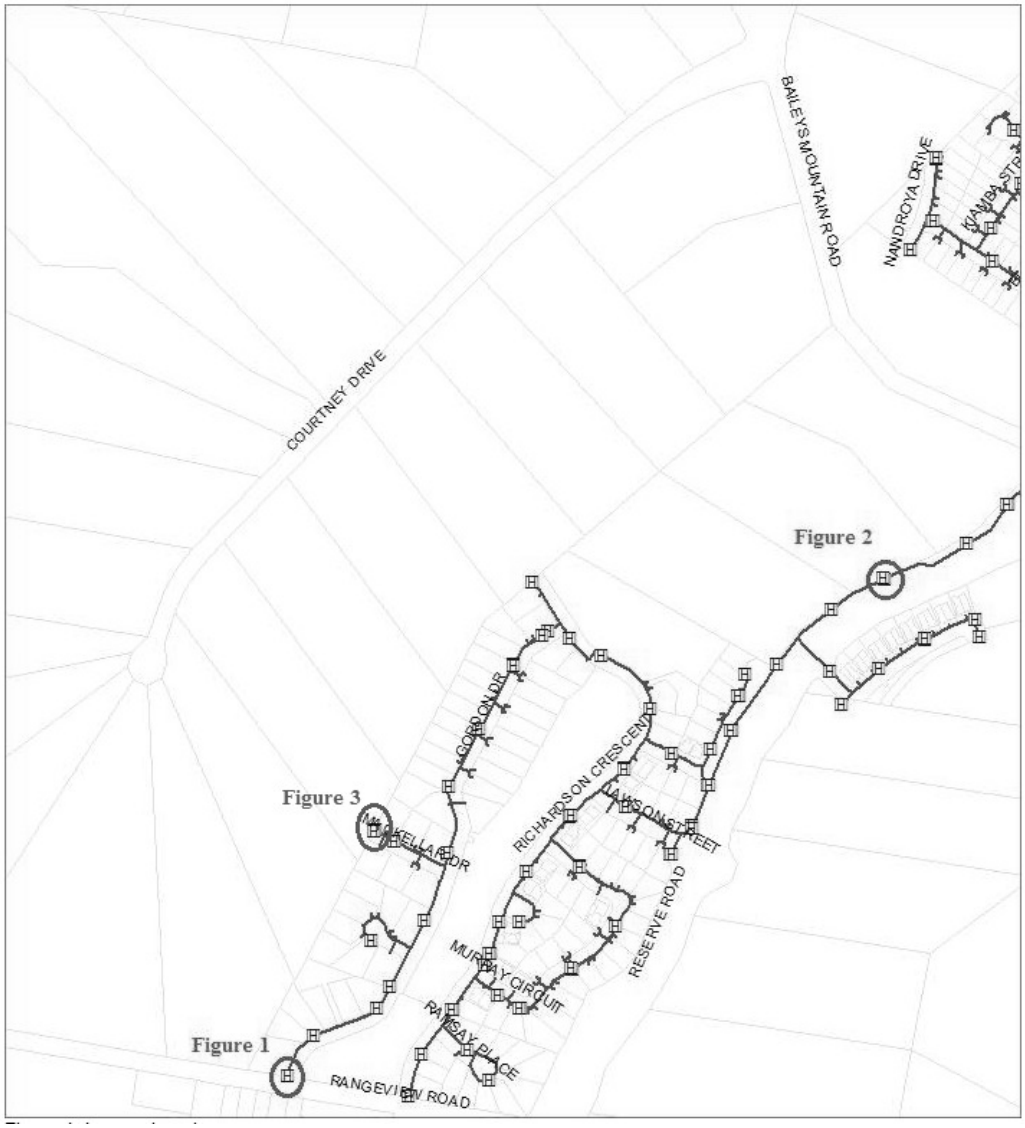
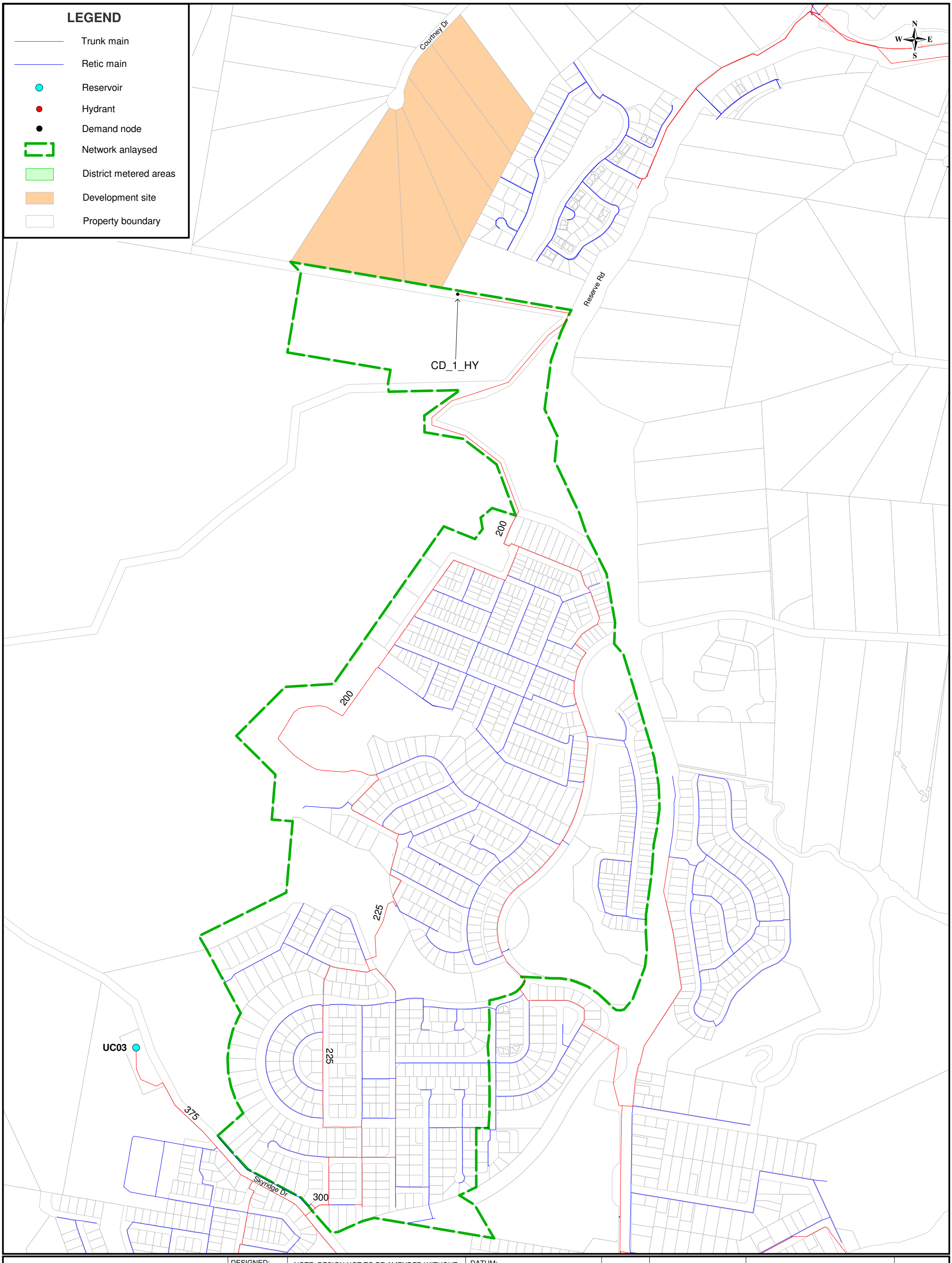


Figure 4: Logger location

Appendix 6. Development site and Upper Coomera HLZ water supply system



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H2One Pty Ltd
PO Box 290
IPSWICH Q 4305
P: 07 5463 9538
E: Info@H2One.com.au
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DRAWN: D Colledge
CHECKED: J May
APPROVED: J May
CLIENT PM:
H2ONE PM: J May

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No.	REVISION	APPROVED
A	ORIGINAL ISSUE - 4 NOV 2019	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:
0 125 250
Metres

SURVEYED BY / DATE:
SURVEY CHECKED:

PROJECT NO: 1804245
FILE REF:
CAD FILE:

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79-99 Courtney Dr Upper Coomera QLD 4209 Water Supply and Sewerage Hydraulic Analysis

Appendix 6. Development site and Upper Coomera HLZ water supply system

NOV, 2019
DATE SCANNED:
DRG No:
REV:

Appendix 7. Sewer hydraulic model pipe layout

LEGEND

Existing

- Gravity main
- Pressure main
- SPS
- Manhole
- Demand manhole
- Property boundary

Proposed

- DN150 gravity main
- DN225 gravity main
- Manhole
- Property boundary

N W E S

Courtney Drive

CDT-447 CDT-451 CDT-453 MH91 CDT-433 CDT-363 CDT-369 MH90 CDT-371 MH123 CDT-373 MH124 CDT-375 MH125 CDT-377

CDT-443 MH66 CDT-441 MH65 CDT-439 MH64 CDT-437 CDT-435 MH60 CDT-331 MH55 CDT-335 MH53 CDT-325 CDT-327 MH52 MH51 CDT-299 CDT-295 MH48 MH47 CDT-293 CDT-291 MH50 MH110 CDT-301 MH111 CDT-323 MH114 CDT-319 MH115

CDT-339 MH62 CDT-341 CDT-343 CDT-345 CDT-347 CDT-351 CDT-355 CDT-357 MH84 MH83 CDT-429 MH75 MH81 CDT-431 CDT-401 CDT-417 CDT-419 MH99 MH79 MH80 CDT-387 CDT-399 CDT-411 MH59 MH58 MH101 CDT-397 CDT-389 CDT-385 MH119 MH120 CDT-393 MH121

CDT-235 CDT-241 CDT-233 CDT-245 CDT-255 CDT-261 MH29 CDT-259 CDT-231 CDT-229 CDT-227 MH15 CDT-223 CDT-221 MH11 MH12 CDT-215 CDT-213 MH7 MH6 MH5 CDT-209 CDT-205 CDT-201 MH1

MH45 CDT-283 CDT-285 CDT-281 CDT-279 MH42 MH40 CDT-271 CDT-273 CDT-269 MH36 CDT-275 CDT-265 CDT-263

S111-03002M

MH126 MH127 CDT-379 JCT-10

Gravity flow to SPS PA1

150

S111-03082M

150

Gordon Dr

Richardson Cres

S111-03071M

Reserve Rd

H2ONE

H2One Pty Ltd
PO Box 290
IPSWICH Q 4305
P: (07) 5463 9538
E: Info@H2One.com.au
W: H2One.com.au

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DESIGNED: D Colledge
DRAWN: D Colledge
CHECKED: J May
APPROVED: J May
CLIENT PM:
H2ONE PM: J May

NOTE: DESIGN NOT TO BE AMENDED WITHOUT H2ONE PTY LTD ACCEPTANCE

No.	REVISION	APPROVED
E	REVISED ISSUE - 4 NOV 2019	
D	REVISED ISSUE - 17 APR 2019	
C	REVISED ISSUE - 26 NOV 2018	
B	REVISED ISSUE - 21 SEP 2018	
A	ORIGINAL ISSUE - 15 MAY 2018	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:
0 40 80
Metres

SURVEYED BY / DATE:
SURVEY CHECKED:

PROJECT NO: 1804245
FILE REF:
CAD FILE:

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79-99 Courtney Dr Upper Coomera QLD 4209 Water Supply and Sewerage Hydraulic Analysis

Appendix 7. Sewer hydraulic model pipe layout

DATE SCANNED:
DRG No:
REV:

Appendix 8. Modelling results for sewer reticulation layout

Nodes

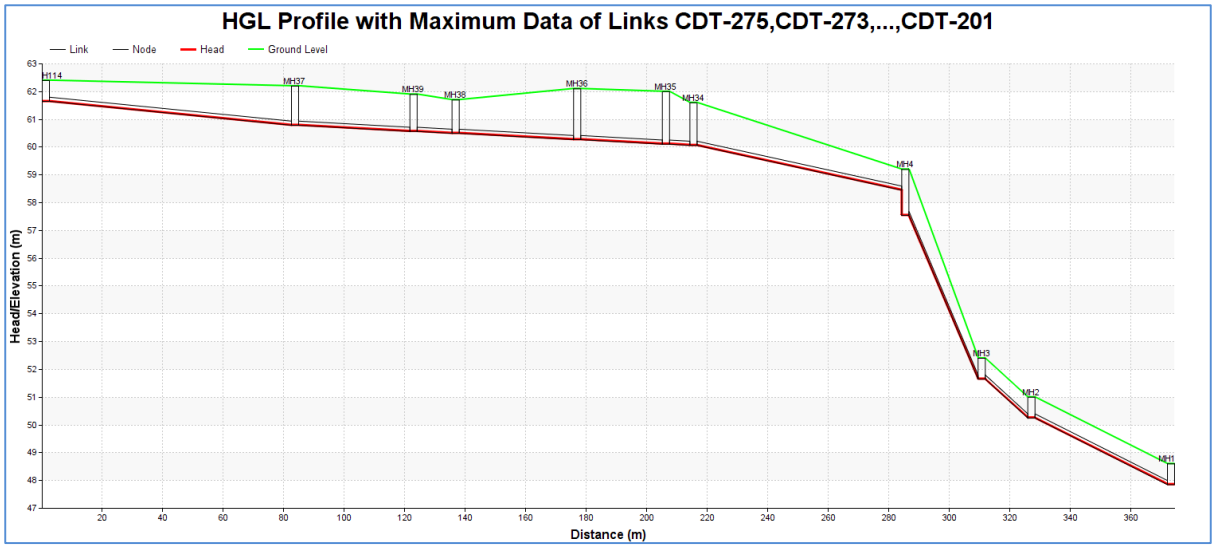
Node ID	IL (RL m)	SL (RL m)	Depth to IL (m)	Demand (EP)
JCT-12	53.450	54.2	0.750	5.24
MH1	47.850	48.6	0.750	6.96
MH10	58.368	60.1	1.732	5.24
MH100	52.450	53.2	0.750	5.24
MH101	53.350	54.1	0.750	5.82
MH102	57.903	59.5	1.597	5.82
MH103	57.827	59.5	1.673	5.82
MH104	57.700	59.4	1.700	5.82
MH105	57.630	59.3	1.670	5.82
MH106	57.577	59.3	1.723	5.82
MH107	57.454	59.1	1.646	5.82
MH108	57.307	59.1	1.793	5.82
MH109	58.450	59.2	0.750	6.96
MH11	58.441	60.1	1.659	5.82
MH110	56.773	58.6	1.827	5.82
MH111	57.103	59.3	2.197	5.82
MH112	59.250	60.0	0.750	5.82
MH113	59.650	60.4	0.750	14.15
MH114	61.650	62.4	0.750	5.82
MH115	60.850	61.6	0.750	5.24
MH116	51.650	52.4	0.750	5.24
MH117	51.850	52.6	0.750	5.24
MH118	53.250	54.0	0.750	5.24
MH119	54.950	55.7	0.750	6.96
MH12	58.852	60.2	1.348	5.24
MH120	54.950	55.7	0.750	5.24
MH121	54.350	55.1	0.750	5.24
MH122	53.650	54.4	0.750	0.00
MH123	35.175	36.0	0.825	0.00
MH124	33.175	34.0	0.825	0.00
MH125	31.575	32.4	0.825	0.00
MH126	27.975	28.8	0.825	0.00
MH127	27.675	28.5	0.825	6.96
MH13	58.750	59.5	0.750	6.96
MH14	58.750	59.5	0.750	4.67
MH15	58.550	59.3	0.750	4.67
MH16	58.450	59.2	0.750	4.67
MH17	57.550	58.3	0.750	4.67
MH18	57.350	58.1	0.750	4.67
MH19	54.514	57.7	3.186	0.00
MH2	50.250	51.0	0.750	4.67
MH20	54.469	57.7	3.231	4.67
MH21	54.364	55.8	1.436	4.67
MH22	54.327	55.2	0.873	4.67
MH23	53.850	54.6	0.750	4.67
MH24	53.450	54.2	0.750	4.67
MH25	50.050	50.8	0.750	0.00
MH26	42.050	42.8	0.750	4.67
MH27	42.450	43.2	0.750	4.67
MH29	53.250	54.0	0.750	0.00
MH3	51.650	52.4	0.750	4.67
MH30	54.720	56.5	1.780	4.67
MH31	55.750	56.5	0.750	4.67
MH32	54.835	56.0	1.165	4.67
MH33	54.950	55.7	0.750	0.00
MH34	60.065	61.6	1.535	6.96
MH35	60.107	62.0	1.893	6.96
MH36	60.270	62.1	1.830	6.96
MH37	60.788	62.2	1.412	0.00
MH38	60.497	61.7	1.203	6.96
MH39	60.567	61.9	1.333	0.00
MH4	57.546	59.2	1.654	5.82

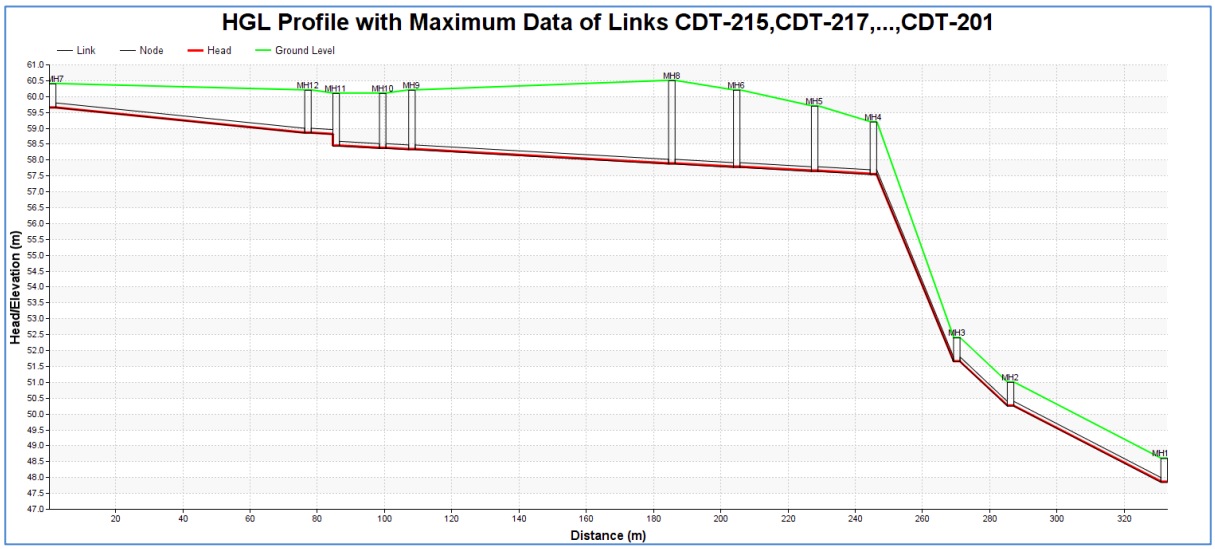
MH40	60.550	61.3	0.750	5.82
MH41	60.350	61.1	0.750	5.82
MH42	59.650	60.4	0.750	5.82
MH43	54.350	55.1	0.750	5.82
MH44	53.650	54.4	0.750	5.82
MH45	53.350	54.1	0.750	5.82
MH46	54.350	55.1	0.750	5.82
MH47	52.650	53.4	0.750	5.82
MH48	52.250	53.0	0.750	5.82
MH49	52.177	53.0	0.823	6.96
MH5	57.640	59.7	2.060	5.82
MH50	56.672	57.8	1.128	5.82
MH51	51.650	52.4	0.750	5.82
MH52	51.550	52.3	0.750	5.82
MH53	53.550	54.3	0.750	5.82
MH54	52.750	53.5	0.750	5.82
MH55	51.450	52.2	0.750	5.82
MH56	50.896	51.8	0.904	5.82
MH57	50.750	51.5	0.750	5.24
MH58	52.050	52.8	0.750	5.24
MH59	51.850	52.6	0.750	6.96
MH6	57.769	60.2	2.431	5.82
MH60	50.350	51.1	0.750	5.82
MH61	45.175	46.0	0.825	5.24
MH62	46.850	47.6	0.750	5.82
MH63	44.175	45.0	0.825	5.82
MH64	43.575	44.4	0.825	5.82
MH65	42.175	43.0	0.825	5.82
MH66	40.875	41.7	0.825	5.24
MH67	39.650	40.4	0.750	5.24
MH68	39.250	40.0	0.750	5.24
MH69	38.981	41.0	2.019	6.96
MH7	59.650	60.4	0.750	5.24
MH70	40.510	41.3	0.790	5.24
MH71	40.450	41.2	0.750	5.24
MH72	40.615	41.4	0.785	5.24
MH73	40.650	41.4	0.750	5.24
MH74	41.050	41.8	0.750	5.24
MH75	42.650	43.4	0.750	5.24
MH76	43.250	44.0	0.750	5.24
MH77	44.850	45.6	0.750	5.24
MH78	46.150	46.9	0.750	5.24
MH79	48.150	48.9	0.750	6.96
MH8	57.874	60.5	2.626	5.24
MH80	48.350	49.1	0.750	5.24
MH81	44.650	45.4	0.750	5.24
MH82	45.450	46.2	0.750	5.24
MH83	43.250	44.0	0.750	5.24
MH84	42.850	43.6	0.750	5.24
MH85	38.903	41.0	2.097	0.00
MH86	36.451	37.4	0.949	0.00
MH87	36.416	37.4	0.984	0.00
MH88	36.376	37.4	1.024	0.00
MH89	36.322	37.4	1.078	6.96
MH9	58.326	60.2	1.874	0.00
MH90	35.975	36.8	0.825	0.00
MH91	36.670	37.5	0.830	0.00
MH92	36.756	37.6	0.844	0.00
MH93	36.775	37.6	0.825	0.00
MH94	37.175	38.0	0.825	5.82
MH95	39.175	40.0	0.825	5.24
MH96	46.250	47.0	0.750	5.24
MH97	48.050	48.8	0.750	5.24
MH98	48.850	49.6	0.750	5.24
MH99	49.950	50.7	0.750	5.24

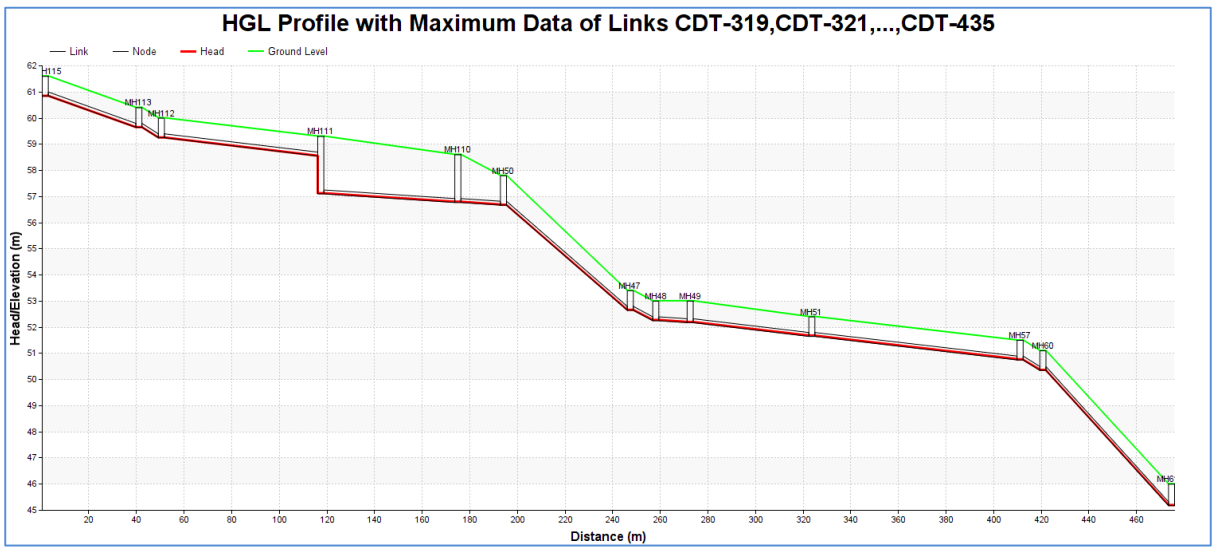
Pipes

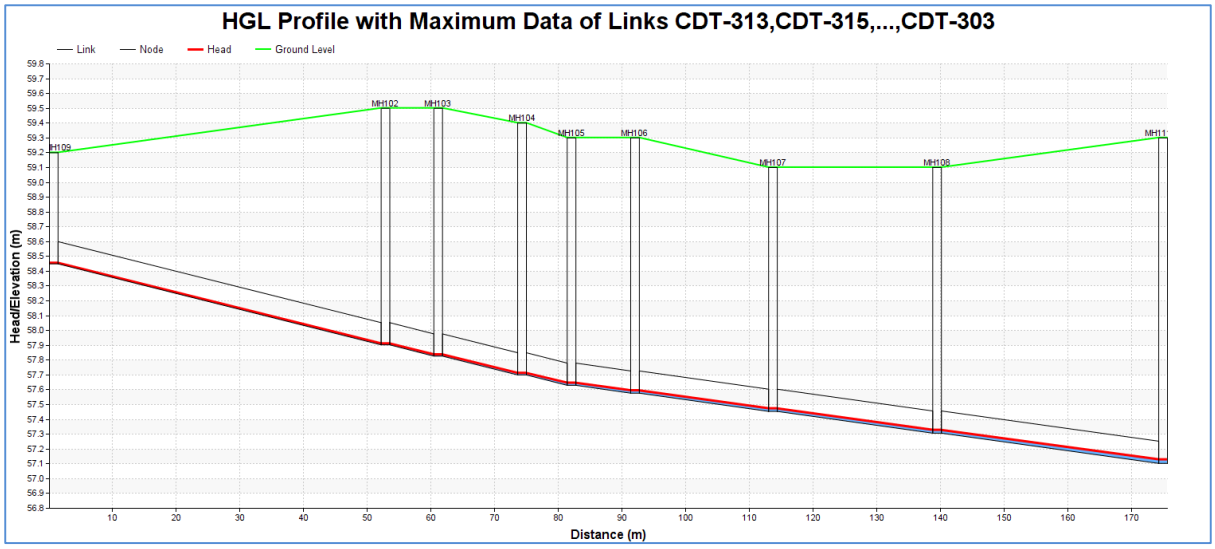
Pipe ID	Diam. (mm)	Length (m)	Manning	US IL (RL m)	DS IL (RL m)	Grade (%)	PWWF (L/s)	d/D (%) @ PWWF
CDT-201	150	47.1	0.0130	50.250	47.850	5.10%	1.36	13.6%
CDT-203	150	15.1	0.0130	51.650	50.250	9.25%	1.36	12.6%
CDT-205	150	24.6	0.0130	57.546	51.650	23.96%	1.36	10.5%
CDT-207	150	16.7	0.0130	57.640	57.546	0.56%	0.85	15.1%
CDT-209	150	22.9	0.0130	57.769	57.640	0.56%	0.76	19.2%
CDT-211	150	18.7	0.0130	57.874	57.769	0.56%	0.68	17.0%
CDT-213	150	81.1	0.0130	58.326	57.874	0.56%	0.59	16.0%
CDT-215	150	79.6	0.0130	59.650	58.852	1.00%	0.08	7.1%
CDT-217	150	6.9	0.0130	58.852	58.812	0.58%	0.17	8.2%
CDT-219	150	12.8	0.0130	58.441	58.368	0.57%	0.34	13.0%
CDT-221	150	7.3	0.0130	58.368	58.326	0.58%	0.51	14.9%
CDT-223	150	33.6	0.0130	58.750	58.412	1.00%	0.08	5.2%
CDT-225	150	30.8	0.0130	58.750	58.441	1.00%	0.08	8.6%
CDT-227	150	44.3	0.0130	58.550	57.550	2.26%	0.06	4.6%
CDT-229	150	40.8	0.0130	58.450	57.350	2.70%	0.06	5.2%
CDT-231	150	12.4	0.0130	57.550	57.350	1.61%	0.11	6.2%
CDT-233	150	63.3	0.0130	57.350	55.750	2.53%	0.23	9.1%
CDT-235	150	12.1	0.0130	55.750	55.682	0.56%	0.28	10.5%
CDT-237	150	11.4	0.0130	54.950	54.835	1.01%	0.06	5.3%
CDT-239	150	11.4	0.0130	54.835	54.720	1.01%	0.11	9.9%
CDT-241	150	36.8	0.0130	54.720	54.514	0.56%	0.45	14.0%
CDT-243	150	7.8	0.0130	54.514	54.469	0.58%	0.51	14.7%
CDT-245	150	18.7	0.0130	54.469	54.364	0.56%	0.57	16.3%
CDT-247	150	6.4	0.0130	54.364	54.327	0.58%	0.62	13.6%
CDT-249	150	8.3	0.0130	54.327	53.850	5.73%	0.68	9.2%
CDT-251	150	3.8	0.0130	53.850	53.450	10.48%	0.74	8.6%
CDT-253	150	27.0	0.0130	53.450	50.050	12.59%	0.79	8.4%
CDT-255	150	50.1	0.0130	50.050	42.450	15.16%	0.85	9.3%
CDT-257	150	2.7	0.0130	42.450	42.050	14.64%	0.96	8.6%
CDT-259	150	3.5	0.0130	42.050	40.680	39.65%	0.96	8.5%
CDT-261	150	61.2	0.0130	53.250	42.450	17.66%	0.06	6.2%
CDT-263	150	72.8	0.0130	60.065	58.450	2.22%	0.51	10.3%
CDT-265	150	7.2	0.0130	60.107	60.065	0.58%	0.51	12.9%
CDT-267	150	29.0	0.0130	60.270	60.107	0.56%	0.43	14.3%
CDT-269	150	40.7	0.0130	60.497	60.270	0.56%	0.34	12.5%
CDT-271	150	12.4	0.0130	60.567	60.497	0.56%	0.34	11.9%
CDT-273	150	39.6	0.0130	60.788	60.567	0.56%	0.26	11.2%
CDT-275	150	86.1	0.0130	61.650	60.788	1.00%	0.17	8.9%
CDT-277	150	7.4	0.0130	60.550	60.350	2.69%	0.07	4.2%
CDT-279	150	95.3	0.0130	60.350	54.350	6.29%	0.14	4.7%
CDT-281	150	82.4	0.0130	59.650	54.350	6.43%	0.07	3.4%
CDT-283	150	7.1	0.0130	54.350	53.350	13.99%	0.14	6.3%
CDT-285	150	8.2	0.0130	54.350	53.650	8.53%	0.21	6.4%
CDT-287	150	13.9	0.0130	53.650	53.350	2.16%	0.28	8.4%
CDT-289	150	43.9	0.0130	53.350	51.650	3.87%	0.49	16.9%
CDT-291	150	17.9	0.0130	56.773	56.672	0.57%	0.92	16.1%
CDT-293	150	54.6	0.0130	56.672	52.650	7.37%	0.99	11.5%
CDT-295	150	8.8	0.0130	52.650	52.250	4.55%	1.06	17.2%
CDT-297	150	12.8	0.0130	52.250	52.177	0.57%	1.13	20.5%
CDT-299	150	52.2	0.0130	52.177	51.650	1.01%	1.20	21.9%
CDT-301	150	59.2	0.0130	57.103	56.773	0.56%	0.85	20.0%
CDT-303	150	36.7	0.0130	57.307	57.103	0.56%	0.57	16.8%
CDT-305	150	26.3	0.0130	57.454	57.307	0.56%	0.49	14.7%
CDT-307	150	21.8	0.0130	57.577	57.454	0.56%	0.42	13.7%
CDT-309	150	9.3	0.0130	57.630	57.577	0.57%	0.35	12.6%
CDT-311	150	6.9	0.0130	57.700	57.630	1.01%	0.28	10.7%
CDT-313	150	54.6	0.0130	58.450	57.903	1.00%	0.07	5.8%
CDT-315	150	7.4	0.0130	57.903	57.827	1.02%	0.14	7.5%
CDT-317	150	12.7	0.0130	57.827	57.700	1.00%	0.21	8.8%
CDT-319	150	39.6	0.0130	60.850	59.650	3.03%	0.07	4.2%
CDT-321	150	7.4	0.0130	59.650	59.250	5.39%	0.14	6.4%
CDT-323	150	69.3	0.0130	59.250	58.550	1.01%	0.21	8.2%
CDT-325	150	91.3	0.0130	51.650	50.750	0.99%	1.77	20.5%
CDT-327	150	65.3	0.0130	51.550	50.896	1.00%	0.07	6.5%

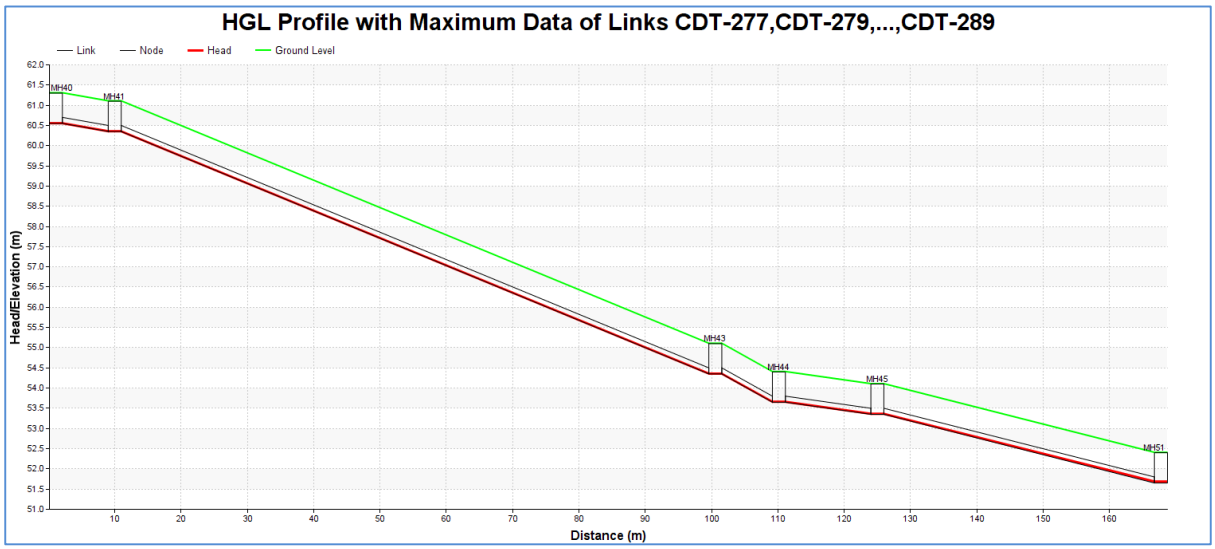
CDT-329	150	18.1	0.0130	50.896	50.350	3.01%	0.35	11.5%
CDT-331	150	7.6	0.0130	50.750	50.350	5.28%	1.84	15.5%
CDT-333	150	11.7	0.0130	53.550	52.750	6.86%	0.07	3.6%
CDT-335	150	15.9	0.0130	52.750	51.450	8.17%	0.14	4.8%
CDT-337	150	7.2	0.0130	51.450	51.050	5.59%	0.21	5.5%
CDT-339	150	89.0	0.0130	46.850	39.650	8.09%	0.06	3.6%
CDT-341	150	6.6	0.0130	39.650	39.250	6.02%	0.13	6.6%
CDT-343	150	48.2	0.0130	39.250	38.981	0.56%	0.19	17.9%
CDT-345	150	97.0	0.0130	51.850	40.550	11.65%	0.06	2.6%
CDT-347	150	5.7	0.0130	40.510	40.450	1.06%	1.08	17.0%
CDT-349	150	7.3	0.0130	40.450	40.250	2.72%	1.15	14.7%
CDT-351	150	101.9	0.0130	52.050	40.650	11.19%	0.06	2.7%
CDT-353	150	13.4	0.0130	40.615	40.510	0.79%	0.96	18.6%
CDT-355	150	6.2	0.0130	40.650	40.615	0.57%	0.83	18.4%
CDT-357	150	6.2	0.0130	41.050	40.650	6.42%	0.76	14.2%
CDT-359	150	13.8	0.0130	38.981	38.903	0.57%	1.40	19.9%
CDT-361	150	12.8	0.0130	38.903	36.575	18.20%	2.29	12.9%
CDT-363	225	10.2	0.0130	36.451	36.416	0.34%	4.98	30.4%
CDT-365	225	11.5	0.0130	36.416	36.376	0.35%	4.98	31.0%
CDT-367	225	15.8	0.0130	36.376	36.322	0.34%	4.98	27.3%
CDT-369	225	36.2	0.0130	36.322	35.975	0.96%	4.98	23.0%
CDT-371	225	75.8	0.0130	35.975	35.175	1.05%	4.98	20.9%
CDT-373	225	85.5	0.0130	35.175	33.175	2.34%	4.98	17.5%
CDT-375	225	43.5	0.0130	33.175	31.575	3.67%	4.98	16.8%
CDT-377	225	122.9	0.0130	31.575	27.975	2.93%	4.98	18.0%
CDT-379	225	14.4	0.0130	27.975	27.675	2.08%	4.98	24.6%
CDT-381	225	25.2	0.0130	27.675	27.580	0.38%	4.98	27.8%
CDT-385	150	73.9	0.0130	54.950	51.850	4.20%	0.06	4.8%
CDT-387	150	18.3	0.0130	51.850	51.650	1.09%	0.13	6.6%
CDT-389	150	46.1	0.0130	54.950	53.250	3.68%	0.06	3.7%
CDT-391	150	21.0	0.0130	53.250	51.650	7.61%	0.13	5.5%
CDT-393	150	50.0	0.0130	54.350	53.650	1.40%	0.06	4.8%
CDT-395	150	9.2	0.0130	53.650	53.450	2.18%	0.13	6.6%
CDT-397	150	7.5	0.0130	53.450	53.350	1.33%	0.19	6.7%
CDT-399	150	66.4	0.0130	53.350	48.150	7.83%	0.25	6.6%
CDT-401	150	28.9	0.0130	48.150	46.150	6.93%	0.45	7.1%
CDT-403	150	9.2	0.0130	46.150	44.850	14.12%	0.51	7.3%
CDT-405	150	17.9	0.0130	44.850	43.250	8.91%	0.57	8.2%
CDT-407	150	7.5	0.0130	43.250	42.650	8.01%	0.64	9.3%
CDT-409	150	34.0	0.0130	42.650	41.050	4.71%	0.70	10.0%
CDT-411	150	45.5	0.0130	52.450	48.350	9.01%	0.06	4.3%
CDT-413	150	12.8	0.0130	48.350	48.150	1.56%	0.13	6.7%
CDT-415	150	31.8	0.0130	51.650	49.950	5.35%	0.32	6.4%
CDT-417	150	7.7	0.0130	49.950	48.850	14.23%	0.38	6.4%
CDT-419	150	8.6	0.0130	48.850	48.050	9.33%	0.45	7.0%
CDT-421	150	16.8	0.0130	48.050	46.250	10.71%	0.51	7.5%
CDT-423	150	9.1	0.0130	46.250	45.450	8.78%	0.57	7.9%
CDT-425	150	7.1	0.0130	45.450	44.650	11.29%	0.64	8.4%
CDT-427	150	17.8	0.0130	44.650	43.250	7.85%	0.70	9.9%
CDT-429	150	9.5	0.0130	43.250	42.850	4.20%	0.76	10.9%
CDT-431	150	54.9	0.0130	42.850	40.250	4.73%	0.83	10.9%
CDT-433	225	65.3	0.0130	36.670	36.451	0.34%	2.69	26.2%
CDT-435	150	55.4	0.0130	50.350	45.175	9.35%	2.26	16.3%
CDT-437	225	30.0	0.0130	45.175	44.175	3.34%	2.33	11.4%
CDT-439	225	14.2	0.0130	44.175	43.575	4.23%	2.40	11.4%
CDT-441	225	35.9	0.0130	43.575	42.175	3.91%	2.47	11.3%
CDT-443	225	24.4	0.0130	42.175	40.875	5.32%	2.54	10.6%
CDT-445	225	24.0	0.0130	40.875	39.175	7.10%	2.61	10.4%
CDT-447	225	30.2	0.0130	39.175	37.175	6.63%	2.69	11.1%
CDT-449	225	9.4	0.0130	37.175	36.775	4.27%	2.69	17.0%
CDT-451	225	5.3	0.0130	36.775	36.756	0.36%	2.69	22.2%
CDT-453	225	25.8	0.0130	36.756	36.670	0.33%	2.69	21.9%

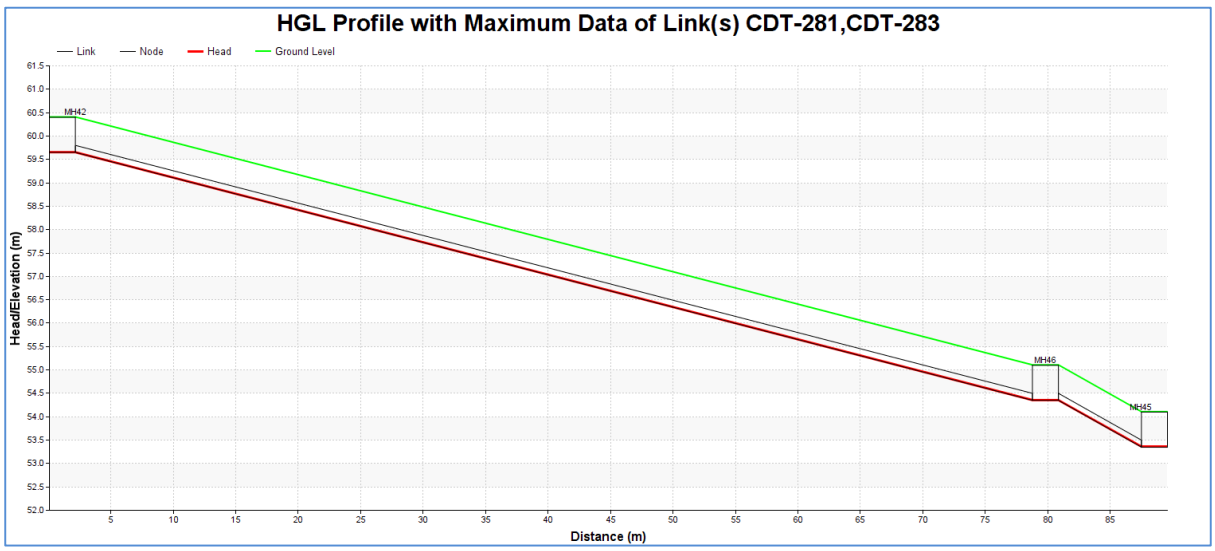

HGL Profile with Maximum Data of Links CDT-275,CDT-273,...,CDT-201
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH114
MH37
MH39
MH38
MH36
MH35
MH34
MH4
MH3
MH2
MH1

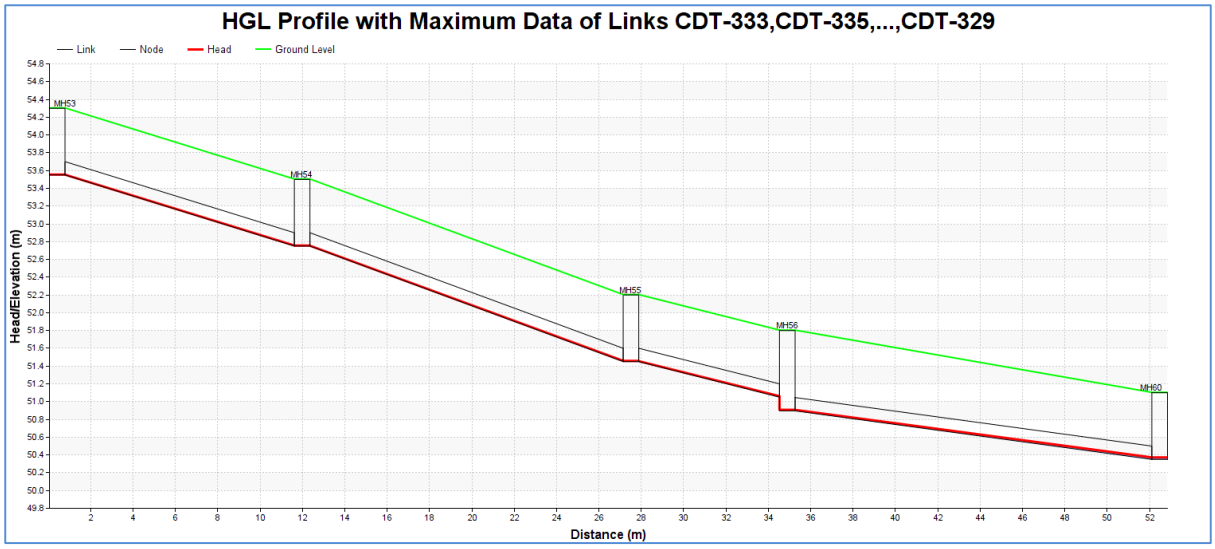

HGL Profile with Maximum Data of Links CDT-215,CDT-217,...,CDT-201
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH7
MH12
MH11
MH10
MH9
MH8
MH6
MH5
MH4
MH3
MH2
MH1

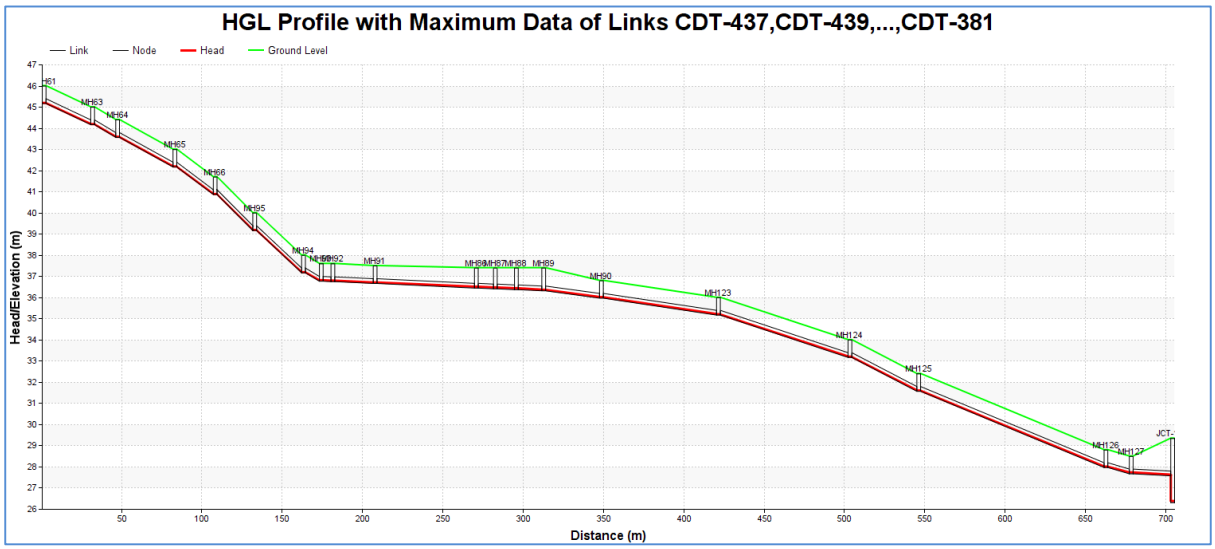

HGL Profile with Maximum Data of Links CDT-319,CDT-321,...,CDT-435
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH115
MH113
MH112
MH111
MH110
MH50
MH47
MH48
MH49
MH51
MH57
MH60
MH6

