Stormwater Management Report

Request for Planning Proposal
1055 Bruxner Highway, Goonellabah

Prepared for: Nimble Estates Pty Ltd

November 2022

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CERTIFICATION

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Table of Contents

1 Introduction

This Stormwater Management Report has been prepared by Barker Ryan Stewart to accompany a Request for Planning Proposal (Planning Proposal) to amend the *Lismore Local Environmental Plan 2012* (**LLEP**) to enable mixed use development of land referred to as 1055 Bruxner Highway, Goonellabah (**the site**) comprising residential, employment and public open space lands

This investigation considers the following:

- The existing site conditions and stormwater quantity and quality.
- The design and installation of on-site detention storage to control the storm events up to the 100-year ARI.
- The design and installation of bio-filtration elements within the detention storage to promote treatment of the small to moderate storm events.
- The stormwater quantity and quality generated as a result of the proposed development.
- Stormwater management and maintenance issues associated with the proposed infrastructure.

Urbanisation of the subject land will tend to cause a decrease in the quality of stormwater runoff through higher pollutant loads and sediments. Managing these risks through storm water treatment controls will reduce the impact of this development on downstream waterways. This strategy outlines the impacts of such treatment controls and recommends a solution that satisfies the development objectives.

Stormwater detention is usually required in developments to reduce and delay the stormwater flow peak arriving at the system outlet. Without stormwater detention, increased peak flows would negatively impact downstream properties through increased flood inundation and erosion. This study considers a scheme of stormwater controls as a means of managing water quantity and therefore the downstream flood risks.

Any adopted stormwater management controls within a development will require on-going maintenance. As this burden will be carried by Lismore City Council, consideration has been given in this report to the appropriate selection based on maintenance and ongoing cost.

1.1 Objectives

The following objectives are identified in Chapter 22 of the DCP as guiding subdivision design with respect to the stormwater impacts:

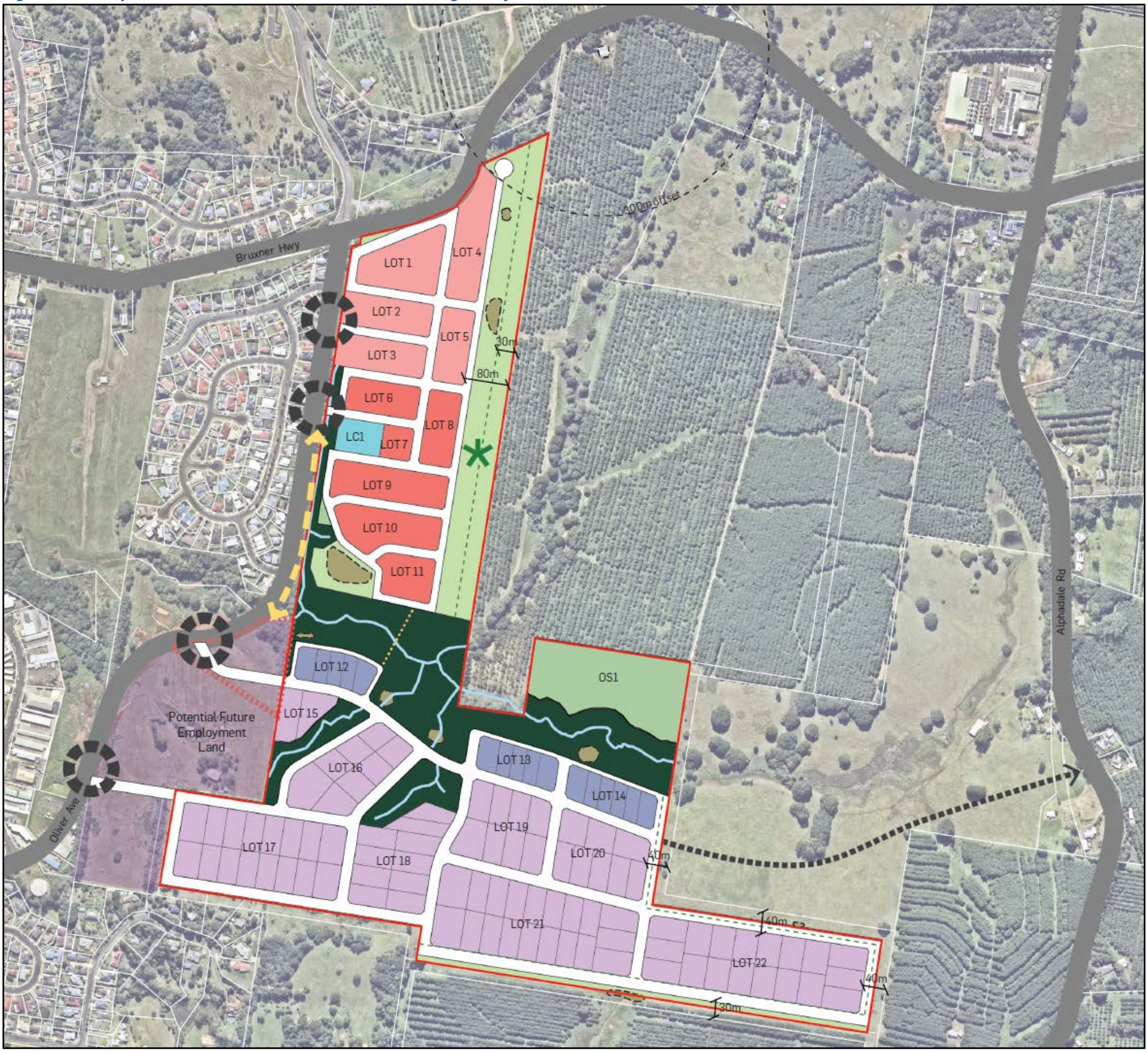
1. To ensure that WSD techniques are incorporated in new developments.
2. To reduce the demand for reticulated water from the town water supply.
3. To ensure that stormwater discharged from new development minimises adverse impacts on the environment and receiving waters.
4. To utilise natural surfaces and landforms as stormwater flow paths and to allow for on-site treatment where suitable.
5. To ensure that water management is a key consideration in the urban design process to maximise opportunities for water reuse and ensure stormwater management infrastructure, in particular, is appropriately integrated with the site design.
6. To protect and restore aquatic ecosystems within the development site and downstream.
7. To ensure the function of the stormwater drainage and flood protection elements of designs are not compromised by incompatible or inappropriate WSD designs.