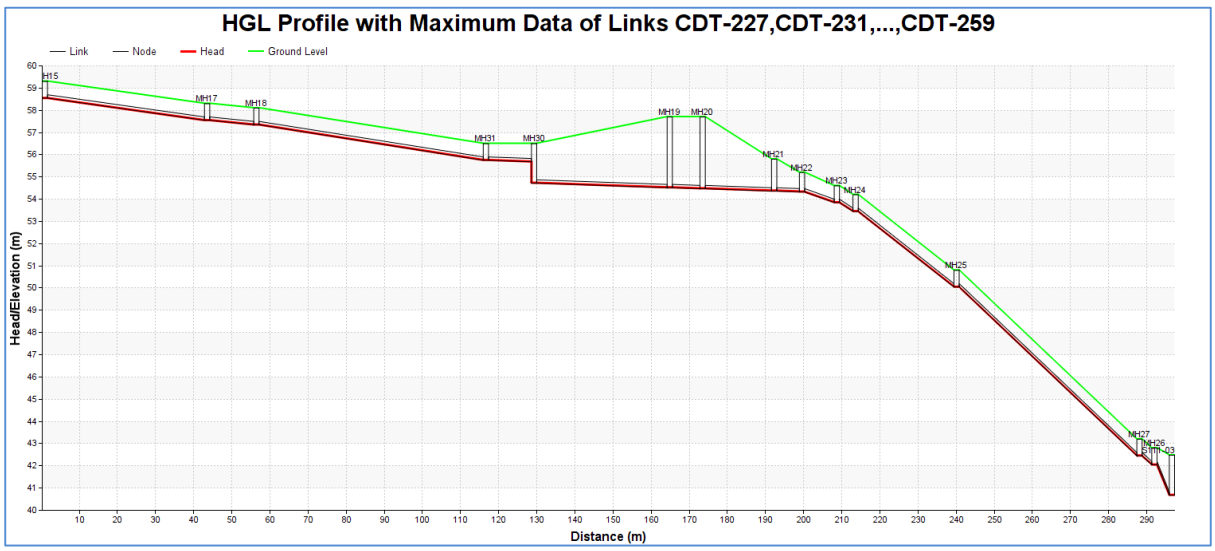

HGL Profile with Maximum Data of Links CDT-313,CDT-315,...,CDT-303
Link
Node
Head
Ground Level
MH102
MH103
MH104
MH105
MH106
MH107
MH108
Head/Elevation (m)
Distance (m)

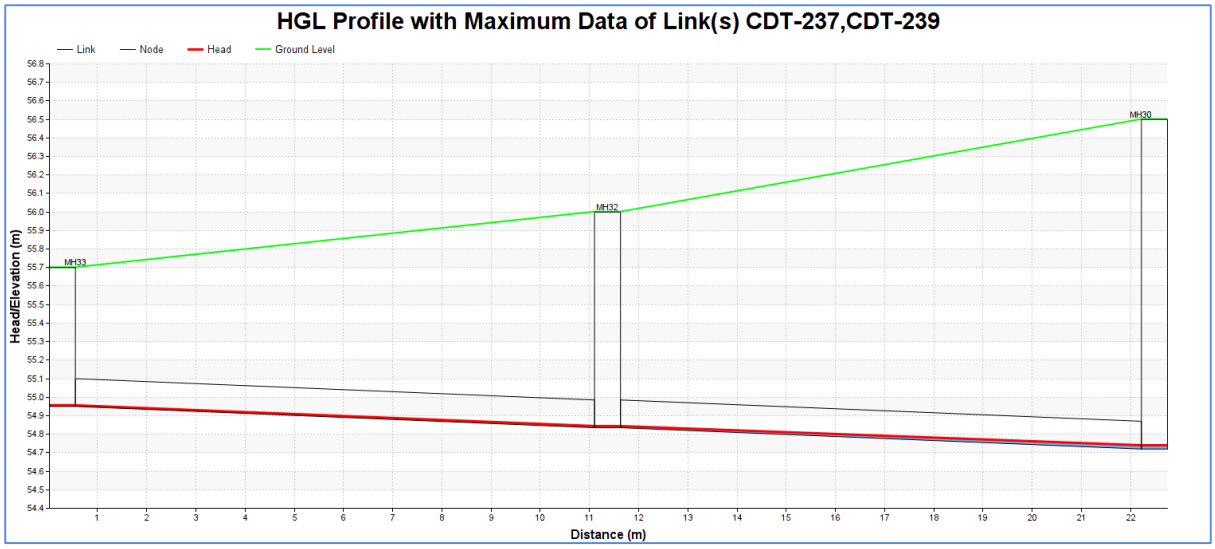

HGL Profile with Maximum Data of Links CDT-277,CDT-279,...,CDT-289
Link
Node
Head
Ground Level
MH40
MH41
MH43
MH44
MH45
MH51
Head/Elevation (m)
Distance (m)

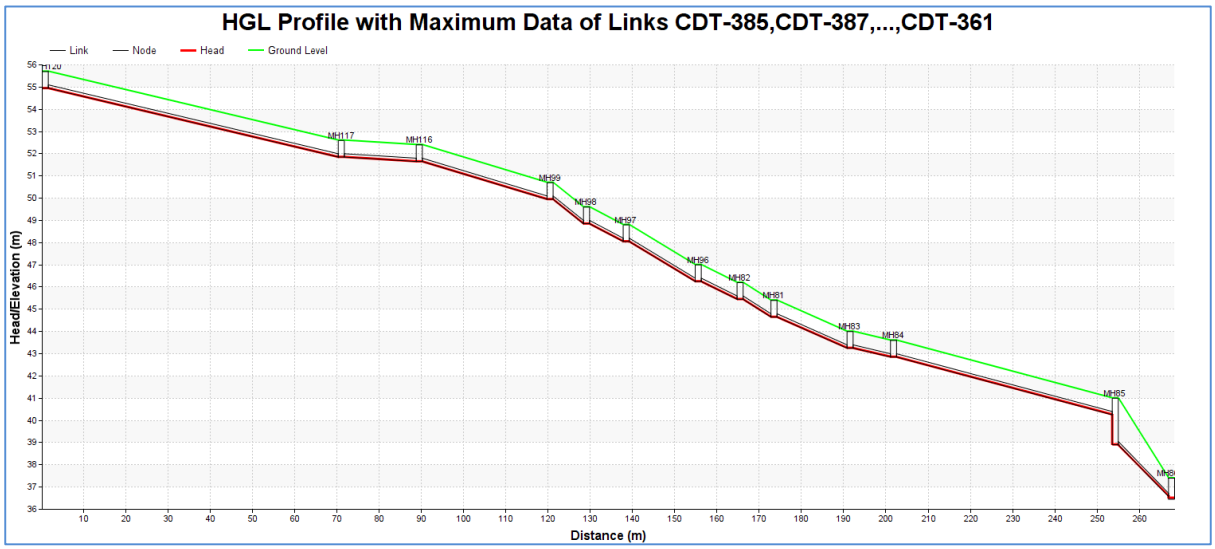

HGL Profile with Maximum Data of Link(s) CDT-281,CDT-283
Link
Node
Head
Ground Level
MH42
MH46
MH45
Head/Elevation (m)
Distance (m)

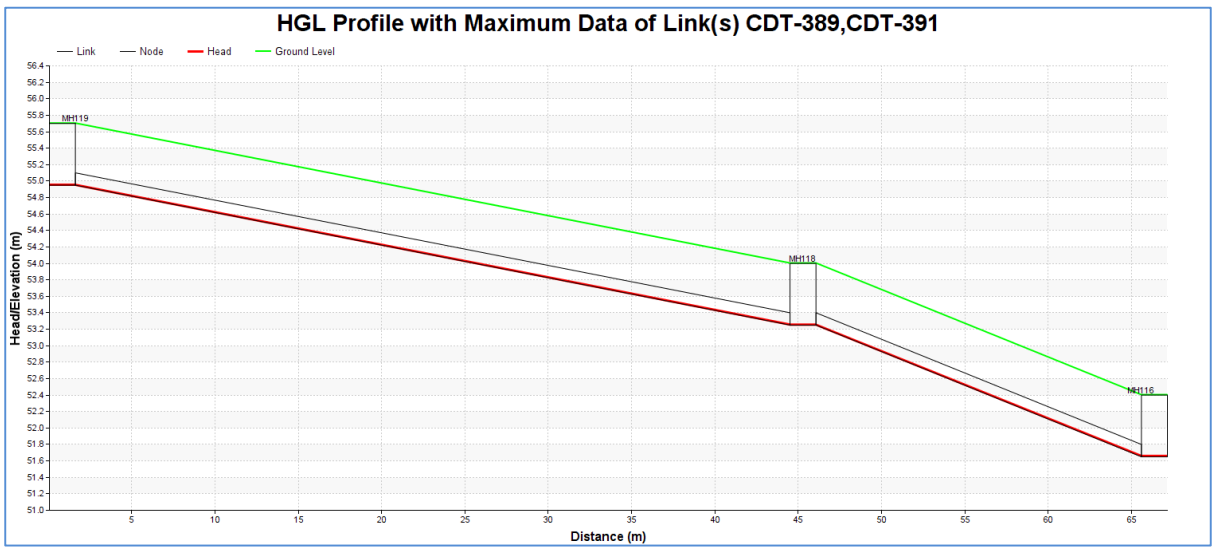

HGL Profile with Maximum Data of Links CDT-333,CDT-335,...,CDT-329
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH53
MH54
MH55
MH56
MH60

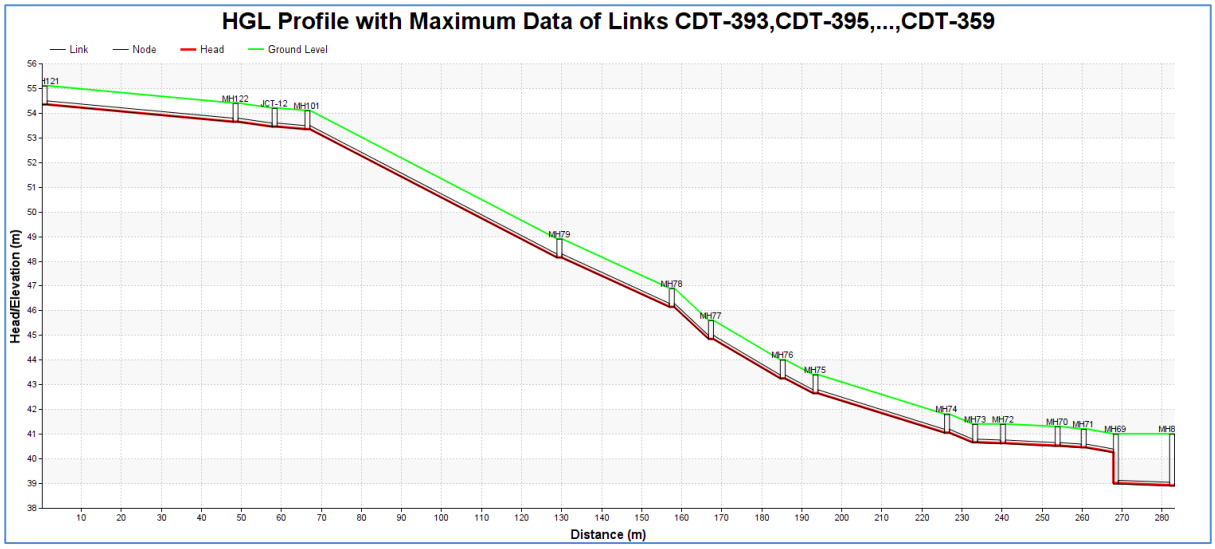

HGL Profile with Maximum Data of Links CDT-437,CDT-439,...,CDT-381
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH61
MH63
MH64
MH65
MH66
MH95
MH94
MH91
MH90
MH123
MH124
MH125
MH126
MH127
JCT-

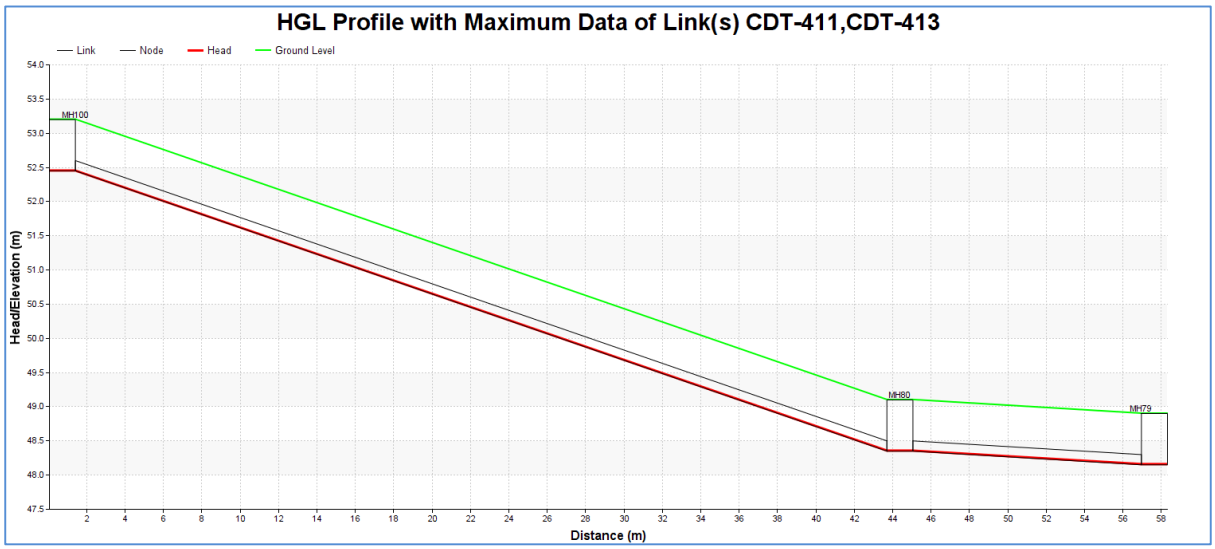

HGL Profile with Maximum Data of Links CDT-227,CDT-231,...,CDT-259
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH15
MH17
MH18
MH31
MH30
MH19
MH20
MH21
MH22
MH23
MH24
MH25
MH27
MH26
STR-03

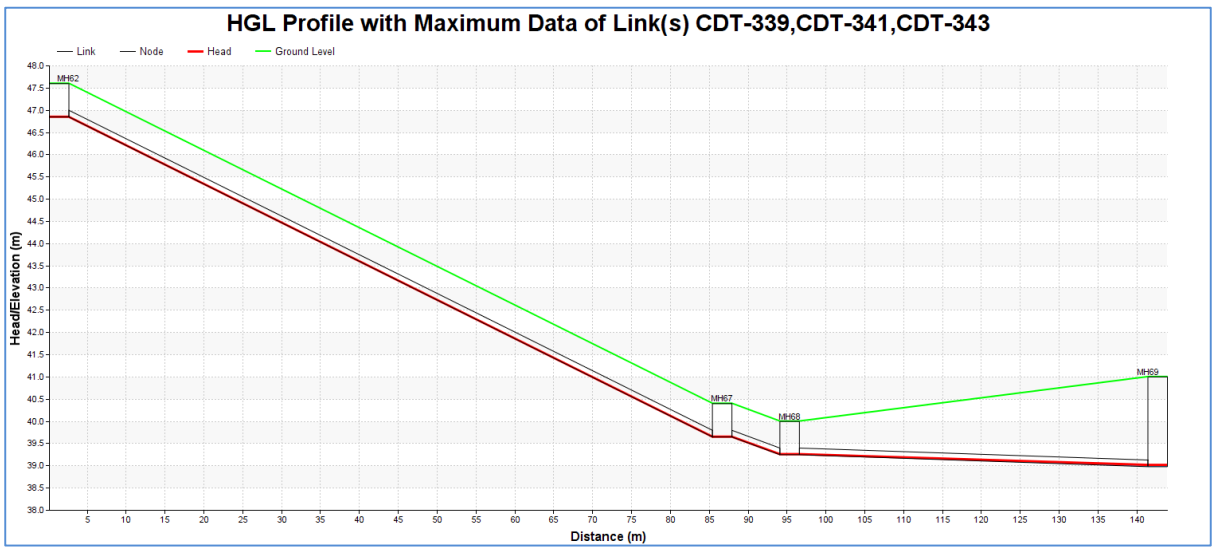

HGL Profile with Maximum Data of Link(s) CDT-237,CDT-239
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH33
MH32
MH30


HGL Profile with Maximum Data of Links CDT-385,CDT-387,...,CDT-361
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH117
MH116
MH99
MH98
MH97
MH96
MH92
MH91
MH83
MH84
MH85


HGL Profile with Maximum Data of Link(s) CDT-389,CDT-391
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH119
MH118
MH116


HGL Profile with Maximum Data of Links CDT-393,CDT-395,...,CDT-359
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
H121
MH122
JCT-12
MH101
MH79
MH78
MH77
MH76
MH75
MH74
MH73
MH72
MH70
MH71
MH69
MH8


HGL Profile with Maximum Data of Link(s) CDT-411,CDT-413
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH100
MH80
MH79


HGL Profile with Maximum Data of Link(s) CDT-339,CDT-341,CDT-343
Link
Node
Head
Ground Level
Head/Elevation (m)
Distance (m)
MH62
MH67
MH68
MH69

Appendix 9. Calculation for sizing of DN225 sewer trunk main

- 19 to 23 dwellings per net hectare, where located in sub-precinct Courtney North-east;
- 13 to 17 dwellings per net hectare, where located in sub-precinct Courtney South-east; and
- 11 to 14 dwellings per net hectare, where located in sub-precinct Courtney West.

The above figure shows the developable area (black outline), external to the subject site, that is likely to be serviced by the proposed DN225 gravity main (refer Appendix 3 for details of DN225 gravity main). This boundary was based on an upper service limit of RL 65 m and contour levels that grade to the proposed trunk main. The surface levels for the allotments to the north-east grade to a connection on the existing DN300 gravity main along Reserve Road, and was therefore excluded from the pipe sizing calculations. A summary of the calculations and assumptions are presented below.

Subject Site

- 220 ET (conservatively adopted entire site loading)
- 600.6 EP
- 1.5 L/s ADWF
- 7.3 L/s PWWF

Area A

- 208,400 m^2 x 75% developable area (assumed)
- 14 ET/Ha density zoning (assumed upper limit)
- 218.8 ET
- 597.4 EP
- 1.5 L/s ADWF
- 7.3 L/s PWWF

Area B

- 60,100 m^2 x 85% developable area (assumed)
- 20 ET/Ha (based on average between CNE and CSE density zoning. This was adopted as approximately half of the site was located across the two different zonings)
- 102.2 ET
- 278.9 EP
- 0.7 L/s ADWF
- 3.4 L/s PWWF

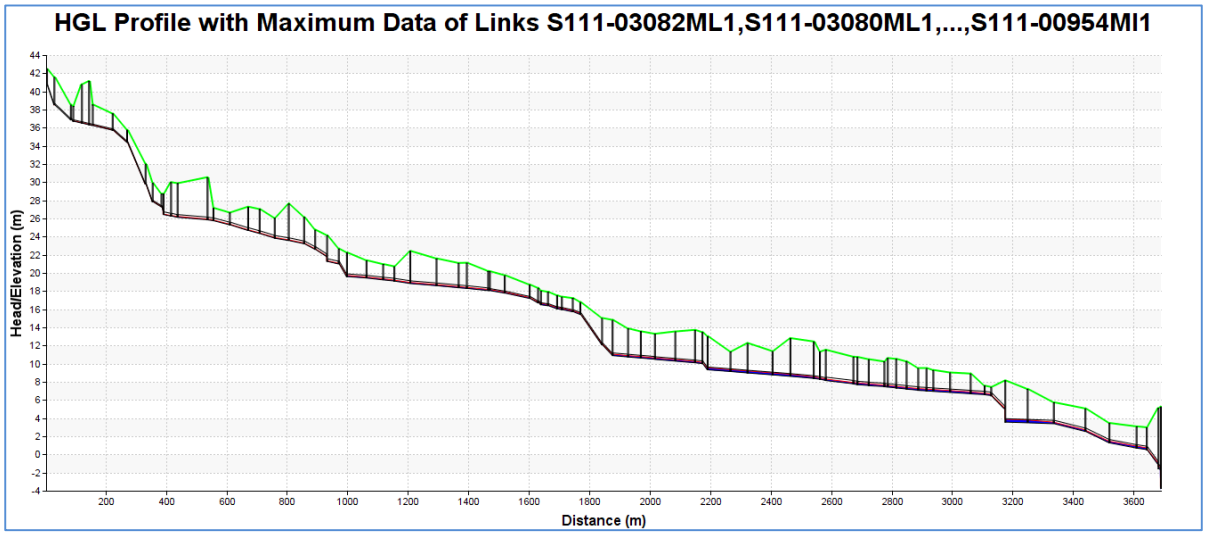
TOTAL

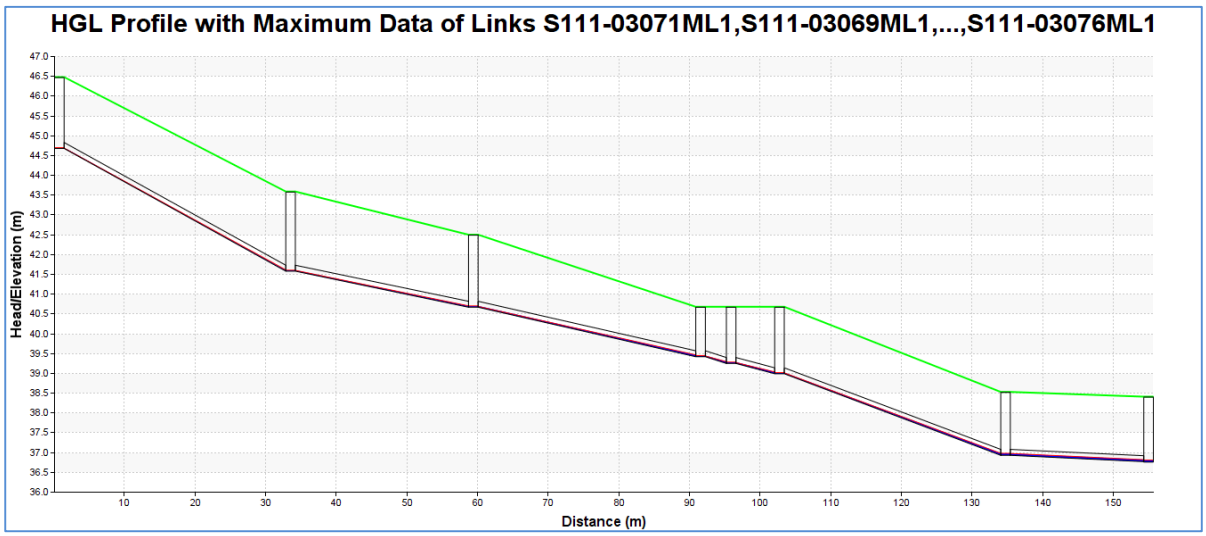
- 3.6 L/s ADWF
- 17.9 L/s PWWF

Appendix 10. Modelling results for sewer network capacity assessment

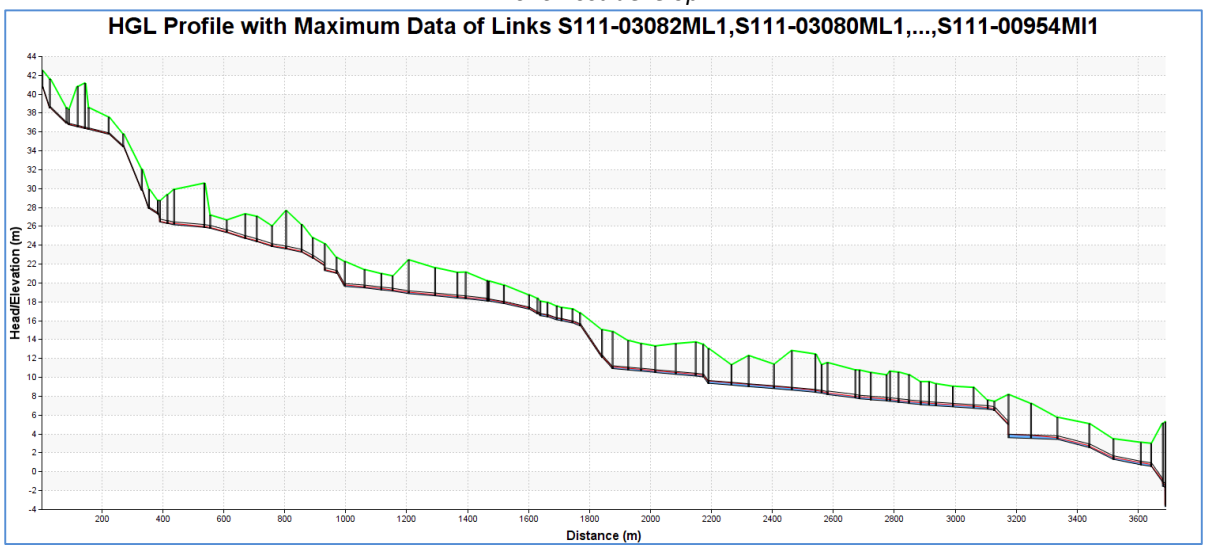
Gravity Mains

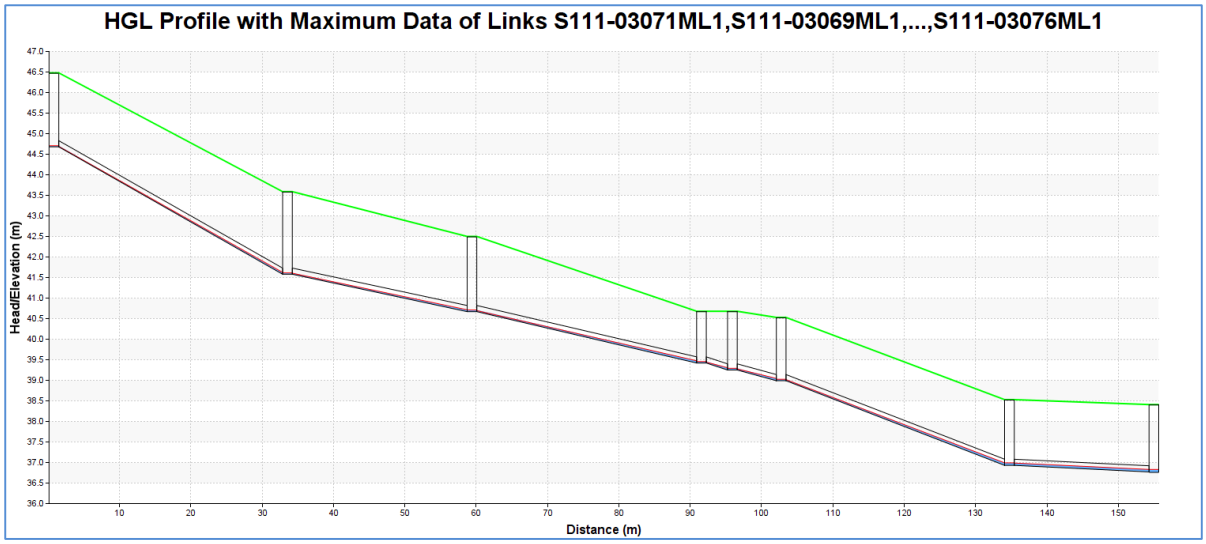
2016 Pre-develop.



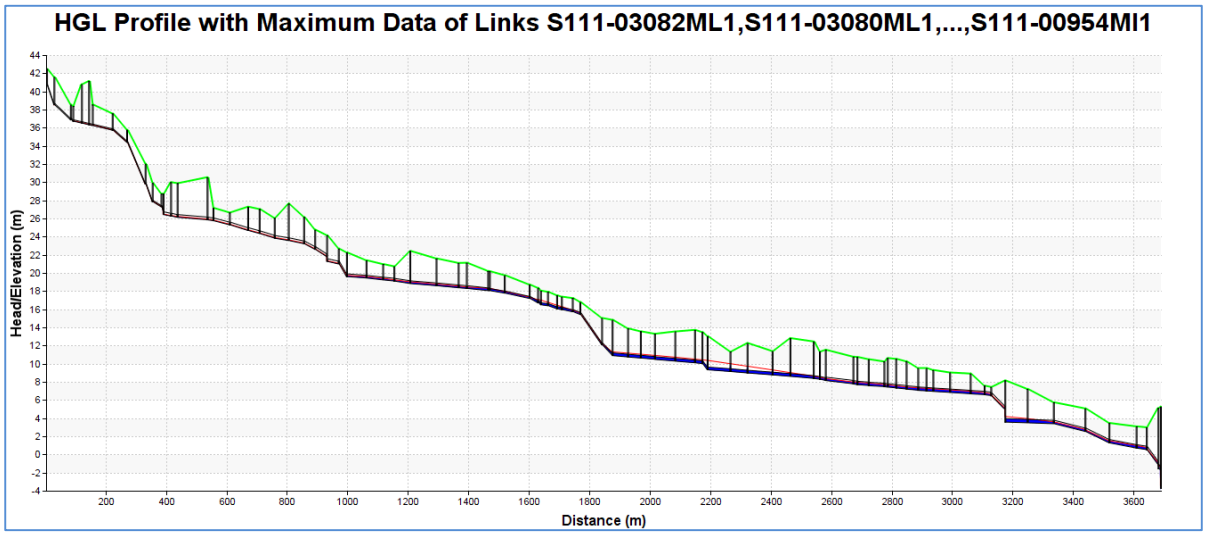


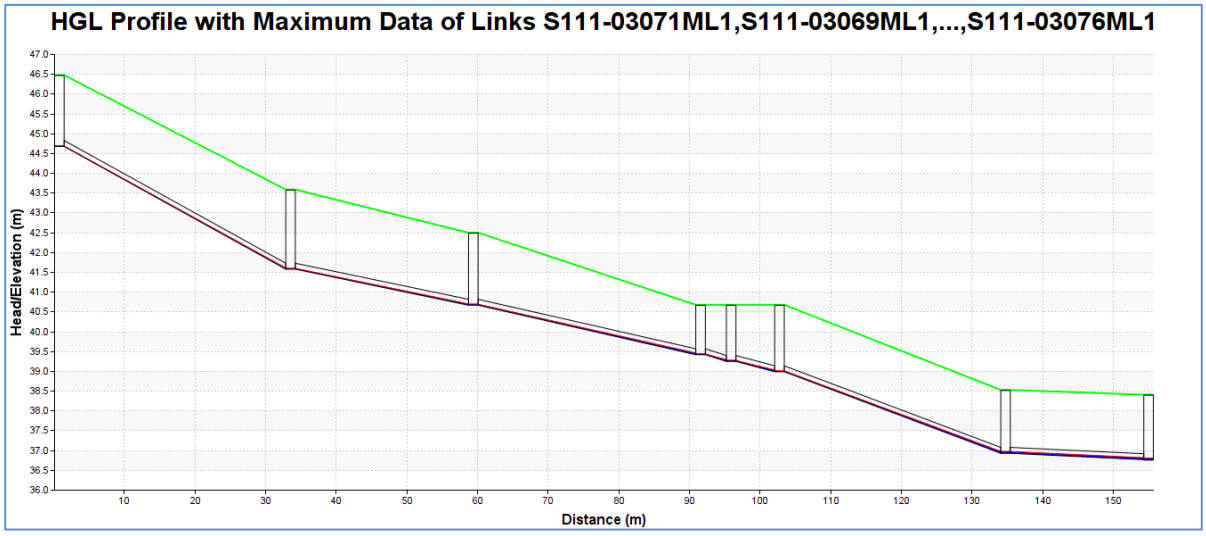
2016 Post-develop.



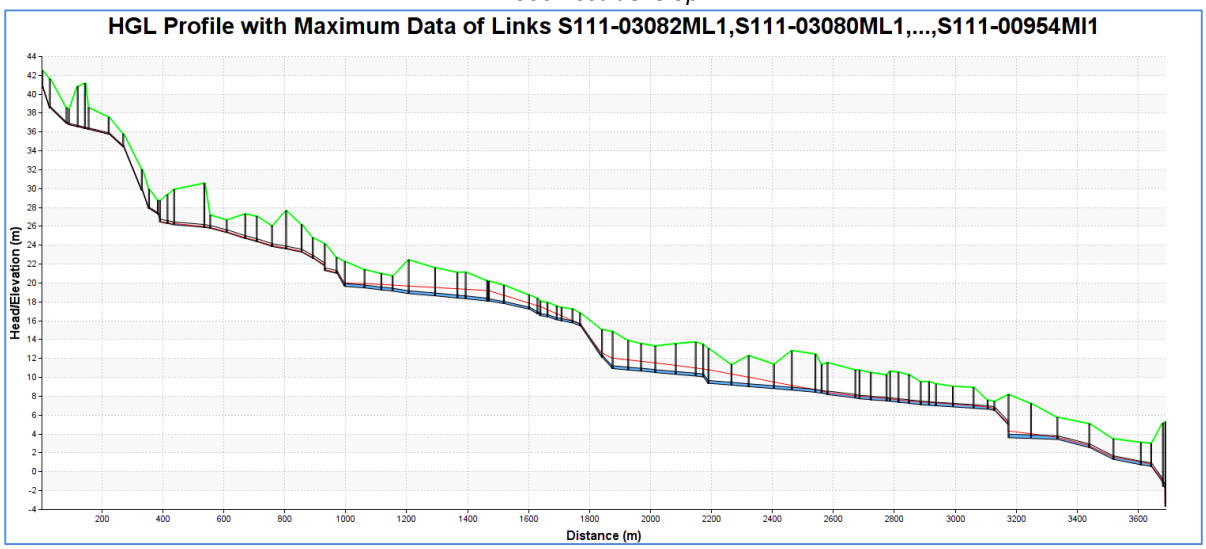


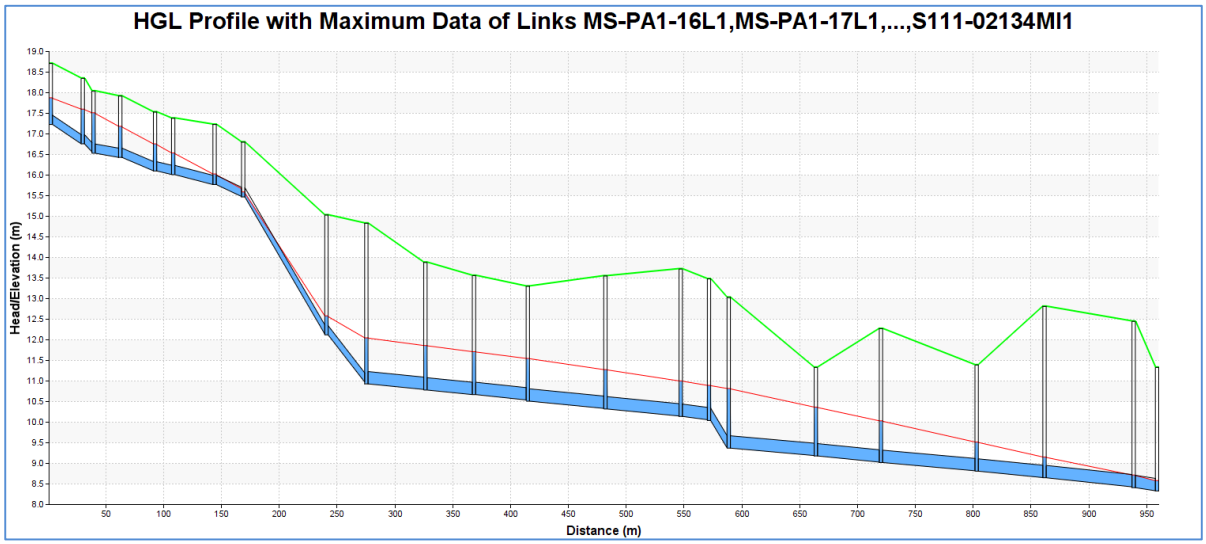
2066 Pre-develop.

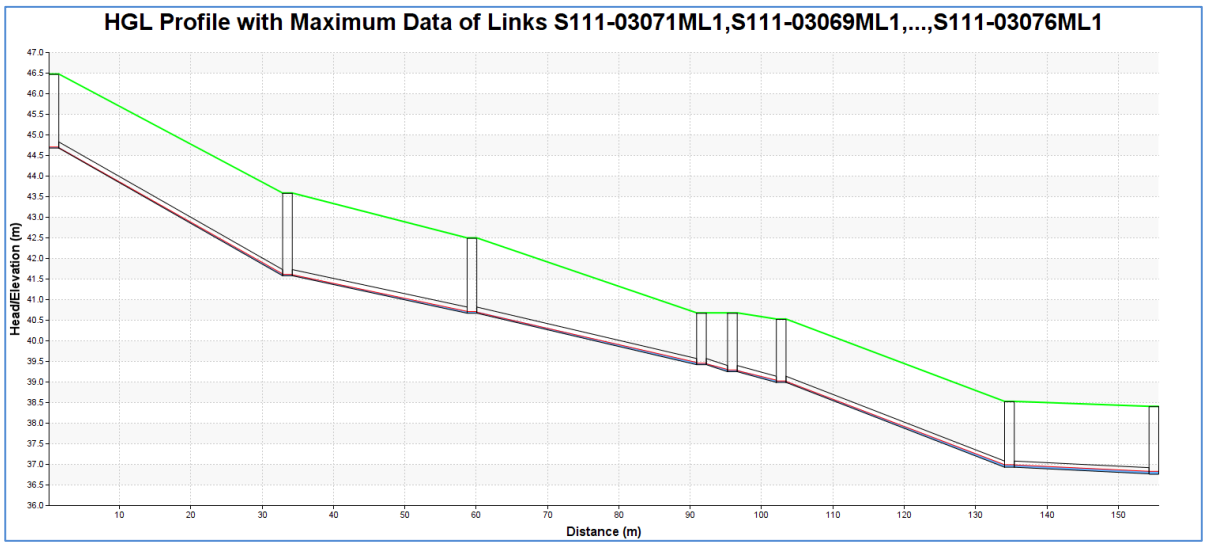




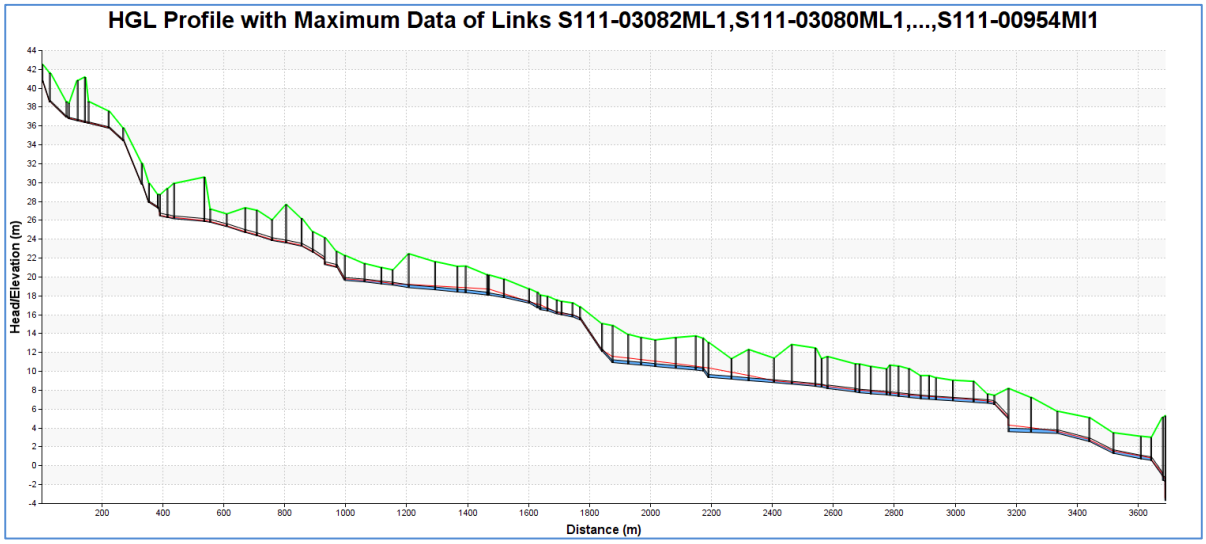
2066 Post-develop.

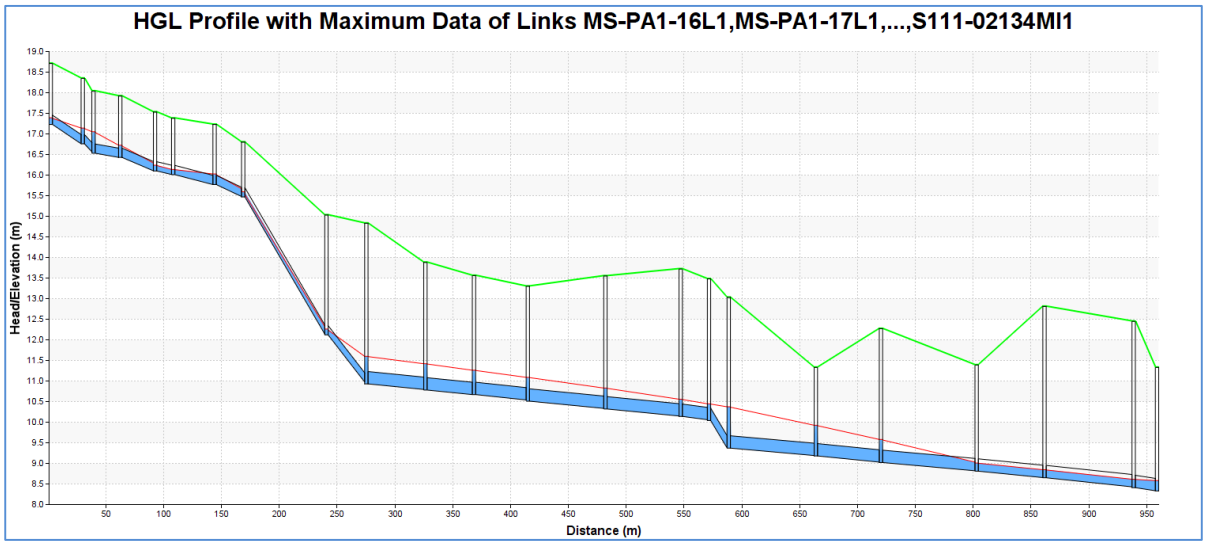




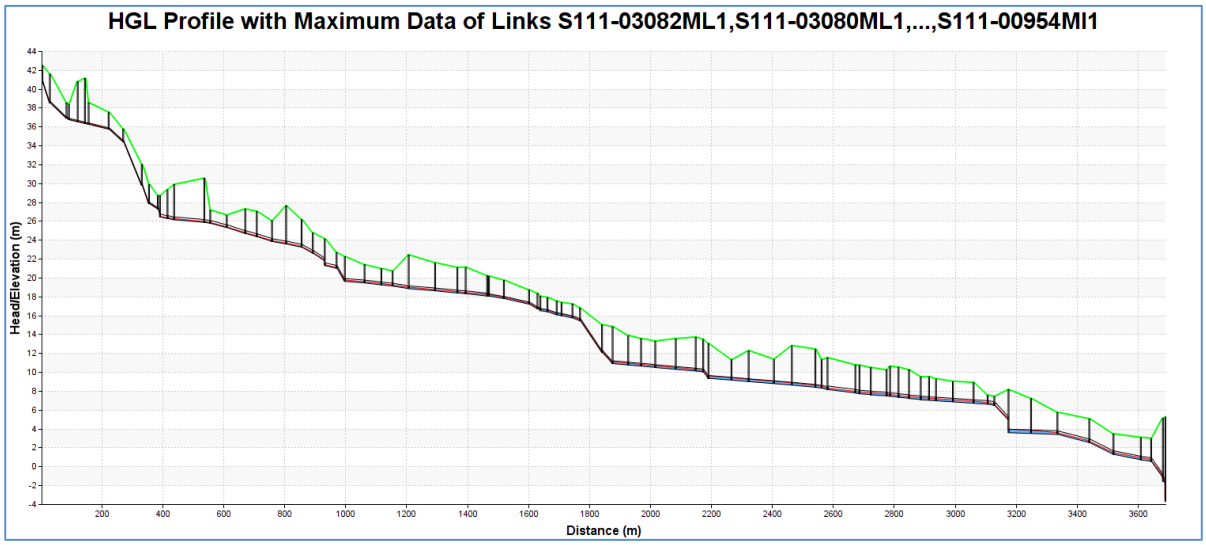


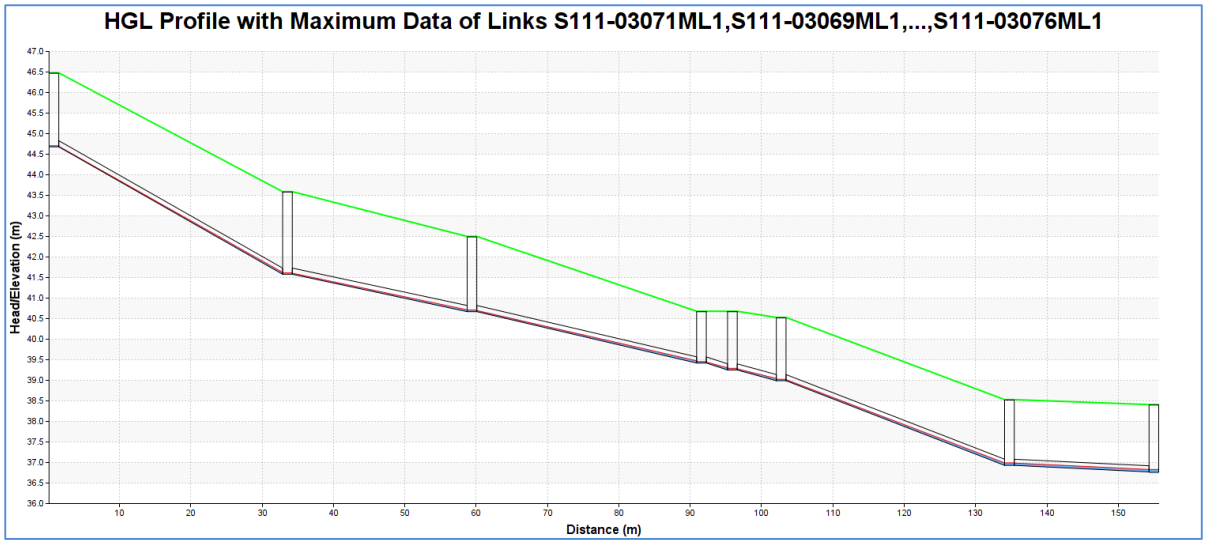
2066 Post-develop. and DN300 Gravity Main Augmentation





2036 Post-develop.





		2016, Post-develop.		2036, Post-develop.		2066, Post-develop.	
Pipe ID	Dia. (mm)	Flow (L/s)	d/D (%)	Flow (L/s)	d/D (%)	Flow (L/s)	d/D (%)
S111-03082ML1	150	1.0	12%	1.0	12%	1.0	12%
S111-03080ML1	150	1.0	13%	1.0	13%	1.0	13%
S111-03078ML1	150	1.0	25%	1.0	25%	1.0	25%
S111-03079ML1	150	5.6	46%	5.6	46%	5.6	46%
S111-03081ML1	150	5.6	46%	5.6	46%	5.6	46%
S111-03084ML1	150	5.6	46%	5.6	46%	5.6	46%
S111-03083ML1	150	5.6	41%	5.6	41%	5.6	41%
S111-03085ML1	150	5.6	32%	5.6	32%	5.6	32%
S111-03086ML1	150	5.6	26%	5.6	26%	5.6	26%
S111-03089ML1	150	7.4	37%	7.4	37%	7.4	37%
S111-03090ML1	150	7.4	37%	7.4	37%	7.4	37%
S111-03091ML1	150	7.4	27%	7.4	27%	7.4	27%
S111-02998ML1	300	7.4	24%	7.4	24%	7.4	24%
GM139	300	12.4	35%	12.4	35%	12.4	35%
S111-03002ML1	300	17.4	39%	17.4	39%	17.4	39%
S111-03001ML1	300	17.4	35%	17.4	35%	17.4	35%
S111-03006ML1	300	17.4	31%	17.4	31%	17.4	31%
S111-03005ML1	300	17.4	29%	17.4	29%	17.4	29%
S111-03009ML1	300	17.4	30%	17.4	30%	17.4	30%
S111-03008ML1	300	17.4	29%	17.4	29%	17.4	29%
S111-03007ML1	300	17.4	34%	17.4	34%	17.4	34%
S111-03012ML1	300	17.4	32%	17.4	32%	17.4	32%
S111-03011ML1	300	17.4	25%	17.4	25%	17.4	25%
S111-03010ML1	300	17.4	24%	17.4	24%	17.4	24%
S111-03013ML1	300	17.4	28%	17.4	28%	17.4	28%
S111-02881ML1	300	17.4	37%	17.4	37%	17.4	59%
S111-00176MI1	300	23.7	48%	23.7	49%	28.0	100%
S111-00175MI1	300	24.1	46%	25.7	48%	39.9	100%
S111-00172MI1	300	24.1	45%	25.7	47%	40.1	100%
S111-00174MI1	300	24.1	44%	25.7	46%	39.8	100%
S111-00173MI1	300	24.1	49%	25.7	51%	40.8	100%
S111-00171MI1	300	24.1	49%	25.7	51%	39.7	100%
S111-00170MI1	300	24.1	48%	25.7	50%	40.0	100%
S111-00169MI1	300	24.2	51%	25.7	53%	41.3	100%
S111-02389MI1	300	25.5	54%	27.1	57%	42.8	100%
S111-00179ML1	225	26.0	66%	27.6	69%	43.4	100%
MS-PA1-15L1	225	26.2	62%	27.7	64%	43.5	100%
MS-PA1-16L1	225	26.2	46%	27.7	47%	43.5	100%
MS-PA1-17L1	225	26.2	62%	27.8	66%	43.6	100%
S111-00462ML1	225	33.5	81%	35.0	82%	52.1	100%

MS-PA1-18L1	225	33.5	73%	35.0	76%	52.1	100%
MS-PA1-19L1	225	33.5	83%	35.0	87%	52.1	100%
MS-PA1-20L1	225	33.5	73%	35.0	76%	52.1	100%
MS-PA1-21L1	225	33.5	62%	35.0	64%	52.1	92%
S111-00438MI1	225	33.5	41%	35.0	42%	54.3	77%
S111-00425MI1	225	33.5	54%	35.0	56%	54.3	100%
S111-00423MI1	300	33.5	60%	35.1	62%	55.9	100%
S111-00424MI1	300	33.5	63%	35.1	65%	55.9	100%
S111-02381MI1	300	34.4	59%	36.0	61%	56.9	100%
S111-00422MI1	300	34.8	64%	36.5	66%	57.5	100%
S111-00420MI1	300	36.8	64%	38.5	66%	60.5	100%
S111-00419MI1	300	36.8	56%	38.5	57%	60.5	100%
S111-00418MI1	300	36.8	56%	38.5	58%	61.1	100%
S111-00421MI1	300	46.8	81%	48.4	85%	71.9	100%
S111-02137MI1	300	46.8	82%	48.4	85%	71.9	100%
S111-01953MI1	300	47.4	82%	49.0	86%	72.9	100%
S111-02136MI1	300	47.4	81%	49.0	84%	72.9	100%
S111-02135MI1	300	47.9	74%	49.6	76%	73.6	98%
S111-02134MI1	300	47.9	65%	49.6	67%	73.7	91%
S111-02133MI1	300	47.9	58%	49.6	59%	73.7	78%
S111-01289MI1	375	48.1	46%	49.7	47%	73.8	62%
S111-01266MI1	375	48.7	52%	50.4	53%	74.5	71%
S111-01265MI1	375	48.7	56%	50.4	57%	74.5	75%
S111-01264MI1	375	48.9	55%	50.6	56%	74.6	73%
S111-01258MI1	375	48.9	53%	50.6	54%	74.6	70%
S111-01263MI1	375	48.9	51%	50.6	52%	74.6	68%
S111-01262MI1	375	49.2	51%	50.9	52%	75.0	69%
S111-01256MI1	375	49.3	54%	51.0	56%	75.0	76%
S111-01331MI1	375	49.6	60%	51.2	61%	75.3	83%
S111-01314MI1	375	50.0	60%	51.7	62%	75.7	83%
S111-01284MI1	375	50.0	60%	51.7	61%	75.7	81%
S111-01294MI1	375	50.2	59%	51.8	60%	75.9	79%
S111-01282MI1	375	50.2	54%	51.8	55%	75.9	71%
S111-01283MI1	375	50.2	47%	51.8	48%	75.9	59%
S111-01281MI1	375	50.2	27%	51.8	28%	75.9	34%
S111-01384MI1	375	68.7	94%	70.4	95%	101.4	100%
S111-01373MI1	375	68.7	69%	70.4	70%	101.4	80%
S111-01311MI1	375	68.8	47%	70.5	48%	101.5	60%
S111-01310MI1	375	68.8	44%	70.5	45%	101.5	56%
S111-01276MI1	375	77.8	57%	79.5	58%	112.1	75%
S111-01309MI1	375	77.8	59%	79.5	60%	112.1	75%
S111-01302MI1	375	85.0	34%	86.7	34%	119.6	41%
S111-00954MI1	450	155.6	54%	158.3	55%	214.5	66%
S111-03071ML1	150	3.1	20%	3.1	20%	3.1	20%
S111-03069ML1	150	3.1	25%	3.1	25%	3.1	25%
S111-03072ML1	150	4.6	26%	4.6	26%	4.6	26%
S111-00932NL1	150	4.6	26%	4.6	26%	4.6	26%
S111-03073ML1	150	4.6	26%	4.6	26%	4.6	26%
S111-00931NL1	150	4.6	32%	4.6	32%	4.6	32%
S111-03076ML1	150	4.6	41%	4.6	41%	4.6	41%

		2066, Post-develop + DN300 Aug.	
Pipe ID	Dia. (mm)	Flow (L/s)	d/D (%)
S111-03082ML1	150	1.0	12%
S111-03080ML1	150	1.0	13%
S111-03078ML1	150	1.0	25%
S111-03079ML1	150	5.6	46%
S111-03081ML1	150	5.6	46%
S111-03084ML1	150	5.6	46%
S111-03083ML1	150	5.6	41%
S111-03085ML1	150	5.6	32%

S111-03086ML1	150	5.6	26%
S111-03089ML1	150	7.4	37%
S111-03090ML1	150	7.4	37%
S111-03091ML1	150	7.4	27%
S111-02998ML1	300	7.4	24%
GM139	300	12.4	35%
S111-03002ML1	300	17.4	39%
S111-03001ML1	300	17.4	35%
S111-03006ML1	300	17.4	31%
S111-03005ML1	300	17.4	29%
S111-03009ML1	300	17.4	30%
S111-03008ML1	300	17.4	29%
S111-03007ML1	300	17.4	34%
S111-03012ML1	300	17.4	32%
S111-03011ML1	300	17.4	25%
S111-03010ML1	300	17.4	24%
S111-03013ML1	300	17.4	28%
S111-02881ML1	300	17.4	38%
S111-00176MI1	300	27.8	58%
S111-00175MI1	300	39.7	64%
S111-00172MI1	300	39.7	60%
S111-00174MI1	300	39.7	78%
S111-00173MI1	300	40.7	100%
S111-00171MI1	300	39.8	100%
S111-00170MI1	300	40.0	100%
S111-00169MI1	300	41.4	100%
S111-02389MI1	300	45.6	100%
S111-00179ML1	225	46.0	100%
MS-PA1-15L1	225	44.1	89%
MS-PA1-16L1	225	43.6	86%
MS-PA1-17L1	225	43.9	100%
S111-00462ML1	225	52.1	100%
MS-PA1-18L1	225	52.1	92%
MS-PA1-19L1	225	22.3	59%
MS-PA1-19L1AUG	300	29.8	45%
MS-PA1-20L1	225	22.5	78%
MS-PA1-20L1AUG	300	29.6	64%
MS-PA1-21L1	225	52.1	92%
S111-00438MI1	225	54.3	55%
S111-00425MI1	225	54.4	82%
S111-00423MI1	300	56.1	100%
S111-00424MI1	300	56.2	100%
S111-02381MI1	300	57.0	100%
S111-00422MI1	300	57.6	100%
S111-00420MI1	300	60.6	100%
S111-00419MI1	300	60.6	100%
S111-00418MI1	300	61.4	100%
S111-00421MI1	300	72.0	100%
S111-02137MI1	300	72.0	100%
S111-01953MI1	300	73.0	85%
S111-02136MI1	300	36.5	65%
S111-02136ML1AUG	300	36.5	65%
S111-02135MI1	300	36.8	63%
S111-02135ML1AUG	300	36.8	63%
S111-02134MI1	300	36.8	75%
S111-02134ML1AUG	300	36.8	75%
S111-02133MI1	300	73.7	78%
S111-01289MI1	375	73.8	62%
S111-01266MI1	375	74.5	71%
S111-01265MI1	375	74.5	75%
S111-01264MI1	375	74.6	73%
S111-01258MI1	375	74.6	70%

S111-01263MI1	375	74.6	68%
S111-01262MI1	375	75.0	69%
S111-01256MI1	375	75.0	76%
S111-01331MI1	375	75.3	83%
S111-01314MI1	375	75.7	83%
S111-01284MI1	375	75.7	81%
S111-01294MI1	375	75.9	79%
S111-01282MI1	375	75.9	71%
S111-01283MI1	375	75.9	59%
S111-01281MI1	375	75.9	34%
S111-01384MI1	375	101.4	100%
S111-01373MI1	375	101.4	80%
S111-01311MI1	375	101.5	60%
S111-01310MI1	375	101.5	56%
S111-01276MI1	375	112.1	75%
S111-01309MI1	375	112.1	75%
S111-01302MI1	375	119.6	41%
S111-00954MI1	450	214.5	66%

Operational Storage

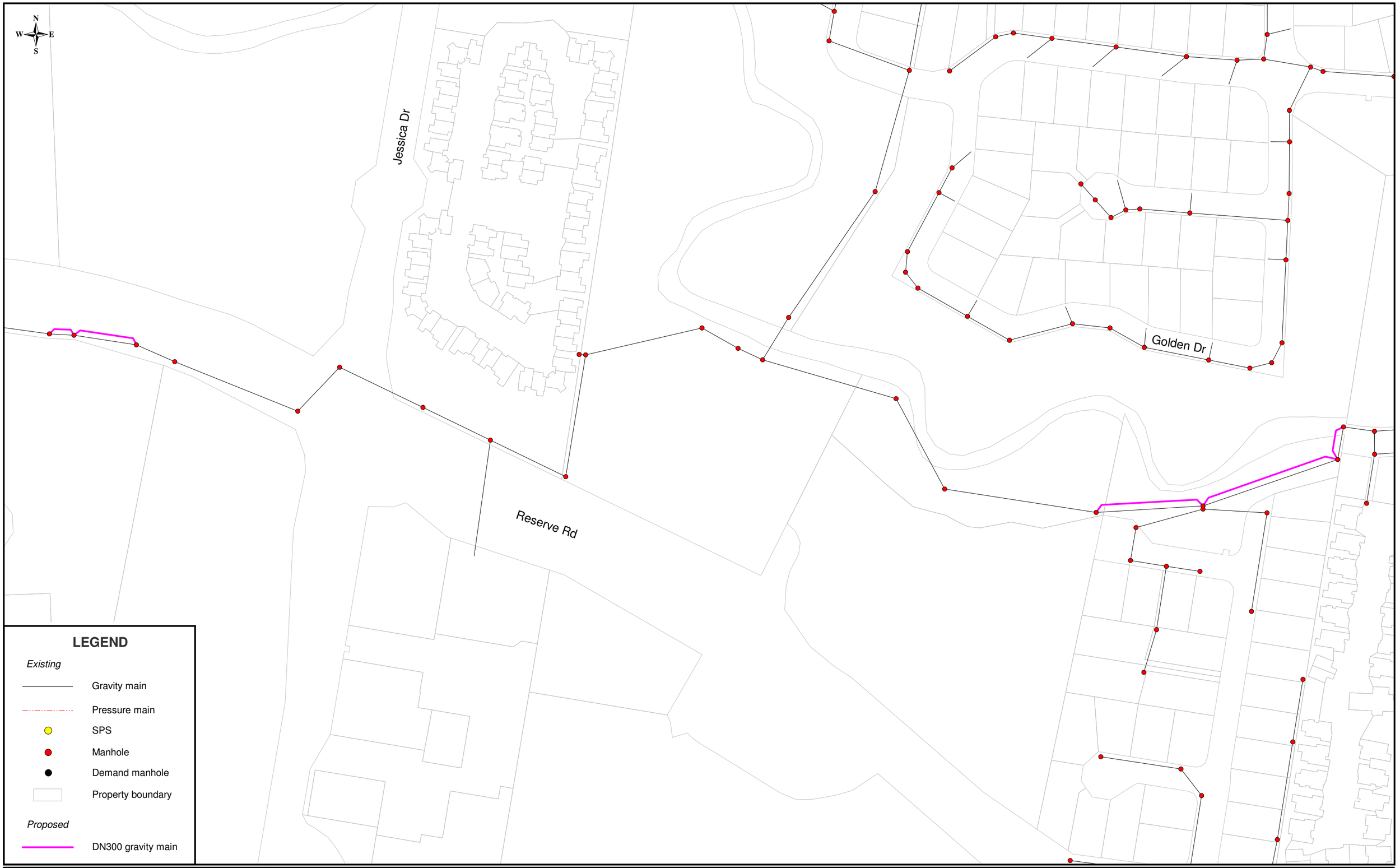
		2016, Post-develop.	2066, Post-develop.
Single Pump Capacity Required	C1	3.5	3.5
	ADWF (L/s)	31.2	42.9
	Q (L/s)	109.1	150.0
Operational Storage Capacity Required	Duty Flow (L/s)	109.1	150.0
	Duty Head (m)	NA	NA
	Pump Efficiency (%)	NA	NA
	Duty Power (kW)	30.0	30.0
	No. pump starts (n)	12.0	12.0
	OSCR (kL)	8.2	11.3
Operational Storage Capacity Available	Duty Start (m)	1.55	1.55
	Duty Stop (m)	0.31	0.31
	Duty Height (m)	1.24	1.24
	WW Diam. (m)	4.0	4.0
	OSCA (kL)	15.6	15.6
OUTCOME	**Difference (kL)**	+7.4	+4.3
	Pass / Fail	PASS	PASS

Emergency Storage

	Pipe ID	US IL (m)	DS IL (m)	Length (m)	Length Below OF (m)	Slope (%)	Diam. (m)	Radius (m)	d/D (%)	Pipe Flow Depth (m)	Pipe Wetted Area (m)	Empty Vol. Below OF (m^3)	ADWF Vol. Below OF (m^3)	ES Vol. (m3)
2016 Pre-develop.	S111-00954MI1	- 1.53	- 1.65	5.4	5.4	0.0223	0.450	0.23	20.3%	0.091	0.0231	0.9	0.1	0.7
	S111-01276MI1	1.31	0.76	93.3	93.3	0.0059	0.375	0.19	21.9%	0.082	0.0179	10.3	1.7	8.6
	S111-01302MI1	0.55	- 1.07	38.2	38.2	0.0425	0.375	0.19	14.2%	0.053	0.0096	4.2	0.4	3.8
	S111-01309MI1	0.74	0.59	33.2	33.2	0.0047	0.375	0.19	23.1%	0.087	0.0193	3.7	0.6	3.0
	S111-01310MI1	2.57	1.33	82.1	82.1	0.0151	0.375	0.19	16.4%	0.062	0.0118	9.1	1.0	8.1
	S111-01311MI1	3.43	2.59	109.2	19.4	0.0077	0.375	0.19	19.1%	0.072	0.0147	2.1	0.3	1.9
2016 Post-develop.	S111-00954MI1	- 1.53	- 1.65	5.4	5.4	0.0223	0.450	0.23	20.9%	0.094	0.0241	0.9	0.1	0.7
	S111-01276MI1	1.31	0.76	93.3	93.3	0.0059	0.375	0.19	23.1%	0.087	0.0193	10.3	1.8	8.5
	S111-01302MI1	0.55	- 1.07	38.2	38.2	0.0425	0.375	0.19	14.9%	0.056	0.0103	4.2	0.4	3.8
	S111-01309MI1	0.74	0.59	33.2	33.2	0.0047	0.375	0.19	24.4%	0.092	0.0209	3.7	0.7	3.0
	S111-01310MI1	2.57	1.33	82.1	82.1	0.0151	0.375	0.19	17.5%	0.066	0.0130	9.1	1.1	8.0
	S111-01311MI1	3.43	2.59	109.2	19.4	0.0077	0.375	0.19	20.3%	0.076	0.0161	2.1	0.3	1.8
2066 Pre-develop.	S111-00954MI1	- 1.53	- 1.65	5.4	5.4	0.0223	0.450	0.23	24.3%	0.109	0.0299	0.9	0.2	0.7
	S111-01276MI1	1.31	0.76	93.3	93.3	0.0059	0.375	0.19	26.7%	0.100	0.0237	10.3	2.2	8.1
	S111-01302MI1	0.55	- 1.07	38.2	38.2	0.0425	0.375	0.19	17.0%	0.064	0.0125	4.2	0.5	3.7
	S111-01309MI1	0.74	0.59	33.2	33.2	0.0047	0.375	0.19	28.4%	0.107	0.0258	3.7	0.9	2.8
	S111-01310MI1	2.57	1.33	82.1	82.1	0.0151	0.375	0.19	20.8%	0.078	0.0166	9.1	1.4	7.7
	S111-01311MI1	3.43	2.59	109.2	19.4	0.0077	0.375	0.19	23.7%	0.089	0.0200	2.1	0.4	1.8
2066 Post-develop.	S111-00954MI1	- 1.53	- 1.65	5.4	5.4	0.0223	0.450	0.23	24.8%	0.112	0.0307	0.9	0.2	0.7
	S111-01276MI1	1.31	0.76	93.3	93.3	0.0059	0.375	0.19	27.8%	0.104	0.0251	10.3	2.3	8.0
	S111-01302MI1	0.55	- 1.07	38.2	38.2	0.0425	0.375	0.19	17.6%	0.066	0.0131	4.2	0.5	3.7
	S111-01309MI1	0.74	0.59	33.2	33.2	0.0047	0.375	0.19	29.5%	0.111	0.0272	3.7	0.9	2.8
	S111-01310MI1	2.57	1.33	82.1	82.1	0.0151	0.375	0.19	21.7%	0.081	0.0177	9.1	1.5	7.6
	S111-01311MI1	3.43	2.59	109.2	19.4	0.0077	0.375	0.19	24.7%	0.093	0.0212	2.1	0.4	1.7

	2016	2036	2066
LGIP ES Available (kL)	277.7	277.7	273.8
LGIP ES Upgrade (kL)	236.9	236.9	236.9
Site ADWF ES Reduction (kL)	-0.34	-0.34	-0.31
ES Required (kL)	-404.8	-410.0	-539.2
Difference (kL)	+109.5	+104.2	-28.8
Pass / Fail	Pass	Pass	Fail

Appendix 11. Recommended sewer parallel gravity main upgrade



LEGEND

Existing

- Gravity main
- Pressure main
- SPS
- Manhole
- Demand manhole
- Property boundary

Proposed

- DN300 gravity main

H2One Pty Ltd
PO Box 290
IPSWICH QLD 4305

P: 07 5463 9538
E: info@H2One.com.au
W: h2one.com.au

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APPROVED:	J May
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No.	REVISION	APPROVED
A	ORIGINAL ISSUE - 15 MAY 2018	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:

0 40 80
Metres

SURVEYED BY / DATE:

SURVEY CHECKED:

H2ONE REFERENCES

PROJECT NO: 1804245

FILE REFERENCE:

CAD FILE:

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79-99 Courtney Dr Upper Coomera QLD 4209 Water Supply and Sewerage Hydraulic Analysis

Appendix 11. Recommended sewer parallel gravity mains upgrade

ORIGINAL ISSUE DATE: MAY, 2018

DATE SCANNED:

DRG No:

REV:

Appendix 12. Water supply hydraulic model pipe layout

LEGEND

- Proposed DN200
- Proposed DN150
- Proposed DN100
- Proposed model node
- Proposed boundary
- Existing boundary

N
W E
S

Courtney Dr

J144 P13656 J128 P13660 J126 P13658 J124 P13662 J130 P13664 J132 P13666 P13676 J140 P13674 J142 P13672 J138 P13668 J134 P13654 P13646 J146 P13652 J114 P13650 J148 P13648 J118 P13644 J120 P13642 J112 P13640 J106 P13636 J110 P13638 J108 P13678 J150 P13680 J152 P13682 P13702 J172 J162 P13684 J160 P13704 P13686 J170 J154 P13690 J156 P13688 J158 P13692 J102 P13698 J164 J168 P13706 P13694 J166 P13696 J100 P13634 J104 P13632 P13630 J98 P13628

Mackellar Dr

Patterson Ct

Proposed connection to existing DN200

H2ONE
H2One Pty Ltd
PO Box 290
IPSWICH Q 4305
P: 07 5463 9538
E: Info@H2One.com.au
W: h2one.com.au

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A	ORIGINAL ISSUE - 4 NOV 2019	

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HEIGHT: AHD

SCALE:
0 35 70
Metres

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SURVEY CHECKED:

PROJECT NO: 1804245
FILE REF:
CAD FILE:

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Appendix 12. Water supply hydraulic model pipe layout

NOV, 2019
DATE SCANNED:
DRG No:
REV:

Appendix 13. Water supply hydraulic model staging pipe layout

LEGEND

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5
- Stage 6
- Proposed model node
- Proposed boundary
- Existing boundary

N
W E
S

Courtney Dr

Mackellar Dr

Patterson Ct

Proposed connection to existing DN200

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H2One Pty Ltd
PO Box 290
IPSWICH Q 4305
P: 07 5463 9538
E: Info@H2One.com.au
W: h2one.com.au

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DRAWN:	D Colledge
CHECKED:	J May
APPROVED:	J May
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No.	REVISION	APPROVED
A	ORIGINAL ISSUE - 4 NOV 2019	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:
0 35 70
Metres

SURVEYED BY / DATE:
SURVEY CHECKED:

PROJECT NO: 1804245
FILE REF:
CAD FILE:

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Appendix 13. Water supply hydraulic model staging pipe layout

NOV, 2019

DATE SCANNED:

DRG No:

REV:

Appendix 14. Modelling results for water supply reticulation layout

Pipes

Develop. Stage	ID	Diameter (DN)	HW Co-efficient	Length (m)	SF PH Flow Rate (L/s)	SF PH Velocity (m/s)	SF PH Head Loss (m/km)
Stage 1	P13628	200	110	64.6	1.3	0.04	0.02
	P13630	150	100	51.5	1.1	0.06	0.08
	P13632	150	100	161.4	0.3	0.02	0.01
	P13696	100	100	79.4	0.1	0.02	0.01
	P13698	100	100	41.7	0.3	0.04	0.05
	P13700	100	100	95.1	0.1	0.01	0.01
	P13706	100	100	91.8	0.6	0.08	0.18
Stage 2	P13628	200	110	64.6	1.8	0.06	0.0
	P13630	150	100	51.5	1.6	0.09	0.1
	P13632	150	100	161.4	0.8	0.04	0.0
	P13634	150	100	101.8	0.6	0.03	0.0
	P13636	100	100	59.8	0.3	0.04	0.0
	P13638	100	100	55.6	0.2	0.02	0.0
	P13640	150	100	69.0	0.2	0.01	0.0
	P13696	100	100	79.4	0.1	0.02	0.0
	P13698	100	100	41.7	0.3	0.04	0.1
	P13700	100	100	95.1	0.1	0.01	0.0
	P13706	100	100	91.8	0.6	0.08	0.2
Stage 3	P13628	200	110	64.6	2.4	0.08	0.07
	P13630	150	100	51.5	2.3	0.13	0.27
	P13632	150	100	161.4	1.3	0.07	0.10
	P13634	150	100	101.8	1.1	0.06	0.07
	P13636	100	100	59.8	0.3	0.04	0.05
	P13638	100	100	55.6	0.2	0.02	0.01
	P13640	150	100	69.0	0.7	0.04	0.03
	P13642	150	100	36.1	0.5	0.03	0.02
	P13648	150	100	32.6	0.4	0.02	0.01
	P13650	150	100	17.8	0.1	0.01	0.00
	P13678	100	100	62.7	0.2	0.02	0.02
	P13680	100	100	36.5	0.1	0.01	0.00
	P13682	100	100	15.3	0.0	0.00	0.00
	P13696	100	100	79.4	0.1	0.02	0.01
	P13698	100	100	41.7	0.3	0.04	0.05
	P13700	100	100	95.1	0.2	0.03	0.03
	P13704	100	100	141.7	0.1	0.02	0.01
	P13706	100	100	91.8	0.8	0.10	0.26
Stage 4	P13628	200	110	64.6	3.2	0.10	0.11
	P13630	150	100	51.5	3.0	0.17	0.46
	P13632	150	100	161.4	1.7	0.10	0.16
	P13634	150	100	101.8	1.5	0.08	0.13
	P13636	100	100	59.8	0.3	0.04	0.05
	P13638	100	100	55.6	0.2	0.02	0.01
	P13640	150	100	69.0	1.0	0.06	0.07
	P13642	150	100	36.1	0.9	0.05	0.05
	P13648	150	100	32.6	0.8	0.04	0.04
	P13650	150	100	17.8	0.1	0.01	0.00
	P13678	100	100	62.7	0.6	0.07	0.15
	P13680	100	100	36.5	0.5	0.06	0.10
	P13682	100	100	15.3	0.3	0.04	0.06
	P13684	100	100	66.0	0.3	0.04	0.06
	P13686	100	100	128.0	0.2	0.03	0.02
	P13688	100	100	19.8	0.3	0.03	0.03
	P13690	100	100	100.7	0.1	0.02	0.01
	P13692	100	100	64.1	0.2	0.02	0.02
	P13694	100	100	41.0	0.3	0.04	0.05
	P13696	100	100	79.4	0.4	0.05	0.09
	P13698	100	100	41.7	0.6	0.08	0.18
	P13700	100	100	95.1	0.3	0.04	0.06
	P13702	100	100	11.6	0.5	0.06	0.10
	P13704	100	100	141.7	0.2	0.03	0.03
	P13706	100	100	91.8	1.1	0.14	0.55

Stage 5	P13628	200	110	64.6	4.2	0.14	0.18
	P13630	150	100	51.5	4.1	0.23	0.81
	P13632	150	100	161.4	2.4	0.14	0.31
	P13634	150	100	101.8	2.2	0.13	0.27
	P13636	100	100	59.8	0.3	0.04	0.05
	P13638	100	100	55.6	0.2	0.02	0.01
	P13640	150	100	69.0	1.8	0.10	0.18
	P13642	150	100	36.1	1.6	0.09	0.15
	P13644	100	100	12.1	0.6	0.07	0.15
	P13646	100	100	106.7	0.4	0.05	0.08
	P13648	150	100	32.6	1.0	0.06	0.06
	P13650	150	100	17.8	0.6	0.03	0.02
	P13652	100	100	20.7	0.5	0.06	0.12
	P13654	100	100	93.8	0.3	0.04	0.06
	P13656	100	100	61.5	0.2	0.02	0.02
	P13658	100	100	21.0	0.3	0.03	0.04
	P13660	100	100	14.6	0.3	0.04	0.04
	P13662	100	100	84.2	0.1	0.02	0.01
	P13678	100	100	62.7	0.3	0.03	0.04
	P13680	100	100	36.5	0.2	0.02	0.01
	P13682	100	100	15.3	0.1	0.01	0.00
	P13684	100	100	66.0	0.2	0.03	0.03
	P13686	100	100	128.0	0.1	0.01	0.01
	P13688	100	100	19.8	0.3	0.03	0.03
	P13690	100	100	100.7	0.1	0.02	0.01
	P13692	100	100	64.1	0.3	0.04	0.04
	P13694	100	100	41.0	0.4	0.05	0.08
	P13696	100	100	79.4	0.5	0.07	0.14
	P13698	100	100	41.7	0.7	0.09	0.24
	P13700	100	100	95.1	0.5	0.07	0.13
	P13702	100	100	11.6	0.3	0.04	0.06
	P13704	100	100	141.7	0.4	0.05	0.08
	P13706	100	100	91.8	1.4	0.18	0.84
Stage 6	P13628	200	110	64.6	5.1	0.16	0.26
	P13630	150	100	51.5	4.9	0.28	1.15
	P13632	150	100	161.4	0.7	0.17	0.46
	P13634	150	100	101.8	0.9	0.16	0.41
	P13636	100	100	59.8	0.7	0.04	0.05
	P13638	100	100	55.6	1.7	0.02	0.01
	P13640	150	100	69.0	3.0	0.13	0.30
	P13642	150	100	36.1	2.8	0.13	0.26
	P13644	100	100	12.1	0.3	0.13	0.44
	P13646	100	100	106.7	2.4	0.11	0.33
	P13648	150	100	32.6	0.2	0.06	0.07
	P13650	150	100	17.8	2.2	0.06	0.06
	P13652	100	100	20.7	1.1	0.11	0.36
	P13654	100	100	93.8	1.0	0.10	0.25
	P13656	100	100	61.5	0.0	0.08	0.17
	P13658	100	100	21.0	0.1	0.09	0.23
	P13660	100	100	14.6	0.2	0.15	0.56
	P13662	100	100	84.2	0.6	0.13	0.43
	P13664	100	100	27.2	0.1	0.11	0.33
	P13666	100	100	72.3	0.0	0.04	0.06
	P13668	100	100	84.6	0.3	0.02	0.02
	P13670	100	100	90.5	0.1	0.01	0.00
	P13672	100	100	51.0	0.4	0.01	0.01
	P13674	100	100	20.1	0.5	0.02	0.01
	P13676	100	100	74.6	0.2	0.05	0.07
	P13678	100	100	62.7	1.0	0.00	0.00
	P13680	100	100	36.5	0.9	0.02	0.01
	P13682	100	100	15.3	0.7	0.03	0.03
	P13684	100	100	66.0	0.6	0.01	0.00
	P13686	100	100	128.0	0.7	0.00	0.00
	P13688	100	100	19.8	1.1	0.03	0.03
	P13690	100	100	100.7	0.9	0.02	0.01
	P13692	100	100	64.1	1.0	0.05	0.08
	P13694	100	100	41.0	0.9	0.07	0.14

	P13696	100	100	79.4	0.3	0.08	0.20
	P13698	100	100	41.7	0.4	0.11	0.33
	P13700	100	100	95.1	0.1	0.08	0.21
	P13702	100	100	11.6	0.1	0.03	0.03
	P13704	100	100	141.7	0.2	0.07	0.15
	P13706	100	100	91.8	0.0	0.22	1.18

Note 1: "SF" is "standard flow" and "PH" is "peak hour"

Note 2: Peak hour occurred at 7 am.

Nodes

Develop. Stage	ID	Demand (EP)	RL AHD (m)	SF PH Demand (L/s)	SF PH Pressure (m)	Fire Flow (L/s)	FF 2/3 PH Pressure (m)
Stage 1	J100	22.4	60.0	0.2	41.3	15	35.8
	J102	22.4	62.0	0.2	39.3	15	27.5
	J104	22.4	60.0	0.2	41.3	15	34.3
	J166	0.0	62.0	0.1	39.3	15	19.4
	J168	22.4	62.5	0.2	38.8	15	24.2
	J170	0.0	61.5	0.1	39.8	15	21.7
	J98	22.4	56.0	0.2	45.3	15	40.4
Stage 2	J100	22.4	60.0	0.2	41.2	15	35.6
	J102	22.4	62.0	0.2	39.2	15	27.3
	J104	22.4	60.0	0.2	41.2	15	34.1
	J106	17.7	58.0	0.2	43.2	15	35.1
	J108	17.7	45.0	0.2	56.2	15	40.4
	J110	17.7	53.0	0.2	48.2	15	36.1
	J112	17.7	56.0	0.2	45.2	15	36.5
	J166	0.0	62.0	0.1	39.2	15	19.2
	J168	22.4	62.5	0.2	38.7	15	24.0
	J170	0.0	61.5	0.1	39.7	15	21.5
	J98	22.4	56.0	0.2	45.2	15	40.2
Stage 3	J100	22.4	60.0	0.2	41.0	15	35.3
	J102	22.4	62.0	0.2	39.0	15	30.1
	J104	22.4	60.0	0.2	41.0	15	34.1
	J106	17.7	58.0	0.2	43.0	15	35.6
	J108	17.7	45.0	0.2	56.0	15	40.8
	J110	17.7	53.0	0.2	48.0	15	36.5
	J112	17.7	56.0	0.2	45.0	15	37.2
	J114	12.9	49.0	0.1	52.0	15	43.8
	J120	12.9	53.5	0.1	47.5	15	39.6
	J148	12.9	51.0	0.1	50.0	15	41.9
	J150	12.9	52.0	0.1	49.0	15	39.5
	J152	12.9	52.0	0.1	49.0	15	39.0
	J166	0.0	62.0	0.1	39.0	15	22.0
	J168	22.4	62.5	0.2	38.5	15	26.8
	J170	12.9	61.5	0.1	39.5	15	29.3
	J172	12.9	52.5	0.1	48.5	15	38.4
	J98	22.4	56.0	0.2	45.1	15	39.9
Stage 4	J100	22.4	60.0	0.2	40.8	15	34.9
	J102	22.4	62.0	0.2	38.8	15	30.0
	J104	22.4	60.0	0.2	40.8	15	33.8
	J106	17.7	58.0	0.2	42.8	15	35.3
	J108	17.7	45.0	0.2	55.8	15	40.6
	J110	17.7	53.0	0.2	47.8	15	36.3
	J112	17.7	56.0	0.2	44.8	15	37.0
	J114	12.9	49.0	0.1	51.8	15	43.6
	J120	12.9	53.5	0.1	47.3	15	39.4
	J148	12.9	51.0	0.1	49.8	15	41.7
	J150	12.9	52.0	0.1	48.7	15	39.7
	J152	12.9	52.0	0.1	48.7	15	39.4
	J154	14.8	60.0	0.1	40.7	15	20.2
	J156	14.8	59.5	0.1	41.2	15	27.4
	J158	14.8	60.0	0.1	40.7	15	28.2
	J160	14.8	53.5	0.1	47.2	15	35.9
	J162	14.8	52.5	0.1	48.2	15	38.5
	J164	14.8	60.0	0.1	40.7	15	28.5
	J166	14.8	62.0	0.1	38.7	15	26.9

	J168	22.4	62.5	0.2	38.2	15	28.0
	J170	12.9	61.5	0.1	39.2	15	28.8
	J172	12.9	52.5	0.1	48.2	15	38.9
	J98	22.4	56.0	0.2	44.8	15	39.5
Stage 5	J100	22.4	60.0	0.2	40.4	15	34.4
	J102	22.4	62.0	0.2	38.4	15	29.4
	J104	22.4	60.0	0.2	40.4	15	33.2
	J106	17.7	58.0	0.2	42.4	15	34.6
	J108	17.7	45.0	0.2	55.4	15	39.9
	J110	17.7	53.0	0.2	47.4	15	35.6
	J112	17.7	56.0	0.2	44.4	15	36.3
	J114	12.9	49.0	0.1	51.3	15	42.9
	J118	17.7	53.5	0.2	46.8	15	38.1
	J120	12.9	53.5	0.1	46.8	15	38.7
	J124	17.7	45.0	0.2	55.3	15	44.3
	J126	17.7	40.5	0.2	59.8	15	48.7
	J128	17.7	40.0	0.2	60.3	15	48.2
	J130	0.0	46.0	0.1	54.3	15	36.6
	J144	17.7	41.0	0.2	59.3	15	48.3
	J146	17.7	49.5	0.2	50.8	15	41.6
	J148	12.9	51.0	0.1	49.3	15	41.1
	J150	12.9	52.0	0.1	48.3	15	39.1
	J152	12.9	52.0	0.1	48.3	15	38.8
	J154	14.8	60.0	0.1	40.3	15	19.7
	J156	14.8	59.5	0.1	40.8	15	26.8
	J158	14.8	60.0	0.1	40.3	15	27.7
	J160	14.8	53.5	0.1	46.8	15	35.3
	J162	14.8	52.5	0.1	47.8	15	37.9
	J164	14.8	60.0	0.1	40.3	15	27.9
	J166	14.8	62.0	0.1	38.3	15	26.3
	J168	22.4	62.5	0.2	37.9	15	27.5
	J170	12.9	61.5	0.1	38.9	15	28.2
	J172	12.9	52.5	0.1	47.8	15	38.3
	J98	22.4	56.0	0.2	44.5	15	39.1
Stage 6	J100	22.4	60.0	0.2	40.1	15	34.0
	J102	22.4	62.0	0.2	38.0	15	29.0
	J104	22.4	60.0	0.2	40.0	15	32.7
	J106	17.7	58.0	0.2	42.0	15	34.1
	J108	17.7	45.0	0.2	55.0	15	39.4
	J110	17.7	53.0	0.2	47.0	15	35.1
	J112	17.7	56.0	0.2	44.0	15	35.8
	J114	12.9	49.0	0.1	51.0	15	42.4
	J118	17.7	53.5	0.2	46.5	15	37.5
	J120	12.9	53.5	0.1	46.5	15	38.1
	J124	17.7	45.0	0.2	54.9	15	43.5
	J126	17.7	40.5	0.2	59.4	15	47.9
	J128	17.7	40.0	0.2	59.9	15	47.3
	J130	16.8	46.0	0.1	53.9	15	35.3
	J132	16.8	46.0	0.1	53.9	15	33.4
	J134	16.8	53.0	0.1	46.9	15	24.0
	J136	16.8	55.0	0.1	44.9	15	21.0
	J138	16.8	55.0	0.1	44.9	15	21.2
	J140	16.8	52.0	0.1	47.9	15	23.6
	J142	16.8	53.0	0.1	46.9	15	23.9
	J144	17.7	41.0	0.2	58.9	15	47.6
	J146	17.7	49.5	0.2	50.5	15	41.0
	J148	12.9	51.0	0.1	49.0	15	40.5
	J150	12.9	52.0	0.1	48.0	15	38.5
	J152	12.9	52.0	0.1	48.0	15	38.3
	J154	14.8	60.0	0.1	40.0	15	19.2
	J156	14.8	59.5	0.1	40.5	15	26.3
	J158	14.8	60.0	0.1	40.0	15	27.2
	J160	14.8	53.5	0.1	46.5	15	34.8
	J162	14.8	52.5	0.1	47.5	15	37.4
	J164	14.8	60.0	0.1	40.0	15	27.4
	J166	14.8	62.0	0.1	38.0	15	25.8
	J168	22.4	62.5	0.2	37.5	15	27.0

	J170	12.9	61.5	0.1	38.5	15	27.7
	J172	12.9	52.5	0.1	47.5	15	37.8
	J98	22.4	56.0	0.2	44.2	15	38.7

Note 1: Red text denotes minimum pressure (critical pressure point) within the network.

Note 2: Peak hour occurred at 7 am and 2/3 peak hour at 7 pm.

Appendix 15. Modelling results for water supply network capacity assessment

Standard Flow

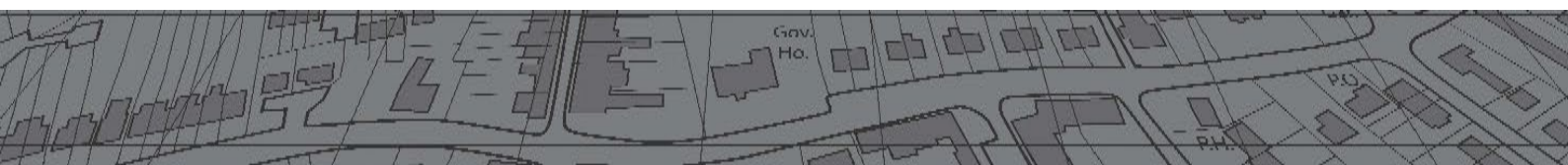
Provision	2016		2021		2026		2031		2036		2066	
	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.
Connection point (*CD_1_HY)* min. pressure (m)	42.6	44.1	42.0	43.6	42.0	43.6	42.0	43.6	42.0	43.5	42.7	43.9
Network min. pressure (m)	23.7	23.9	23.6	23.7	23.3	23.5	23.3	23.5	23.3	23.5	23.5	23.6
Network no. failures	0	0	0	0	0	0	0	0	0	0	0	0
Tank min. water level (%)	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Max. pipe velocity (m/s)	2.5	1.9	2.8	2.1	2.7	2.1	2.7	2.1	2.7	2.1	2.5	1.9
Network min. pressure ID	HE_11100514189_WTHY											

Fire Flow

Scenario		2016		2021		2026		2031		2036		2066	
		Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.	Pre-develop.
Peak Hour	Site hydrant (*CD_1_HY)* min. pressure (m)	29.2	32.8	28.4	32.1	28.6	32.2	28.6	32.2	28.6	32.2	29.6	32.6
	Network hydrant min. pressure (m)	13.5	14.0	13.3	32.1	28.6	13.7	13.2	13.7	13.2	13.7	13.5	13.8
	Network hydrant no. failures	0	0	0	0	0	0	0	0	0	0	0	0
	Min. pressure node ID	HE_11100010870_WTHY											
2/3 Peak Hour	Site hydrant (*CD_1_HY)* min. pressure (m)	32.4	#N/A	32.0	34.1	32.1	34.2	32.1	34.2	32.1	34.2	32.7	34.4
	Network hydrant min. pressure (m)	14.6	14.8	14.4	34.1	32.1	14.6	14.4	14.6	14.4	14.6	14.6	14.6
	Network hydrants no. failures	0	0	0	0	0	0	0	0	0	0	0	0
	Min. pressure node ID	HE_11100010870_WTHY											

Note: Peak hour occurred at 7 am and 2/3 peak hour occurred at 7 pm.

ATTACHMENT 10
Email from CoGC re Owners Consent



From:	MADDEN Brendan
To:	ALLEN Karl
Cc:	TAYLOR Cameron; Nicole Webb; NELSON Gerry; NELSON Gerry; NELSON Gerry
Subject:	FW: Courtney Drive, Upper Coomera (COM/2019/82)
Date:	Tuesday, 5 November 2019 7:41:05 AM
Attachments:	image013.png image014.png image016.png image018.png image020.png image003.png image004.png image005.png image007.png image008.png image015.jpg image017.jpg RE Sewer connection through public open space - Courtney Drive Upper Coomera (COM201982).msg

---

Karl- in accordance with the attached, this email should be treated as owner's consent under Delegation503 for the sewer connection along the northern boundary of Lot 999 SP292346.

Brendan Madden
Executive Coordinator, Property Management
First Floor Waterside West, Holden Place, Bundall
City of Gold Coast

T: 07 5581 6763 **M:** 0414 180 087 **F:** 07 5581 6445
PO Box 5042 Gold Coast Mail Centre Qld 9726
cityofgoldcoast.com.au

From: MADDEN Brendan
Sent: Wednesday, 30 October 2019 11:16 AM
To: TAYLOR Cameron
Cc: JOSEPH Dominic; ALLEN Karl; NELSON Gerry
Subject: RE: Courtney Drive, Upper Coomera (COM/2019/82)

Cameron- the sewer connection for the subject application provides for a corridor along the northern boundary of Lot 999 SP292346. Your call on whether owner's consent can be given for Lot 999 to be included into the application.

Brendan Madden
Executive Coordinator, Property Management
First Floor Waterside West, Holden Place, Bundall
City of Gold Coast

T: 07 5581 6763 **M:** 0414 180 087 **F:** 07 5581 6445
PO Box 5042 Gold Coast Mail Centre Qld 9726
cityofgoldcoast.com.au

From: ALLEN Karl
Sent: Wednesday, 30 October 2019 10:08 AM
To: MADDEN Brendan
Cc: JOSEPH Dominic
Subject: Re: Courtney Drive, Upper Coomera (COM/2019/82)

Hi Brendan,

I am assessing the above mentioned combined application for MCU and ROL. As part of the information request sent to the applicant, they were required to seek consent of land owners to accommodate new sewer infrastructure and associated easements.
It is noted the site is within the Courtney Drive investigation area.

Can you assist to provide information to the applicant on the process so that they can apply for Council's consent as landowner of Lot 999 on SP292346?

If you have any further queries please do not hesitate to contact me on the details below.

Regards

Karl Allen
Planner
City Development
City of Gold Coast

T: 5582 9124
PO Box 5042 Gold Coast Mail Centre Qld 9729
cityofgoldcoast.com.au

From: Nicole Webb [mailto:nwebb@zoneplanning.com.au]
Sent: Tuesday, 29 October 2019 4:47 PM
To: ALLEN Karl
Cc: David Geyer; LAWLER Karley
Subject: Courtney Drive, Upper Coomera (COM/2019/82)

Hi Karl

Reference is made to the abovementioned development application. We are currently working through the matters raised in Council's Information Request and refer to Item FF relating to consent to accommodate new sewer infrastructure and associated easement/s. One of the properties listed in Council's IR relates to Lot 999 on SP292346 which is public open space, I believe in the form of drainage (see below diagram which shows proposed sewer line into Lot 999 - white line circled in yellow).

Whilst consent is being sort from relevant private property owners to the north of the site, your assistance in facilitating consent from Council in regard to L999 is kindly requested. As the development of this area is intended for urban development (as per Council's City Plan Major Update 2 & 3 amendment package), it is hoped that a level of assistance / coordination from Council will be available to address matters such as this.

Your advice in this regard would be very much appreciated.

Kindly

Nicole Webb | Senior Town Planner

Monday to Thursday only

M 0405 539 160 | **e** nwebb@zoneplanning.com.au | **w** zoneplanning.com.au

Gold Coast 1638 Tweed Street, Burleigh Heads QLD 4220 | PO Box 3805, Burleigh Town QLD 4220 | Ph 07 5562 2303.

Gladstone 2/172 Goondoon St | PO Box 5332 | Gladstone, QLD 4680

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From: ALLEN Karl <KALLEN@goldcoast.qld.gov.au>
Sent: Wednesday, 9 October 2019 11:26 AM
To: Nicole Webb <nwebb@zoneplanning.com.au>
Cc: David Geyer <dgeyer@zoneplanning.com.au>
Subject: RE: Request to Extend Applicant's Response Period - Courtney Drive, Upper Coomera (COM/2019/82)

Good Morning Nicole and David,

I confirm receipt of your email and I note the request to further extend the applicant's IR response period until 11 December 2019.

Council officers have no objection to the applicant's request and Council records will be updated accordingly.

If you have any further queries please do not hesitate to contact me on the details below.

Regards

Karl Allen
Planner
City Development
City of Gold Coast

T: 5582 9124
PO Box 5042 Gold Coast Mail Centre Qld 9729
cityofgoldcoast.com.au

From: Nicole Webb [mailto:nwebb@zoneplanning.com.au]
Sent: Wednesday, 9 October 2019 10:44 AM
To: ALLEN Karl
Cc: City of Gold Coast mail; David Geyer
Subject: Request to Extend Applicant's Response Period - Courtney Drive, Upper Coomera (COM/2019/82)

This email originates from outside of the City of Gold Coast. If suspicious send it to spam@goldcoast.qld.gov.au

Hi Karl

Reference is made to the abovementioned development application.