2 The Development

2.1 Site Location

The site at 1055 Bruxner Highway has an area of approximately 76ha and is located adjoining existing urban development on the eastern fringe of Goonellabah. The site comprises two allotments being Lot 42 DP868366 and Lot 1 DP957677 and benefits from frontages to the Bruxner Highway to the north and Oliver Avenue to the west. The site is zoned RU1 Primary Production and has been used for many years for grazing purposes and is largely cleared of vegetation except for remnant trees dispersed across the site. The property is bisected by Tucki Tucki creek with several minor watercourses feeding into it. The site is free from extensive flooding other than waters confined within Tucki Tucki Creek.

Figure 1: Subject site location – 1055 Bruxner Highway Goonellabah



2.2 Development Proposal

The Planning Proposal seeks to amend the LLEP as follows:

- Rezone the site from RU1 Primary Production to the following mix of land use zones:
    - R1 General Residential.
    - B4 Mixed Use.
    - RE1 Public Recreation.
    - IN1 General Industrial.
- Amend the Lot Size Map (Sheet LSZ_005 and Sheet LSZ_006) to remove the current minimum lot size requirement of 40ha and 20ha and impose the following minimum lot sizes:
    - R1 zoned land: a minimum lot size of 300m2
    - B4 zoned land to the north of Tucki Tucki creek: a minimum lot size of 300m2
    - B4 zoned land to the south of Tucki Tucki creek: a minimum lot size of 1,500m2
    - IN1 zoned land: a minimum lot size of 1,500m2
- Amend the LLEP 2012 Height of Building Map (Sheet HOB_005 and Sheet HOB_006) to impose the following maximum height of building control (excluding the RE1 and IN1 zoned land):
    - B4 zoned land to the north of Tucki Tucki creek: maximum building height of 13.5m
    - R1 zoned land: maximum building height of 8.5m

Changes to the planning controls facilitate the potential development of the site to accommodate a diversity of new housing, employment, and public open space opportunities in an environmentally and socially sustainable environment.

An Indicative Layout Plan (**ILP**), informed by detailed technical investigations into the characteristics of the site and adjoining land along with available servicing and community infrastructure, confirms the capacity to accommodate urban development comprising the following:

- Approximately 346 residential and mixed use zoned allotments capable of accommodating a variety of housing forms and densities with an estimated population of over 855 residents.
- Approximately 105 allotments zoned industrial and mixed use capable of supporting a variety of employment generating and service activities with an associated potential 2,614 direct jobs.
- Provision of over 14ha of the site to open space comprising land zoned and utilised for public recreation along with riparian corridors and landscape buffers.

3 Planning Guidelines

3.1 Office Of Water

NRAR mapping shows a watercourse within the subject land. This watercourse is identified as a third order stream as classified under the Strahler System of ordering watercourses.

The following works are proposed within 40m of the stream. These activities are permitted as per Table 2 – Riparian Corridor Matrix.

- Detention basins
- Stormwater outlet structures
- Minor earthworks

4 Stormwater Management Strategy

Proposals such as this study require a planning approach adopting water cycle management, which includes source, conveyance, and discharge controls. Construction related impacts are also identified as relevant to the proposal.

4.1 Water Cycle Management

4.1.1 Water Harvesting and re-use

The principles of storing rainwater on site through above or below ground rainwater tanks have been shown to have a beneficial effect through reduced mains water (potable) demand and decrease in storm water runoff, to counter the impacts of urbanisation. Rainwater tanks are typically required for residential development to comply with the NSW State Government's Building Sustainability Index (BASIX) requirements to provide water efficiency among other building efficiency measures.

4.1.2 Water Infrastructure

Potable water will be supplied through the development to provide adequate water pressure for drinking water and fire-fighting purposes. Water servicing has been considered separately.

4.1.3 Water Sensitive Urban Design

Water Sensitive Urban Design (WSUD) is considered as part the whole life of a development, including the planning phase. The principals of WSUD include consideration to improving water efficiency, water harvesting, reducing impervious surfaces, and implementation of stormwater controls as part of a subdivision design to reduce stormwater runoff and improve stormwater quality.

4.1.4 Erosion And Sediment Controls

Temporary measures adopted to control erosion during the construction phase would be maintained by the civil works contractor. This may include a sediment fence or bund on the lots to minimise sediment transfer until the turf or grass is established. Diversion banks or cut-off drains may also be formed for the construction phase to limit mixing of dirty and clean water for the period where the site is disturbed during bulk earthworks. Dirty water created as a result of the works will be directed to adequately sized sediment basins in accordance with the blue book.

A Soil and Water Management Plan would be required prior to commencement of construction works in accordance with the Blue Book (2004) so as to prevent erosion and runoff during site construction to minimise impacts on receiving waterways.

5 Water Quantity

Urbanisation of a catchment tends to increase flows, which results in greater flooding risks downstream. The development can be regarded as satisfying water quantity control measures if the developed peak stormwater discharge is no greater than the pre-developed peak stormwater discharge. By providing detention storage and sizing an outlet structure that releases water in a controlled manner, the peak stormwater flow from a defined storm event can be shown to be sufficiently reduced to be less than the pre-developed flow targets.

5.1 DRAINS Model

A stormwater network was prepared in accordance with the requirements of Australian Rainfall and Runoff (2019), Lismore City Council's Development Control Plan 2012 (Chapter 22), and the Northern Rivers Local Government Design Specification D5 – Stormwater Drainage. Design of the drainage network incorporated Council's preferred standards and the design was modelled in DRAINS.

5.1.1 Design Rainfall Data

Design rainfall data has been provided by the Bureau of Meteorology.

5.1.2 Catchments

The stormwater network was prepared for the entire development site. The pre-developed catchments for this development were delineated by the natural surface contours for the development locality. The post-developed catchments were delineated based on the proposed layout for the subdivision of the land. The pre-developed catchment condition was modelled as having 0% impervious area. The post-developed catchments were modelled as follows for each proposed zoning type:

- 40% impervious for Standard residential lots (600m² Lot area)
- 70% impervious for Smaller residential lots (200m² Lot area)
- 65% impervious for road reserves within the industrial zoned lots
    - NOTE: It is assumed the water quantity and quality control for these lots will be dealt with on a lot by lot basis in subsequent DA submissions.
- 90% impervious for Business lots

Catchment Hydrology was based on the ILSAX model regime using a soil type of D and Antecedent Moisture Condition (AMC) of 3 in accordance with Council's standards. These soil parameters are representative of relatively wet clayey soils at the commencement of each modelled storm event.

Below is a summary of each Catchment shown in the figure below.

- **Catchment 1**
    - Catchment Area = 0.82Ha
    - Zoning = Standard Residential Lots
    - % Impervious = 40%
    - Contributing to Basin 1
- **Catchment 2**
    - Catchment Area = 3.58Ha
    - Zoning = Standard Residential Lots
    - % Impervious = 40%
    - Contributing to Basin 2
- **Catchment 3**
    - Catchment Area = 4.85Ha
    - Zoning = Standard Residential Lots
    - % Impervious = 40%
    - Contributing to Basin 3 / 4
- **Catchment 4**
    - Catchment Area = 8.1Ha
    - Zoning = Smaller residential lots
    - % Impervious = 70%
    - Contributing to Basin 3 / 4

- **Catchment 5**
    - Catchment Area = 1.88Ha
    - Zoning = Road Reserves within the industrial zoned lots
    - % Impervious = 65%
    - Contributing to Basin 5

- **Catchment 6**
    - Catchment Area = 2.56Ha
    - Zoning = Road Reserves within the industrial zoned lots
    - % Impervious = 65%
    - Contributing to Basin 6

- **Catchment 7a**
    - Catchment Area = 2.16Ha
    - Zoning = Road Reserves within the industrial zoned lots
    - % Impervious = 65%
    - Contributing to Basin 7

- **Catchment 7b**
    - Catchment Area = 1.913Ha
    - Zoning = Business lots
    - % Impervious = 90%
    - Contributing to Basin 7

- **Catchment 8**
    - Catchment Area = 2.38Ha
    - Zoning = Road Reserves within the industrial zoned lots
    - % Impervious = 65%
    - Contributing to Basin 8

- **Catchment 9**
    - Catchment Area = 0.76Ha
    - Zoning = Road Reserves within the industrial zoned lots
    - % Impervious = 65%
    - Contributing to Basin 9

- **Catchment 10**
    - Catchment Area = 1.3Ha
    - Zoning = Business lots
    - % Impervious = 90%
    - Contributing to Basin 10

5.1.3 Performance Criteria

The stormwater modelling of the proposed stormwater network has been undertaken for the storm events including the 10% and the 1% AEP storm event in accordance with the requirements set out in the DCP. The network was designed to satisfy pre-developed to post developed flows. The results of the 10% and 1% AEP stormwater analysis for the entire project are presented in this report.

5.1.4 Onsite Detention

Nine stormwater bioretention basins are provided across the site to provide both water quality and quantity treatment. A summary of the detention details and minimum biofiltration media area of the bioretention basins are provided below.

Basin	Basin Volume (m^3)	Biofiltration Area (m^2)	Arrangement
Basin 1	117	81	Bioretention basin
Basin 2	1047	400	
Basin 3 / 4	3086	1250	
Basin 5	448	188	
Basin 6	538	225	
Basin 7	822	360	
Basin 8	489	200	Underground tank and biotreatment basin
Basin 9	170	64	
Basin 10	334	120	

Table 1 - OSD Details

5.1.5 Pre-Developed Results

The DRAINS model was run for the 10yr and 100yr storm events over a number of durations. A common point for comparison of flows from this predeveloped model to the Post developed model was created at the bottom of each catchment and located at the outlet points for the proposed onsite detention basins.

Table 2 shows the flows recorded at these locations for both pre and post developed models. All DRAINS results are contained within this report.

5.1.6 Post-Developed Results

A Post Developed DRAINS model was created. The proposed subdivision has been modelled as it has been designed. All catchments have been separated into individual catchments and flows modelled to be routed through detention basins.