My records indicate the response to Council's IR is due Friday, 11 October 2019. In accordance with section 13.1 of the DA Rules the applicant seeks to further extend the Applicant's Response Period for an additional 2 months (11 December 2019) to enable sufficient time for the to prepare the response to the matters raised in Council's Information Request and subsequent meetings with officers.

Can you please confirm acceptance of this requested at your earliest opportunity.

Kindly

Nicole Webb | Senior Town Planner
Monday to Thursday only

M 0405 539 160 | **e** nwebb@zoneplanning.com.au | **w** zoneplanning.com.au

Gold Coast 1638 Tweed Street, Burleigh Heads QLD 4220 | PO Box 3805, Burleigh Town QLD 4220 | Ph 07 5562 2303.
Gladstone 2/172 Goondoon St | PO Box 5332 | Gladstone, QLD 4680

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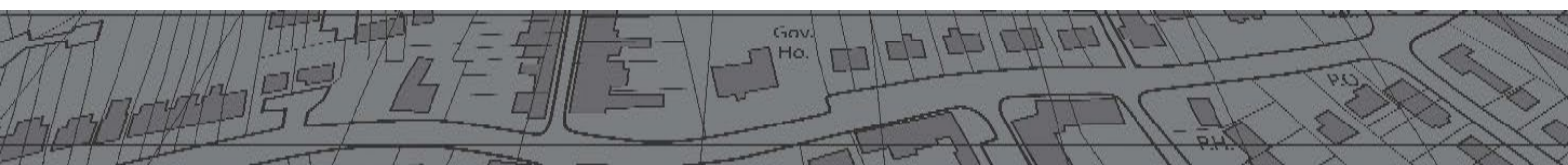
ATTACHMENT 11
Open Space Management Statement



Open Space Management Statement

79-99 Courtney Drive, Upper Coomera

Gallery Homes

November 2019

BC-16090

BIOME

WATER AND ENVIRONMENTAL CONSULTING

Document Control

Project Name	79-99 Courtney Drive, Upper Coomera
Project Number	BC-16090
Report Title	Open Space Management Statement
Prepared by	Nadya Lees BSc (Hons)
Reviewed by	Brad Comley
Approved by	Brad Comley CEnvP MEIANZ, MIEAust, MSc, BAppSc

Version Number	Date	Distribution
1	March 2019	Gallery Homes
2	6 November 2019	Gallery Homes Zone Planning

Biome Consulting Pty Ltd
ABN: 86 166 087 476

PO Box 3469, Australia Fair SOUTHPORT QLD 4215
Office: 5532 7779
Mobile: 0415 935 222
Email: admin@BIOMEconsulting.com.au
Internet: www.BIOMEconsulting.com.au

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Abbreviations and Definitions

Term	Meaning
ACH Act	*Aboriginal Cultural Heritage Act 2003*
Biome	Biome Consulting Pty Ltd
CGC	City of Gold Coast
City Plan	City of Gold Coast Planning Scheme *City Plan Version 7*
CPTED	Crime Prevention through Environmental Design
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EVNT	Endangered, vulnerable or near threatened
Fauna	Refers to all animal species
Flora	Refers to all plant species
LAP	Local Area Plan
MLES	Matters of Local Environmental Significance
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NCA	*Nature Conservation Act 1992*
Non-trunk infrastructure	Refers to development infrastructure that is either internal to a development or connects development to trunk infrastructure. It is the responsibility of the developer to provide non-trunk infrastructure.
OSMS	Open Space Management Statement
Planning Scheme	City of Gold Coast Planning Scheme *City Plan*
PMST	Protected Matters Search Tool
RE	Regional Ecosystems. Defined as a vegetation community that is consistently associated with a particular combination of geology, landform and soil
RoL	Reconfiguration of a lot
SDAP	State Development Assessment Provisions
SPP	State Planning Policy
SPRP	State Regulatory Planning Provisions
SRI	Statement of Rehabilitation Intent
Threatened species	Species listed under the NCA or EPBC Act as having a conservation status of near threatened, vulnerable, endangered or critically endangered.
Trunk infrastructure	Refers to development infrastructure that is planned for and commonly provided by local governments. Trunk infrastructure is shared between developments.
VMA	*Vegetation Management Act 1999*

Executive Summary

This report has been prepared for Gallery Homes to guide the design, management, construction and operational principles of the open space within the proposed development, located at 79-99 Courtney Drive, Upper Coomera. The open space within the subject site provides an opportunity to enhance the livability of the proposed residential development by providing an outdoor environment where people can recreate and socialise, while still maintaining habitat for wildlife.

This report has been prepared in accordance with the City of Gold Coast Open Space Management Guideline. Guideline for the Preparation of Reports and Plans Associated with the Dedication of Public Open Space. Version 1 November 2007 and Park Design Guideline. Safe, Responsive and Sustainable Parks for Our City. January 2016 – Version 1.0.

The total area of open space proposed is 42,645 m^2. Three categories of open space have been proposed. These include:

- Utility Reserves (Drainage and Natural Drainage Reserves);
- Open Space Parks (Recreation); and
- Conservation Estate (Environmental Reserve).

The open space areas provide community meeting places and allow for pedestrian connectivity to community infrastructure (such as schools and convenience stores) in the local area. All open space areas are linked by footpaths.

The conservation estate totals 22,267 m^2 and will enable connectivity to bushland external to the site to be maintained. The conservation estate (environmental reserve) will enable the preservation of environmentally significant areas in perpetuity.

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1 Introduction

Gallery Homes is proposing a new residential sub-development in the rapidly developing northern Gold Coast region. Biome Consulting Pty Ltd (Biome) has been commissioned to prepare an Open Space Management Statement (OSMS) to accompany a planning application for Reconfiguration of Lots to accommodate the sub-division components. The current version of the report has been updated to reflect the latest plan of development.

The location of the sub-division is described as Lots 188-192 on RP173728, at 79-99 Courtney Drive, Upper Coomera (hereafter referred to as 'the subject site').

This report has been prepared in accordance with the City Gold Coast Open Space Management Guideline. Guideline for the Preparation of Reports and Plans Associated with the Dedication of Public Open Space. Version 1 November 2007 and Park Design Guideline. Safe, Responsive and Sustainable Parks for Our City. January 2016 – Version 1.0.

The intent of this OSMS is to guide the design, management, construction and operational principles of the open space within the proposed development.

1.1 Report Scope

This OSMS has been prepared in accordance with relevant documentation guidelines and policies. Specifically, the OSMS will:

- Provide a summary of the physical and statutory constraints identified from the technical studies which have informed the location and function of open space areas;
- Define the parameters for the open space context and function; and
- Address relevant codes and development compliance.

1.2 Vision and Goals

1.2.1 Vision statement

The proposed master planned community provides an opportunity to conserve bushland, Koala habitat connectivity and riparian vegetation in perpetuity. The proposed open space networks offer an opportunity to enhance the livability of the residential development by providing an outdoor environment where people can recreate and socialise, while also preserving habitat for wildlife.

1.2.2 Goals

The following goals for the proposed open space network provide a foundation on which to base the implementation of this Management Statement:

1. Vegetation – protect the functional values and enhance the quality, diversity and health of retained native vegetation communities;
2. Wildlife – protect and enhance the wildlife habitat on the site while maintaining connectivity to adjacent bushland areas;
3. Parkland – provide an outdoor passive recreation area where people can socialise; and
4. Walking paths and infrastructure – manage access to provide a recreational experience within the urban environment while minimising impacts to ecosystems.

2 Site Specifics

The following sections describe the site and its current environmental condition.

2.1 Site Location

The subject site is located at 79-99 Courtney Drive, Upper Coomera on Lots 188-192 on RP173728 and is located within the City of Gold Coast Local Government Area. The site comprises of five allotments with a total land area of 18.849 ha (Table 2.1).

Table 2.1 Allotment Details

Street Number	Lot Plan Number	Lot Size (ha)
79	188 RP173728	3.079
89	189 RP173728	3.034
91	190 RP173728	3.095
97	191 RP173728	3.739
99	192 RP173728	5.902

Figure 2.1 Site Location (Google Earth, image date 2016)

2.2 Climate

The Bureau of Meteorology collect weather and climate information. The nearest weather station to the site is Southport Ridgeway Avenue (station number 040190). The average annual rainfall is 1451.7mm and average temperature range is 15.3-25.0º C (Table 2.2).

Table 2.2 Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean minimum temperature (°C)	28.5	28.3	27.6	25.9	23.3	21.2	20.6	21.4	23.3	25.2	26.7	28.1
Mean minimum temperature (°C)	20.3	20.5	19.2	16.5	13.4	10.6	9.1	9.8	12.1	15.0	17.4	19.2
Mean Rainfall (mm)	181.2	190.2	198.9	136.4	128.9	96.3	72.8	56.9	57.5	96.8	105.8	136.2

2.3 Current and Surrounding Land Use

The site is used for rural purposes. Residential dwellings and associated out buildings are present on the site. The site is grazed by livestock. Several dams are present on the site. Yaun Creek and/or its tributaries passes through Lots 188, 191 and 192.

The immediate surrounding land use pattern is characterised by rural residential allotments to the immediate west, south and north. These allotments range in size from 3 – 157 ha. Smaller lot residential developments are present to the immediate east of the site.

2.4 Current Land Use Zoning

Under the CGC Planning Scheme *City Plan* (Version 7) (City Plan), the site is designated as Rural and Rural Residential (Figure 2.2). Some areas of the site are designated Rural Landscape and Environment Precinct (hatched areas in Figure 2.2).

The site falls within an Investigation Area for Future Development. The Draft Concept Plan (GHD, 2017) identifies the site as *Suburban Neighbouhood.*

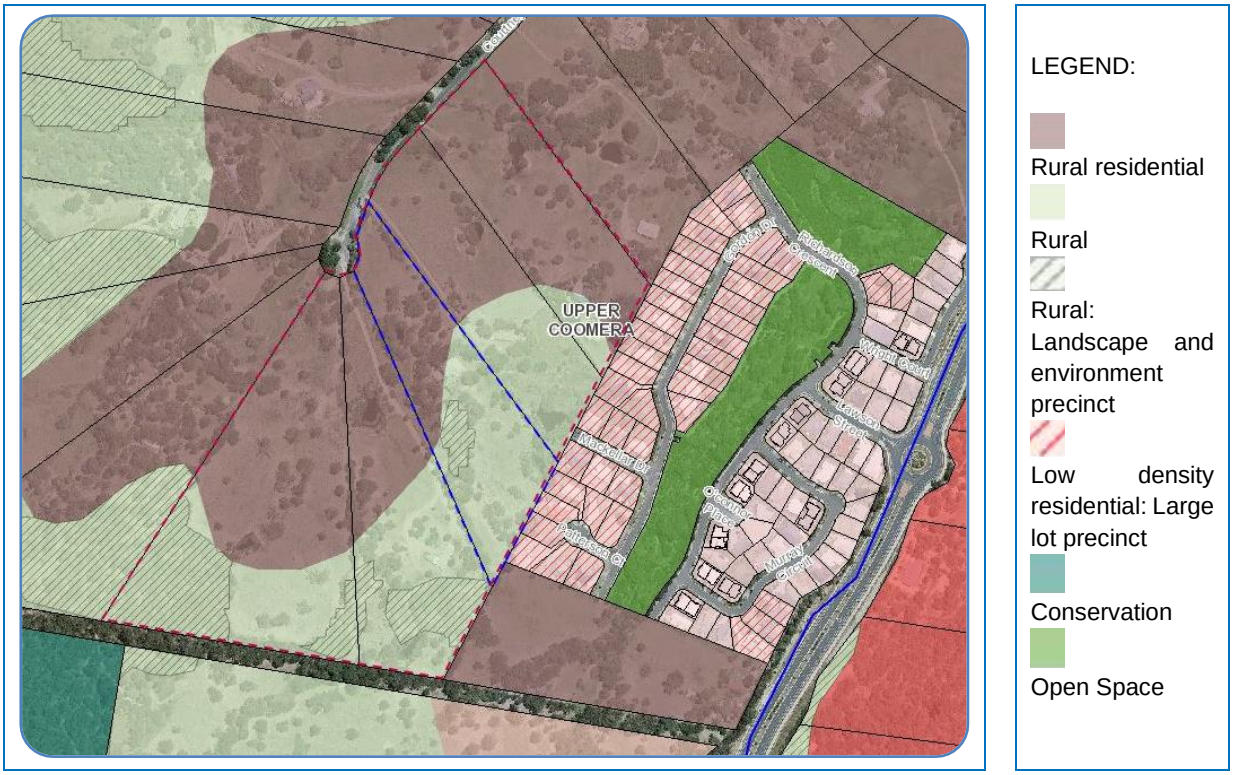


Figure 2.2 Zones under the City Plan

2.5 Draft Concept Plan

Under the City Plan, 13 non-urban areas within the urban footprint of the *South East Queensland Regional Plan 2009-2031*, were identified for investigation into land use opportunities and constraints. Courtney Drive was given the highest ranking in terms of marketability and development suitability (GHD, 2017).

The subject site falls within the Courtney South East and Courtney West Precincts of the investigation area (Figure 2.3). Three potential land use categories have been identified on the subject site – suburban neighbourhood, suburban neighbourhood (constrained) and green space. Constrained suburban neighbourhood areas require special design considerations as the land is above Reduced Level (RL) 60.

The draft concept plan recommends the amalgamation of allotments to maximise the development potential, connectivity and bushfire management.

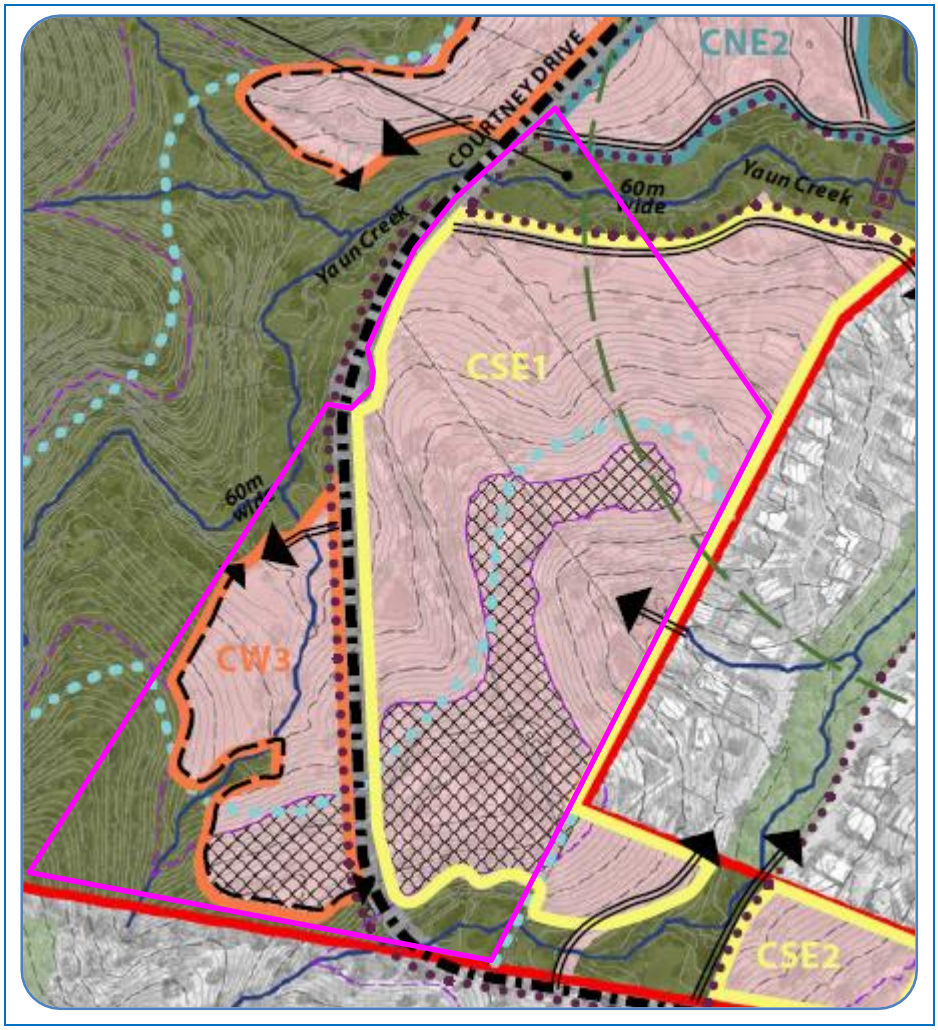


Figure 2.3 Draft Concept Plan (GHD, 2017)

2.5.1 Courtney South East Precinct

The Courtney South East Precinct includes the extension of Courtney Drive to connect with Reserve Road and the Yaun Creek Corridor at its northern edge.

GHD concluded that based primarily on slope, lot sizes that are similar to the adjoining residential area are the most appropriate response for the majority of housing in this precinct. Where properties can be amalgamated, increased density may be suitable. A density estimate of future dwellings for this precinct was determined to be 9.7-13.3 (GHD, 2017).

A large area of this precinct is greater than RL 60. These areas are considered suitable for significant earthworks to reduce the amount of land above RL 60 and achieve an extension of Courtney Drive that improves the development potential and connectivity.

Yaun Creek is considered a key character element.

2.5.2 Courtney West Precinct

The Courtney West Precinct is characterised by its proximity to Conservation open space, its higher elevation and several overland flow paths. The extent of development in this precinct relies on the amalgamation of the site to address bushfire management.

The density estimate of future dwellings was determined to be 8.4-10.9 (GHD, 2017).

2.5.3 Green Space

Green Space areas have been proposed in the concept plan. Green Space is land suitable for a conservation or open space.

This land is considered not suitable for development based on the following constraints (GHD, 2017):

- High Value and Medium Value ecological constraints;
- Extreme slopes 1:3 (33.33 %) or steeper;
- Land above RL 60 (where servicing issues, bushfire risk/ fire-fighting capabilities and scenic amenity values are anticipated to affect development potential); or
- Within 30 m from the outer bank of watercourse.

3 Development Proposal

The development involves reconfiguring the existing site into 315 lots (Figure 3.1). The development will include:

- An internal road network with pedestrian footpath;
- A constructed waterway; and
- Three categories of public open space:
  - Conservation Estate (Environmental Reserve) to protect existing ecologically significant areas;
  - Utility Reserve (Drainage and Natural Drainage Reserve); and
  - Open Space Parks.

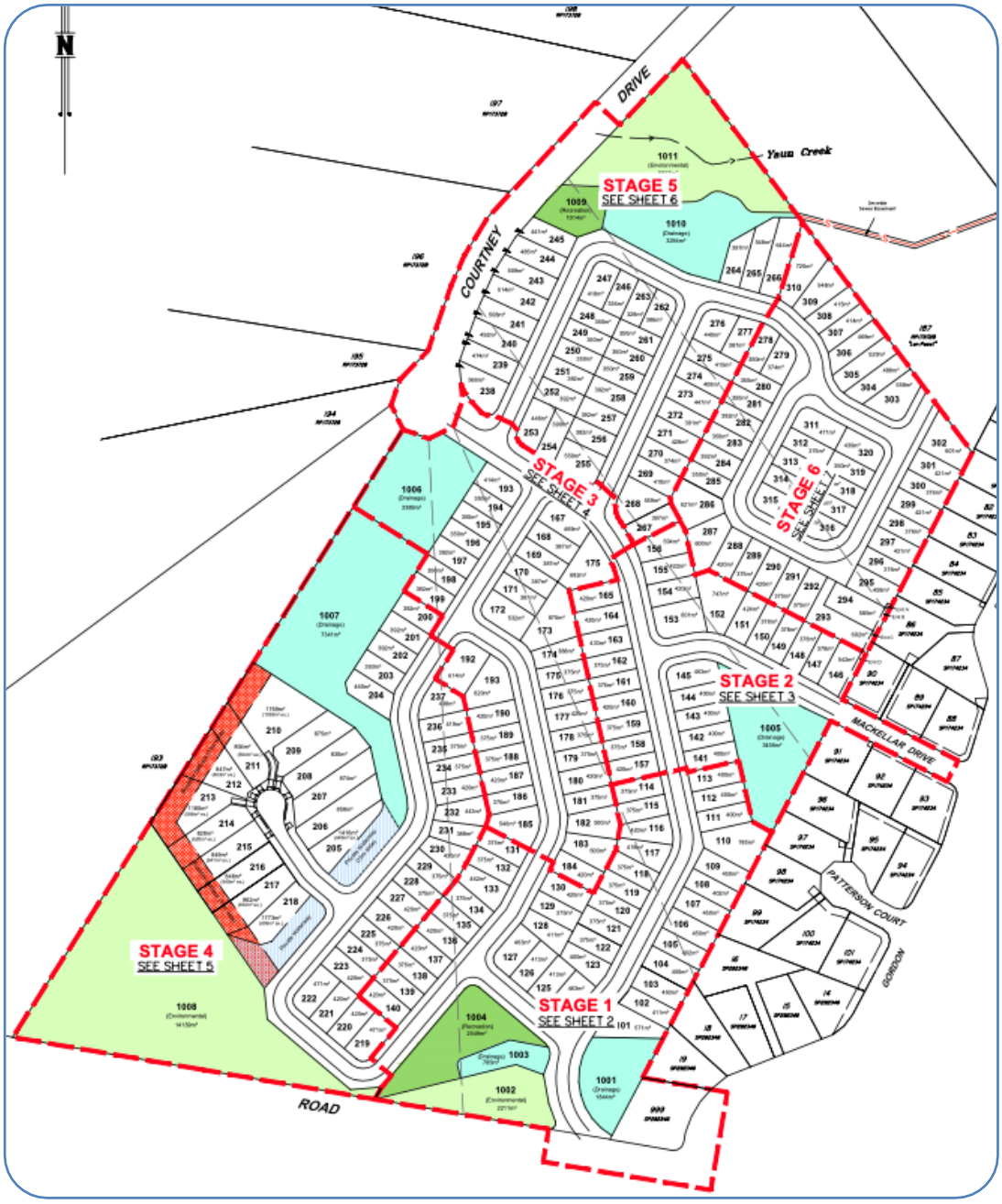


Figure 3.1 Proposed Development Layout (Bennett and Bennett, 2019)

3.1 Development Footprint

The development footprint has been situated to avoid impacts to medium priority vegetation mapped under the City Plan and regulated vegetation mapped under the *Vegetation Management Act 1999*. General priority vegetation has been avoided and incorporated into the open space network where possible. Conservation of identified Koala habitat and the establishment of regional riparian fauna linkages are incorporated into the development design.

3.2 Open Space Areas

The three open space categories proposed to be provided as part of the development are summarised below. Please note detailed descriptions of each category including design descriptions are included in Section 6.

3.2.1 Conservation Estate (Environmental Reserve)

The conservation estate of the proposed development totals an area of 2.22 ha. Management of these areas aims to conserve and enhance regulated vegetation, Koala habitat areas, wildlife movement corridors and riparian zones. Connectivity to bushland external to the site is maintained through these open space areas.

3.2.2 Utility Reserves

Utility Reserves include drainage reserves containing stormwater treatment devices and occupy a total area of 1.68 ha of the proposed development.

A natural drainage reserve is also planned along Yaun Creek. This will be rehabilitated and upon completion, incorporated into the conservation estate.

3.2.3 Open Space Park (Recreation)

The recreation parks will provide an informal setting for community residents to socialise and play.

Two recreation parks have been included in the development layout and will occupy a total area of 3,563 m^2. One is located adjacent to the natural drainage reserve along Yaun Creek in the north of the site and the other adjoining drainage and environmental reserves in the south-eastern corner of the site.

4 Development Constraints Overview

This section provides a synopsis of the site's development constraints, in relation to the open space areas, together with physical and management constraints on site. This information has been acquired from relevant planning scheme provisions and the ecological assessment prepared for the site (Biome, 2018).

Table 4.1 provides a summary of the legislative considerations.

Table 4.1 Summary of Legislative Considerations

Legislation	Applicable to Development
Commonwealth Legislation	
Environment Protection and Biodiversity Conservation Act 1999	Referral under the EPBC Act is only required if impacts to Koala (or other threatened species or ecological communities) deemed to be significant. No referral is required for this development.
State of Queensland Legislation	
Nature Conservation Act 1992	Protected Plants Survey required for the site prior to vegetation clearing. Essential habitat is mapped on the site and is excluded from development.
Vegetation Management Act 1999	Regulated vegetation present on the site: • Least Concern RE 12.11.5/12.11.24; • Regulated vegetation intersecting a watercourse; and • Essential habitat. Regulated vegetation intersecting a watercourse is retained and appropriately buffered.
Biosecurity Act 2014	Restricted and invasive weeds must be controlled on the site.
Local Government	
City Plan	Development and constraint codes applicable to the design and designation of open space have been addressed in Section 9 of this report.

Table 4.2 provides a summary of the management constraints, including those under the City Plan. These constraints are discussed in greater detail in Section 5 of this report.

Table 4.2 Management Constraints

Constraint	Present	Absent	Comment
Easements and/or restrictions on title		x	
Zoning provisions	x		Rural and rural residential zoned land
Waterways and Wetlands	x		Mapping for wetlands and watercourses identifies minor waterways on the site. Buffer widths defined in the Ecological Assessment must be incorporated into the development design.
Nature Conservation	x		Areas of the site are mapped under the Environmental Significance Overlay code as containing medium and general priority vegetation, state signficant species and Koala habitat areas. Habitat of state significant species and medium priority vegetation are conserved within public open space network and are excluded from the development.
Bushfire Risk	x		State development planning mapping indicates that the site falls within a bushfire prone area. CGC mapping indicates the site falls within an area of medium to high potential bushfire hazard.
Nature Conservation Areas		x	No nature conservation areas are present on the site.
Airport Environs		x	
Aboriginal cultural heritage		x	No known aboriginal cultural heritage sites are present on the subject site.
European cultural heritage		x	
Acid sulphate soils - risk		x	
Flood hazard		x	
Erosion prone	x		CGC mapping indicates areas of the site have moderate landslide risks.
Tree Preservation Order		x	
Mapped Vegetation	x		A small area of the site in the south-western corner is mapped as Category B regulated vegetation, which is further defined as least concern RE 12.11.5/12.11.24. This area is excluded from the development footprint and will be managed for conservation within the open space network.
Mapped Essential Habitat	x		Essential habitat for Koala is mapped on the site. Habitat for Koala will be conserved within the open space network.
Wildlife Online – threatened species	x		Seven threatened species have been recorded within 2 km of the site. Assessment of the habitat requirements of these species concluded that two species would potentially occur on the site.
Observed threatened species	x		One threatened species – Koala, observed on-site during site assessments.
SPRP Koala Assessable Development Area		x	The site is not within a SPRP Koala assessable development area.

5 Site Analysis

This section details the existing natural features and functions of the site in the context of its surrounds.

5.1 Topography

The site slopes from an elevation of approximately 82 m in the south-western corner of the site, to a low point of approximately 42 m near the tributary of Yaun Creek in the north (Figure 5.1).

Figure 5.1 Contours (Source: City Plan interactive mapping)

5.2 Flooding

City Plan mapping indicates that no area of the site is subject to flooding. Biome has assessed local flooding and conveyance.

5.4 Landslide Hazards

Areas of the site are mapped as having moderate landslide hazards (Figure 5.2).

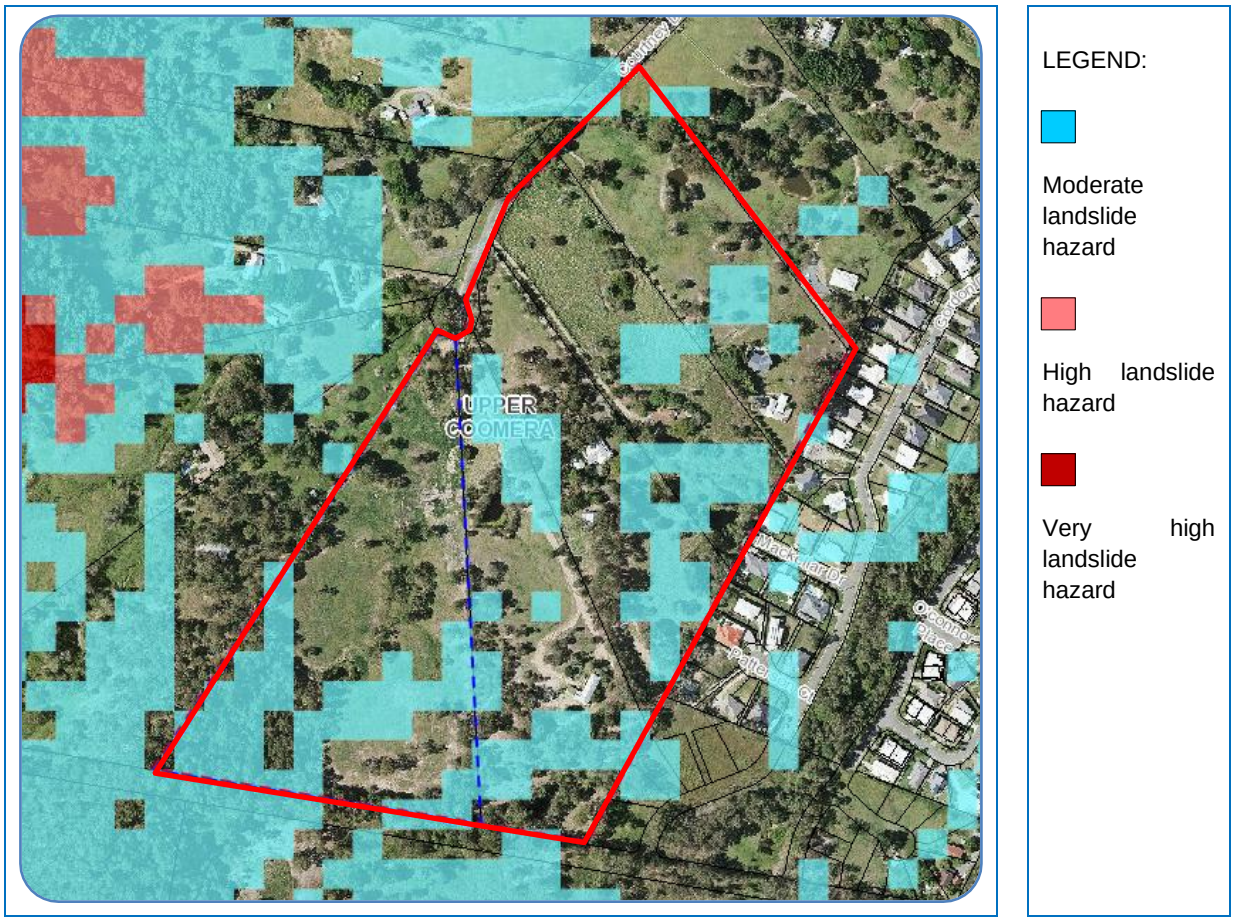


Figure 5.2 Landslide Hazard (City Plan)

5.5 Native Vegetation Communities

One native vegetation community has been identified as occurring on the site, regional ecosystem (RE) 12.11.5/12.11.24.

RE 12.11.5 is described as *Corymbia citriodora* subsp. *variegata, Eucalyptus siderophloia, E. major* open forest. The sub-dominant RE 12.11.24 is described as *Eucalyptus carnea, E. tindaliae, Corymbia intermedia* +/- *E. siderophloia* or *E. crebra* woodland.

Figure 5.3 shows the locations of the vegetation communities within the development site.

Figure 5.3 Vegetation Management Support Map (Qld Globe, 2018)

On-site field assessment identified four broad vegetation communities:

1. *Acacia* low open forest;
2. Spotted Gum / Grey Ironbark Open Forest (RE 12.11.5);
3. *Acacia* low open woodland/mosaic +/- landscaping around dwellings; and
4. Pasturelands +/- copses of native/exotic trees.

These vegetation communities are described in the following sections and are summarised from the Ecological Assessment (Biome, 2018). Figure 5.4 shows the locations of the vegetation communities.

Vegetation community 2 and much of community 1 will be incorporated into the Conservation Estate (Environmental Reserve).

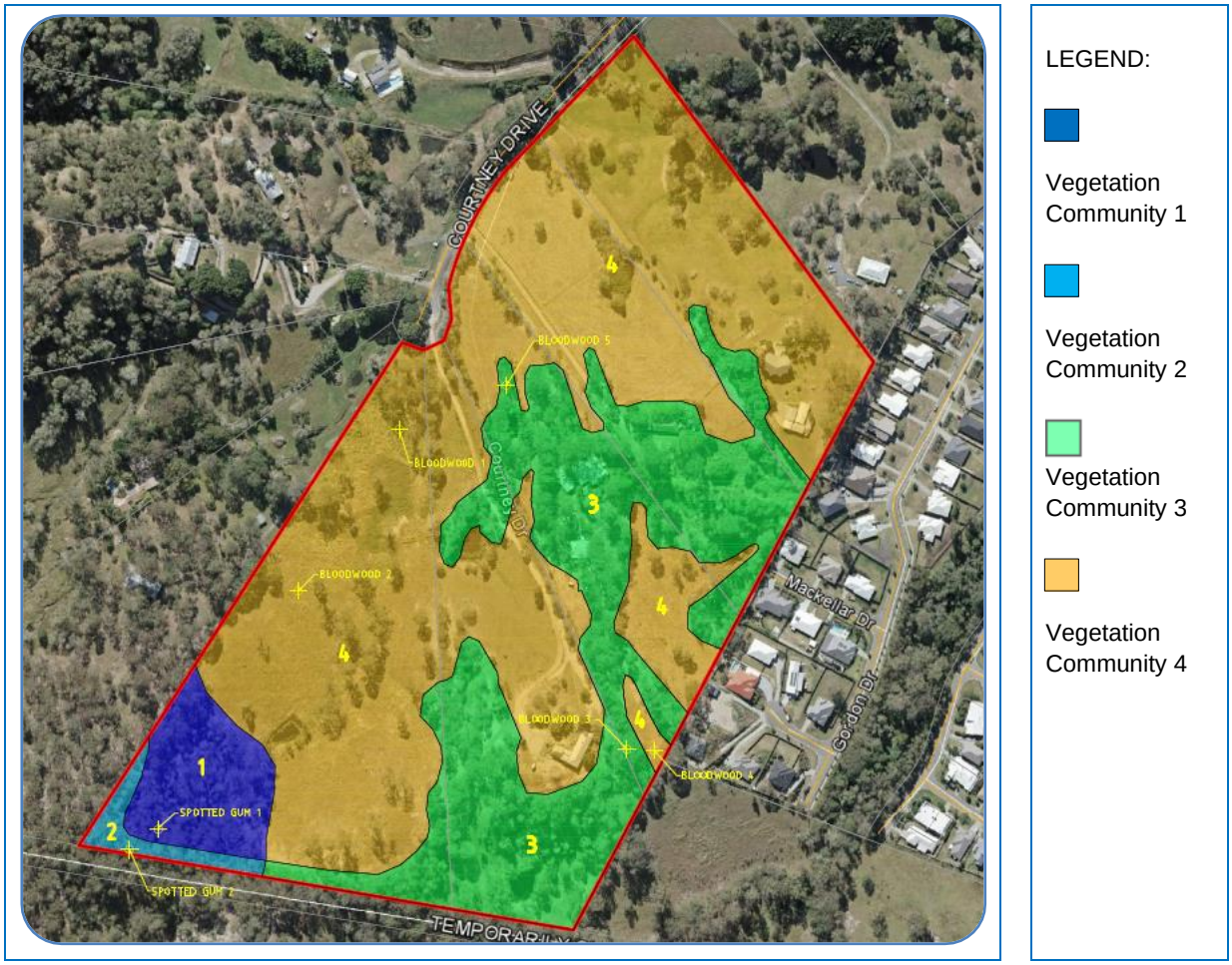


Figure 5.4 Vegetation Communities

5.5.1 Vegetation Community 1 – Acacia low open forest

Vegetation community 1 is comprised of mature *Acacia disparrima* regrowth with occasional emergent *Corymbia citriodora, Eucalyptus siderophloia, E. propinqua, and E. tereticornis*. Other common species in the mid stratum include *Lophostemon suaveolens* and *Allocasuarina littoralis*. Lantana (*Lantana camara*) dominates the shrub layer. Low level livestock grazing is presently occurring.

Figure 5.5 Vegetation Community 1

5.5.2 Vegetation Community 2 – Spotted Gum/Grey Ironbark Open Forest (RE 12.11.5)

Vegetation community 2 comprises a small area of the total subject site in the south-west corner and is an extension of a larger area of the same vegetation type beyond the site boundary. The composition of canopy trees is generally representative of RE 12.11.5. Low level grazing is presently occurring with negligible weed incursion.

Figure 5.6 Vegetation Community 2

5.5.3 Vegetation Community 3 - Acacia low open woodland/mosaic +/- landscaping around dwellings

Vegetation community 3 is primarily mature *Acacia* regrowth proximate to dwellings and outbuildings on the subject site. There are occasional larger eucalypts and small isolated thickets of lantana and vine weeds are common. Low level grazing is presently active throughout most of this community.

Figure 5.7 Vegetation Unit 3

5.5.4 Vegetation Community 4 - Pasturelands +/- copses of native/exotic trees

Vegetation community 4 covers much of the site comprising introduced pasture species, copses of endemic tree species and trees associated with landscaping. Some of the largest eucalypt trees on site occur as isolated trees or within the copses of this community.

Figure 5.8 Vegetation Community 4

5.5.5 Threatened plant species and communities

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protected matters search tool enables searches for Matters of National Environmental Significance (MNES) in a specified area. MNES include threatened species and ecological communities. Results of this database search (using a 1 km buffer to a central coordinate: Latitude -27.856753; Longitude 153.324814) identified a total of seven threated flora species, *known* or considered *likely to occur*, are recorded within a 1 km radius of the site (Table 5.1).

In addition to the protected matters search, a search of the Queensland Government Wildlife Online database was also undertaken. One threatened flora species; Floyd's Walnut (*Endiandra floydii*) was identified in this database as occurring within 2 km of the site.

Table 5.1 Protected Matters Search Results

Scientific Name	Common Name	Status
Baloghia marmorata	Marbled Baloghia	V
Bosistoa transversa	Three-leaved Bosistoa	V
Corchorus cunninghamii	Native Jute	E
Endiandra floydii	Floyd's Walnut	E
Macadamia integrifolia	Macadamia Nut	V
Samadera bidwillii	Quassia	V
Thesium australe	Austral Toadflax	V

Status: E = Endangered, V = Vulnerable

No threatened species were identified during the ecological site assessment.

5.6 Invasive weeds

A total of 55 non-endemic species were identified on the subject site, 15 of which are invasive plants under the Queensland *Biosecurity Act 2014* (Table 5.3).

Table 5.2 Weeds Observed On-site

Scientific Name	Common Name	Status
Ageratum houstonianum	Blue Billygoat Weed	
Amaranthus spinosus	Red Amaranth	
Ambrosia artemisiifolia	Ragweed	RIP
Anagallis arvensis	Scarlet Pimpernel	
Asclepias curassavica	Tropical Milkweed	
Asparagus aethiopicus cv. sprengelii	Ground Asparagus	RIP
Bidens pilosa	Cobbler's Pegs	
Cinnamomum camphora	Camphor Laurel	RIP
Cirsium vulgare	Scotch Thistle	
Conyza canariensis	Canadian Fleabane	
Conyza sumatrensis	Tall Fleabane	
Corymbia torelliana	Cadagi	
Crassocephalum crepidioides	Thickhead	
Crotalaria incana	Woolly Rattlepod	
Crotalaria lanceolata	Lance-leaved Rattlepod	
Cupressus sempervirens	Pencil Pine	
Cyperus papyrus	Papyrus	
Emelia sonchifolia	Emelia	
Gomphocarpus sp.	Cotton Bush	
Hypochaeris radicata	Flatweed	
Jacaranda mimosifolia	Jacaranda	
Lantana camara	Lantana	RIP
Macrotyloma axillare	Horse Gram	
Megathyrsus maximus	Guinea Grass	
Melinis minutiflora	Molasses Grass	OIP
Murraya paniculata	Mock Orange	OIP
Neonotonia wightii	White Glycine	
Nymphaea capensis	Cape Waterlily	
Oxalis corniculata	Yellow Wood Sorrel	
Oxalis debilis var. corymbosa	Soursob	
Paspalum dilatatum	Paspalum	
Passiflora edulis	Passionfruit	

Scientific Name	Common Name	Status
Passiflora foetida	Stinking Passionflower	OIP
Passiflora suberosa	Corky Passionfruit	OIP
Passiflora subpeltata	White Passionflower	OIP
Polygala paniculata	Polygala	
Phytolacca octandra	Inkweed	
Psidium guajava	Yellow Guava	
Ravenala madagascariensis	Traveller's Palm	
Richardia brasiliensis	White Eye	
Schefflera actinophylla	Umbrella Tree	OIP
Senecio madagascariensis	Fireweed	RIP
Senna pendula var. glabrata	Easter Senna	OIP
Setaria sphacelata	Setaria	
Sida cordifolia	Flannel Weed	
Sida rhombifolia	Paddy Lucerne	
Solanum chrysotrichum	Giant Devil's Fig	
Solanum mauritianum	Wild Tobacco	OIP
Solanum capsicoides	Devil's Apple	
Sphagneticola trilobata	Singapore Daisy	RIP
Sporobolus africanus	Paramatta Grass	
Syagrus romanzoffiana	Cocos Palm	OIP
Tagetes minuta	Stinking Roger	
Urena lobata	Urena Burr	
Verbena bonariensis	Purple Top	

*Species listed under the Queensland *Biosecurity Act 2014*, where:

PIP = Prohibited invasive plants must not be kept, moved, given away or sold without a permit. The Biosecurity Act requires that all sightings to be reported to Biosecurity Queensland within 24 hours. By law, everyone has a general biosecurity obligation to take all reasonable and practical steps to minimise the risk of spreading prohibited invasive plants until they receive advice from an authorised officer.

RIP = Restricted invasive plants must not be given away, sold or released into the environment without a permit. The Biosecurity Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. At a local level, each local government must have a biosecurity plan that covers invasive plants and animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws.

OIP = Other invasive plants are not prohibited or restricted, however, by law, everyone has a general biosecurity obligation to take reasonable and practical steps to minimise the risks associated with invasive plants under their control. Local governments must have a biosecurity plan that covers invasive plants and animals in their area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws.

5.7 Waterways

Minor waterways are mapped on the site (Figure 5.9). Field investigations identified these waterways to be degraded; primarily consisting of eroded and/or heavily weed infested ephemeral overland flow paths which discharge to dams created as stock watering points.

Under the definitions of the *Water Act 2000*, these waterways have been mapped as a drainage feature.

Yaun Creek (the waterway in the north of the site) will be rehabilitated and a buffer to the watercourse provided. This riparian linkage will facilitate fauna movement along Yuan Creek.

The waterway in the south-eastern corner of the site will also be rehabilitated to facilitate wildlife movement. Where this waterway passes under the road, a fauna underpass will be constructed (refer to Statement of Rehabilitation Intent provided as Appendix A). This will maintain the connection to the waterway within the residential community to the east, which is primarily used for storm water conveyance.

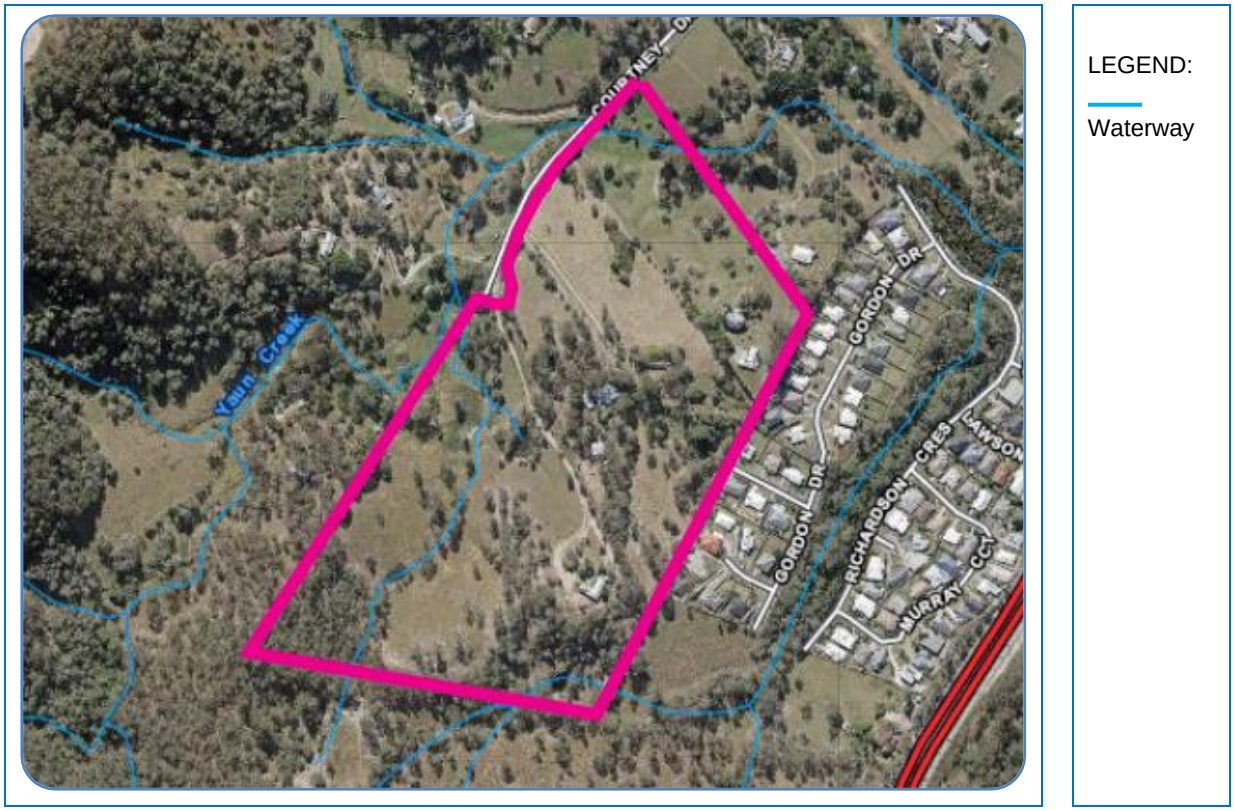


Figure 5.9 Waterways (Qld Globe, 2018)

The waterway running through the site from south to north (refer to figure 5.9) is heavily degraded and consists of a grassed swale that directs flow from one dam to another. In its current state, this waterway does not provide a fauna movement corridor or have any riparian vegetation communities.

Given its degraded nature, it is proposed that this waterway be realigned, with the water captured near the environmental reserve in the south-western corner and directed through the site to a large drainage area on the western site boundary.

The realigned waterway corridor will be 15 m wide and rehabilitated to resemble a natural waterway (refer to Statement of Rehabilitation Intent, Appendix A). The water will flow to a drainage reserve where it will be treated prior to its discharge into Yaun Creek.

The realignment and consequent reconstruction of this waterway will enable wildlife corridors to be created and enable water quality to be managed.

5.8 Fauna

The ecological site assessment identified 54 fauna species occurring on the site, including one threatened species, Koala (*Phascolarctos cinereus*) (Biome, 2018).

5.8.1 Threatened species

Evidence of one conservation significant species - Koala, was observed on the subject site. The Koala is listed as vulnerable under the Queensland *Nature Conservation Act 1994* (NCA) and Commonwealth EPBC Act.