Table 2 shows the flows recorded at all proposed Basins for both the Pre and the Post development flows for the minor and major storm events:

BRS DRAINS Modelling				
	10yr Predeveloped Flows (m^3)	10yr Postdeveloped Flows (m^3)	100yr Predeveloped Flows (m^3)	100yr Postdeveloped Flows (m^3)
Basin 1	0.175	0.168	0.277	0.221
Basin 2	0.608	0.534	0.964	0.802
Basin 3 / 4	2.693	2.61	4.267	3.742
Basin 5	0.392	0.337	0.62	0.51
Basin 6	0.533	0.475	0.845	0.81
Basin 7	0.848	0.815	1.917	1.471
Basin 8	0.496	0.459	0.785	0.715
Basin 9	0.158	0.138	0.485	0.179
Basin 10	0.306	0.248	0.485	0.429

Table 2 - Pre/Post Developed Flows

The results in Table 2 confirm the post developed site discharge satisfies council requirements. For full modelling results please refer to Attachment A.

6 Water Quality

Frequent, low-intensity rainfall events tend to mobilise harmful pollutants such as suspended solids, nutrients, and litter into the stormwater streams. Conversely, pollutant loads are generally insignificant and sufficiently diluted in large flows from relatively low frequency storm events (typically any storm event greater than the 3-month ARI). Best management practice suggests water quality controls are designed to treat stormwater runoff from the frequent rainfall events.

6.1 Water Quality Analysis

Water quality modelling was performed in the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) program, which uses temporal (time variable) rainfall data to simulate stormwater runoff and pollutant concentrations through a continuous time series. Unlike hydrological/hydraulic modelling based on event rainfall, for example temporal patterns of rainfall bursts as outlined in Australian Rainfall and Runoff (AR&R), MUSIC continuously models the pollutant loads through the treatment train to determine mean annual loads and effectiveness of the water treatment controls over one or more years. This approach is determined to be the best practice for simulating stormwater quality, as pollutant concentrations tend to be randomly sampled about a log-normal distribution.

MUSIC simulated results can be provided in the form of treatment train effectiveness, and directly compared with LSC's water quality standards. These standards are represented as a percentage target removal for each treatment category. The MUSIC Link function has been utilised based on Ballina Shire Council's MUSIC Link function.

6.1.1 Treatment Controls

Gross Pollutant Traps

Gross pollutants and course suspended sediment are to be treated in a trash rack and sump prior to discharge to the basins. This was modelled by a suitably sized GPT device using templates and guides provided by ROCLA.

- Basin 1 Catchment will be run via a CDS P0708 GPT device
- Basin 2 Catchment will be run via a CDS P1009 GPT device
- Basin 3/4 Catchment will be run via a CDS P1009 & CDS P1015 GPT device
- Basin 5 Catchment will be run via a CDS P0708 GPT device
- Basin 6 Catchment will be run via a CDS P1009 GPT device
- Basin 7 Catchment will be run via a CDS P1009 GPT device
- Basin 8 Catchment will be run via a CDS P1009 GPT device
- Basin 9 Catchment will be run via a CDS NIPPER GPT device
- Basin 10 Catchment will be run via a CDS P0708 GPT device

Bioretention Basins

Nutrient control occurs in the final bioretention node. Rainwater tanks for each lot were not modelled for simplicity. MUSIC model schematics are provided below.

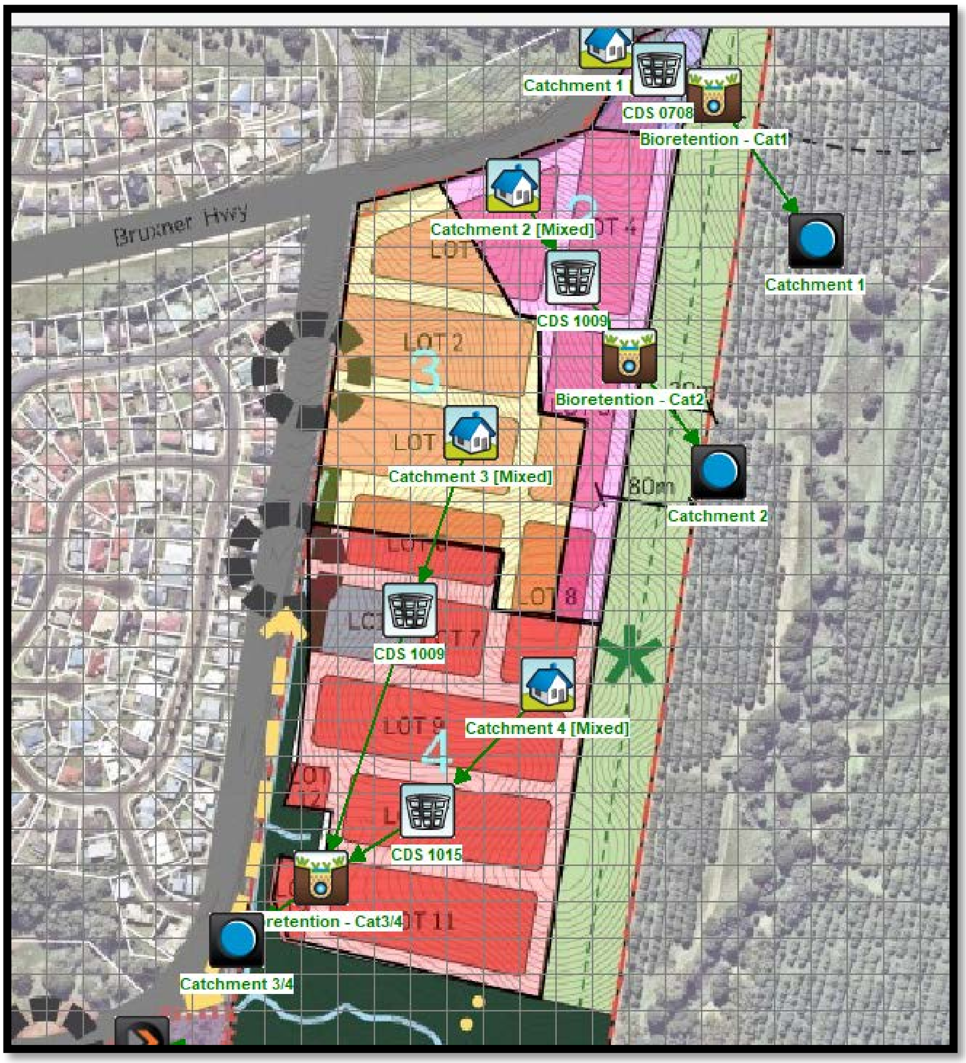


Table 3 - Residential Catchments - MUSIC Model

Table 4 - Industrial & Business Catchments - MUSIC Model

The basins were modelled using the “Biofiltration” node in MUSIC with the following key assumptions applied:

- The basins will have a 0.3 m extended detention depth. The basin will be overtopped via outlet pits when the extended detention depth is exceeded.
- The filter media will be 0.7 m deep and will comprise a sandy loam soil layer 400mm thick, a transition layer of clean well graded sand 100mm thick and a 200mm thick drainage layer of clean gravel of 2-5mm aggregate size. It is expected that the long-term hydraulic conductivity will be 100 mm/hr. The filter media will have TN content no greater than 800 mg/kg and orthophosphate content no greater than 50 mg/kg.
- Subsurface drainage will be provided to collect treated water from the base of the filter.
- The basins will be unlined to allow some exfiltration of treated water. A conservative exfiltration rate of 0.36 mm/hr was assumed (this is the low end of the range for medium clays provided in Table 13.8-D in the Gold Coast City Council WSUD Guidelines)

6.1.2 Design of the Biofiltration Basin

Design of the biofiltration basin includes the following features:

- Filtration media is to comprise of a sandy loam material that will achieve an initial hydraulic conductivity of 200 mm/hr. It is expected that this will reduce to 100mm/hr over time due to clogging. The filter media will have a TN content no greater than 800 mg/kg and an orthophosphate content no greater than 50 mg/kg.
- The filter area will be vegetated with native species that are appropriate for the filter media characteristics and the local climate conditions. The vegetation must be capable of withstanding extended dry periods and frequent wetting.
- The basin will have a 0.3 m extended detention depth.
- Scour protection will be provided at basin inlets/outlets.
- The basins will be unlined to allow some exfiltration of treated water. Subsurface drainage will be provided to collect any excess treated water from the base of the filter.
- Basin batters will be 1V:4H on the inner face of the basin and 1V:4H on the outer face of the basins.
- The Biofiltration outlet from the basins will not be connected to the stormwater system until the majority of construction activities have concluded in the contributing catchment (80% of dwellings constructed). This is to prevent potentially high sediment loads clogging the filter media.
- Filter Areas have been shown in Table 1.

6.1.3 MUSIC Modelling Results

Below are the results of the MUSIC modelling.

	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)	Gross Pollutants (kg/yr)
Lismore City Council Requirements	**75%**	**65%**	**40%**	**90%**
Basin 1	91.5%	66.2%	53.6%	100%
Basin 2	89.3%	66%	55.4%	100%
Basin 3 / 4	87.9%	65.8%	53.6%	100%
Basin 5	88.5%	66.5%	52.9%	100%
Basin 6	89.3%	65.9%	50.9%	100%
Basin 7	87.1%	65.1%	50.2%	100%
Basin 8	88.9%	65.8%	50.5%	100%
Basin 9	87.9%	65.6%	51.2%	100%
Basin 10	89.3%	66.7%	49.9%	100%

The Table above shows that all post developed flows exiting the basin have been treated successfully and the reduction percentages are within LCC's WSUD guidelines. Therefore, it is considered that the proposed configuration of the Basins will adequately cleanse the expected stormwater runoff to acceptable standards prior to its discharge to the receiving watercourse. All MUSIC Modelling files can be made available if required by Council

7 Fencing Requirements

The internal batter slopes of the basins will be 1 vertical to 4 horizontal and as per the spec, this will not require any exclusion fencing.

8 Flooding

Council has provided preliminary advice that for this early phase of servicing assessment works should be maintained above RL 140 to avoid interaction with flood waters (Lucas Myers, pers. comm. 16/09/22). While this level will be determined more accurately as part of detailed design, Figure xxx demonstrates adequate detention volumes and treatment areas can be readily provided above RL 140, and, if necessary, higher.

9 Conclusion

After modelling within DRAINS and water quality modelling using MUSIC software, BRS has found that the proposed OSD with Biofiltration to be constructed at the Bruxner Highway Subdivision is adequate to attenuate flows from storms and effectively cleanse all stormwater runoff onsite.

This report has shown that the proposed OSD Basins successfully attenuates storms from the 10yr and 100yr events, flows are kept below the predeveloped (existing) flows. Water quality improvement devices have achieved adequate reduction percentages of all pollutants through the use of ROCLA GPT units and Biofiltration layers for Basins.

10 Maintenance Management

To ensure the system functions efficiently over the long term, it will be necessary to carry out regular maintenance on the stormwater system and the water quality devices.

The maintenance of the on-site detention systems will be undertaken during regular inspections and a maintenance schedule should be prepared in accordance with the Facility for Advancing Water Biofiltration (FAWB) Maintenance requirements for Biofiltration systems document. This schedule sets out the frequency of maintenance inspections and who should undertake them.

In addition, during construction, erosion sediment control devices will have to be put in place to protect the riparian buffer zone and the bio-retention basin. The construction of the basin and infiltration system should not be commenced until the majority of the construction has been completed. This will prevent the bio-retention swale from clogging with construction sediment and silt.