Assessment of likelihood of occurrence of conservation significant species identified in database searches was also made. The database searches included the Protected Matters Search and Wildlife Online. Likelihood of occurrence assessment identified two species as having potential to occur on the site, at least on a transient basis (Table 5.4).

The protection of the sites' ecologically significant vegetation and known Koala habitat within the open space network will ensure the impacts to habitat for many fauna species is limited.

Table 5.3 Likelihood of Occurrence Assessment

Scientific Name	Common Name	Status	Ecology	Likelihood of Occurrence
Phascolarctos cinereus	Koala	V, V[#]	Koalas inhabit dry open sclerophyll forests and woodlands occurring on fertile soils (Van Dyck, 1995; Menkhorst and Knight, 2001; Environmental Protection Agency, 2006). Communities containing denser vegetation and larger trees are generally preferred; however, Koalas can also inhabit less optimal habitat such as young forests, highly fragmented vegetation communities, and small remnants (Environmental Protection Agency, 2006). They mainly feed on *Eucalyptus* species, along with some *Corymbia*, *Angophora*, *Lophostemon*, *Melaleuca*, and *Leptospermum* species (Environmental Protection Agency, 2006).	**KNOWN TO OCCUR** This species was not directly recorded during surveys. However, scats of Koala were found during the KSAT surveys.
Pteropus poliocephalus	Grey-headed Flying-fox	V[#]	The Grey-headed Flying-fox occurs in the coastal belt from Rockhampton to Melbourne. The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands (Eby, 1998). None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year, so the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly (Eby & Lunney, 2002).	**POTENTIAL TO OCCUR** The site would provide seasonal foraging resources. No flying-fox camps are present on the site.

Scientific Name	Common Name	Status	Ecology	Likelihood of Occurrence
			The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. They most frequently travel around 15 km from a roost site to feed (Tidemann, 1998), although can travel up to 50 km as food resources change (Eby, 1991).	

Status: V = Vulnerable under NCA, V# = Vulnerable under the EPBC Act

5.8.2 Habitat Trees

Habitat trees are defined under Schedule 1.2 of the City Plan as a living or dead tree greater than 80 cm diameter at 1.4 m, that has one or more hollows within its trunk or branches greater than 10 cm in entrance diameter.

While no trees on the site met with this definition, seven trees that contained hollows and were considered to perform habitat function, were recorded. The locations of these trees are shown in Figure 5.4. The clearing of hollow-bearing trees that are not able to be retained, will be offset through compensatory planting and/or nest box installation in the open space network.

5.9 Environmentally Significant Areas

Based on an appraisal of the site and desktop analysis against the criteria for defining environmentally significant areas, it has been concluded that the site contains habitat for nationally, state and locally significant wildlife (Koala) and natural waterways. The establishment of an open space network will enable Koala habitat on the site to be conserved in perpetuity.

Yaun Creek, where it traverses the site, will be rehabilitated to repair damage from grazing, erosion and to control invasive species. The waterway in the south-eastern corner of the site will also be rehabilitated to facilitate fauna movement to external bushland areas. The central waterway will be realigned and fabricated to resemble a natural flowpath.

5.10 Surrounding Environment

The surrounding environment influences the value of the proposed open space and its contribution to the amenity of the area.

5.10.1 Scenic Amenity

To the north, west and south of the site, the land use is currently rural residential. Some open space areas will be visible from these allotments and from Courtney Drive.

A residential development is located to the east of the site. A proposed drainage reserve is located behind some of these dwellings. The outlook of these dwellings will not be compromised by the construction of the drainage reserve and may be improved with the removal of weeds and sympathetic landscaping.

5.10.2 Pedestrian and Vehicle Access

Current access to the site is via Courtney Drive. Vehicle access will also be via Mackellar Drive to the east. Connectivity to the future developments to the south have been provided (refer to Figure 3.1).

The proposed development layout will incorporate a network of internal roadways and interconnecting pedestrian footpaths. The footpaths will allow for safe pedestrian movement to public open space recreation areas within and external to the development. The footpaths will connect to those external to the site and allow for pedestrian access to community infrastructure such as schools and convenience stores.

5.10.3 Ecological Corridors

Ecological corridors are necessary to allow the movement of fauna between patches of habitat that are of insufficient size to support a population in isolation. They allow individuals to seek mates and alternate foraging resources. Ecological corridors are of importance to species with limited mobility.

The proposed environmental open spaces serve to increase the conservation value of connecting bushland habitat in the south. Open space areas in the north along Yaun Creek and along the waterway on the south-eastern corner will function as a riparian linkage to bushland located to the east and west (Figure 5.10). The rehabilitation of these areas will create valuable linkages to facilitate fauna movement through the local area.

Figure 5.10 Ecological connectivity in the local landscape

5.10.4 Open Space Linkages

An analysis of public open space in the surrounding locality has identified several public open space areas within a 1 km radius of the site (Figure 5.11). These open space areas include conservation parks and recreation parks. They cater for informal and formal recreation as well as habitat protection.

The level of pedestrian connectivity to open space areas and community facilities, in terms of dedicated footpaths and cycleways, is relatively high, particularly from the residential development located to the immediate east. These pathways extend to community facilities such as schools in the local area.

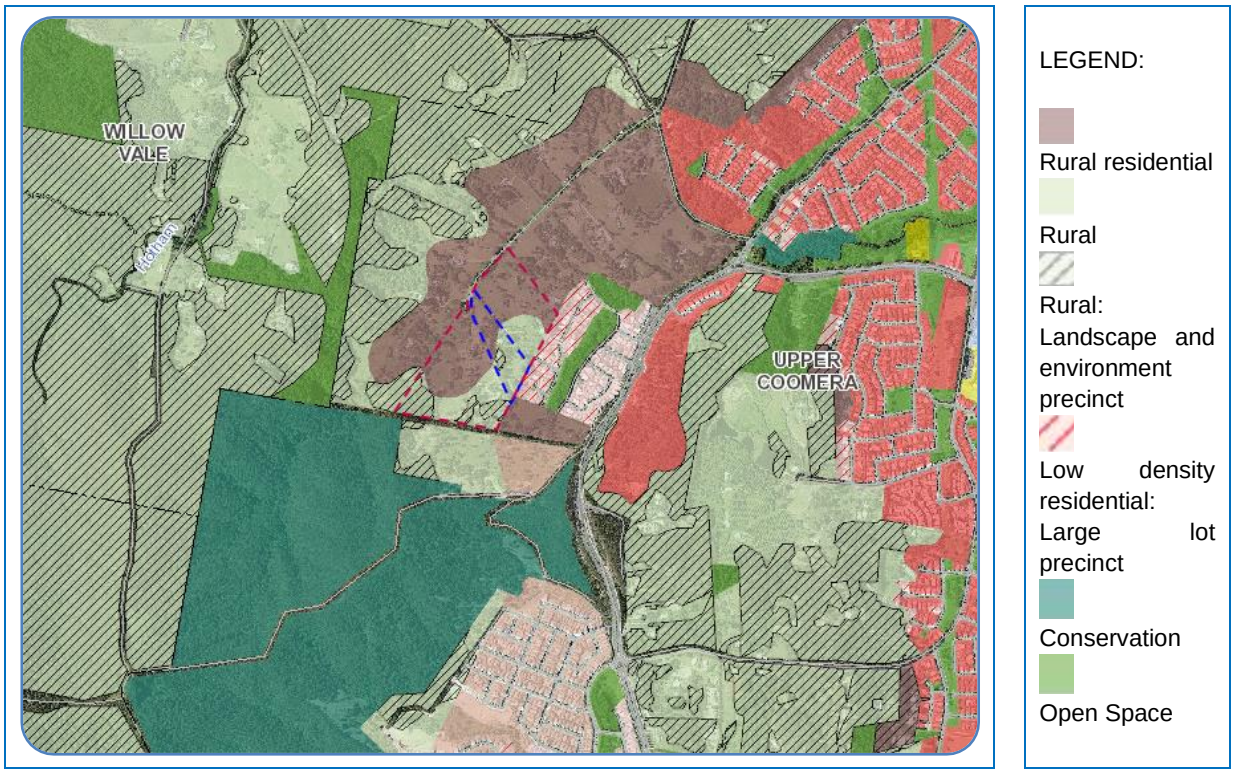


Figure 5.11 Open space areas in local area

5.11 Bushfire Hazard Areas

The Bushfire Hazard overlay identified areas within the site as having a bushfire hazard rating of medium and high (Figure 5.12). Confirmed medium or high bushfire hazard areas are considered as designated bushfire prone areas for the purposes of the *Building Code of Australia* and *AS3959-1999 Construction of Buildings in Bushfire-Prone Areas*, and all building work must be carried out in a manner consistent with this standard.

A Bushfire Risk Management Plan is to be prepared for the site to guide bushfire mitigation and management.

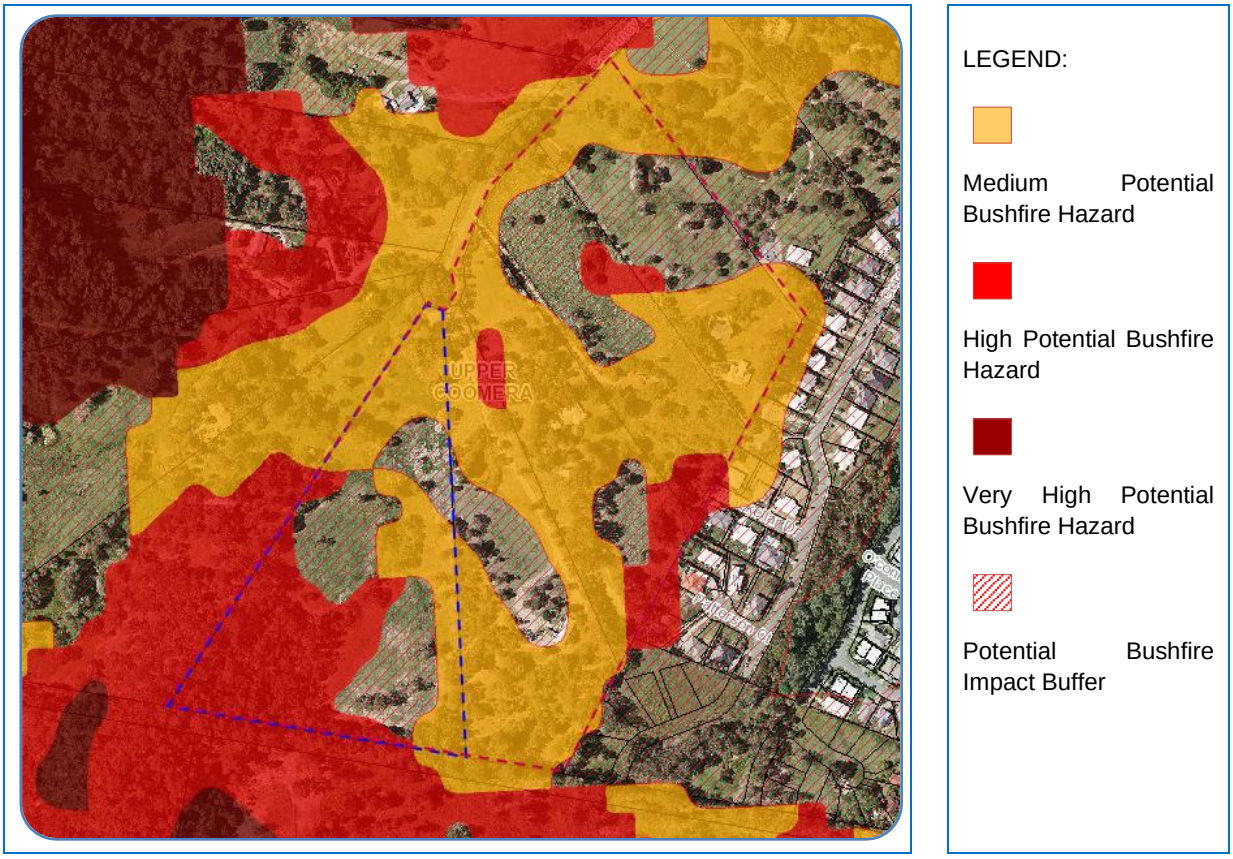


Figure 5.12 Bushfire Hazard

5.12 Cultural Heritage

The Aboriginal and Torres Strait Islander Cultural Heritage Register was consulted to determine if any cultural heritage studies have been conducted over the site. The register contains information about cultural heritage studies recorded under Part 6 of the *Aboriginal Cultural Heritage Act 2003* (ACH Act), cultural heritage management plans registered under Part 7 of ACH Act, designated landscape area recorded under previous legislation, registered cultural heritage bodies, and details about statutory Aboriginal and Torres Strait Islander parties for an area.

No cultural heritage studies for the site were recorded on the register.

Should unrecorded cultural heritage sites or materials be discovered during construction, work at that location will cease until Traditional Owners are contacted to provide advice on the significance of the finds and discuss management and mitigation options.

5.13 Existing Infrastructure and Infrastructure Requirements

The following sections provide a summary of the infrastructure in the local area that potentially impact the proposed development or are required to facilitate the development. These sections have been prepared in reference to the Local Government Infrastructure Plan (LGIP). The LGIP is an overarching document that outlines where required trunk infrastructure will be delivered, when it will be delivered and how it will be delivered. Trunk infrastructure includes water supply, sewerage, public parks and land for community facilities and transport networks.

Constraints identified in the Draft Concept Plan (GHD, 2017) will be mitigated through bulk earthworks to reduce the RL to 60 m. This will enable sewer and water supply to be connected to the residences.

5.14 Stormwater Management

The construction phase of the development has the potential to impact on the water quality of downstream environments, especially within Yaun Creek. Water quality impacts are a result of disturbance and suspension of soils during periods of heavy rain, which are conveyed downstream causing turbidity and sedimentation. These impacts can be managed through the implementation of sediment erosion control measures that intercept stormwater and collect sediment loads prior to discharge. Uncontrolled erosion and sediment transportation off the site and into downstream environments have the potential to cause adverse ecological harm.

A Stormwater Management Plan has been prepared which will incorporate recommendations to be implemented during the construction and operational phases of the development. Six drainage bio-retention systems have been planned for the site to provide on-site detention, capture pollutants and treat stormwater prior to discharge.

No stormwater treatment will be undertaken in areas proposed for public open space managed for conservation or recreation.

5.15 Wastewater Management

The City of Gold Coast planning scheme identifies the location of current and future wastewater networks within the city.

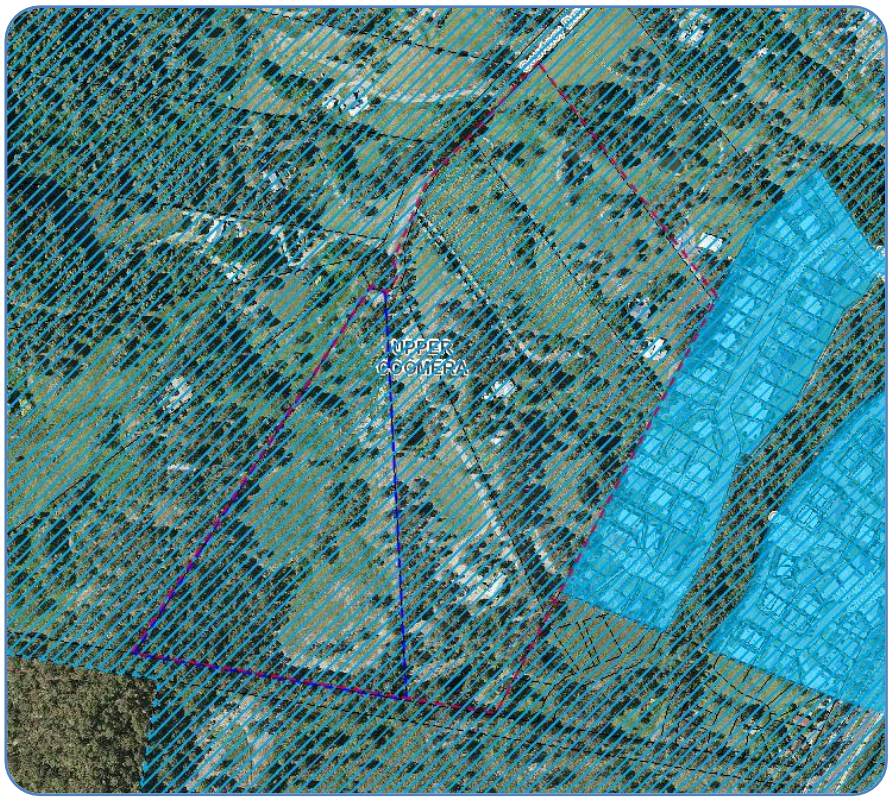
Figure 5.13 identifies the location of current and future sewerage connection areas in relation to the subject site. The site is not mapped as being within the ultimate or existing sewerage connection area. As described earlier, bulk earthworks to reduce the RL to 60 m will be undertaken to enable sewerage connection to the development.

Figure 5.13 Sewerage connection

5.15.1 Potable water connection

The City of Gold Coast planning scheme identifies the location of current and future potable water networks within the city.

Figure 5.14 identifies the location of current and future potable water connection areas in relation to the subject site. The site is not mapped as being within the ultimate potable water connection area. However, as described earlier, bulk earthworks to reduce the RL to 60 m will be undertaken to enable potable water connection to the development.



LEGEND:

Ultimate potable water connection area

Existing potable water connection area

Figure 5.14 Potable Water Supply Network

6 Open Space Dedication and Design Description

The total open space proposed will have an area of approximately 42,645 m^2. Three categories of open space are proposed, each with differing functions and opportunities.

A summary of each of the open space categories that are applicable to the proposed development is provided below and discussed in further detail in the following sections.

6.1 Open Space Category 1 – Utility Reserve

Utility reserves are defined by the CGC as parcels of land that do not provide any formalised terrestrial recreation function but may informally contribute to the City's park network.

Within the classification of Utility Reserves are four categories:

1. Utility reserve;
2. Drainage reserve;
3. Natural drainage reserve; and
4. Access linkage.

Two classifications of Utility Reserve are proposed for the subject site; Drainage and Natural Drainage Reserve.

6.1.1 Drainage Reserve

A waterway/drainage reserve is defined as land associated with waterways, creeks, drainage lines and stormwater infrastructure. These types of parks are usually maintained as a natural area. They are part of the stormwater network where the primary purpose is water flow and drainage. Drainage Reserves may have footpath connections or other recreational embellishments but the development or potential of the park for recreational use is encumbered due to the presence of the drainage, the stormwater device or to the wetness of the area. Drainage reserves occupy an area of 16,815 m^2.

6.1.2 Natural Drainage Reserve

The primary purpose is natural drainage and may buffer waterways which serve to support water quality. These parks may contain recreational connections and may also provide some local scale wildlife corridor values and urban/suburban amenity.

The total area of natural drainage reserves within the proposed development is 8,128 m^2. Yaun Creek and associated buffers as well as the waterway in the south-east corner, will form the natural drainage reserves. These areas will be rehabilitated to provide regional riparian fauna linkages. Drainage reserves will contribute to the site's passive recreational opportunities and scenic amenity.

6.2 Open Space Category 2 – Open Space Parks

The CGC defines recreation parks as open space areas that positively contribute to the Recreation Facilities Network.

Within the classification of Recreation Parks are five categories:

1. Local parks;
2. District parks;
3. City parks;
4. Open space linkage;
5. Amenity space; and
6. Water body.

Recreation areas of the open space network within the proposed development fall into the Local Park classification.

6.2.1 Local Recreation Parks

Local parks generally serve the needs of the immediate neighborhood (within 400 m or 5 minutes' walk) by providing limited recreational opportunities, and catering for short visits only. Most local parks will be used for informal social activities and informal sporting activities. Typical facilities include shaded seating areas, open space areas for 'kick and play' and shaded pathway connectivity throughout the park.

The open space provisions of the City Plan require a minimum of 20 m^2 of land per dwelling dedicated to recreation. Specific to this development, 6,300 m^2 of recreation parks are required. The total area of the recreation park in the proposed development is 3,563 m^2.

The function of the recreation parks in the context of this development is to:

- Provide passive recreational opportunities for the community; and
- Provide an outdoor area to gather and socialize.

The shortfall in recreation park area is augmented through the provision of environmental reserves which will also provide passive recreation opportunities for the community.

6.3 Open Space Category 3 – Conservation Estate (Environmental Reserve)

Conservation Estate is defined by the CGC as 'areas of land, predominantly with native vegetation cover, managed principally for nature conservation purposes'. The Conservation Estate is broken down into four categories.

1. Conservation area;
2. Environmental reserve;
3. Bushland reserve; and
4. General reserve.

Areas of high ecological significance on the subject site fall into the Environmental Reserve classification and will be managed for conservation.

The total area of proposed environmental reserve is 22,267 m^2 (which includes the natural drainage reserves). The function of the environmental reserve is to:

- Provide a continued ecological conservation corridor;
- Provide nature observation and passive recreation opportunities;

- Retain vegetation and ecosystems of ecological significance, particularly, Koala and riparian habitat; and
- Provide a level of protection for existing natural value and habitat for flora and fauna.

7 Open Space Assessment

For each open space area, an assessment regarding its purpose and management has been made. A Statement of Landscape Intent has been prepared by Zone Planning and presents the design concepts for each of the open space areas (Appendix B). Extracts from the Statement of Landscape Intent have been used to illustrate the open space design.

7.1 Open Space Category 1 – Utility Reserve (Drainage Reserve)

Six separate drainage reserves are proposed for the development. In total, they occupy an area of 16,815 m^2. They incorporate existing overland flow paths or drainage channels and associated dams created originally for livestock watering (refer to Figure 3.1).

7.1.1 Drainage Reserve 1

Size, Shape and Location

Drainage Reserve 1 is roughly triangular and is in the south-eastern corner of the proposed development. The total area of the reserve is 1,844 m^2 (Figure 7.1).

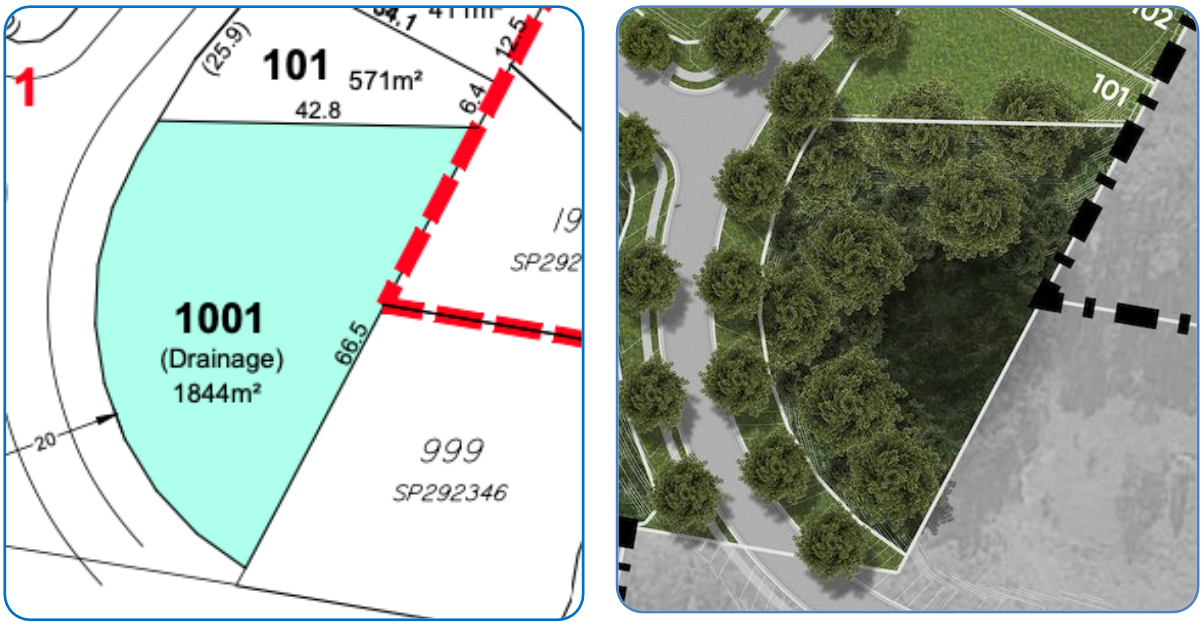


Figure 7.1 Drainage Reserve 1

Function and Connectivity

The drainage reserve will include a stormwater treatment and detention basin. This reserve will maintain connectivity to bushland and to the storm water conveyance waterway within the residential development located to the immediate east. Wildlife movement corridors between this drainage reserve and the open space areas to the west will be maintained via a fauna underpass.

A Statement of Landscape Intent has been prepared by Zone Planning which details landscaping of this drainage reserve. The Statement of Rehabilitation Intent prepared by Biome Consulting provides a concept design for the fauna underpass.

Access

Pedestrian access to Drainage Reserve 1 will be from the internal road network and pedestrian walkway. Maintenance access will be via the road frontage.

7.1.2 Drainage Reserve 2

Size, Shape and Location

Drainage Reserve 2 is approximately rectangular in shape and located to the west of Drainage Reserve 1 in the south-eastern corner of the site. The total area of the reserve is 785 m^2.

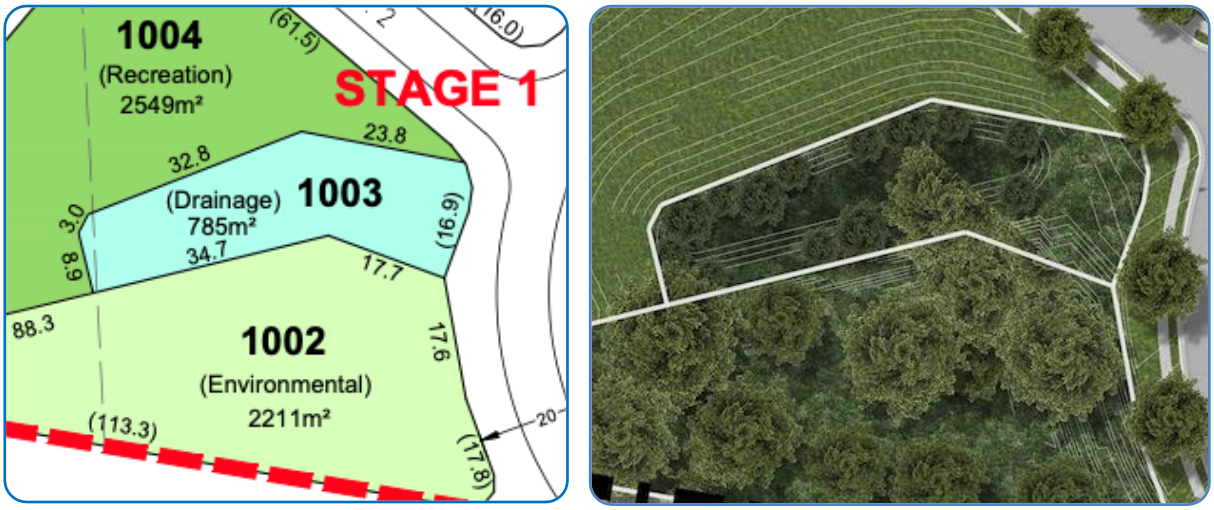


Figure 7.2 Drainage Reserve 2

Function and Connectivity

The drainage reserve will include a stormwater treatment and detention basin. This reserve will be directly connected to the environmental reserve to the south and recreation reserve to the north. Wildlife movement corridors between this drainage reserve and Drainage Reserve 1 will be maintained via a fauna underpass.

A Statement of Landscape Intent has been prepared by Zone Planning which details landscaping of this drainage reserve. The Statement of Rehabilitation Intent prepared by Biome Consulting provides a concept design for the fauna underpass.

Access

Pedestrian access to Drainage Reserve 2 will be from the internal road network and pedestrian walkway. Maintenance access will be via the road frontage.

7.1.3 Drainage Reserve 3

Size, Shape and Location

Drainage Reserve 3 is roughly triangular and is located at the south of the Mackellar Drive entrance on the eastern side of the proposed development. The total area of the reserve is 3,456 m^2 (Figure 7.3).

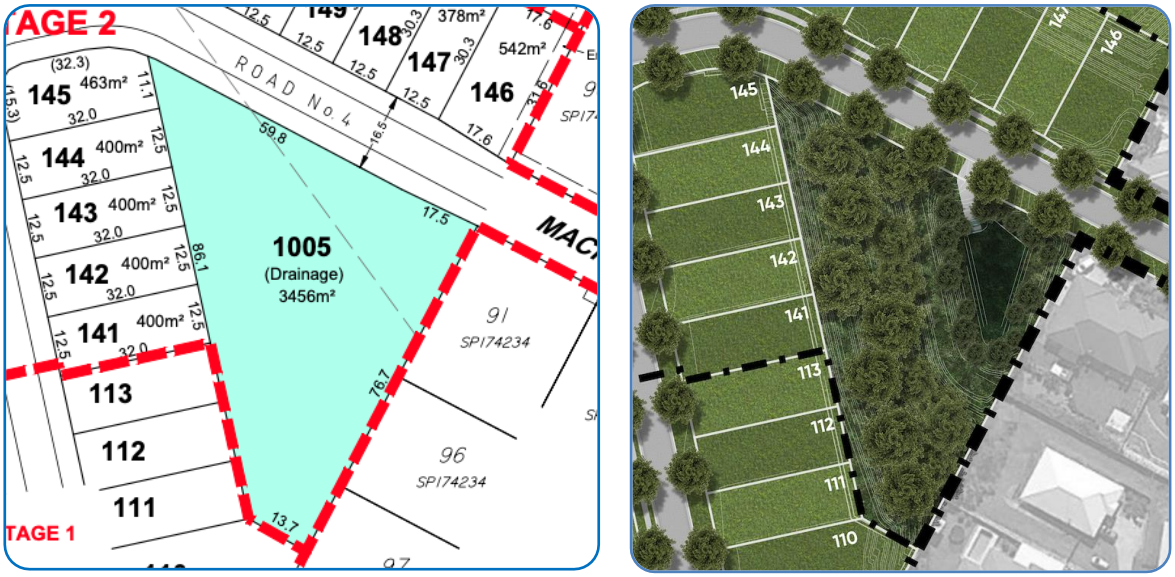


Figure 7.3 Drainage Reserve 3

Function and Connectivity

The primary function of Drainage Reserve 3 is stormwater treatment and detention. It will provide informal, passive recreation opportunities, although the space will be dominated by a bioretention basin.

This location will not have any habitat or drainage linkages to retained bushland given its location adjacent to an established development and planned residential housing.

A Statement of Landscape Intent has been prepared by Zone Planning.

Access

Pedestrian access to Drainage Reserve 3 will be from the internal road network and footpath located to the north. Maintenance access will be via the road frontage.

7.1.4 Drainage Reserve 4

Size, Shape and Location

Drainage Reserve 3 is L-shaped and is located on the western side of the proposed development and directly adjoins Drainage Reserve 5, located to the north. A fabricated waterway flows into this drainage reserve from the south. The total area of the reserve is 7,341 m^2 (Figure 7.4).

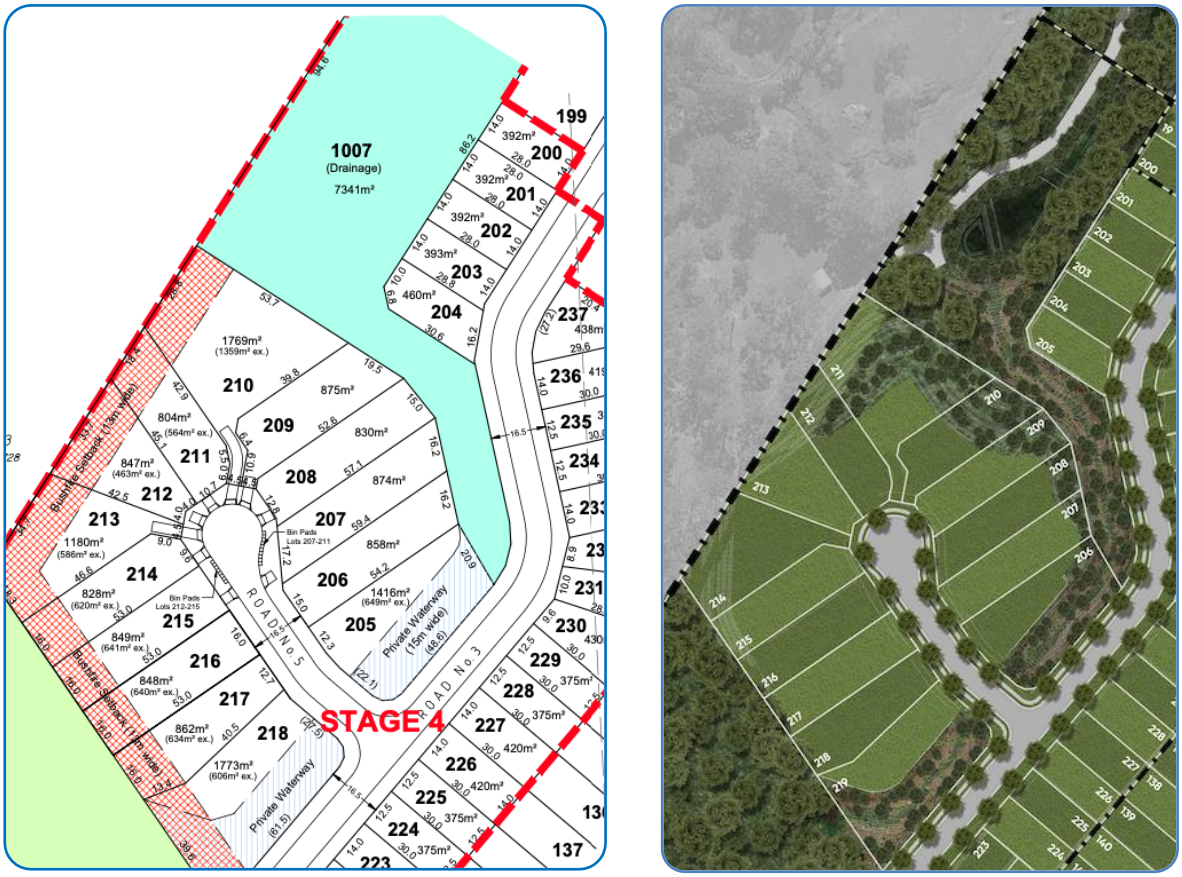


Figure 7.4 Drainage Reserve 4

Function and Connectivity

The primary function of Drainage Reserve 4 is for stormwater treatment and detention along with conveyance of upstream catchment flows. It will provide informal, passive recreation opportunities, although the space will be dominated by a detention basin.

This reserve will provide a welcoming area of green space to one of the major access points to the development. It will maintain connectivity to adjacent residential rural allotments.

A Statement of Landscape Intent has been prepared by Zone Planning.

Access

Pedestrian access to Drainage Reserve 4 will be from the internal road network and footpath to the east. Residential blocks 200-210 back onto this reserve.

Maintenance access will be via the road frontage.

7.1.5 Drainage Reserve 5

Size, Shape and Location

Drainage Reserve 5 is located to the immediate north of Drainage Reserve 4. It is rectangular in shape and has direct connectivity to Courtney Drive (Figure 7.5). The total area of this reserve is 3,389 m^2.

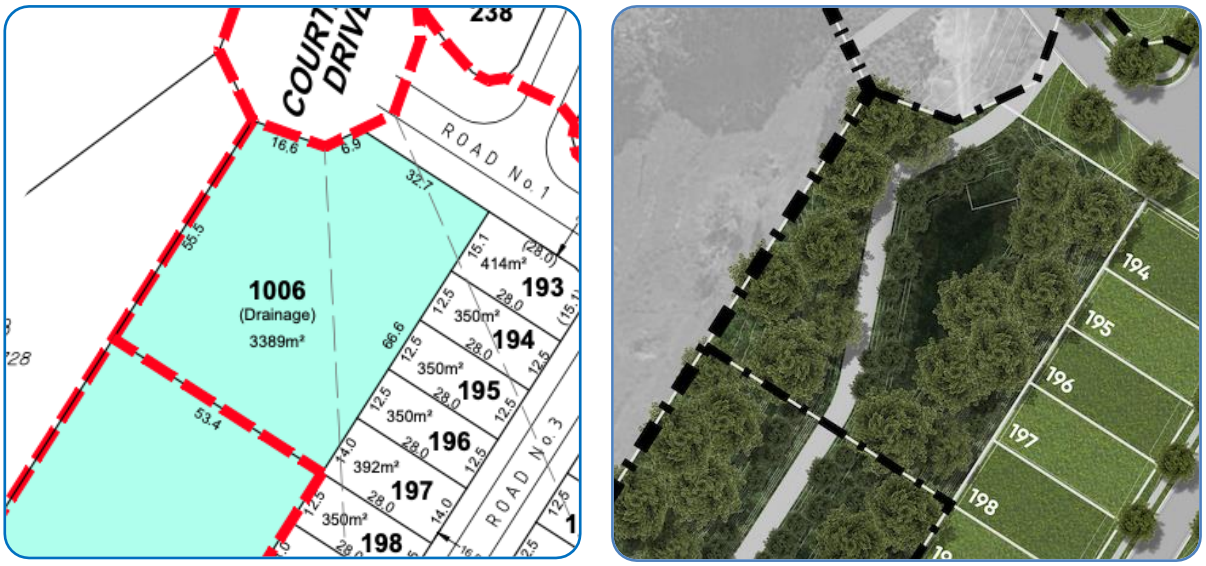


Figure 7.5 Drainage Reserve 5

Function and Connectivity

The primary function of Drainage Reserve 5 is for stormwater treatment and detention along with conveyance of upstream catchment flows. It will provide informal, passive recreation opportunities, although the space will be dominated by a detention basin.

This reserve will provide a welcoming area of green space to one of the major access points to the development. It will maintain connectivity to adjacent residential rural allotments.

A Statement of Landscape Intent has been prepared by Zone Planning.

Access

Pedestrian access to Drainage Reserve 5 will be from the internal road network and footpath to the north. Residential blocks 139-197 back onto this reserve.

Maintenance access will be via the road frontage.

7.1.6 Drainage Reserve 6

Size, Shape and Location

Drainage Reserve 4 is approximately rectangular in shape and is in the north of the proposed development. It is directly connected to the Yaun Creek Natural Drainage Reserve to the north and the recreation park to the immediate west. The total area of the drainage reserve is 3,294 m^2 (Figure 7.6).

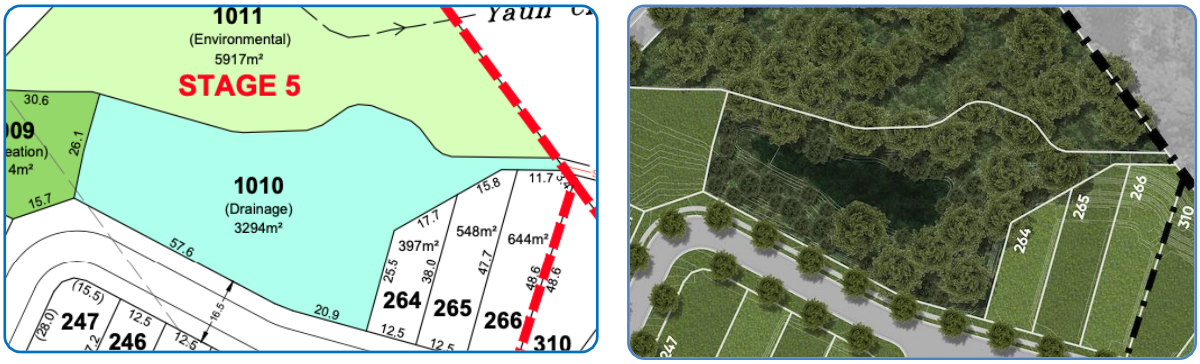


Figure 7.6 Drainage Reserve 6

Function and Connectivity

The primary function of Drainage Reserve 6 is stormwater treatment and detention. It will provide informal, passive recreation opportunities, although the space will be dominated by a bio-retention basin.

Drainage Reserve 4 will be directly connected to Natural Drainage Reserve to the immediate north and the recreation park to the west. The location of this drainage reserve will effectively increase the buffer to Yaun Creek.

A Statement of Landscape Intent has been prepared by Zone Planning.

Access

Pedestrian access to Drainage Reserve 5 will be from the internal road network. Residential allotments 264-266 back onto this reserve.

Maintenance access will be via the road frontage.

7.1.7 Drainage Reserve Embellishments

Signage will be erected at the main access point to the drainage reserves. No picnic or play nodes are planned for any of the drainage reserves. A Statement of Landscape Intent has been prepared by Zone Planning which provides details of the fencing and street front access control for each of the drainage reserves (Appendix B). At the boundary of the residential allotments and the drainage reserves, 50% transparent POS interface is proposed. Along the road frontage, standard council bollards placed 1.5 m apart are to be installed.

7.1.8 Landscape Design

The landscape design for the drainage reserves will incorporate native, endemic species suitable for drainage and detention areas. The planting palate will not obstruct the line of sight for park users and will increase the scenic amenity of the development. A Statement of Landscape Intent has been prepared by Zone Planning and provides a suitable planting palette.

7.1.9 Safety

All drainage reserves will be planned and designed in accordance with Crime Prevention through Environmental Design (CPTED) principles. This will increase people's comfort levels as they will feel and be safer. CPTED principles include landscaping to provide clear sight lines

across the open space and to potential hazards (such as standing water) to increase the capacity for passive and active surveillance.

7.1.10 Bushfire Hazard Management

Sections of the proposed development site have been identified as having a medium to high bushfire hazard rating. Mitigation of bushfire hazards is detailed in the Bushfire Management Plan.

7.1.11 Environmental Impact and Protection

All the planned drainage reserves are located within areas where existing waterways or dams are present. The environmental impacts associated with creating drainage reserves is therefore considered negligible.

The rehabilitation of drainage reserves to remove weeds and establish plants to assist in storm water treatment will serve to enhance their ecological values.

7.1.12 Maintenance

In accordance with the City's *Planning Scheme Policy: Land Development Guidelines* and notwithstanding normal cadastral survey requirements, 1.5 m marker posts shall be located adjacent to each corner peg of dedicated Public Open Space areas. The purpose of these marker posts is to reduce fencing errors and to better define the City's maintenance responsibility.

The parks will be maintained regularly (e.g. mowing and weed management) and landscaped in accordance with the Statement of Landscape Intent. The drainage reserves will be maintained by the developers for a yet-to-be specified establishment and maintenance period. This will be further defined in the Open Space Management Plan (to be prepared in the operational phase of the development).

7.1.13 Ownership

Ownership will be transferred to the City of Gold Coast upon the completion of the maintenance period.

7.2 Open Space Category 1 – Utility Reserve (Natural Drainage Reserve)

The Natural Drainage Reserves detailed in the following sections will become part of the environmental reserve once rehabilitation has been established and managed for conservation.

7.2.1 Natural Drainage Reserve 1 – Yaun Creek

Size, Shape and Location

The total area of the Natural Drainage Reserve 1 is 5,917 m^2. It is triangular and located in the northern-most corner of the proposed development (Figure 7.7). The Natural Drainage Reserve incorporates buffers to Yaun Creek which will be extensively rehabilitated.

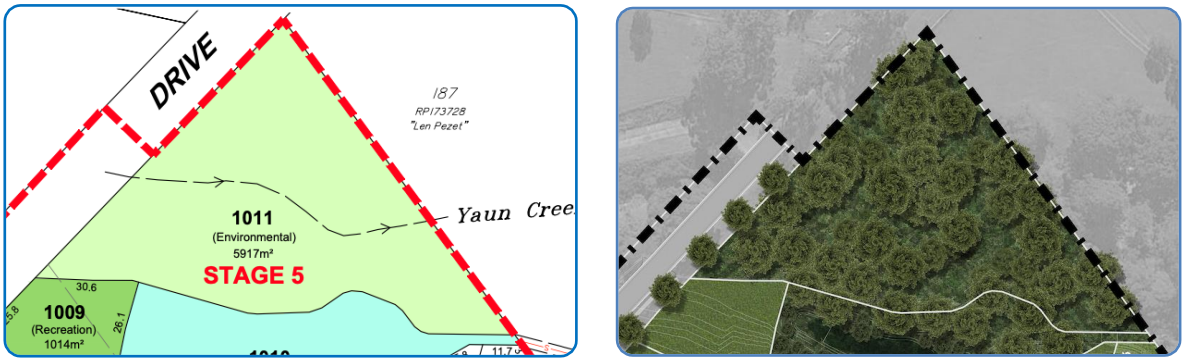


Figure 7.7 Natural Drainage Reserve 1

Function and Connectivity

The Natural Drainage Reserve serves as a buffer to Yaun Creek, which is currently in a degraded state due to bank erosion resulting from a lack of riparian vegetation and unrestricted livestock access. When rehabilitated, it will provide passive recreation and nature observation opportunities while enhancing its ecological function. The rehabilitation of this waterway will provide valuable linkages along Yaun Creek and facilitate fauna movement. A Statement of Rehabilitation Intent has been prepared to support this development application and set out the rehabilitation approach. The rehabilitation of this reserve will increase riparian connectivity along Yaun Creek external to the development.

This reserve is directly connected to Drainage Reserve 6 and a recreation reserve, located to the south. As the drainage reserve and recreation park will be planted with endemic trees, this will effectively provide a total corridor width of greater than 60 m to Yaun Creek.

Access

Pedestrian and maintenance access are provided via Courtney Drive. A 1.2 m wide concrete path will form the southern boundary of this reserve.

7.2.2 Natural Drainage Reserve 2

Size, Shape and Location

The total area of the Natural Drainage Reserve 2 is 2,211 m^2. It is triangular and located in the south-eastern corner of the proposed development (Figure 7.8). This Natural Drainage Reserve incorporates buffers to a waterway which will be extensively rehabilitated to enable wildlife movement corridors to be maintained.

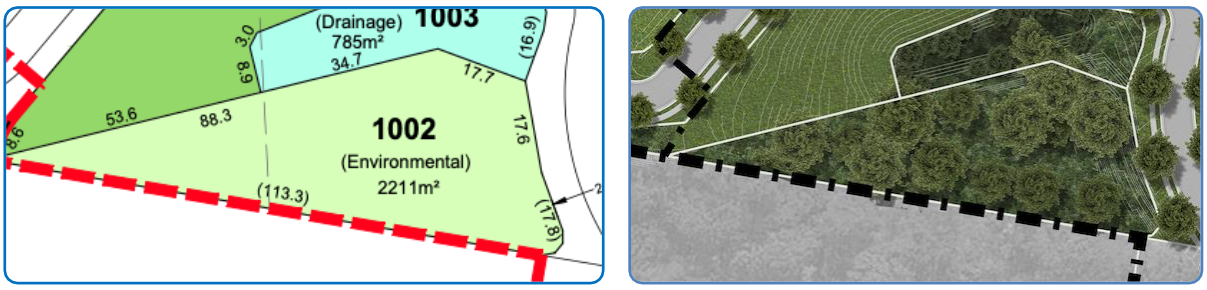


Figure 7.8 Natural Drainage Reserve 2

Function and Connectivity

The Natural Drainage Reserve 2 serves as a buffer to a waterway, which is currently in a degraded state. When rehabilitated, it will provide passive recreation and nature observation opportunities while enhancing its ecological function. The rehabilitation of this waterway will provide valuable linkages to the drainage reserve and bushland to the east. Wildlife movement will be facilitated by the construction of a fauna underpass.

A Statement of Rehabilitation Intent has been prepared to support this development application and set out the rehabilitation approach. A concept design of the fauna underpass is also presented in this document.