Attachment A – DRAINS Modelling Results

DRAINS results prepared from Version 2022.012

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surfa Flow Arrivi (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N5798	1.19		0				
N12632	1.47		0				
N12631	1.33		0				
N12633	1.29		0				
N12634	1.36		0				
N12635	1.44		0				
N12636	1.35		0				
N12637	1.18		0				
N12638	1.25		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat1 - Predev	0.175	0	0.175	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 1 - Postdev	0.219	0.18	0.08	5	20	2	10% AEP, 15 min burst, Storm 3
Cat 2 - Predev	0.608	0	0.608	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 2 - Postdev	0.934	0.768	0.341	5	20	2	10% AEP, 15 min burst, Storm 3
Cat 3 - Predev	1.033	0	1.033	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 3 - Postdev	1.266	1.04	0.462	5	20	2	10% AEP, 15 min burst, Storm 3
Cat 4 - Predev	1.66	0	1.66	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 4 - Postdev	2.923	2.537	0.386	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 5 - Predev	0.392	0	0.392	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 6 - Predev	0.533	0	0.533	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 7 - Predev	0.45	0	0.45	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 8 - Predev	0.496	0	0.496	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 9 - Predev	0.158	0	0.158	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 10 - Predev	0.306	0	0.306	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 5 - Postdev	0.651	0.547	0.104	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 6 - Postdev	0.887	0.745	0.142	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 7 - Postdev	0.748	0.628	0.12	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 8 - Postdev	0.824	0.692	0.132	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 9 - Postdev	0.263	0.221	0.042	5	20	2	10% AEP, 15 min burst, Storm 5
Cat 10 - Postdev	0.57	0.562	0.008	5	20	2	10% AEP, 5 min burst, Storm 1
Cat7 - Predev Business	0.398	0	0.398	5	20	2	10% AEP, 30 min burst, Storm 4
Cat 7 - Post Dev business	0.839	0.826	0.012	5	20	2	10% AEP, 5 min burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.168	1.79	1.383	1.197	10% AEP, 1 hour burst, Storm 3
Pipe3 4	2.61	3.1	1.673	1.466	10% AEP, 1 hour burst, Storm 6
Pipe2	0.534	2.42	1.537	1.337	10% AEP, 1 hour burst, Storm 10
Pipe5	0.337	2.28	1.62	1.295	10% AEP, 1 hour burst, Storm 6
Pipe6	0.475	2.37	1.661	1.358	10% AEP, 1 hour burst, Storm 6
Pipe7	0.815	2.66	1.704	1.439	10% AEP, 1 hour burst, Storm 3
Pipe8	0.459	2.32	1.633	1.352	10% AEP, 1 hour burst, Storm 3
Pipe9	0.138	2.03	1.543	1.176	10% AEP, 30 min burst, Storm 4
Pipe10	0.248	2.33	1.667	1.247	10% AEP, 30 min burst, Storm 4

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Widtł	Max V	Due to Storm
OFcat1	0.219	0.219	0	0.044	0.03	11.09	0.68	10% AEP, 15 min burs
OFcat2	0.934	0.934	0	0.086	0.09	15.31	1.06	10% AEP, 15 min burs
OFcat3	1.266	1.266	0	0.099	0.12	16.6	1.17	10% AEP, 15 min burs

OFcat4	2.923	2.923	0	0.146	0.22	20.77	1.48	10% AEP, 15 min burs
OFCat5	0.651	0.651	0	0.073	0.07	13.96	0.95	10% AEP, 15 min burs
OFCat6	0.887	0.887	0	0.084	0.09	15.08	1.05	10% AEP, 15 min burs
OFCat7road	0.748	0.748	0	0.078	0.08	14.43	1	10% AEP, 15 min burs
OFCat8	0.824	0.824	0	0.081	0.08	14.78	1.03	10% AEP, 15 min burs
OFCat9	0.263	0.263	0	0.048	0.03	11.44	0.73	10% AEP, 15 min burs
OFCat10	0.57	0.57	0	0.068	0.06	13.49	0.92	10% AEP, 5 min burst,
OF1	0	0	0.908	0	0	0	0	
OFcat3 4	0	0	0.908	0	0	0	0	
OF2	0	0	0.908	0	0	0	0	
OF5	0	0	0.908	0	0	0	0	
OF6	0	0	0.908	0	0	0	0	
OF7	0	0	0.908	0	0	0	0	
OF8	0	0	0.908	0	0	0	0	
OF9	0	0	0.908	0	0	0	0	
OF10	0	0	0.908	0	0	0	0	
OFCat7business	0.839	0.839	0	0.082	0.08	14.9	1.02	10% AEP, 5 min burst,

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin1	1.5	62	0.168	0.168	0
Basin3-4	1.97	2209	2.61	2.61	0
Basin2	1.78	601.9	0.534	0.534	0
Basin5	1.89	267.6	0.337	0.337	0
Basin6	1.97	349.2	0.475	0.475	0
Basin7	2.08	593	0.815	0.815	0
Basin8	1.92	298.7	0.459	0.459	0
Basin9	1.72	86.8	0.138	0.138	0
Basin10	1.94	207	0.248	0.248	0

Run Log for 220615 Bruxner Hwy run at 07:51:51 on 26/9/2022 using version 2022.012

The maximum flow in these overflow routes is unsafe: OFCat7business, OFCat10, OFCat9, OFCat8, OFCat7road, OFCat6, OFCat5, OFcat4, OFCa