This reserve is directly connected to Drainage Reserve 2 and a recreation reserve, located to the north. As the drainage reserve and recreation park will be planted with endemic trees, this will effectively increase the buffer to the waterway.

Access

Pedestrian and maintenance access are provided via the internal road network.

7.2.3 Natural Drainage Reserve Embellishments

No embellishments for the natural drainage reserves are planned, as its primary intent is to buffer the waterways.

7.2.4 Landscape Design

Landscaping will focus on recreating pre-clearing communities within the waterway buffers. A Statement of Rehabilitation Intent has been prepared which sets out the rehabilitation approach for the open space network. This has been provided as Appendix A of this report. A Rehabilitation Management Plan will be prepared to guide the detailed rehabilitation and on-going maintenance of this reserve during the operation phase of the development.

7.2.5 Safety

Egress/access points have been incorporated into the design along Courtney Drive and the internal road network, to allow multiple escape routes if people are in a position of danger.

7.2.6 Bushfire Hazard Management

Sections of the proposed development site have been identified as having a medium to high bushfire hazard rating. Mitigation of bushfire hazards is detailed in the Bushfire Management Plan.

7.2.7 Maintenance

A maintenance regime, including weed management, will be specified within the Rehabilitation Management Plan (to be prepared during the operational phase of the development).

All the natural drainage reserves will be maintained by the developers for a yet-to-be specified establishment and maintenance period. This will be further defined in the Rehabilitation Management Plan and the Open Space Management Plan (to be prepared in the operational phase of the development). Once rehabilitation of the waterways has been established, they will become part of the environmental reserve open space and managed for conservation.

7.2.8 Environmental Impact and Protection

The natural drainage reserves are located along existing waterways. The environmental impacts associated with creating these drainage reserves is therefore considered negligible.

The rehabilitation of these reserves to reflect pre-clearing ecosystems will serve to enhance its ecological values. Rehabilitation is expected to decrease erosion by stabilizing stream banks and slow overland inflows.

7.2.9 Ownership

Ownership will be transferred to the CGC at the end of the maintenance phase, which will be specified in the Rehabilitation Management Plan.

7.3 Open Space Category 2 – Open Space Parks (Local Recreation Park)

Two recreation parks are proposed for the development. Both have direct connectivity to other open space areas.

7.3.1 Local Recreation Park 1

Size, Shape and Location

The larger of the two recreation parks is in the south-eastern corner of the site and has a total area of 2,549 m^2. It is roughly triangular (Figure 7.9).

Function and Connectivity

The Recreation Park 1 will cater for informal social and play activities. It is located within 400 m of approximately 75% of the proposed residences. The Recreation Park is linked to the residential dwellings by a pedestrian footpath network. Natural Drainage Reserve 2 and Drainage Reserve 2 have direct connectivity to this recreation park.

A Statement of Landscape Intent has been prepared by Zone Planning which shows the landscape intent for the recreation park (Appendix B).

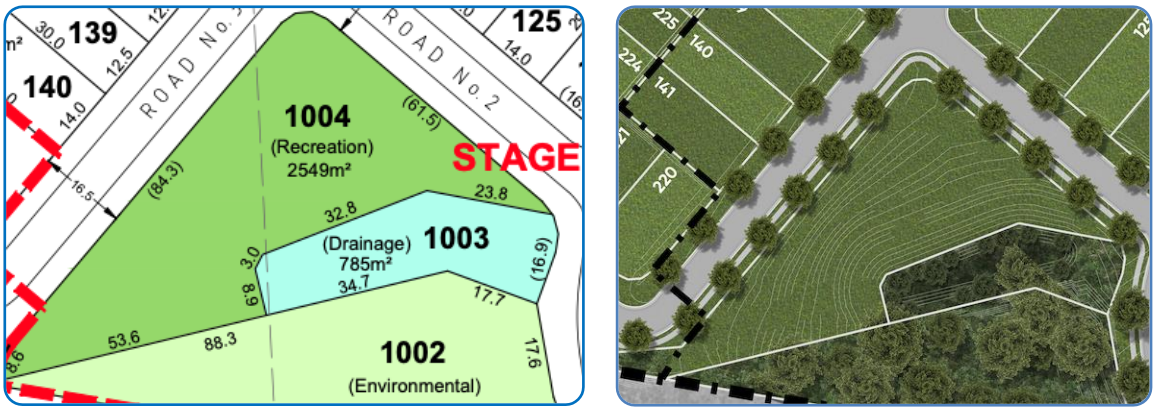


Figure 7.9 Recreation Park 1

Access

Pedestrian access is via footpaths along the western, northern and eastern boundaries. Maintenance access will be via the internal road network.

Recreation Reserve 1 Embellishments

Bollards along street frontages will be erected to prevent accidental or intentional vehicle access to the Recreation Parks.

An informal kick about space is to be provided within the recreation park. A shaded playground is also proposed in the northern sector of the park. It will feature a climbing structure and swing set. Seating will also be installed.

This recreation reserve has direct connectivity to other open space areas which will provide for passive recreation opportunities and nature observation.

7.3.2 Local Recreation Park 2

Size, Shape and Location

The total area of Recreation Park 2 is 1,014 m^2. This park has a rectangular shape and directly adjoins the Natural Drainage Reserve 1 (located to the north) and Drainage Reserve 6 (Figure 7.10).

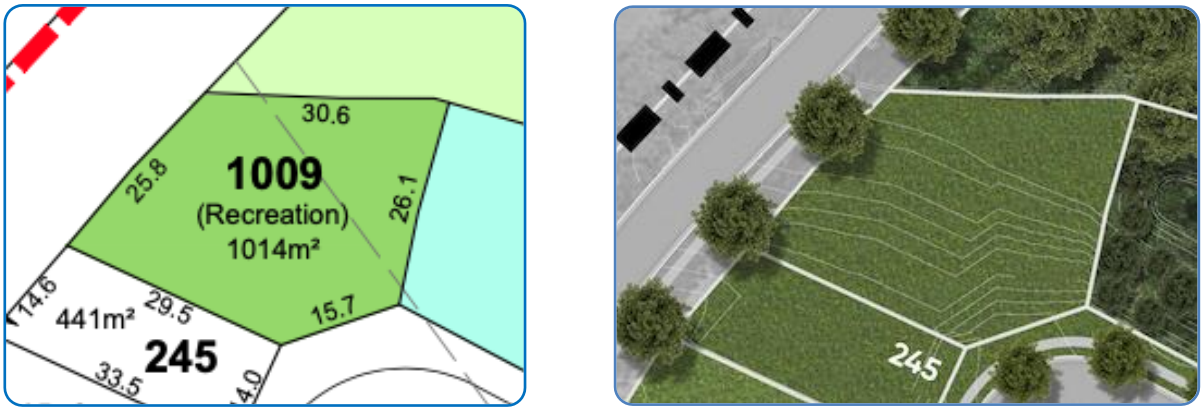


Figure 7.10 Recreation Park 2

Function and Connectivity

Recreation Park 2 will provide a kick and play area. This parks' direct connectivity with the drainage reserves will effectively increase the buffer to Yaun Creek.

This recreation park is linked to residential dwellings by a network of footpaths and is accessed via the internal road network. Allotment 245 back onto this reserve.

Recreation Reserve 2 Embellishments

Bollards along street frontages will be erected to prevent accidental or intentional vehicle access to the Recreation Parks. At the boundary of the park and the residential allotment, a 50% transparent POS interface is proposed.

An informal kick about space is to be provided within the recreation park. This recreation reserve has direct connectivity to other open space areas which will provide for passive recreation opportunities and nature observation.

7.3.3 Landscape Design

Landscaping will consist of endemic species that will enable unimpeded vision through the parks, while providing shaded spots. Ground cover will consist of maintained lawn. A Statement of Landscape Intent has been prepared (Appendix B).

7.3.4 Safety

The Recreation Parks will be planned and designed in accordance with Crime Prevention through Environmental Design (CPTED) principles. This will increase people's comfort levels as they will feel and be safer. CPTED principles include landscaping to provide clear sight lines across the open space and to potential hazards (such as roadways) to increase the capacity for passive and active surveillance.

7.3.5 Bushfire Hazard Management

Sections of the proposed development site have been identified as having a medium to high bushfire hazard rating. Bushfire hazard mitigation has been detailed in the Bushfire Management Plan.

7.3.6 Maintenance

Regular mowing and weed management will be conducted. A maintenance schedule will be formulated in the planned Open Space Management Plan (to be prepared during the operational phase of the development).

7.3.7 Environmental Impact and Protection

The Recreation Parks will be created within areas currently cleared of vegetation. The environmental impacts associated with creating these parks is therefore considered negligible.

7.3.8 Ownership

The Recreation Park will be maintained by the developer until the end of the establishment period (to be defined in the Open Space Management Plan). Ownership will be transferred to the CGC at the end of the establishment period.

7.4 Open Space Category 3 – Conservation Estate (Environmental Reserve)

In addition to the environmental reserve in the south-western corner of the site, the natural drainage reserves will be managed for conservation and become part of the environmental open space upon completion of rehabilitation.

7.4.1 Size, Shape and Location

The total area of the open space linkage is 14,139 m^2. It is roughly triangular and protects areas of ecological significance, as identified in the Ecological Assessment. It is situated in the south-western corner of the proposed development (Figure 7.11).

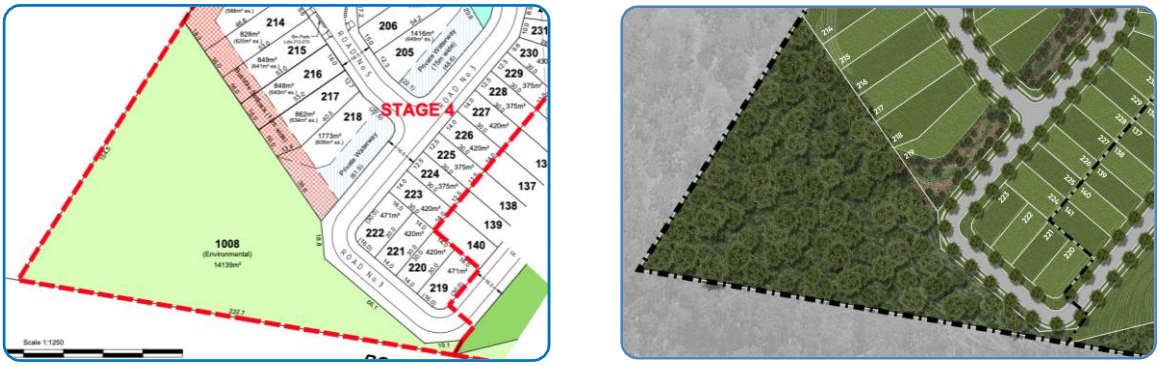


Figure 7.11 Environmental Reserve

7.4.2 Function and Connectivity

The primary function of the Environmental Reserve is to protect an area of ecological significance and associated fauna and flora habitat. This area is mapped as containing regulated vegetation and habitat of Koala. The Environmental Reserve will also provide passive recreational opportunities and nature observation, although no formal walking paths or facilities are planned.

The Environmental Reserve will enable connectivity with existing vegetation to the south to be maintained. Connectivity to bushland to the east from the environmental reserve is maintained through the drainage reserve 1 and natural drainage reserve 2.

The ecological assessment identified some areas of degradation through weed incursion in this reserve. The rehabilitation of this area is detailed in the Statement of Rehabilitation Intent (Appendix A).

7.4.3 Access

Access to this area will not be encouraged by providing formal pathways, however, access will be via the internal road network or the road reserve located to the south.

7.4.4 Embellishments

No embellishments for this Environmental Reserve are planned.

7.4.5 Landscape Design

Landscaping will be minimal in this area and primarily consist of rehabilitation of degraded areas. A Rehabilitation Management Plan will be prepared to guide and inform the rehabilitation and restoration process. This Rehabilitation Management Plan will be informed by the Statement of Rehabilitation Intent (Appendix A). In areas where restoration is required, the planting palette will reflect the pre-clearing ecosystems.

7.4.6 Safety

To protect the natural features of the Environmental Reserve, no formal infrastructure will be created. The creation of this reserve provides an opportunity for promoting environmental awareness. Nonetheless, public safety and wellbeing is of paramount importance and where feasible, CPTED principles will be incorporated into the design of the Environmental Reserve.

7.4.7 Bushfire Hazard Management

Sections of the proposed development site have been identified as having a medium to high bushfire hazard rating. Bushfire hazard mitigation has been detailed in the Bushfire Management Plan.

7.4.8 Maintenance

On-going weed control will be necessary in the Environmental Reserve. Rehabilitation of the degraded areas will enhance the ecological values of this open space. A Rehabilitation Management Plan will be prepared to guide and inform the rehabilitation and restoration process during the operation phase of the development. Maintenance schedules and duration of establishment and maintenance periods will be defined in the Rehabilitation Management Plan.

7.4.9 Environmental Impact and Protection

The Environmental Reserve is in an area of ecological significance and is designed to conserve these features. The environmental impacts associated with creating this reserve is therefore considered negligible. The Environmental Reserve is designed so that its natural features will not be adversely impacted upon or damaged by visitors, thus destroying all or some of the fundamental features of the reserve.

The rehabilitation of this reserve to reflect pre-clearing ecosystems will serve to enhance its ecological values.

7.4.10 Ownership

The ownership of the conservation area will be transferred to the CGC following the establishment period of the rehabilitated areas. During the establishment period, maintenance will be the responsibility of the developer. Once ownership has been transferred to the CGC, the City will be responsible for on-going maintenance. The dedication of this area to the CGC will allow it to be conserved in perpetuity.

8 Open Space Design

The design elements of public open space areas have been depicted within the Landscape Intent Statement prepared by Zone Planning.

As described earlier, a Statement of Rehabilitation Intent has been prepared to define the areas that will fall within the rehabilitation areas of the development (Appendix A).

8.1 Breakdown of Open Space Areas

Table 8.1 summarises the areas of public open space planned in the proposed residential development.

Trunk infrastructure is defined by the Queensland Department of Infrastructure, Local Government and Planning as that shared between multiple developments. Non-trunk infrastructure is not shared between developments and is generally internal to a development site.

Table 8.1 Breakdown of Open Space Areas

Open Space Type	Area (m^2)	Local Government Infrastructure Plan Use
Drainage Reserves (including detention areas and flood affected areas)	16,815	Non-trunk infrastructure
Natural Drainage Reserve (including buffer areas)	8,128	Non-trunk infrastructure
Recreation Parks	3,563	Non-trunk infrastructure
Environmental Reserve	14,139	Non-trunk infrastructure

A total area of 42,645 m^2 of non-trunk infrastructure will be created within the proposed development.

9 Code and Development Compliance

This section references the relevant Development and Constraint Codes contained within the City Plan and how each has been addressed within the development design.

Table 9.1 Compliance Table

Performance Outcomes	Acceptable Outcomes	Compliance with Code
DEVELOPMENT CODES		
9.4.6 Landscape Work Code		
Public Open Space Areas		
PO10 **Landscape works in public open space areas (including open space dedicated as an open space contribution) must be designed to be appropriate to their function and location by:** • **utilising suitable land for its intended purpose;** • **incorporating, complementing and enhancing existing vegetation and ecological systems;** • **enhancing the visual amenity of local area and contributing to the amenity of the region;** • **providing an inclusive and sustainable community resource; and** • **reinforcing and enhancing hydraulic or drainage regimes on the site and within the adjacent surrounding areas.**	**AO10** No acceptable outcome provided.	Complies with PO10 A Statement of Landscape Intent has been prepared to support the development application. The Statement of Landscape Intent identifies the areas to the landscaped and includes a planting palette that will enhance existing vegetation communities and enhance visual amenity and drainage regimes.
PO11 **Landscape works in public open space areas (including open space dedicated as an open space contribution) are appropriately managed during the construction and subsequent maintenance phases.**	**AO11** An Open Space Management Plan prepared in accordance with SC6.10 City Plan policy – Landscape work is submitted where the site includes one or more of the following: 1. threatened flora or habitat for threatened fauna under the *Nature Conservation Act 1992*;	Will comply with AO11 via conditions An Open Space Management Plan will be prepared to support the construction phase of the development and accompany an operational works application. It will be prepared in accordance with SC6.10.

Performance Outcomes	Acceptable Outcomes	Compliance with Code
	2. assessable vegetation; 3. includes retention of matters of environmental significance; 4. includes extensive areas of replanting and large rehabilitation areas; 5. includes wetlands, watercourses and other drainage corridors; 6. requires storage of materials on-site during construction; 7. forms part of a wider open space system; 8. may be subject to sediment deposition or erosion; 9. includes fauna habitats that require protection or expansion, including habitat features; 10. includes areas of land subject to the Bushfire hazard overlay map; 11. incorporates significant public facilities or spaces likely to attract high visitation and use; or 12. incorporates treatment to the banks of wetlands, watercourses or edges of other water bodies and other drainage corridors. **Note: Where an Open Space Management Statement has been endorsed through an earlier approval, the Open Space Management Plan should be in accordance with that approval.**	The site contains assessable vegetation, threatened fauna habitat and watercourse/drainage channels requiring rehabilitation.
PO12 **Landscape work is designed and constructed to achieve a reasonable and practicable response to all public risk – duty of care issues.**	**AO12** The design and construction of Landscape work in public open space areas is consistent with all relevant Australian standards or other international landscape standards where a standard is not available in Australia or New Zealand for the specific work item or practice.	Will comply with AO12 via conditions All landscape work in public open space areas will be consistent with all relevant Australian standards and industry best practice.
9.4.8 Reconfiguring a Lot Code		

Performance Outcomes	Acceptable Outcomes	Compliance with Code
Open Space Provision		
PO20 A public open space network is provided which: 1. has a range of recreation settings and adequate facilities to meet the needs of the community; 2. offers opportunities for residents to conveniently participate in passive recreational activities; 3. delivers well distributed public open space that contributes to the legibility, accessibility, safety, and character of the development; 4. creates safe and attractive settings and focal points; 5. facilitates casual surveillance from adjacent streets and land uses and provides for open space areas with public road frontages; 6. delivers for stormwater and flood management and care of valuable environmental resources; and 7. is cost effective to maintain.	**AO20.1** Land intended for public open space is of a physical standard and condition in accordance with the SC6.9 City Plan policy – Land development guidelines. **AO20.2** **For trunk recreational open space** Recreation and sporting parklands and land for community facilities are designed and provided in accordance with the Local government infrastructure plan and approved Council master plans. **OR** Public open space is provided in accordance with an already approved open space strategy, relevant approved material change of use, adopted concept plan, master plan or structure plan. **AO20.3** **For non-trunk recreational open space** Residential subdivisions creating more than 100 lots provide a minimum of 20m^2 of land per dwelling, for open space that is: 1. within 400m walking distance of all residential lots; and 2. designed to adequately meet the recreational needs of users.	Will comply with AO20.1 via conditions All land intended for public open space will be rehabilitated to standards and conditions in accordance with SC6.9. Complies with AO20.2 Recreational open space is designed in accordance with the Local government infrastructure plan. The designated recreation parks are within 400 m of all the residential community within the proposed development. The network of footpaths enables the recreation park to be accessed within a 5-minute walk by all residences. Public open spaces that provide passive recreational opportunities are easily accessible to all within this residential community. Alternative solution to AO20.3 The proposed development will create 315 blocks (one dwelling per block). A minimum of 6,300 m^2 of non-trunk recreational open space is therefore required. The development will create a total of 3,563 m^2 of dedicated recreation park, which is supplemented by 22,267 m^2 of environmental reserve open space. All non-trunk open space is within 400 m walking distance of all residential lots. The variety of public open space areas and the network of pedestrian footpaths will meet the recreational needs of all users within the residential community.

Performance Outcomes	Acceptable Outcomes	Compliance with Code
PO21 The design and location of open space results in high-quality parkland which: 1. enables the retention and protection of matters of environmental significance, their associated buffers, assessable vegetation, habitat features and natural cultural features; 2. contributes to the visual amenity of the area and facilitates casual surveillance; 3. can be easily accessed along road frontages; 4. directly adjoins existing or proposed open space areas; and 5. creates opportunities for linkages between open space areas.	**AO21.1** Open space is provided adjacent to waterway buffers with roads servicing linear parkland and lots located on the opposite side of the road. **AO21.2** Open space for conservation purposes is consolidated with other conservation areas to allow for a connected movement corridor. **AO21.3** Recreational open space areas less than 5000m^2 directly adjoin existing or proposed recreational open space areas to provide: 1. a consolidated useable area; and 2. connectivity between open spaces.	Complies with PO21 High quality parkland has been created that protects areas of environmental significance, provides a buffer to waterways, contributes to visual amenity and creates open space linkages. Complies with AO21.1 All public open space has been designed to accommodate the waterway buffers. These areas will be rehabilitated to enhance the ecological values of the waterways and provide increased bank stability, reduce erosion and provide for wildlife movement corridors. Complies with AO21.2 The Environmental Reserves will conserve ecologically significant areas of the site and adjoin conservation estate located externally. This will allow for fauna movement to and from the site. Alternative solution to AO21.3 Site constraints such as steep slopes limit the amount of suitable recreational local park space. The internal walkways join recreation areas and additional open space within the development, providing consolidated areas.
Open Space Safety and Design		

Performance Outcomes	Acceptable Outcomes	Compliance with Code
PO22 Open space areas are designed and managed to promote user safety.	**AO22.1** Areas intended for use during times of darkness are lit in accordance with SC6.9 City Plan policy – Land development guidelines. **AO22.2** Casual surveillance is achieved by parks and open space being overlooked by housing, commercial or other development, as well as passing pedestrian and vehicle traffic. **AO22.3** Fencing greater than 1.2m in height adjoining a park is to be at least 50% transparent (i.e. swimming pool style or timber picket fencing) and any landscaping adjacent to the fence is to be designed to maximise the opportunity for casual surveillance.	AO22.1 Not applicable No areas are intended for use during the evening. Complies with AO22.2 Residential housing overlooks all public open space areas. The positioning of the roadways and footpaths also allows for casual surveillance from passing vehicle and pedestrian traffic. Will comply with AO22.3 via conditions Fencing and landscaping adjoin public open space areas will comply with that stipulated in AO22.3.
9.4.15 Works for Infrastructure Code		
Open space and recreational facilities design		
PO6 **Open-space areas and recreational facilities are designed and constructed to an appropriate standard, having regard to their intended recreational use and environmental values.**	**AO6** Open-space areas and recreation facilities are designed and constructed in accordance with the requirements of the relevant sections of SC6.9 City Plan policy – Land development guidelines	Complies with AO6 All public open space areas are designed in accordance with SC6.9. Will comply with AO6 via conditions All public open space areas will be constructed in accordance with the requirements of SC6.9.
OVERLAY CODES		
8.2.3 Bushfire Hazard Overlay Code		
Open space management plan		

Performance Outcomes	Acceptable Outcomes	Compliance with Code
PO8 **For areas to be dedicated to Council as open space, management strategies to mitigate bushfire risk must be identified.**	**AO8** The Bushfire management plan contains a separate section detailing management strategies for areas to be dedicated to Council that can be included within the Open space management plan.	Will comply with AO8 via conditions A Bushfire Management Plan will be prepared for the site. Strategies to mitigate bushfire risk to public open space areas will be identified in this plan.
8.2.6 Environmental Significance Overlay Code		
Tenure, ownership and management arrangements		
PO23 Matters of environmental significance and associated buffers, mapped areas as identified on the Environmental significance – vegetation management overlay map proposed for retention and areas requiring rehabilitation are suitably protected in perpetuity and will: 1. enable necessary fire management in accordance with an approved fire management plan and any adopted bushfire management plan; 2. allow unimpeded movement of native fauna through matters of environmental significance and associated buffers; 3. enable maintenance access and regular management; 4. enable auditing and reporting of maintenance and management activities; 5. provide for public access along major watercourses, where such access is consistent with the ecological functions; 6. allow for linkages and buffers to adjacent areas of ecological significance; and 7. allow for a coordinated approach to the management of adjacent areas of conservation estate.	**AO23** Matters of environmental significance and associated buffers, mapped areas as identified on the Environmental significance – vegetation management overlay map proposed for retention and areas requiring rehabilitation are transferred to Council ownership as Public Open Space. **OR** Where not required for public access, matters of environmental significance and associated buffers, and mapped areas as identified on the Environmental significance – vegetation management overlay map proposed for retention and areas requiring rehabilitation are retained in private ownership and protected under a statutory covenant (under the *Land Title Act 1994*). **Note: Where the area is adjacent to existing public open space, or is a buffer to a major waterway, Council's preference is for the land to be dedicated as Public Open Space.**	Complies with AO23 via suggested conditions It is the intent of the developers to transfer ownership of all public open space areas to the City upon completion of rehabilitation projects.

Performance Outcomes	Acceptable Outcomes	Compliance with Code
PO24 **An Open Space Management Plan prepared in accordance with SC6.10 City Plan policy – Landscape work is prepared for areas to be dedicated to Council as Public Open Space.**	**AO24** No acceptable outcome provided.	Will comply with PO24 via suggested conditions An Open Space Management Plan will be prepared in accordance with SC6.10 and accompany an operational works application. This plan will incorporate all open space areas that are to be dedicated to the City upon completion of rehabilitation of these areas.

10 Conclusion

This report has been prepared in accordance with the Open Space Management Guideline for the preparation of reports and plan associated with the dedication of public open space (GCCC, 2007). The open space meets the requirements of the City of Gold Coast Park Design Guidelines by providing an open space design in harmony with the development, the surrounding environs and the environmental constraints.

The open space areas planned for the development will maintain connectivity to existing bushland, provide community meeting points, passive recreational opportunities and allow for pedestrian connectivity to community facilities in the local region. The open space network also includes drainage reserves, including a natural drainage reserve that will be rehabilitated to provide riparian linkages along Yaun Creek and a waterway in the south-eastern corner of the site.

The open space network seeks to improve the environmental values of the site through retaining and rehabilitating an area of existing native vegetation of conservation significance.

Relevant development and constraint code responses to applicable Planning Scheme requirements have been provided.

11 References

Biome Consulting 2018. Environmental Assessment 79-99 Courtney Drive, Upper Coomera. Report to Gallery Homes.

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Appendix A

Statement of Rehabilitation Intent

DATE: 06.11.19
PROJECT No. : BC-16090
DRAWING No. : SRI-00
REVISION No. : B

STATEMENT OF REHABILITATION INTENT

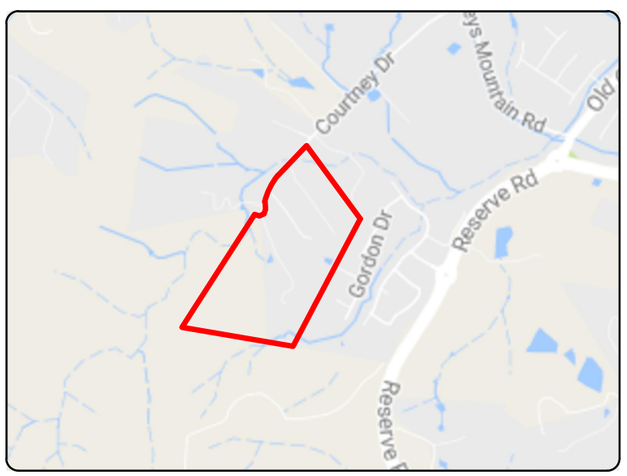
Lots 188-192 on RP173728, 79-99 Courtney Drive, Upper Coomera

for

Gallery Homes

Project No: BC-16090

November 2019



Site Location

BIOME Consulting Pty Ltd
Unit 30201, Southport Central Tower 3,
9 Lawson St, Southport QLD 4215
PO Box 3469, Australia Fair, Southport
O 07 5532 7779
M 0415 935 222
E brad@BIOMEconsulting.com.au
W www.BIOMEconsulting.com.au
ABN 86 166 087 476

SCHEDULE OF DRAWINGS

Drawing No.	Drawing Title
SRI-00	LOCALITY AND DRAWING INDEX PLAN
SRI-01	EXISTING ECOLOGICAL FEATURES
SRI-02	REHABILITATION STRATEGY & REHABILITATION ZONES
SRI-03	PLANTING SPECIFICATIONS
SRI-04	REHABILITATION PROCEDURES & WEED CONTROL
SRI-05	REHABILITATION AREA MANAGEMENT

EXISTING ECOLOGICAL FEATURES

Vegetation

The vegetation on site has been broadly classified into four (4) vegetation communities:

- V1 - Acacia low open forest
- V2 - Spotted Gum / Grey Ironbark Open Forest (RE 12.11.5);
- V3 - Acacia low open woodland/mosaic +/- landscaping around dwellings
- V4 - Pasturelands +/- copses of native/exotic trees

Vegetation Community V1

V1 is a regrowth extension of Regional Ecosystem vegetation at the site's southwestern boundary corner. It comprises mature Acacia disparrima regrowth with occasional emergent Corymbia citriodora, Eucalyptus siderophloia, E. propinqua, and E. tereticornis. Other common species in the mid stratum include Lophostemon suaveolens and Allocasuarina littoralis. The notable disturbance within this vegetation community is the incursion of weeds with Lantana dominating the shrub layer.

Vegetation Community V2

V2 comprises a small area of the total subject site in the south-west corner and is an extension of a larger area of the same vegetation type beyond the site boundary. The composition of the canopy is generally representative of RE 12.11.5, primarily Corymbia citriodora and Eucalyptus siderophloia. The understorey is a mixture of juvenile canopy species, endemic shrubs and endemic ground species with negligible weed incursion.

Vegetation Community V3

V3 primarily mature acacia regrowth proximate to dwellings and outbuildings on the subject site. There are occasional larger eucalypts and small isolated thickets of lantana and vine weeds are common. Low level grazing is presently active throughout most of this community. Prevalent endemic flora species for this community include Acacia disparrima, Eucalytpus siderophloia, E. tereticornis, Lophostemon confertus, Cynodon dactylon var. dactylon. Prevalent weed species include Lantana camara, Setaria sphacelata, and Panicum megathyrsus.

Vegetation Community V4

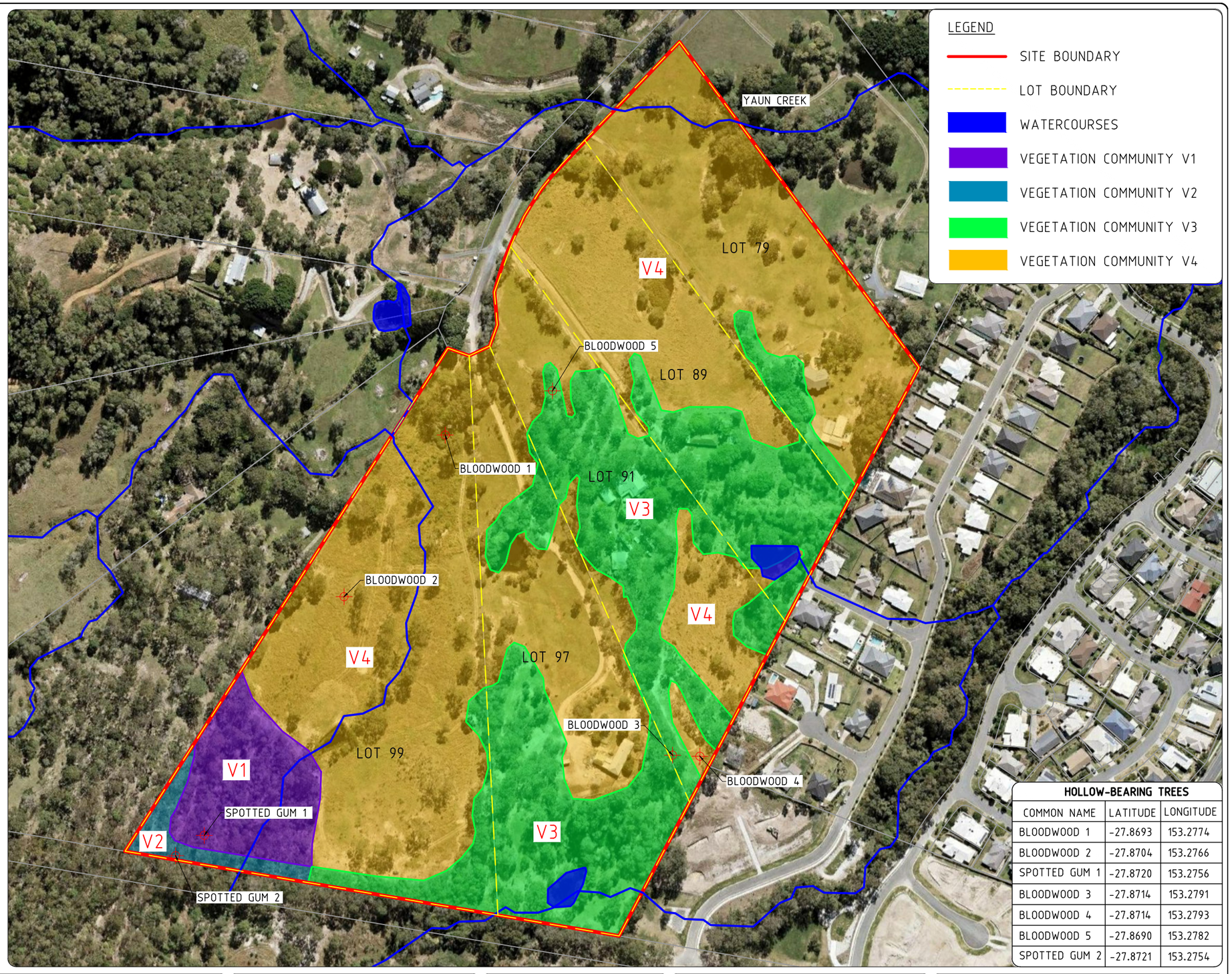
V4 covers the majority of the site and comprises introduced pasture species, copses of endemic tree species and trees associated with landscaping. Some of the largest eucalypt trees on site occur as isolated trees or within the copses.

Hollow-bearing Trees

Seven (7) Hollow-bearing Trees have been identified across the site as shown in the adjacent image.

Watercourses and Drainage Features

The site contains two main drainage lines. Yaun Creek is the primary drainage line which traverses the site's northern corner for approximately 100 m. An ephemeral drainage line, originating at the site's southern boundary, converges with Yaun Creek on the site's central western boundary.



HOLLOW-BEARING TREES

COMMON NAME	LATITUDE	LONGITUDE
BLOODWOOD 1	-27.8693	153.2774
BLOODWOOD 2	-27.8704	153.2766
SPOTTED GUM 1	-27.8720	153.2756
BLOODWOOD 3	-27.8714	153.2791
BLOODWOOD 4	-27.8714	153.2793
BLOODWOOD 5	-27.8690	153.2782
SPOTTED GUM 2	-27.8721	153.2754

DATE: 06.11.19
PROJECT No. : BC-16090
DRAWING No. : SRI-01
REVISION No. : B

PROJECT: STATEMENT OF REHABILITATION INTENT
DRAWING TITLE: EXISTING ECOLOGICAL FEATURES
CLIENT: GALLERY HOMES
ADDRESS: LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

DRAFTED BY :	DESIGNED BY :	CHECKED BY:	PAPER SIZE :	SCALE :
TP / LD	NL	BC	A3	1:3000

APPROVED FOR AND ON BEHALF OF BIOME CONSULTING PTY LTD
ACN 166 087 476
RPEQ No. :

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		29.03.19
B	INFORMATION REQUEST		06.11.19

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M 0415 935 222
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REHABILITATION STRATEGY

This Statement of Rehabilitation Intent (SRI) has been prepared to set out the rehabilitation approach for the open space network. It will be used as a basis upon which the detailed Rehabilitation Management Plan will be prepared.
The proposed development includes several open space areas, three of which will require rehabilitation. The rehabilitation strategy has been designed to protect and enhance ecological values.

REHABILITATION OBJECTIVES

The fundamental rehabilitation objective is to construct an ecosystem that will be self-sustaining and resilient to environmental stress (e.g. flooding and drought).
Specific objectives of this SRI are to:

- Provide fauna habitat and movement opportunities;
- Recreate a waterway; and
- Re-establish vegetation reflective of pre-clearing regional ecosystems.

REHABILITATION APPROACHES

Three approaches are required to achieve the rehabilitation objectives:

- Fabrication;
- Reconstruction; and
- Assisted natural regeneration.

Fabrication

Where significant reprofiling of the land's relief is undertaken, subsequent planting is prescribed to achieve the purposes of the modified area.

Reconstruction

Reconstruction of vegetation communities is necessary where the site is highly degraded or altered and has poor regeneration capacity (resilience). Suitable species will be planted at a density of one plant per square meter which, when established, will provide the necessary structure and seed bank to enable successful ongoing rehabilitation.

Assisted Natural Regeneration

Assisted natural regeneration is appropriate where the native plant community is largely healthy and functioning and there is evidence of high ecosystem resilience (e.g. native seedling recruitment). The primary objective for this zone is targeted weed control, although some supplementary planting will be undertaken in disturbed areas. These areas are expected to recover with limited intervention. The control of weeds is intended to facilitate the re-establishment of endemic species via the seed bank or by other natural seed dispersal vectors. Disturbed areas greater than five square meters will be planted with suitable species at a density of one plant per square meter.

REHABILITATION ZONES

Three rehabilitation zones have been proposed according to the approach required.

Zone R1

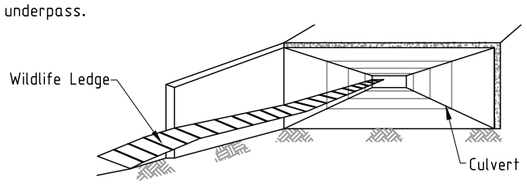
Regional ecosystem 12.11.5 occurs along the fringes of the southern and western boundary with negligible weed incursion. The balance of the area comprises advanced regrowth dominated by Acacia disparrima and other species consistent with RE12.11.5 with moderate weed incursion.
Areas under canopy will require assisted natural regeneration.
Weed control will include:

- Woody and vine weeds either manually removed or treated via cut/paint or drill/inject; and
- Ground layer weeds sprayed with herbicide.

Where gaps in the canopy exceed 5 square meters, infill planting with species selected from planting schedule PS1 will occur.

Zone R2

This restoration zone occurs along waterways. The majority of these areas are cleared of vegetation and highly disturbed.
Areas under canopy will require assisted natural regeneration. Cleared areas will require reconstruction as per planting schedule PS2 and planting module PM2.
The waterway in the south-eastern corner of the site will be piped under the roadway. A fauna underpass will be provided to enable movement corridors to be maintained.
Figure 1 shows detail of the wildlife ledge to be fitted in the fauna underpass.



WILDLIFE LEDGE 3D SECTION

PLAN

SECTION A - A

FIGURE 1: WILDLIFE LEDGE DETAIL

SCALE 1:25

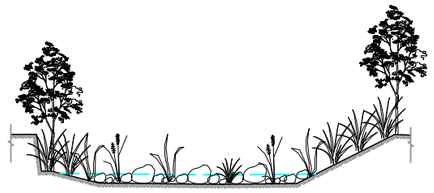


FIGURE 2: WATERWAY CROSS SECTION

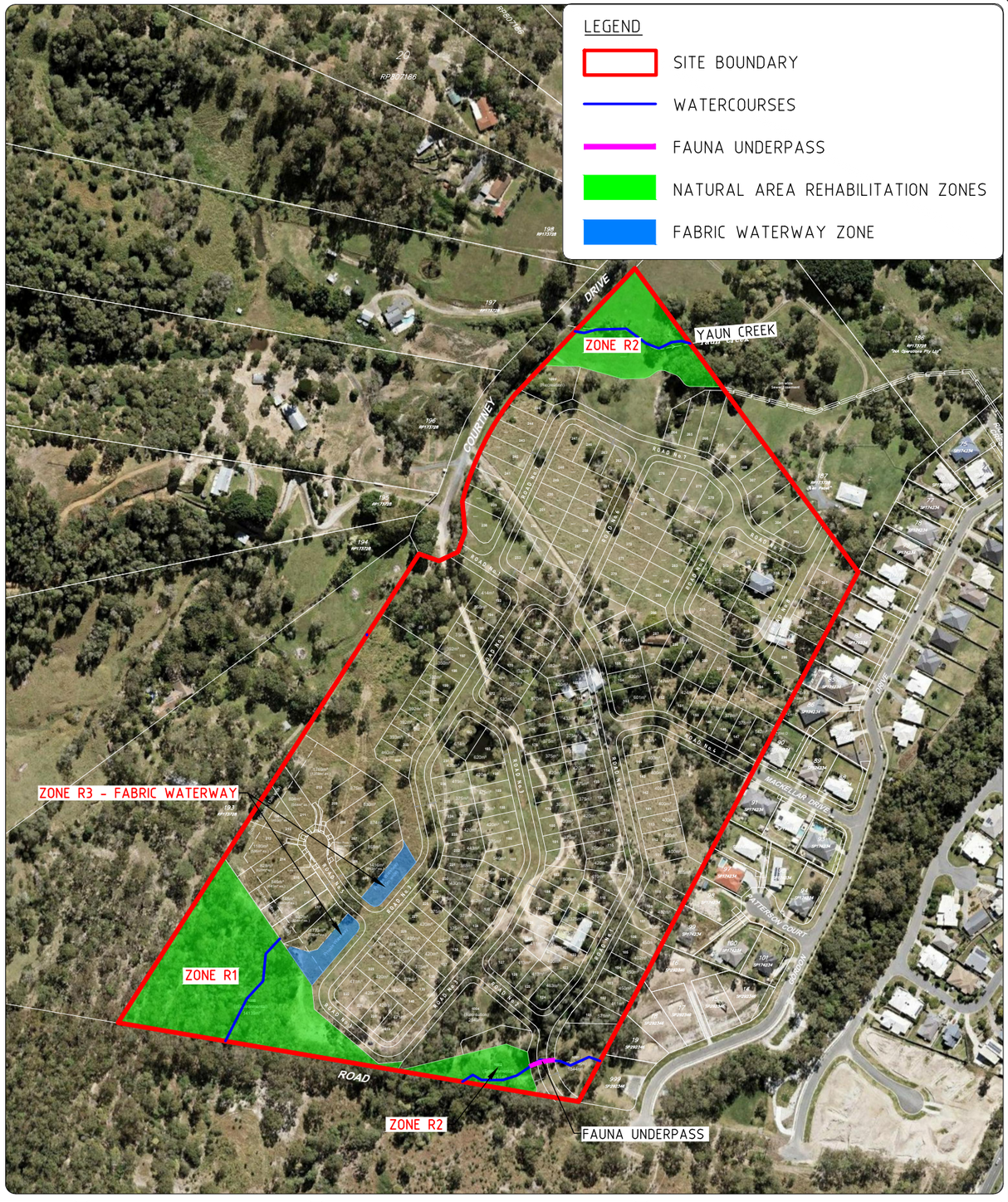
SCALE 1:250

Zone R3

This zone is a reconstructed waterway. The aim of the waterway reconstruction is to:

- Emulate a natural waterway to provide linkages from the environmental reserve to Yaun Creek; and
- Provide the required hydraulic conveyance while providing for environmental values in the channel design where possible.

Yaun Creek can be described as a depositional chain-of-ponds; relatively deep, permanent ponds are separated by bars of sediment stabilised with vegetation. These permanent ponds provide water and habitat for a range of wildlife.
The restoration objective within the realigned waterway is to recreate a depositional style chain-of-pools in a channelized stream. The restoration strategy involves creating stable pools and bars.
Bars can be created from low earthen or rock weirs that are well vegetated with appropriate species to prevent erosion. The lower embankment of the weirs should be planted with reeds or semi-aquatic vegetation. Stream verges should be revegetated for stabilising and shading. To recreate the pools, a bed of gullies can be stabilised with rock-chutes, with the crest of the chute set higher than normal. The upstream end of the pool needs to be densely vegetated.



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PROJECT	STATEMENT OF REHABILITATION INTENT
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CLIENT	GALLERY HOMES
ADDRESS:	LOTS 188-192 ON RP173728 79-99 COURTNEY DRIVE, UPPER COOMERA

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BIOME Consulting Pty Ltd
PO Box 3469, Australia Fair, Southport
M 0415 935 222
E brad@BIOMEconsulting.com.au
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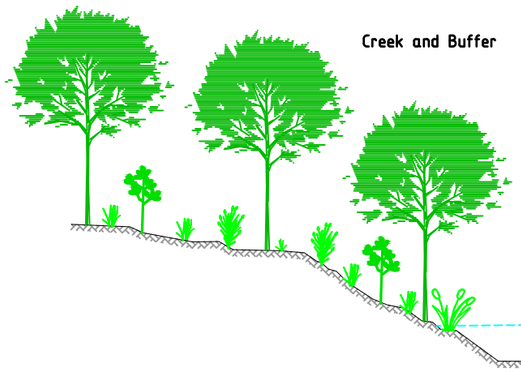
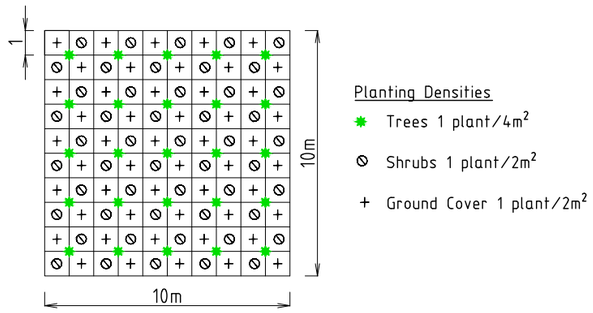
PLANTING SCHEDULE - PS1

Scientific Name	Common Name	Planting Density	Container Size
Trees			
Corymbia intermedia	Pink Bloodwood	1 plant / 4m^2	Tube
Eucalyptus grandis	Flooded Gum		
Eucalyptus tereticornis	Queensland Blue Gum		
Ficus watkinsiana	Strangler Fig		
Grevillea robusta	Silky Oak		
Lophostemon confertus	Brushbox		
Melaleuca bracteata	River Tea Tree		
Tristaniopsis laurina	Water Gum		
Small Trees/Shrubs			
Acacia disparrima	Hickory Wattle	1 plant / 2m^2	Tube
Alphitonia excelsa	Red Ash		
Allocasuarina littoralis	Black Sheoak		
Babingtonia similis	Twiggy Myrytle		
Ficus coronata	Creek Sandpaper Fig		
Glochidion ferdinandi	Cheese Tree		
Glochidion sumatranum	Umbrella Cheese Tree		
Lophostemon suaveolens	Swamp Box		
Melaleuca quinquenervia	Broad-leaved Paperbark		
Groundcovers			
Lomandra hystrix	Creek Mat Rush	1 plant / 2m^2 (along creek)	Tube
Lomandra longifolia	Spiny-headed Mat Rush	1 plant / 2m^2 (beyond creek)	

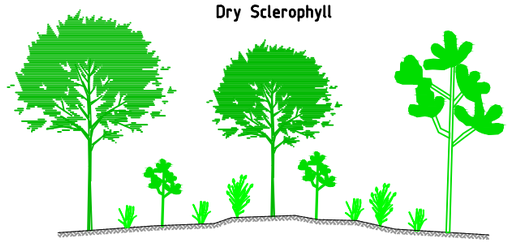


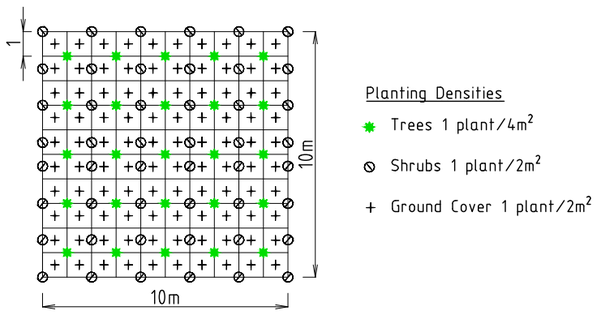


PLANTING MODULE - PM1

PLANTING SCHEDULE - PS2

Scientific Name	Common Name	Planting Density	Container Size
Trees			
Corymbia citriodora	Spotted Gum	1 plant / 4m^2	Tube
Corymbia intermedia	Pink Bloodwood		
Eucalyptus carnea	Broad-leaved White Mahogany		
Eucalyptus propinqua	Small-fruited Grey Gum		
Eucalyptus siderophloia	Grey Ironbark		
Eucalyptus tereticornis	Queensland Blue Gum		
Lophostemon confertus	Brushbox		
Small Trees/Shrubs			
Acacia disparrima	Hickory Wattle	1 plant / 2m^2	Tube
Allocasuarina littoralis	Black Sheoak		
Lophostemon suaveolens	Swamp Box		
Melaleuca salignus	White Bottlebrush		
Groundcovers			
Cymbopogon refractus	Creek Mat Rush	1 plant / 1m^2	Tube
Imperata cylindrica	Blady Grass		
Lomandra longifolia	Spiny-headed Mat Rush		
Themeda triandra	Kangaroo Grass		





PLANTING MODULE - PM2

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PROJECT
STATEMENT OF REHABILITATION INTENT
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GALLERY HOMES
ADDRESS:
LOTS 188-192 ON RP173728
79-99 COURTNEY DRIVE, UPPER COOMERA

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BIOME Consulting Pty Ltd
PO Box 3469, Australia Fair, Southport
M 0415 935 222
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REHABILITATION PROCEDURES

PLANT PROCUREMENT

Local provenance tube stock is to be utilised for all restoration works involving planting. Where this is not possible due to circumstances out of the control of the applicant, Council approval must be sought.

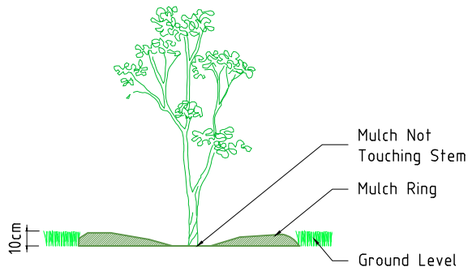
PLANT INSTALLATION PRACTICE NOTES:

- Plants are to be vigorous, well established, hardened off, consistent with species or variety, free from disease and insect pests, with large root systems and no evidence of having been restricted or damaged;
- Plants are to be planted immediately after delivery to the planting site. If not possible, they are to be stored in the shade and watered sufficiently during the day;
- Excavate planting medium to a depth suitable for the installation of tube or pot specimens. In areas where the planting substrate is deemed to be very poor (compacted, nutrient depauperate, hydrophobic etc.) and above areas of potential frequent inundation and water flow, soil shall be suitably prepared (e.g. through use of fertilizer, and mechanical ripping where required) and enough topsoil to sustain long term plant growth shall be used;
- Pre-water plant hole if soil is dry, to decrease root stress upon planting and assess the infiltration of water through the soil;
- Incorporate into the planting substrate the appropriate quantity of prepared water crystals or other suitable hydrating product;
- Place plant into hole and backfill ensuring that the plant is upright, and the stem is not covered in any less than 10 mm or any more than 20 mm of planting medium;
- Plants are to be watered thoroughly immediately after planting (ensure deep irrigation) and thereafter as required during the construction phase of the development depending on climatic conditions. Creation of a concave hollow around the base of each plant will aid water infiltration to the plant roots;
- A complete, slow release fertiliser is recommended, and is to be administered appropriately during planting. Top dressing with slow release fertiliser is preferred to avoid toxic levels of fertiliser accumulating in the plant hole around the plant roots;
- To ensure successful establishment, all planting surfaces must be covered in either:
  - a 10 cm layer of high quality, debris and weed-free composted chip mulch (Note: to avoid possible stem rot in some 'drier' species ensure mulch is 'dished' and not covering plant stem by more than 2 cm); or
  - suitable individual anchored natural fibre weed mat (e.g. jute mat) in areas subject to high velocity flows;
- Mulched material is to be sourced from cleared vegetation if suitably seasoned;
- A long-term slow release fertiliser will be used for all plantings after initial plant establishment;
- Seedling and saplings are to be encouraged and maintained throughout the Establishment period;
- Monitoring and evaluation for site maintenance (watering, weed control, stock replacement, fertilising, managing inappropriate site access etc.) is to occur monthly for the period from October to May and bi-monthly for June to September;
- Where specimens show signs of very poor health, do not replace unless the plant is determined to be dead below ground. Many species are capable of strongly recovering from transplant stress or adjustment to site conditions. If a particular species is consistently doing poorly in certain site conditions, it is recommended to replace with an alternate species; and
- A minimum 90% survival rate must be achieved.

SUPPLEMENTARY PLANTING

Supplementary planting should be undertaken in areas where plants have failed to thrive or where weed removal activities have resulted in site disturbance.

Supplementary planting should consider the existing species composition, for example, in areas with good canopy cover but degraded lower strata, ground cover and understory species are to form the predominant part of the revegetation planting.



MULCHING TECHNIQUE

WEED CONTROL

The control of weeds is essential to the restoration process. The removal of invasive species reduces competition and therefore assists the germination and establishment of native species.

In areas where assisted regeneration is undertaken, weed control should be designed to reduce impacts to existing native vegetation, maintain juvenile species and retain the existing seed bank in the soil profile.

The control of weeds is to be undertaken generally in accordance with the following phases:

- Primary weed control
- Involves selective and strategic removal of weeds rather than the removal of all weed species at once to reduce erosion risks.
- Secondary weed control
- Follows the completion of primary work. This is necessary to manage the growth of weeds and regenerating natives.
- Maintenance and follow-up weed control
- On-going maintenance and follow-up weed control is essential for successful restoration works. The frequency and duration of this process shall vary according to the resilience of native vegetation, viability of weed seed in the seed bank, the proximity of weed sources and the skill level of workers.

All weed control works are to be either actively supervised or undertaken by personnel suitably qualified in botany or bush regeneration disciplines. Weed removal should be undertaken in accordance with the methodologies outlined within the South East Queensland Ecological Restoration Framework: Manual (Chenoweth EPLA and Bushland Restoration Services, 2012). Methods for removing weeds include hand, chemical or mechanical control, or a combination of these.

Specific control techniques for weeds identified on site have been provided in the Covenant Management Plan. General weed control techniques are presented as follows.

WEED CONTROL TECHNIQUES

The following describes the current best practice methods for weed control.

Cut-scrape-paint

This weed control method applies to all woody shrubs, trees and some vines.

- Cut plant low to the ground at an angle.
- Apply Glyphosate immediately at the rate of 1 part Glyphosate to 1.5 parts water, with a paintbrush.
- Scrape sides lightly to reveal green tissue and apply the herbicide to the scraped area.
- Take care that the brush is not contaminated with soil.
- Note - all seed that has high viability and longevity, or plants with a high invasive potential must be removed from the parent and either composted on site or removed from the site.

Stem Injection

This weed control method applies to all woody trees and shrubs with a diameter of about six to ten centimetres or greater.

- With a tomahawk, make a cut the width of the blade, at a slight angle, into the trunk. Note - it is important not to make cuts too deep.
- Apply herbicide immediately into the cut using a tree-injecting device (if using Glyphosate, apply at the rate of 1 part Glyphosate to 1.5 parts water).
- Repeat this procedure in a brickwork pattern around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, make a cut above it. Note - two rows of cuts will be enough for trees with trunks of six to ten centimetres; larger trunk diameters will need correspondingly more.
- Treat all visible lateral roots as per dot point 1.

Spraying

This weed control method is carried out using a backpack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used with the addition of a marker dye. For plants that show some resistance or where growing conditions are not optimal, an acidifying agent is added. Metsulfuron methyl can also be used for resistant species and grasses. It should be used with a surfactant.

Dilution rates for Glyphosate and Metsulfuron methyl are in accordance with the manufacturer's recommendations and any variation requires a permit from the National Registration Authority.

Overspray

This weed control method is applicable to large, dense infestations and where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, protect native seedlings from foragers such as wallabies, and avoid trampling by humans.

- Spray over the top of the infestation, using a weak solution of Glyphosate
- Any native plants that may be under the weed will be protected by the foliage cover of the weed.
- Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.

Alternatively, weeds can be cut and flattened with bush-hooks or loppers and the subsequent regrowth sprayed with Glyphosate. In many cases it is preferable to overspray wherever practicable as this will cause less erosion and trampling of suppressed native plants, such as ferns and seedlings. However, handwork will be necessary to cut-scrape-paint any unsprayed weeds that surround native plants.

Crowning

This weed control method is applicable to weeds which have their growing points below the surface of the ground (corms, bulbs, rhizomes, clumped or fibrous root systems, etc.).

- Grasp the leaves or stems and hold them tightly so that the base of the plant is visible. Plants with sharp leaves or stems should be cut back first.
- Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.
- Cut through the roots close to the base. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.
- Remove the plant. Make sure that the base of the plant where the roots begin is completely removed.

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79-99 COURTNEY DRIVE, UPPER COOMERA

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PO Box 3469, Australia Fair, Southport
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REHABILITATION AREA MANAGEMENT

Monitoring

Routine monitoring must be undertaken monthly. During monitoring, the rehabilitation areas are assessed for:

- New weed infestations;
- Poor health or mortality of plantings;
- Adequate mulch coverage; and
- Presence of rubbish.

Establishment Period

Following primary weed control and plant installation, a 12-month establishment period will be undertaken. During this period, the developer is responsible for the following:

- Control of weeds
- Monthly inspections;
- Supplementary or replacement plantings as required to achieve prescribed densities;
- Monthly litter collection; and
- Irrigation as needed.

On-Maintenance

Upon completion of the establishment period, works shall then undergo a further 12 month on-maintenance period. During this period, the developer is responsible for the following:

- Monthly progress inspections;
- Management of weeds to achieve prescribed outcomes;
- Replacement planting as required to achieve required densities; and
- Irrigation as needed.

Performance Criteria

The following key performance criteria shall be met:

- No invasive plant species as identified under the Biosecurity Act 2014;
- Removal of a minimum of 95% of weeds;
- Achieve a minimum success rate of 90% survival rate of all installed plants
- Achieve a minimum cover of 95% in the reconstruction zone (Zone R1); and
- Removal of all temporary construction structures (if installed).

Compliance

The developer is responsible for undertaking the rehabilitation works. The developer must provide to Council certification from a qualified professional that all works have been implemented on site and plants are established following a minimum establishment period of 12 months and on-maintenance period of 12 months. Certification is to demonstrate that all site works have been completed in accordance with applicable conditions of approval and relevant management plans.

Rehabilitation Schedule

A summary of the rehabilitation schedule has been included in the table below.

Rehabilitation Stage	Actions Required	Timing
Initial site works	Undertake primary weed control	At the commencement of rehabilitation works
	Revegetation in accordance with plans. This will include: • soil preparation; • planting; • fertilising (slow release for native plants); • mulching; and • installation of stakes and seedling protection covers where deemed appropriate.	After primary weed control
Establishment period	Irrigation	Irrigation requirements will depend on rainfall. Irrigation will be undertaken at a minimum every three to five days for first eight weeks depending on weather.
	Routine weed control	Monthly
	Routine management: • reinstate mulch; • application of fertiliser to tube stock; • replacement of staked and tree guards; • replace dead or dying plants; and • remove rubbish.	Following inspection as required
	Monitoring	Monthly
On Maintenance period	Routine weed control	Monthly
	Routine management	Following inspection as required
	Monitoring	Monthly

DATE
06.11.19

PROJECT No. :
BC-16090

DRAWING No. :
SRI-05

REVISION No. :
B

PROJECT
STATEMENT OF REHABILITATION INTENT

DRAWING TITLE
REHABILITATION AREA MANAGEMENT

CLIENT
GALLERY HOMES

ADDRESS:
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79-99 COURTNEY DRIVE, UPPER COOMERA

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E brad@BIOMEconsulting.com.au
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Appendix B

Statement of Landscape Intent

ZLA

79-99 COURTNEY DRIVE

UPPER COOMERA, QLD

PROJECT REFERENCE L19124

SLI.

REVISION **A** | NOVEMBER **2019**

GOLD COAST
1638 TWEED STREET, BURLEIGH HEADS QLD 4220
PO BOX 3805, BURLEIGH TOWN QLD 4220

GLADSTONE
2/172 GOONDOON ST, GLADSTONE, QLD 4680
PO BOX 5332, GLADSTONE QLD 4680 | PH 07 4972 3831

ADMIN@ZONELANDSCAPE.COM.AU

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	3.5	Sections	20
4.0	**Design Details**		**21**
	4.1	Planting Palette: General Planting	22
	4.2	Planting Palette: Bio Basin & Batters	23
	4.3	Planting Palette: Bushfire Suitable Species	24

1.0
Site Analysis.

Site Analysis

1.1 Project Description

188-192 Courtney Drive, Upper Coomera

Statement of Landscape Intent

Site Information:

The subject site consists of (5) lots totaling approximately 188,490m² of land within Division 1 of the City of Gold Coast comprising of lots:

- Lot 188 on RP173728 (79 Courtney Drive, 30,790m²)
- Lot 189 on RP173728 (89 Courtney Drive, 30,340m²)
- Lot 190 on RP173728 (91 Courtney Drive, 30,950m²)
- Lot 191 on RP173728 (97 Courtney Drive, 30,390m²)
- Lot 192 on RP173728 (99 Courtney Drive, 30,020m²)

The land is currently zoned as the following:

- Rural
- Rural Residential
- Rural Landscape & Environmental Precinct

The following City of Gold Coast City Plan Overlay Maps impact the site:

- Bushfire Hazard
- Dwelling House
- Environmental Significance - Vegetation Management
  - Vegetation Management

- Environmental Significance - Wetlands & Watercourse
  - Natural Watercourse Line
  - Watercourse 30m Buffer Area

- Landslide Hazard

Design Intent:

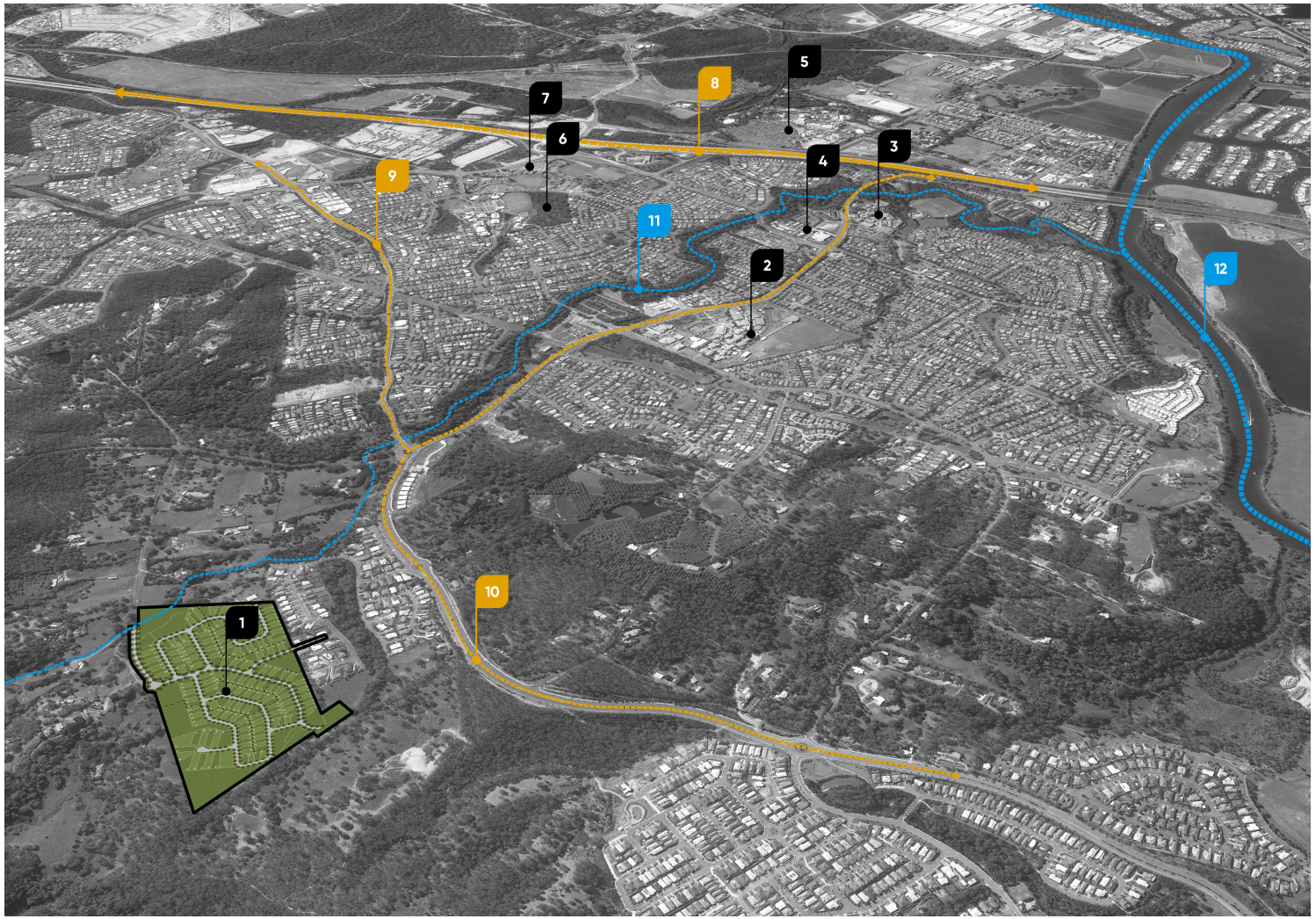
The landscape concept for proposed residential development is based on the surrounding context, response to the proposed urban and civil layout, and the desired outcomes of the City of Gold Coast City Plan.

The design intent is to contribute positively to the image, identity and character of Upper Coomera by providing a contemporary, sensitive and appropriate landscape environment.

The key landscape elements comprise:

- Provide leafy streets
- Connect and link open space typologies to create an interconnected and diverse open space character
- High quality recreation open space interconnected with environmental open space corridors
- Shaded playground and recreation pathways within green open space
- Assisted natural regeneration of environmental open spaces
- A contemporary textually appropriate softscape planting palette which includes a variety of native plant species
- Creating a safe and accessible space, characterised by open sight lines
- Integration of water sensitive urban design elements into residential layout

Landscape Intent to be read in conjunction with Open Space Management Report prepared by Biome Consulting.



Legend

1. Subject Site (77-99 Courtney Drive)
2. Upper Coomera State College
3. Saint Stephens College
4. Upper Coomera Library & Aquatic Centre
5. Dream World
6. Assisi Catholic College
7. Coomera Anglican College
8. Pacific Motorway
9. Old Coach Road
10. Reserve Road
11. Yuan Creek
12. Coomera River

Site Analysis

1.2 Site Context

2.0

Landscape Design.

Legend

1. Recreational Open Space
2. Environmental Open Space
   30m Yaun Creek Buffer
   Assisted Natural Regeneration
   Refer Environmental report for details
3. Proposed Environmental Open Space
   Assisted Natural Regeneration
   Refer Environmental report for details
4. Proposed Bio Basin & Batters
   Refer Stormwater Management Report
5. Adjacent Properties
6. Bushfire Management Buffer Zone
   Refer Bushfire Report

Landscape Design

2.1 Landscape Masterplan

0M 30M 60M 90M 120M

Legend

Street Tree Planting

Street tree planting to CoGC standards. The streets to feature a range of broadleaf species to establish a strong estate theming and character. Refer Street Tree Planting Page 9 for species and typical setout.

Environmental Areas

Refer Environmental Report (Biome) for details on treatment of these areas.

Bio-Retention Basins & Batters

Bio Retention basins and batters are to be treated with species identified with CoGC LDG Section 13 and WBD Guidelines. Refer also Bio Basin Planting palette Page 23 for proposed species. Refer Storm Water Management Report for Basin Design.

Fire Buffer Area (13m)

13.0, wide bushfire setback as per Bushfire Report. Planting treatment (densities and species selection) to these areas is to reflect best practice for limiting fuel . Fire suitable species palette is provided Page 24. Refer Bushfire Report for more details on acceptable outcomes for this area.

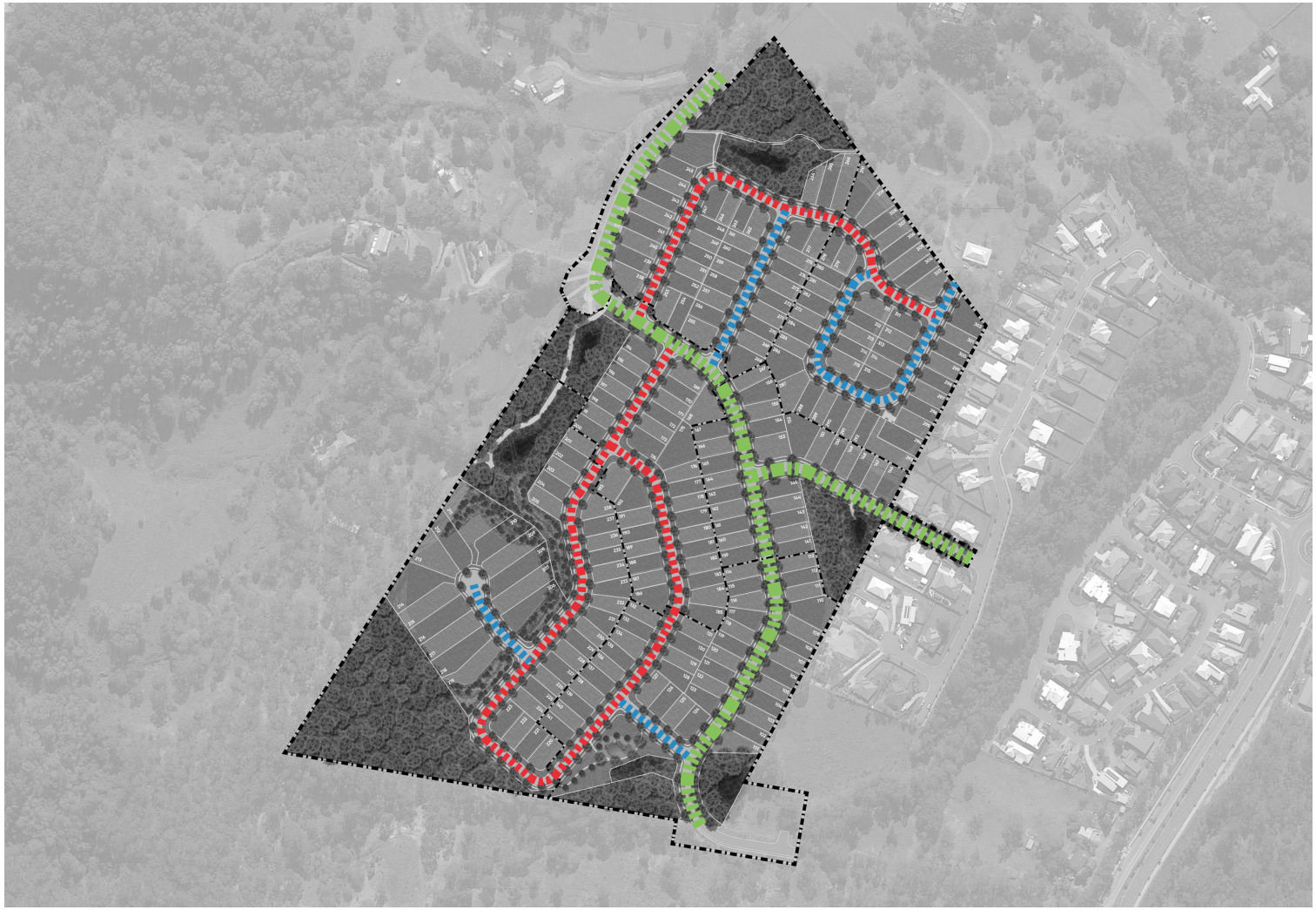
Rock Lined Swale

Area to be treated with rock lined swale with scattered planting throughout the base and larger tree plantings to the swales edge. Placement of larger rocks external to low flow to act as energy dissipaters and also protect copses of trees within this zone. Planting to this area is to ensure nil impedance to low flow channel and to maintain bushfire safe buffers to adjoining dwellings.

Landscape Design

2.2 Landscape Planting Zones

0M 30M 60M 90M 120M



Legend

1 Primary Street Tree
Melaleuca linariifolia (Flying Paperbark)
Flindersia brayleyana (QLD Maple)

2 Secondary Street Tree
Tristaniopsis laurina (Water Gum)
Harpulia pendula (Tulipwood)

3 Tertiary Street Tree
Cupaniopsis anacardiodes (Tuckeroo)
Buckinghamia celsissima (Ivory Curl)

Melaleuca linariifolia (Flying Paperbark)

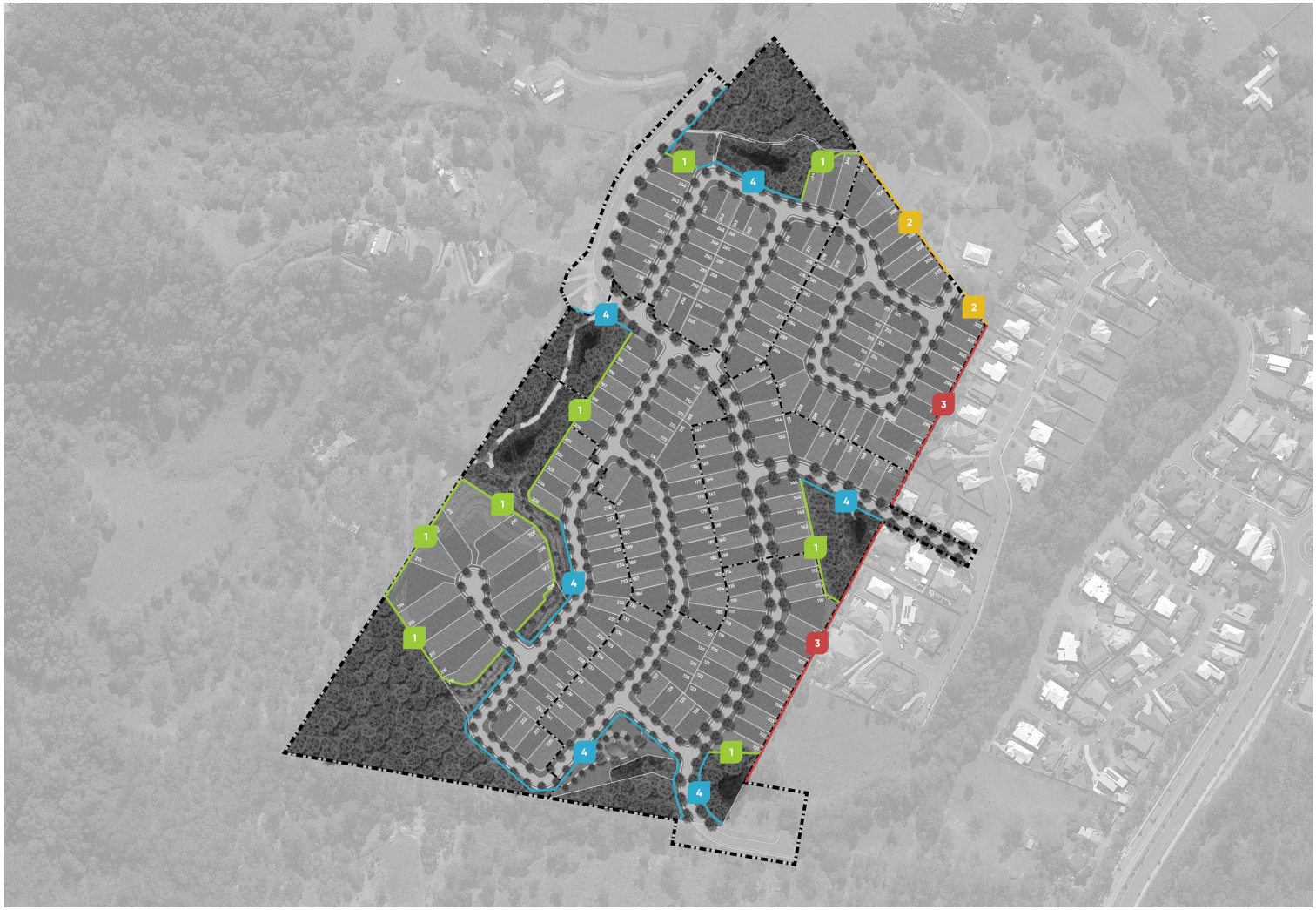
Tristaniopsis laurina (Water Gum)

Cupaniopsis anacardiodes (Tuckeroo)

Landscape Design

2.3 Street Tree Planting

0M 30M 60M 90M 120M



Legend

1. 50% Transparent POS Interface
2. Proposed 1.8m Good Neighbour Fencing
3. Existing 1.8m Good Neighbour Fencing
4. Standard Council Bollard Line 1.5m Centres

Landscape Design

2.4 Fencing & Bollard Locations

0M 30M 60M 90M 120M

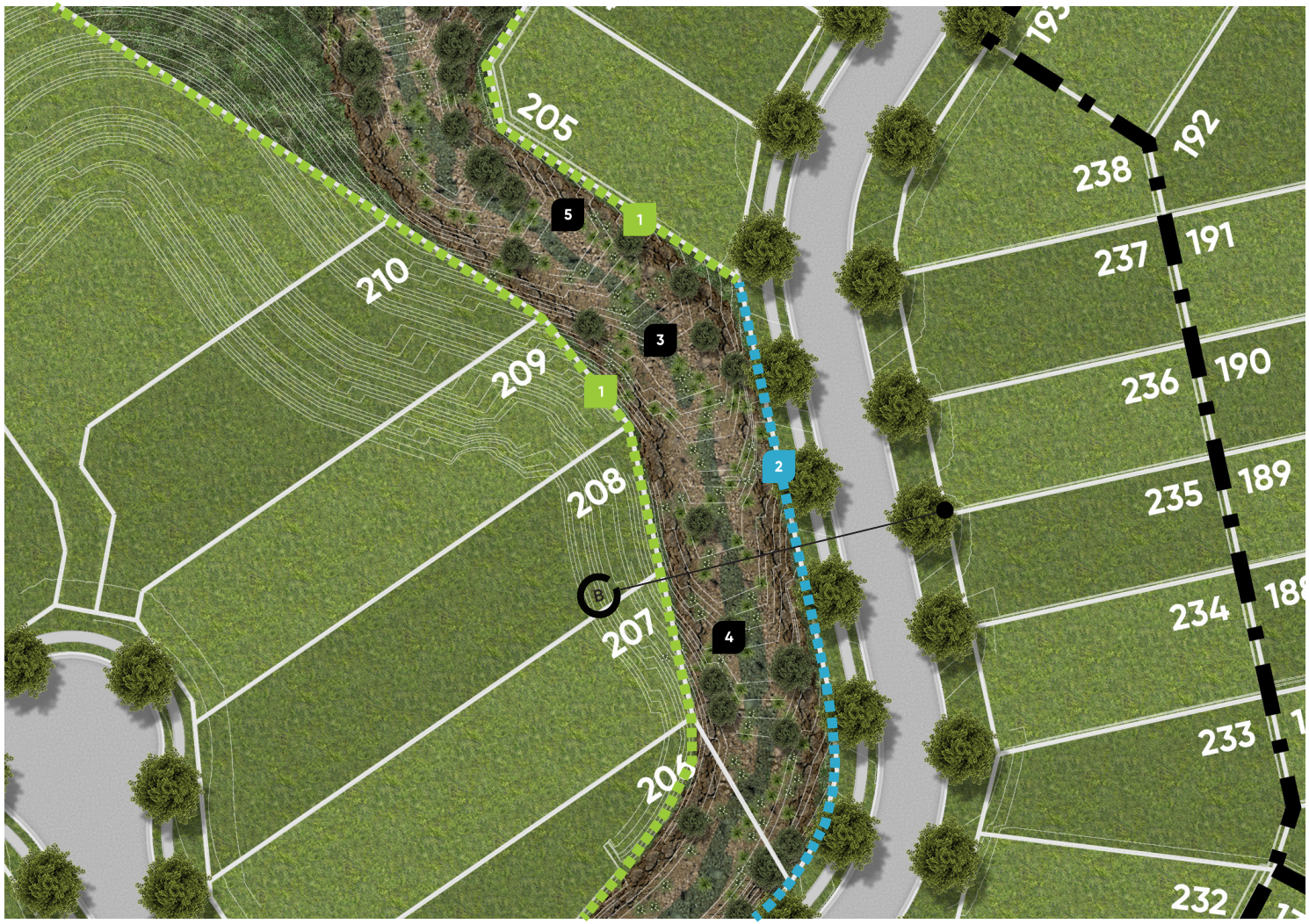
Legend

1 1.2m Wide Brushed Concrete Footpath

Landscape Design

2.5 Footpath Location Plan

0M 30M 60M 90M 120M



Legend

1. 50% Transparent POS Interface
2. Standard Council Bollard Line 1.5m Centres
3. Area to be treated with rock lined swale with scattered planting throughout the base and larger tree plantings to the swales edge. Planting at densities recomended by the Bushfire Report to maintain bushfire safe buffers to adjoining dwellings.
4. Low ground cover species ex. Gahnia sp. to ensure nil impedance to low flow channel .
5. Edges of swale to be constructed from larger rock formations for a natural aesthetic. Top of batter where space allows to be planted with larger broadleaf species ex Melalueca sp. or Casuarina sp. Placement of larger rocks external to low flow to act as energy dissipaters and also protect copses of trees within this zone. Planting to this area is to ensure nil impedance to low flow channel and to maintain bushfire safe buffers to adjoining dwellings. Example imagery provided below.

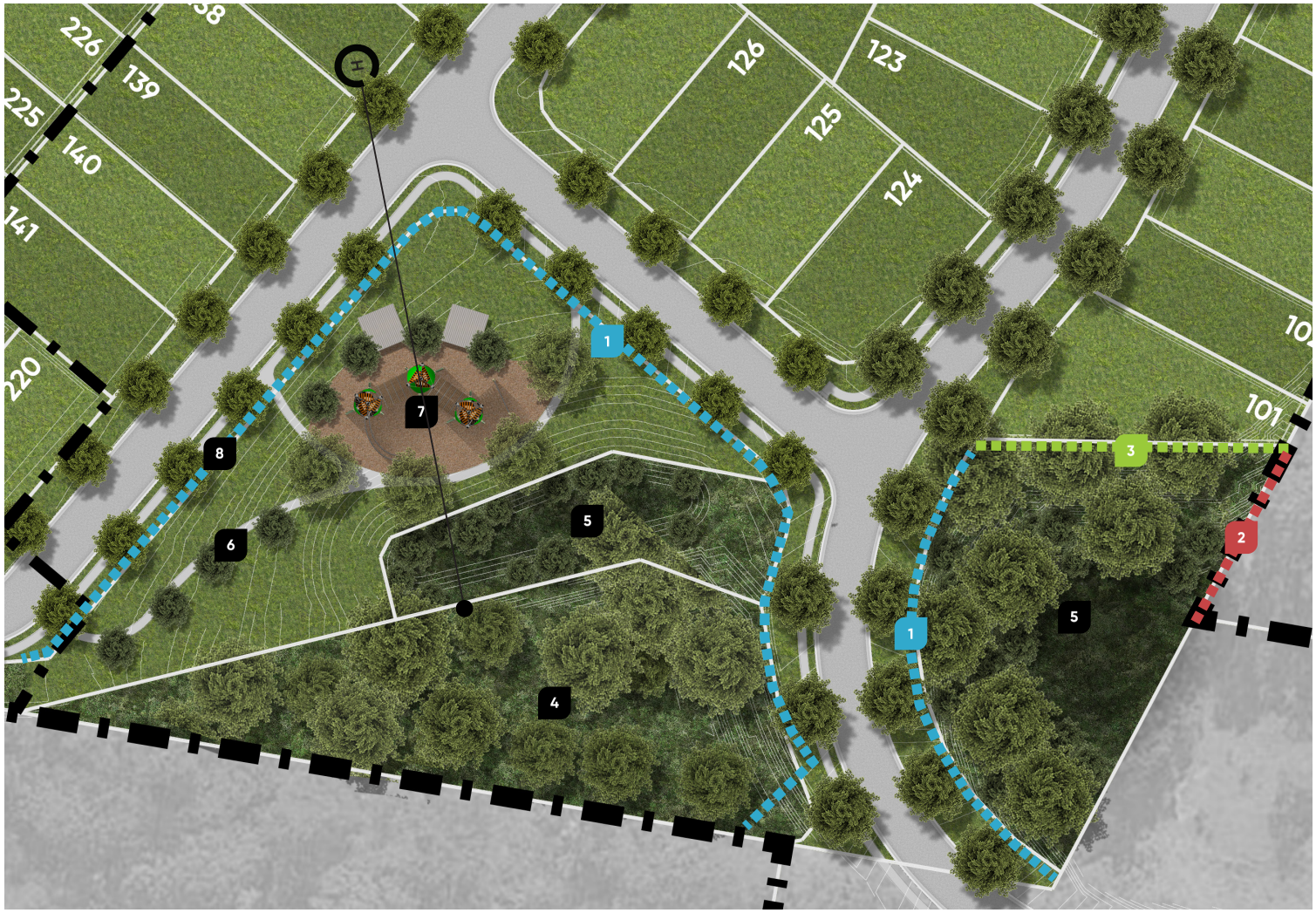
Refer Environmental Management Report for more details on the treatment of this area. Refer Section B for more details on this location.

Example Image of Rock Lined Swale

Landscape Design

2.6 Natural Rock Lined Swale

0M 15M 30M



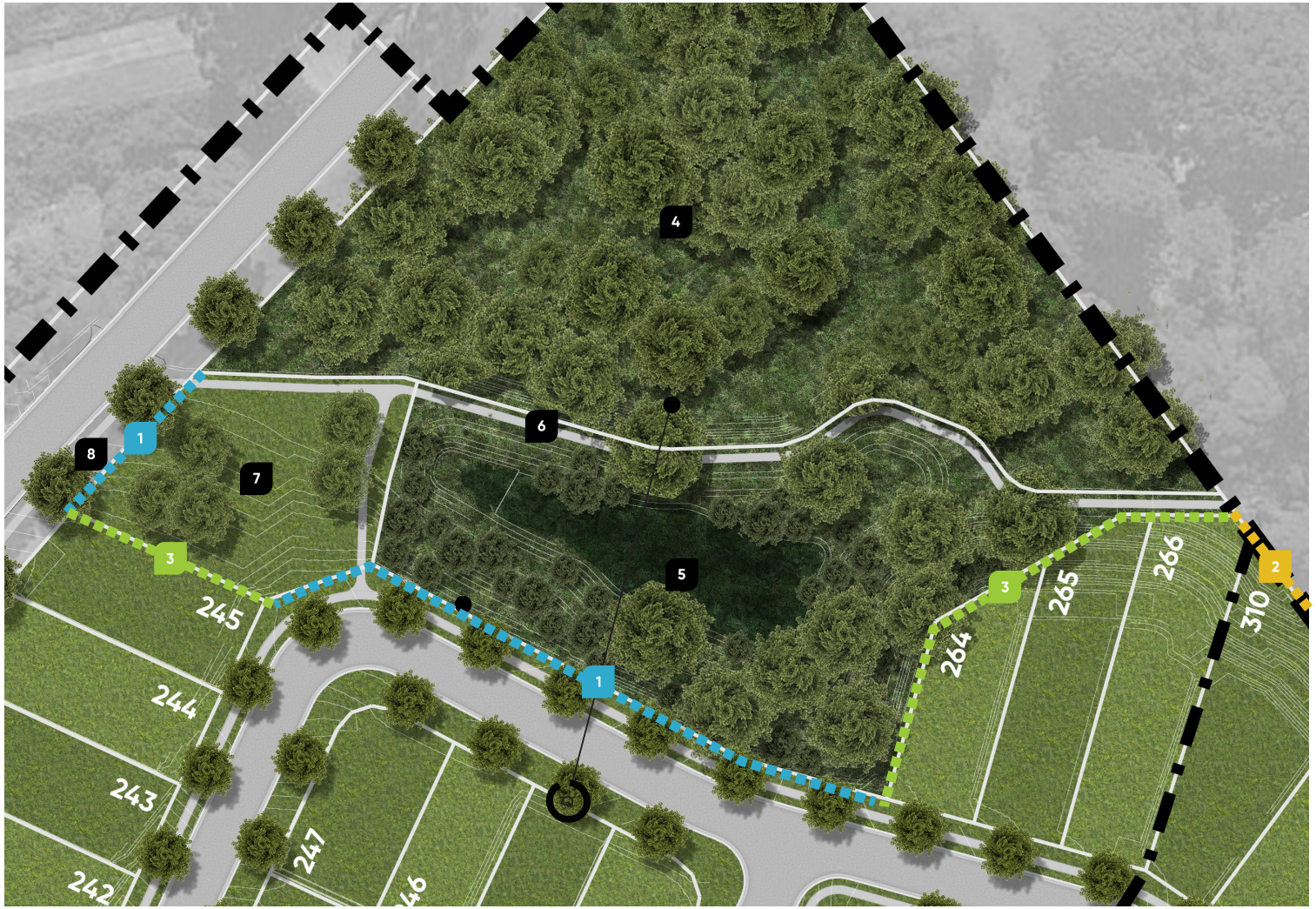
Legend

1. Standard Council Bollard Line 1.5m Centres
2. Existing 1.8m Good Neighbour Fencing
3. 50% Transparent POS Interface
4. Environmental Area - Refer Report (Biome) for details on treatment of these areas.
5. Bio Retention basins and batters are to be treated with a suitable palette for the basins and the stabalisation of the batters. Refer Bio Basin Planting palette this document for information on proposed species. Refer Storm Water Management Report for Basin Design.
6. 1.2m wide brushed concrete footpath to recreational open space and perimeter.
7. Proposed shaded playground comprising large feature climbing structure, swing set etc. Mulch softfall to base and skillion shelter / seating provided.
8. Street front access control comprising of timber bollards and maintenance access gate.

Landscape Design

2.7 Recreational Open Space

0M 15M 30M



Legend

1. Standard Council Bollard Line 1.5m Centres
2. Proposed 1.8m Good Neighbour Fencing
3. 50% Transparent POS Interface
4. Environmental Area - Refer Report (Biome) for details on treatment of these areas.
5. Bio Retention basins and batters are to be treated with a suitable palette for the basins and the stabalisation of the batters. Refer Bio Basin Planting palette this document for information on proposed species. Refer Storm Water Management Report for Basin Design.
6. 1.2m wide brushed concrete footpath to recreational open space and perimeter.
7. Large open turf 'Kick-a-bout' area is proposed to secondary recreational open space area. Pathway through POS allows connections through the site as well as connections through to future adjoining developments.
8. Street front access control comprising of timber bollards and maintenance access gate.

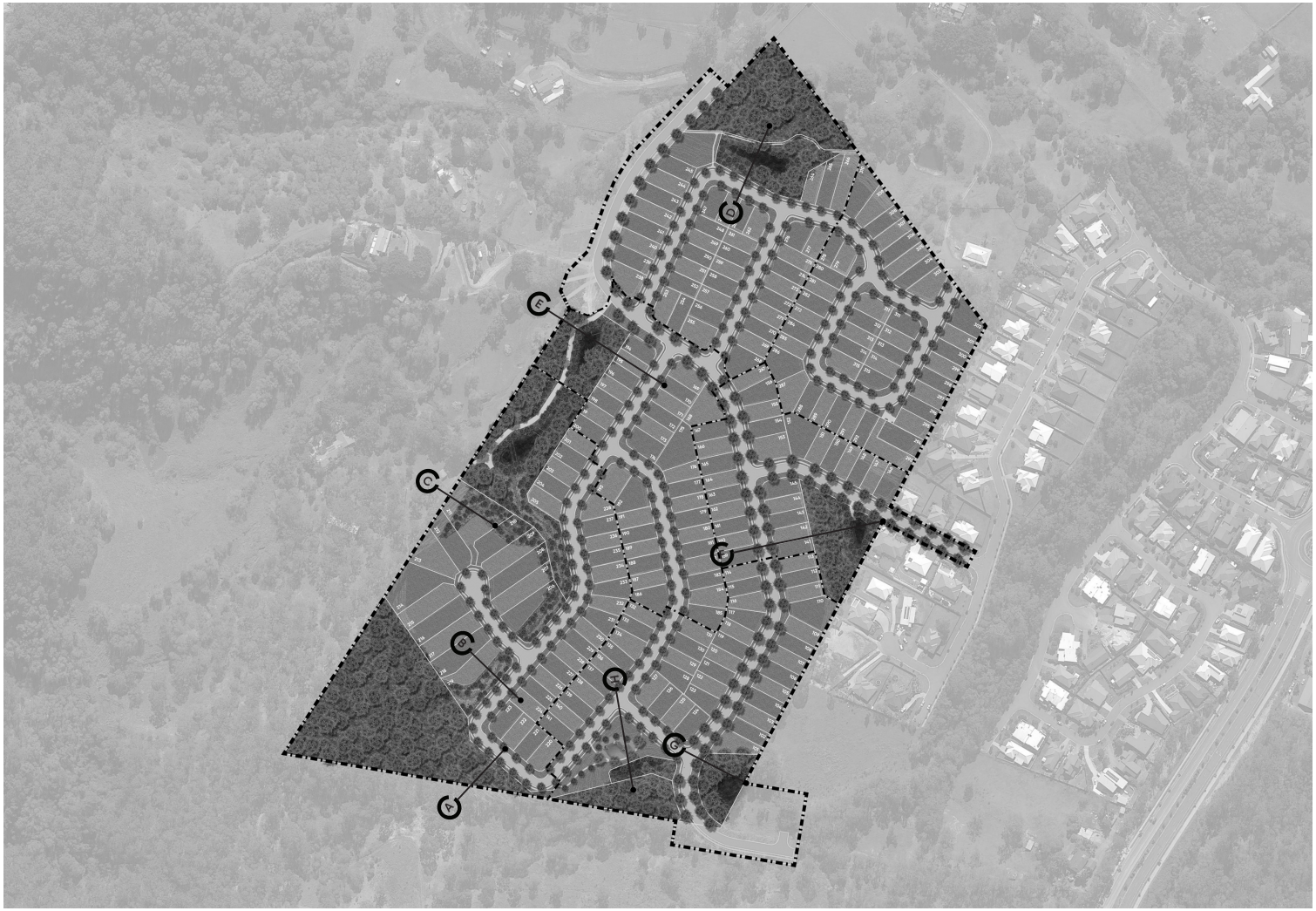
Landscape Design

2.8 Recreational Open Space

0M 15M 30M

3.0

Sections & Elevations.