DRAINS results prepared from Version 2022.012

PIT / NODE DETAILS

Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N5798	1.24		0				
N12632	1.54		1.677				
N12631	1.43		0.404				
N12633	1.32		0.339				
N12634	1.39		0.553				
N12635	1.5		1.126				
N12636	1.38		0.459				
N12637	1.19		0.019				
N12638	1.26		0.363				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat1 - Predev	0.277	0	0.277	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 1 - Postdev	0.346	0.186	0.16	5	20	2	1% AEP, 20 min burst, Storm 1
Cat 2 - Predev	0.964	0	0.964	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 2 - Postdev	1.474	0.792	0.681	5	20	2	1% AEP, 20 min burst, Storm 1
Cat 3 - Predev	1.637	0	1.637	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 3 - Postdev	1.996	1.074	0.923	5	20	2	1% AEP, 20 min burst, Storm 1
Cat 4 - Predev	2.63	0	2.63	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 4 - Postdev	4.469	4.158	0.311	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 5 - Predev	0.62	0	0.62	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 6 - Predev	0.845	0	0.845	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 7 - Predev	0.713	0	0.713	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 8 - Predev	0.785	0	0.785	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 9 - Predev	0.251	0	0.251	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 10 - Predev	0.485	0	0.485	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 5 - Postdev	0.98	0.896	0.084	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 6 - Postdev	1.335	1.22	0.115	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 7 - Postdev	1.126	1.03	0.097	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 8 - Postdev	1.241	1.134	0.107	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 9 - Postdev	0.396	0.362	0.034	5	20	2	1% AEP, 5 min burst, Storm 1
Cat 10 - Postdev	0.875	0.858	0.017	5	20	2	1% AEP, 5 min burst, Storm 1
Cat7 - Predev Business	0.63	0	0.63	5	20	2	1% AEP, 25 min burst, Storm 1
Cat 7 - Post Dev busine	1.287	1.262	0.024	5	20	2	1% AEP, 5 min burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.221	2.12	1.566	1.236	1% AEP, 45 min burst, Storm 6
Pipe3 4	3.105	3.16	1.782	1.548	1% AEP, 45 min burst, Storm 6
Pipe2	0.7	2.64	1.782	1.433	1% AEP, 2 hour burst, Storm 2
Pipe5	0.419	2.7	1.831	1.322	1% AEP, 45 min burst, Storm 1
Pipe6	0.571	2.73	1.837	1.385	1% AEP, 45 min burst, Storm 6
Pipe7	0.942	2.8	1.856	1.5	1% AEP, 20 min burst, Storm 8
Pipe8	0.564	2.7	1.824	1.384	1% AEP, 45 min burst, Storm 6
Pipe9	0.179	2.55	1.789	1.191	1% AEP, 45 min burst, Storm 1
Pipe10	0.3	2.75	1.87	1.26	1% AEP, 45 min burst, Storm 9

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm

OFcat1	0.346	0.346	5.889	0.054	0.04	12.09	0.79	1% AEP, 20 min burst, Storm 1
OFcat2	1.474	1.474	5.889	0.107	0.13	17.36	1.21	1% AEP, 20 min burst, Storm 1
OFcat3	1.996	1.996	5.889	0.123	0.16	19	1.32	1% AEP, 20 min burst, Storm 1
OFcat4	4.469	4.469	5.889	0.177	0.3	22.6	1.7	1% AEP, 5 min burst, Storm 1
OFCat5	0.98	0.98	5.889	0.088	0.1	15.49	1.08	1% AEP, 5 min burst, Storm 1
OFCat6	1.335	1.335	5.889	0.102	0.12	16.89	1.18	1% AEP, 5 min burst, Storm 1
OFCat7road	1.126	1.126	5.889	0.094	0.11	16.07	1.13	1% AEP, 5 min burst, Storm 1
OFCat8	1.241	1.241	5.889	0.099	0.11	16.54	1.15	1% AEP, 5 min burst, Storm 1
OFCat9	0.396	0.396	5.889	0.058	0.05	12.44	0.82	1% AEP, 5 min burst, Storm 1
OFCat10	0.875	0.875	5.889	0.083	0.09	15.02	1.05	1% AEP, 5 min burst, Storm 1
OF1	0	0	1.479	0	0	0	0	
OFcat3 4	0.637	0.637	1.479	0.124	0.18	4	1.46	1% AEP, 45 min burst, Storm 6
OF2	0.102	0.102	1.479	0.051	0.04	4	0.71	1% AEP, 2 hour burst, Storm 2
OF5	0.091	0.091	1.479	0.049	0.03	4	0.68	1% AEP, 45 min burst, Storm 1
OF6	0.239	0.239	1.479	0.074	0.07	4	1	1% AEP, 45 min burst, Storm 6
OF7	0.529	0.529	1.479	0.112	0.15	4	1.37	1% AEP, 20 min burst, Storm 8
OF8	0.151	0.151	1.479	0.061	0.05	4	0.83	1% AEP, 45 min burst, Storm 6
OF9	0	0	1.479	0	0	0	0	
OF10	0.129	0.129	1.479	0.056	0.04	4	0.79	1% AEP, 45 min burst, Storm 9
OFCat7business	1.287	1.287	5.889	0.1	0.12	16.72	1.16	1% AEP, 5 min burst, Storm 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin1	1.78	116.9	0.221	0.221	0
Basin3-4	2.28	3085.6	3.742	3.105	0.637
Basin2	2.2	1046.8	0.802	0.7	0.102
Basin5	2.25	447.5	0.51	0.419	0.091
Basin6	2.29	537.6	0.81	0.571	0.239
Basin7	2.36	821.7	1.471	0.942	0.529
Basin8	2.27	488.3	0.715	0.564	0.151
Basin9	2.08	169.7	0.179	0.179	0
Basin10	2.26	334.1	0.429	0.3	0.129

Run Log for 220615 Bruxner Hway run at 07:52:12 on 26/9/2022 using version 2022.012

Flows were safe in all overflow routes.