Legend

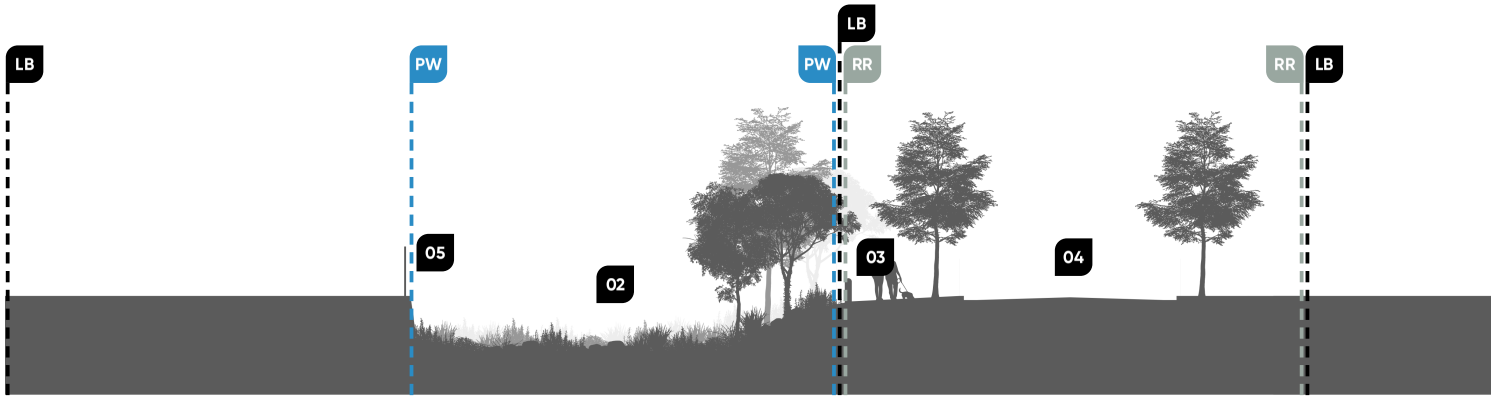
A 3.2 Section A | PG 17
B 3.2 Section B | PG 17
C 3.3 Section C | PG 18
D 3.3 Section D | PG 18
E 3.4 Section E | PG 19
F 3.4 Section F | PG 19
G 3.5 Section G | PG 20
H 3.5 Section H | PG 20

Sections & Elevations

3.1 Section Locations

0M 30M 60M 90M 120M

Section A | Lot 1008 (Environmental) & Road 3 Section



Section B | Lot 218 / Private Waterway & Road 3 Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Environmental reserve area. Refer Environmental Report for details.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

05 Proposed retaining wall to Private Waterway. 50% transparent interface fencing to top of wall.

Sections & Elevations

3.2 Sections

Section C - Lot 210 Fire Buffer & Batter Section

Section D | Road 07 & Lot 1010 (Drainage) Basin & Environmental Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Environmental reserve area. Refer Environmental Report for details.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

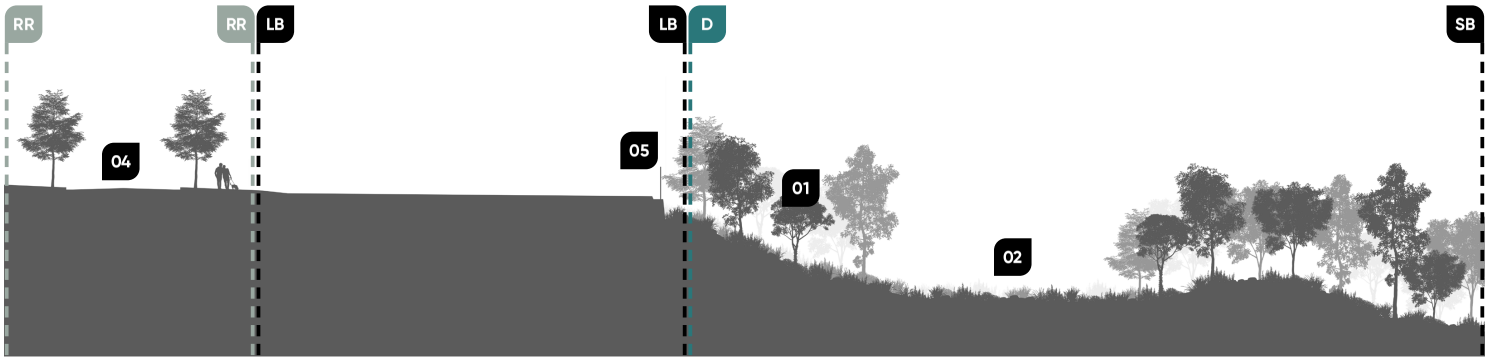
03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

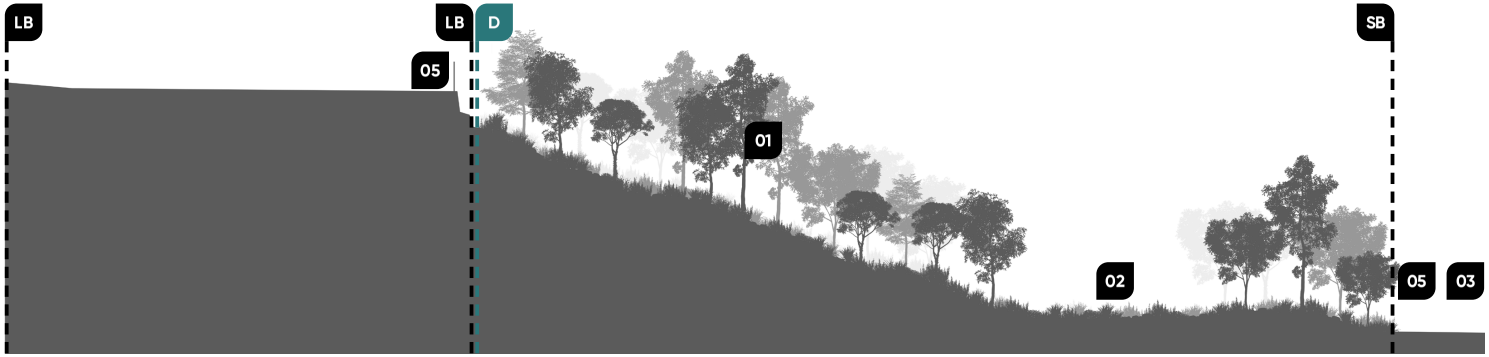
05 13m Bushfire Setback area. Minimal planting to this zone. Refer Bushfire Report for details.

Sections & Elevations

3.3 Sections



Section E | Road 03 & Lot 1006 (Drainage) Basin Section



Section F | Lot 141 & Lot 1005 (Drainage) Basin Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Batter Planting to Lot / Bio Basin Batter Interfaces. Refer Planting Palette.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Adjoining Lot

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

05 Proposed retaining wall to Private Waterway. 50% transparent interface fencing to top of wall.

Section G | Road No 1, Lot 1001 & Lot 1005 (Drainage) Basin Section

Section H | Road 3, Lot 1004 (Recreation) & Lot 1003 (Drainage) Basin Section

Legend

- SB — Site Boundary
- LB — Lot Boundary
- OS — Open Space
- D — Drainage (Bio Basin)
- RR — Road Reserve
- PW — Private Waterway
- EV — Environmental
- BS — Bushfire Setback

Notes

01 Batter Planting to Lot / Bio Basin Batter Interfaces. Refer Planting Palette.

02 Proposed Bio Basin. Refer Stormwater Management Report and Planting Palette.

03 Council standard bollards to all Open Space / Environmental & Drainage Areas.

04 Road reserve street tree planting treatment. Refer Planting Palette & Street Tree Location Plan.

05 Open Space / Recreation area. Playground climbing equipment with meandering footpaths.

Sections & Elevations

3.5 Sections

4.0
Design Details.

Trees

1	Cupaniopsis anacardiodes	Tuckeroo
2	Tristaniopsis laurina	Water Gum
3	Callistemon viminalis	Bottlebrush
4	Casuarina equisetifolia	Coastal She-Oak
	Corymbia maculata	Spotted Gum
	Elaeocarpus grandis	Blue Quandong
	Grevillea robusta	Water Gum
	Lophostemon confertus	QLD Brush Box
	Melaleuca linarifolia	Flying Paperbark

Shrubs & Strappy Plants

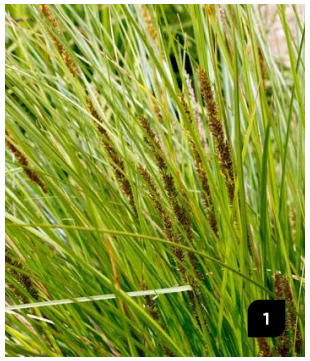
5	Callistemon 'Little John'	Karuri Pine
6	Cordyline 'Rubra'	Red Palm Lily
7	Crinum pedunculatum	River Lily
8	Dianella caerulea	Flax Lily
	Liriope 'Evergreen Giant'	Giant Liriope
	Rhagodia spinenscens	Aussie Flat Bush
	Syzygium sp.	Lilly Pilly
	Westringia 'Grey Box'	Coastal Rosemary

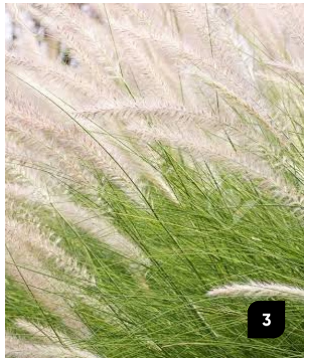
Groundcovers & Climbers

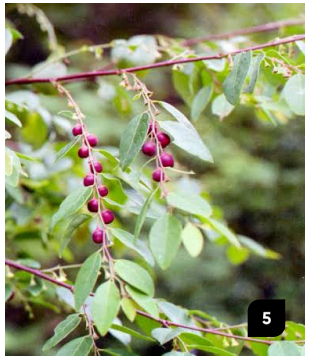
9	Hardenbergia violacea	Native Sarsparilla
10	Myoporum ellipticum	Coastal Boobialla
11	Pandorea pandorana	Wonga Wonga Vine
	Themeda triandra	Kangaroo Grass
12	Trachelospermum jasminoides	Star Jasmine

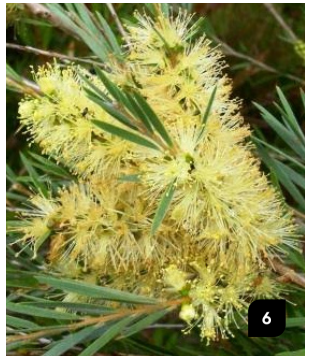
Design Details

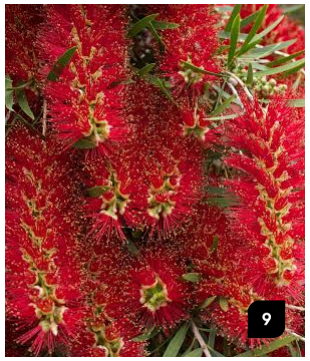
4.1 Planting Palette: General Planting

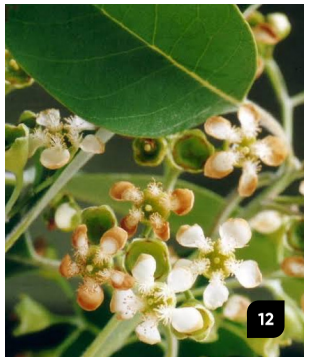












Groundcovers

			Density (Qty/m2)
1	Carrex Appressa	Tall Sedge	6-8
2	Finicia nodosa	Knobby Club Rush	4-6
3	Imperata cylindrica	Blady Grass	6-8
4	Lomandra hystrix	Creek Matt Rush	4-6
	Lomandra longifolia	Matt Rush	4-6
	Myoporum parvifolium	Creeping Boobialla	4-6
	Themeda australis	Kangaroo Grass	6-8

Shrubs

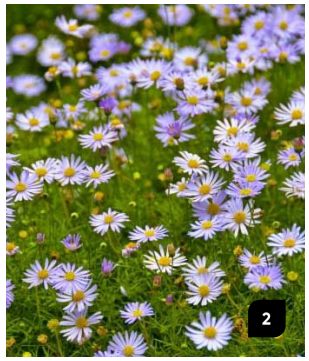
			Density (Qty/m2)
5	Breynia oblongifolia	False Coffee Bush	2-4
6	Callistemon sieberi	River Bottlebrush	1
7	Hardenbergia violacea	Purple Coral Pea	2-4
8	Leptospermum polygalifolium	Wild May	2-4
	Lomatia silaifolia	Crinkle Bush	2-4
	Myoporum acuminatum	Coastal Boobialla	2-4

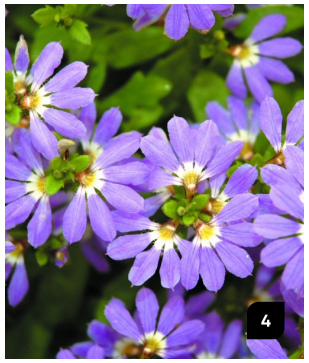
Trees

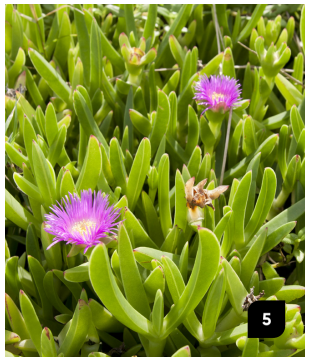
			Density (Qty/m2)
9	Callistemon viminalis	Weeping Bottle Brush	< 1
10	Eucalyptus obovatus	Hard Quandong	< 1
11	Lophostemon confertus	Brush Box	< 1
12	Lophostemon suaveolens	Swamp Box	< 1
	Melaleuca nodosa	Prickly-leaf Paperbark	2-4
	Melaleuca quinquenervia	Broad-leaved Paperbark	< 1
	Melaleuca sieberi	Small -leaved Paperbark	< 1

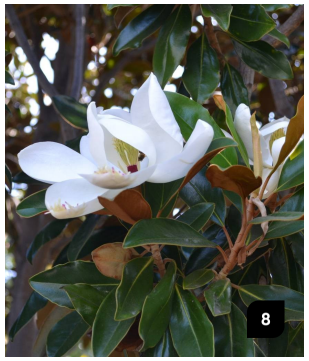
Design Details

4.2 Planting Palette: Bio Basins & Batters









Groundcovers

1	Ajuga australis	Bugleweed
2	Brachyscome multifidia	Cut-Leafed Daisy
3	Dampiera diversifolia	Blue Dampiera
4	Scaevola aemula	Aussie Crawl
5	Carpobrotus chilensis	Pig Face
6	Myoporum parvifolium	Creeping Boobialla

Trees

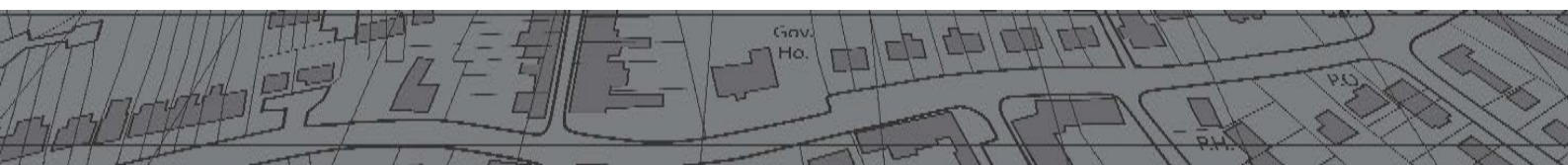
7	Magnolia grandiflora	Bull Bay Magnolia
8	Magnolia 'Little Gem'	Little Gem
9	Acacia howittii	Sticky Wattle
10	Acmena smithii	Lilly Pilly
11	Cupaniopsis anacardiodes	Tuckeroo
12	Eleocarpus reticulatus	Blueberry Ash

Design Details

4.3 Planting Palette: Bushfire Suitable Species

ZLA

ATTACHMENT 12
Approved ROL Plans for Highland Reserve



PLANS AND DOCUMENTS referred to in the DEVELOPMENT APPROVAL

Application No: MCU201800342

Dated: 1 June 2018

Development shall comply with the conditions of approval as detailed in the Decision Notice and Council's Planning Scheme, Local Laws and Planning Policies

This is an authorised version of the original document
Council of the City of Gold Coast

15m Wide Covenant Area

RESERVE ROAD

PARK

HILLTOP COMMUNITY 3

SCHOOL SITE

COMMUNITY FACILITIES 1&3

STEPHENS STREET

DEVELOPMENT STATISTICS

Total Site Area	296.16 ha (approx)
Total Net Developable Area (NDA)	105.06 ha
Total Area Open Space	191.5 ha
Total No. of Allotments	1098
Villa + Premium Villa (250-400m²)	140
Courtyard Allotments (401-550m²)	221
Premium Courtyard Allotments (551 - 599m²)	59
Traditional Allotments (600m² +)	545
Duplex Allotments (600m² +)	12 (24 dwellings)
Conservation Allotments (800 - 1999m²)	99
Hillside Allotments (2000m² +)	19
Hilltop Community Precinct	1 (6 dwellings)
Detached Housing Precinct	1 (71 dwellings)
Community Facilities	1
Total No. of Dwellings	1184
Total Length of New Road	19079 m

KEY

- Road Widening
- Public Open Space
- Environmental Open Space
- Premium Villa and Villa
- Courtyard Allotments
- Premium Courtyard Allotments
- Traditional Allotments
- Duplex Allotments
- Conservation Allotments
- Hillside Allotments
- Hilltop Community Precinct
- Detached Housing
- Community Facilities
- Final Building Location Envelope - Approved Building Location Envelope
- Preliminary Building Location Envelope - The illustrated envelopes are approximate only subject to detail survey, on site vegetation analysis and individual inspections.

* These lots are subject to further detailed design review & preparation of a slope analysis plan. The lots will be deleted, unless it can be demonstrated that building envelopes can be achieved on the relevant allotment type on slopes less than 20% for all "Traditional" and "Conservation" allotments and less than 25% for all "Hillside" allotments. Building allotments to the aforementioned lots shall be surveyed and pegged out for approval by Council's Subdivisions and Environmental Assessment Branch prior to the approval of any operational works application over these stages.

CLIENT: STOCKLAND

PLAN: SUBDIVISION PROPOSAL PLAN

SHEET 1
HIGHLAND RESERVE
LOT NUMBERS

SCALE: 1:4000 (A1) 50 0 50 100 150

Level Datum	Date	1 DECEMBER 2017
Level Origin	Surveyed	GEL
	Drafted	BJB
Data Origin CB DCDB	Parish	BARROW
7563BDY-2017-11-27(REDESIGN)	County	WARD

REVISIONS

No.	DETAILS	DATE	Init.
T	REVISION	23.10.14	BJB
V	REVISION	30.10.14	BJB
W	REVISION	11.2.15	BJB
X	REVISE STAGE 19B	28.5.15	BJB
Y	REVISE STAGE 35	19.4.17	BJB
Z	REVISE STAGE 35	28.7.17	BJB
AA	REVISE STAGE 35	28.8.17	BJB
AB	REVISE STAGE 35	1.12.17	BJB

RPS Australia East Pty Ltd
ACN 140 292 762
ABN 44 140 292 762
Suite 4, Robina East Quay Corporate Park (North Building) 34-36 Glenferrie Drive, Robina
PO Box 1048 Robina DC, Qld 4226
T +61 7 555 36900
F +61 7 555 36999
W rpsgroup.com.au

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Local Authority	Plan	Plan Ref	Sheet
G.C.C.C.	A1	7563-PP-62ab	1 of 1

DISCLAIMER

IMPORTANT NOTE
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PLANS AND DOCUMENTS referred to in the DEVELOPMENT APPROVAL

Application No: MCU201800342

Dated: 1 June 2018

Development shall comply with the conditions of approval as detailed in the Decision Notice and Council's Planning Scheme, Local Laws and Planning Policies

This is an authorised version of the original document
Council of the City of Gold Coast

15m Wide Covenant Area

RESERVE ROAD

RESERVE ROAD

DEVELOPMENT STATISTICS	
Total Site Area	296.16 ha (approx)
Total Net Developable Area (NDA)	105.06 ha
Total Area Open Space	191.5 ha
Total No. of Allotments	1098
Villa + Premium Villa (250-400m²)	140
Courtyard Allotments (401-550m²)	221
Premium Courtyard Allotments (551 - 599m²)	59
Traditional Allotments (600m² +)	545
Duplex Allotments (600m² +)	12 (24 dwellings)
Conservation Allotments (800 - 1999m²)	99
Hillside Allotments (2000m² +)	19
Hilltop Community Precinct	1 (6 dwellings)
Detached Housing Precinct	1 (71 dwellings)
Community Facilities	1
Total No. of Dwellings	1184
Total Length of New Road	19079 m

KEY

Road Widening

Final Building Location Envelope - Approved Building Location Envelope

Preliminary Building Location Envelope - The illustrated envelopes are approximate only subject to detail survey, on site vegetation analysis and individual inspections.

* These lots are subject to further detailed design review & preparation of a slope analysis plan. The lots will be deleted, unless it can be demonstrated that building envelopes can be achieved on the relevant allotment type on slopes less than 20% for all "Traditional" and "Conservation" allotments and less than 25% for all "Hillside" allotments. Building allotments to the aforementioned lots shall be surveyed and pegged out for approval by Council's Subdivisions and Environmental Assessment Branch prior to the approval of any operational works application over these stages.

CLIENT	STOCKLAND
PLAN	SUBDIVISION PROPOSAL PLAN
	SHEET 2 HIGHLAND RESERVE LOT AREAS
Level Datum	Date 1 DECEMBER 2017
Level Origin	Surveyed GEL
	Drafted BJB
Data Origin CB[DEAD]	Parish BARROW
7563SDY-2017-11-27(REDESIGN)	County WARD
SCALE: 1:4000 (A1)	50 0 50 100 150

REVISIONS

No.	DETAILS	DATE	Init.
S	REVISION	23.10.14	BJB
T	REVISION	30.10.14	BJB
U	REVISION	11.2.15	BJB
V	REVISE STAGE 19B	28.5.15	BJB
W	REVISE STAGE 35	19.4.17	BJB
X	REVISE STAGE 35	28.7.17	BJB
Y	REVISE STAGE 35	28.8.17	BJB
Z	REVISE STAGE 35	1.12.17	BJB

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T +61 7 555 36900
F +61 7 555 36999
W rpsgroup.com.au

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Local Authority	Plan	Plan Ref	Sheet
G.C.C.C.	A1	7563-PP-64z	1 of 1

DISCLAIMER

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HIGHLAND RESERVE
SUBDIVISION REDESIGN
STAGE 35

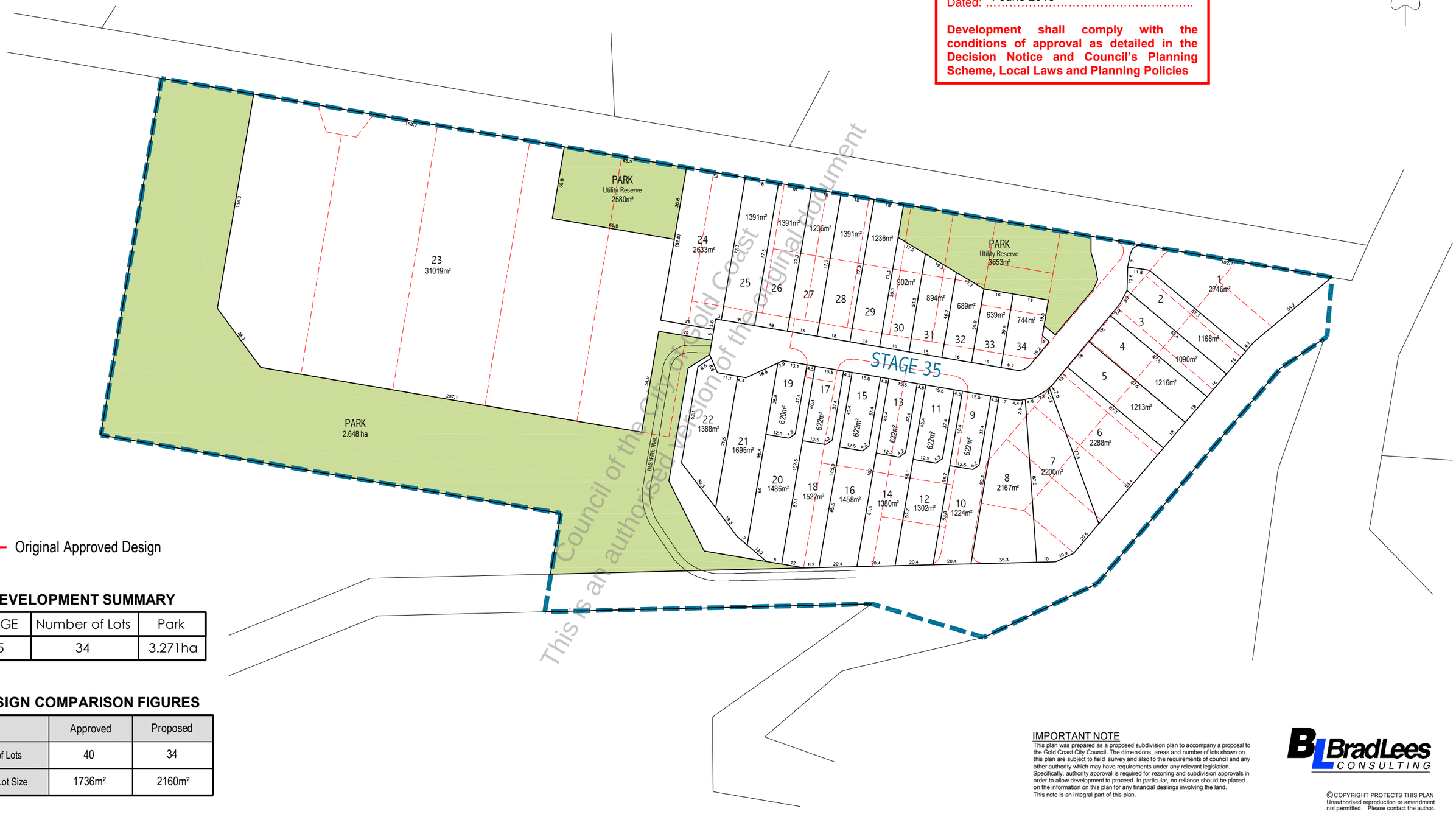
PLANS AND DOCUMENTS referred to in the DEVELOPMENT APPROVAL

Application No: MCU201800342

Dated: 1 June 2018

Development shall comply with the conditions of approval as detailed in the Decision Notice and Council's Planning Scheme, Local Laws and Planning Policies

N



KEY:

Original Approved Design

DEVELOPMENT SUMMARY

STAGE	Number of Lots	Park
35	34	3.271ha

DESIGN COMPARISON FIGURES

	Approved	Proposed
Number of Lots	40	34
Average Lot Size	1736m²	2160m²

IMPORTANT NOTE

This plan was prepared as a proposed subdivision plan to accompany a proposal to the Gold Coast City Council. The dimensions, areas and number of lots shown on this plan are subject to field survey and also to the requirements of council and any other authority which may have requirements under any relevant legislation. Specifically, authority approval is required for rezoning and subdivision approvals in order to allow development to proceed. In particular, no reliance should be placed on the information on this plan for any financial dealings involving the land. This note is an integral part of this plan.

BL BradLees CONSULTING

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SUBDIVISION REDESIGN
HIGHLAND RESERVE - STAGE 35

REF: 7563-PP-498d DATE: 1 DECEMBER 2017 CLIENT: STOCKLAND

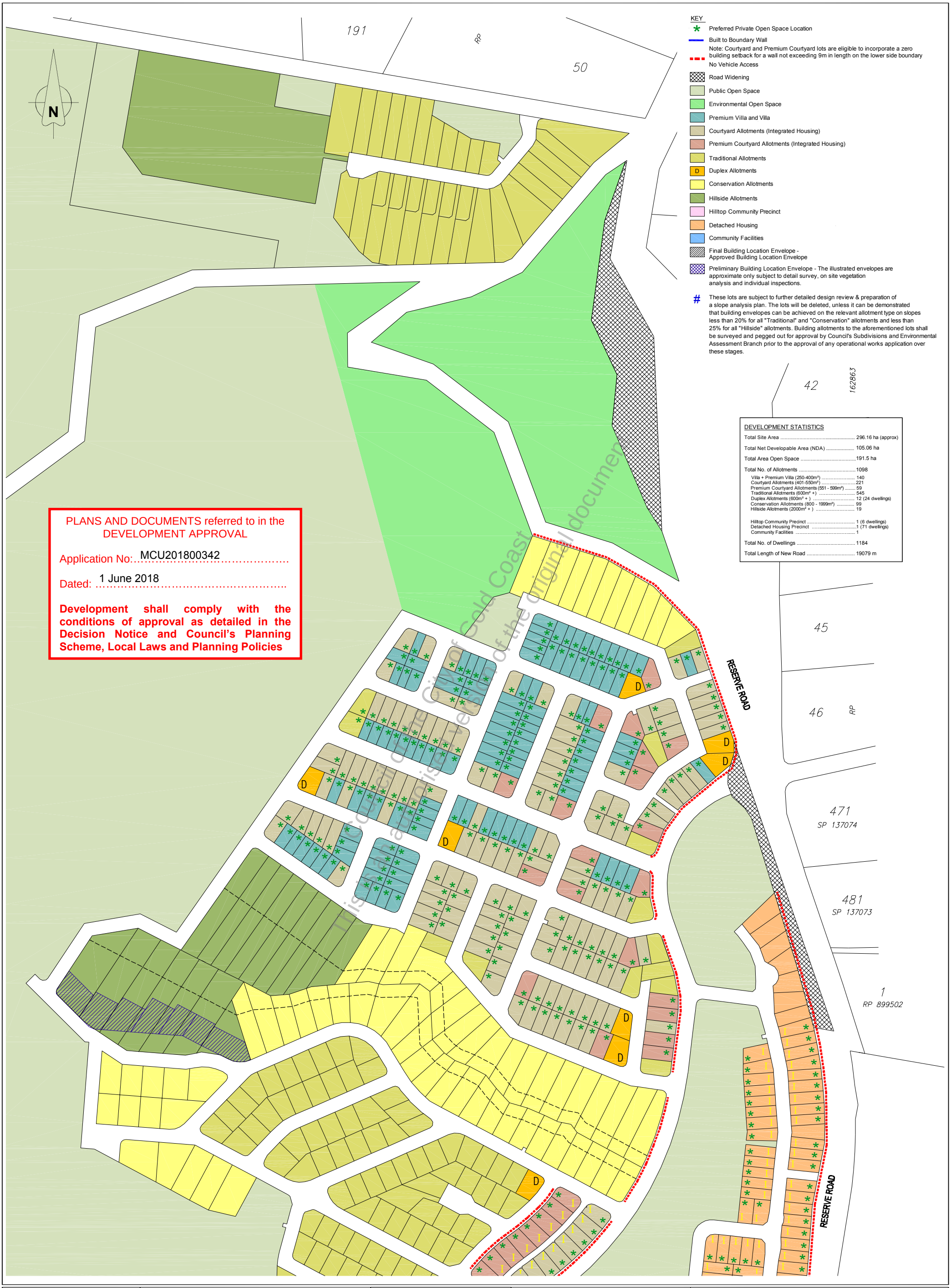
LENGTHS ARE IN METRES

20 0 20 40 60

Note: All dimensions and areas on this plan are subject to survey and requirements for lodgement of survey plans in the Department of Natural Resources and Mines.

DATA ORIGIN : 7563BDY-2017-11-27{REDESIGN}

RPS



KEY

- Preferred Private Open Space Location
- Built to Boundary Wall
- Note: Courtyard and Premium Courtyard lots are eligible to incorporate a zero building setback for a wall not exceeding 9m in length on the lower side boundary
- No Vehicle Access
- Road Widening
- Public Open Space
- Environmental Open Space
- Premium Villa and Villa
- Courtyard Allotments (Integrated Housing)
- Premium Courtyard Allotments (Integrated Housing)
- Traditional Allotments
- D — Duplex Allotments
- Conservation Allotments
- Hillside Allotments
- Hilltop Community Precinct
- Detached Housing
- Community Facilities
- Final Building Location Envelope - Approved Building Location Envelope
- Preliminary Building Location Envelope - The illustrated envelopes are approximate only subject to detail survey, on site vegetation analysis and individual inspections.

\# These lots are subject to further detailed design review & preparation of a slope analysis plan. The lots will be deleted, unless it can be demonstrated that building envelopes can be achieved on the relevant allotment type on slopes less than 20% for all "Traditional" and "Conservation" allotments and less than 25% for all "Hillside" allotments. Building allotments to the aforementioned lots shall be surveyed and pegged out for approval by Council's Subdivisions and Environmental Assessment Branch prior to the approval of any operational works application over these stages.

DEVELOPMENT STATISTICS

Total Site Area	296.16 ha (approx)
Total Net Developable Area (NDA)	105.06 ha
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Detached Housing Precinct	1 (71 dwellings)
Community Facilities	1
Total No. of Dwellings	1184
Total Length of New Road	19079 m

PLANS AND DOCUMENTS referred to in the DEVELOPMENT APPROVAL

Application No: MCU201800342

Dated: 1 June 2018

Development shall comply with the conditions of approval as detailed in the Decision Notice and Council's Planning Scheme, Local Laws and Planning Policies

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CLIENT	STOCKLAND		
Level Datum	Date	1 DECEMBER 2017	
Level Origin	Surveyed	RPS GC	
	Drafted	BJB	
Data Origin CB DEAD	Parish	BARROW	
7563BDY-2017-11-27(REDESIGN)	County	WARD	
PLAN	PLAN OF DEVELOPMENT		
	HIGHLAND RESERVE		
SCALE: 1:2000 (A1)	50 0 50 100 150		

REVISIONS

No.	DETAILS	DATE	Init.
M	REVISION	28.4.14	BJB
O	REVISION	30.10.14	BJB
P	REVISION	11.2.15	BJB
Q	REVISED STAGE 19B	28.5.15	BJB
R	REVISED STAGE 35	19.4.17	BJB
S	REVISED STAGE 35	28.7.17	BJB
T	REVISED STAGE 35	28.8.17	BJB
U	REVISED STAGE 35	1.12.17	BJB

RPS Australia East Pty Ltd
ACN 140 292 762
ABN 44 140 292 762
Suite 4, Robina East Quay Corporate Park (North Building) 34-36 Glenferrie Drive, Robina
PO Box 1048 Robina DC, Qld 4226
T +61 7 555 36900
F +61 7 555 36999
W rpsgroup.com.au

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Local Authority	Plan	Plan Ref	Sheet
G.C.C.C.	A1	7563-POD-165u	1 of 2

DISCLAIMER

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PLANS AND DOCUMENTS referred to in the DEVELOPMENT APPROVAL

Application No: MCU201800342

Dated: 1 June 2018

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This is an authorised version of the original document Council of the City of Gold Coast

HILLTOP COMMUNITY

MAX. 6 DWELLINGS SUBJECT TO FURTHER CODE ASSESSMENT APPLICATION, DETAIL BUILT FORM DESIGN & DWELLING SITING

2
ID 4335

102
WD4335

156
C.849

RESER

D

D D

D

DEVELOPMENT STATISTICS

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REVISIONS

No.	DETAILS	DATE	Init.
H	REVISION	20.6.12	BJB
I	REVISION	13.10.12	BJB
J	REVISION	13.6.13	BJB
K	REVISION	14.4.14	BJB
L	REVISION	23.4.14	BJB
M	REVISION	28.4.14	BJB
O	REVISION	30.10.14	BJB
P	REVISION	11.2.15	BJB
Q	REVISED STAGE 19B	28.5.15	BJB
R	REVISED STAGE 35	19.4.17	BJB
S	REVISED STAGE 35	28.7.17	BJB
T	REVISED STAGE 35	28.8.17	BJB
U	REVISED STAGE 35	1.12.17	BJB

N

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CLIENT

STOCKLAND

PLAN

PLAN OF DEVELOPMENT

HIGHLAND RESERVE

Level Datum	
Level Origin	
Data Origin	SE:DSA2
	7563BDY-2017-11-27(REDESIGN)
Date	1 DECEMBER 2017
Surveyed	RPS GC
Drafted	BJB
Parish	BARROW
County	WARD
Local Authority	G.C.C.C.
Scale	1:2000 (A1)
Sheet	2 of 2
Plan Ref	7563-POD-165u

RPS

RPS Australia East Pty Ltd
ACN 140 292 762
ABN 44 140 292 762

Suite 4, Robina East Quay Corporate Park
(North Building) 34-36 Glenferrie Drive, Robina
PO Box 1048 Robina DC, Qld 4226

T +61 7 555 36900
F +61 7 555 36999

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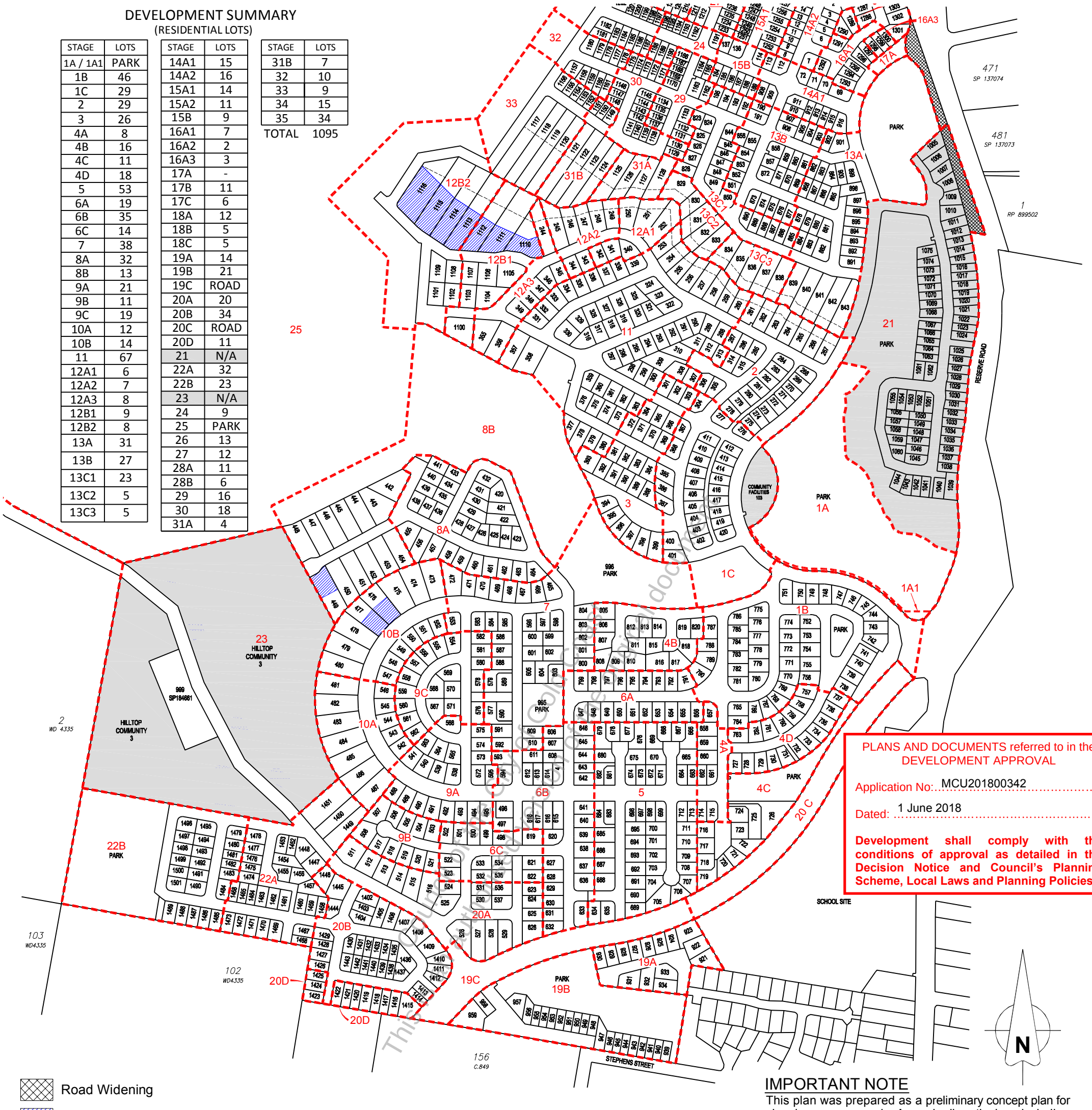
DEVELOPMENT SUMMARY
(RESIDENTIAL LOTS)

STAGE	LOTS
1A / 1A1	PARK
1B	46
1C	29
2	29
3	26
4A	8
4B	16
4C	11
4D	18
5	53
6A	19
6B	35
6C	14
7	38
8A	32
8B	13
9A	21
9B	11
9C	19
10A	12
10B	14
11	67
12A1	6
12A2	7
12A3	8
12B1	9
12B2	8
13A	31
13B	27
13C1	23
13C2	5
13C3	5

STAGE	LOTS
14A1	15
14A2	16
15A1	14
15A2	11
15B	9
16A1	7
16A2	2
16A3	3
17A	-
17B	11
17C	6
18A	12
18B	5
18C	5
19A	14
19B	21
19C	ROAD
20A	20
20B	34
20C	ROAD
20D	11
21	N/A
22A	32
22B	23
23	N/A
24	9
25	PARK
26	13
27	12
28A	11
28B	6
29	16
30	18
31A	4

STAGE	LOTS
31B	7
32	10
33	9
34	15
35	34
TOTAL	1095



Road Widening

Approved Building Location Envelope

Building Location Envelope - The illustrated envelopes are approximate only subject to detail survey, on site vegetation analysis and individual inspections.

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Application No: MCU201800342

Dated: 1 June 2018

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REVISIONS			
No.	DETAILS	DATE	Init.
AL	REVISED STAGE 19B	28/5/15	BJB
AM	REVISED STAGE BDYS	26/6/15	BJB
AN	REVISED STAGE 35	19/4/17	BJB
AO	REVISED STAGE 35	28/7/17	BJB
AP	REVISED STAGE 35	28/8/17	BJB
AQ	REVISED STAGE 35	1/12/17	BJB

CLIENT
STOCKLAND

Level Datum	Date	1 DECEMBER 2017
Level Origin	Surveyed	RPS GC
	Drafted	BJB
Data Origin CS CSAD	Parish	BARROW
7563BDY-2017-11-27(REDESIGN)	County	WARD

PLAN
STAGING PLAN

HIGHLAND RESERVE

SCALE: 1:6000 (A3)

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ACN 140 292 762
ABN 44 140 292 762
Suite 4, Robina East Quay Corporate Park (North Building) 34-36 Glenferrie Drive, Robina
PO Box 1048 Robina DC, Qld 4226
T +61 7 555 36900
F +61 7 555 36999
W rpsgroup.com.au

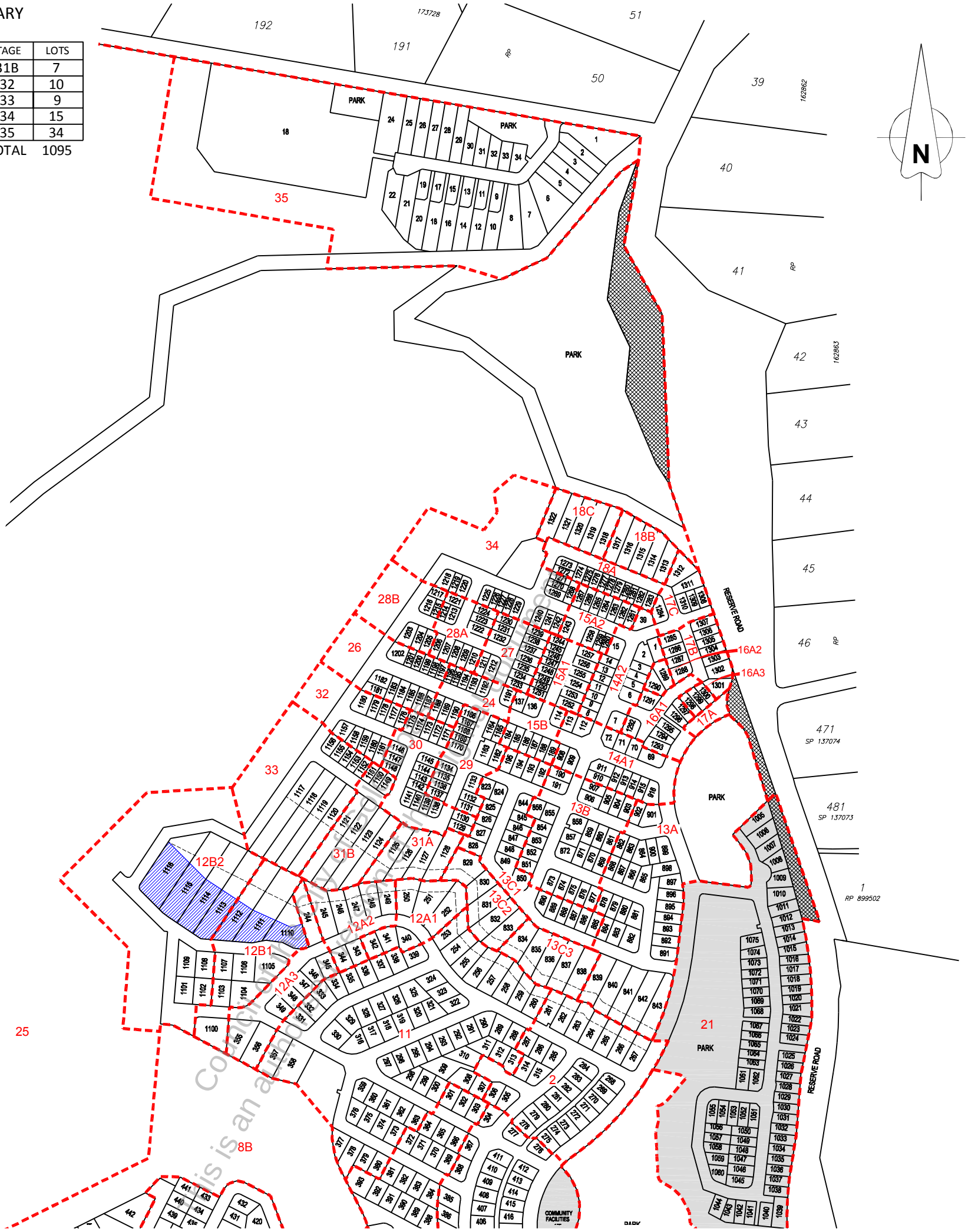
Local Authority	Plan	Plan Ref	Sheet
G.C.C.C.	A3	7563-STP-75aq	1 of 2

DEVELOPMENT SUMMARY
(RESIDENTIAL LOTS)

STAGE	LOTS
1A / 1A1	PARK
1B	46
1C	29
2	29
3	26
4A	8
4B	16
4C	11
4D	18
5	53
6A	19
6B	35
6C	14
7	38
8A	32
8B	13
9A	21
9B	11
9C	19
10A	12
10B	14
11	67
12A1	6
12A2	7
12A3	8
12B1	9
12B2	8
13A	31
13B	27
13C1	23
13C2	5
13C3	5

STAGE	LOTS
14A1	15
14A2	16
15A1	14
15A2	11
15B	9
16A1	7
16A2	2
16A3	3
17A	-
17B	11
17C	6
18A	12
18B	5
18C	5
19A	14
19B	21
19C	ROAD
20A	20
20B	34
20C	ROAD
20D	11
21	N/A
22A	32
22B	23
23	N/A
24	9
25	PARK
26	13
27	12
28A	11
28B	6
29	16
30	18
31A	4

STAGE	LOTS
31B	7
32	10
33	9
34	15
35	34
TOTAL	1095



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AP	REVISED STAGE 35	28/8/17	BJB
AQ	REVISED STAGE 35	1/12/17	BJB

CLIENT
STOCKLAND

Level Datum	Date	1 DECEMBER 2017
Level Origin	Surveyed	RPS GC
	Drafted	BJB
Data Origin CS CSAD	Parish	BARROW
7563BDY-2017-11-27(REDESIGN)	County	WARD

PLAN
STAGING PLAN

HIGHLAND RESERVE

SCALE: 1:6000 (A3) 100 0 100 200

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Local Authority	Plan	Plan Ref	Sheet
G.C.C.C.	A3	7563-STP-75aq	2 of 2