Attachment B – Catchments and Basins Layouts

80 0 80 160 240 320 400
METRES
1:4000

File ref: 220615-D004 Bruxner Plotted: 28/09/2022 6:14 AM

REV	AMENDMENT	ISSUED	DATE

BARKER RYAN STEWART

SYDNEY P: 02 9659 0005
CENTRAL COAST P: 02 4325 5255
HUNTER P: 02 4966 8388
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Client:

Developed Pty Ltd

PLANNING PROPOSAL
1055 BRUXNER HIGHWAY, GOONELLABAH

Stormwater Management Plan
Catchment Layout

NORTH

Designed: JS
Drawn: CH
Checked: JS

Scales: @A1 Plan - Horiz. - Vert. - X-Sect. - Refer sheet

Datum: AHD

Plan No.
Plan No.

File Ref.
220615-D004 Bruxner

REV.

Layout - North

Scale @ A1 1:2500

Layout - South

Scale @ A1 1:2500

50 0 50 100 150 200 250 METRES 1:2500

REV	AMENDMENT	ISSUED	DATE

BARKER RYAN STEWART

SYDNEY P: 02 9659 0005 · CENTRAL COAST P: 02 4325 5255 · HUNTER P: 02 4966 8388 · S.E. QLD P: 07 5582 6555

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Client: Developed Pty Ltd

PLANNING PROPOSAL
1055 BRUXNER HIGHWAY, GOONELLABAH

Stormwater Management Plan
Basins Layout

NORTH

Designed: JS
Drawn: CH
Checked: JS

Scales: @A1 Plan - Horiz. - Vert. - X-Sect. - Refer sheet

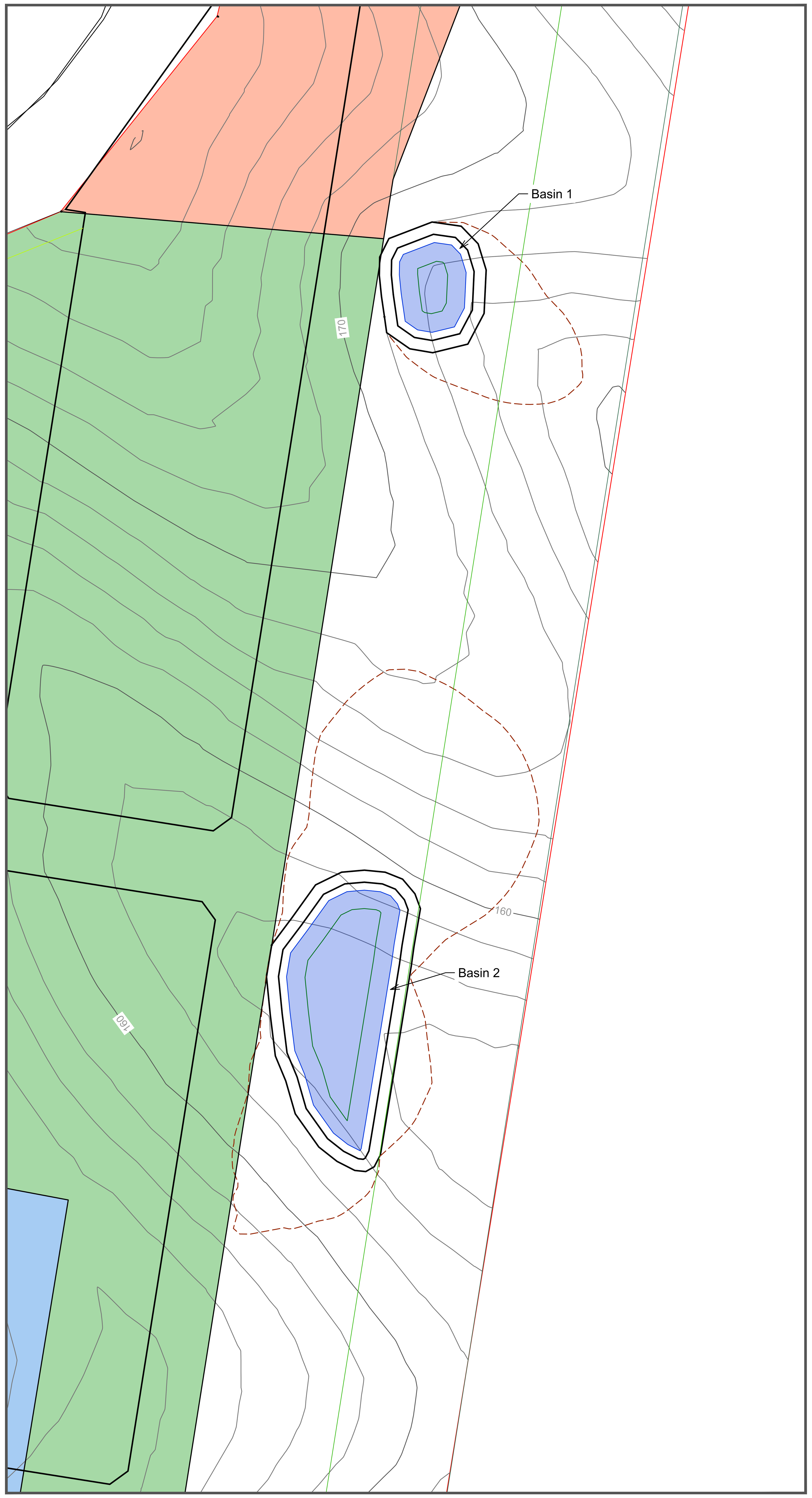
Datum: AHD

Plan No. 220615-01-002

File Ref. 220615-D004 Bruxner

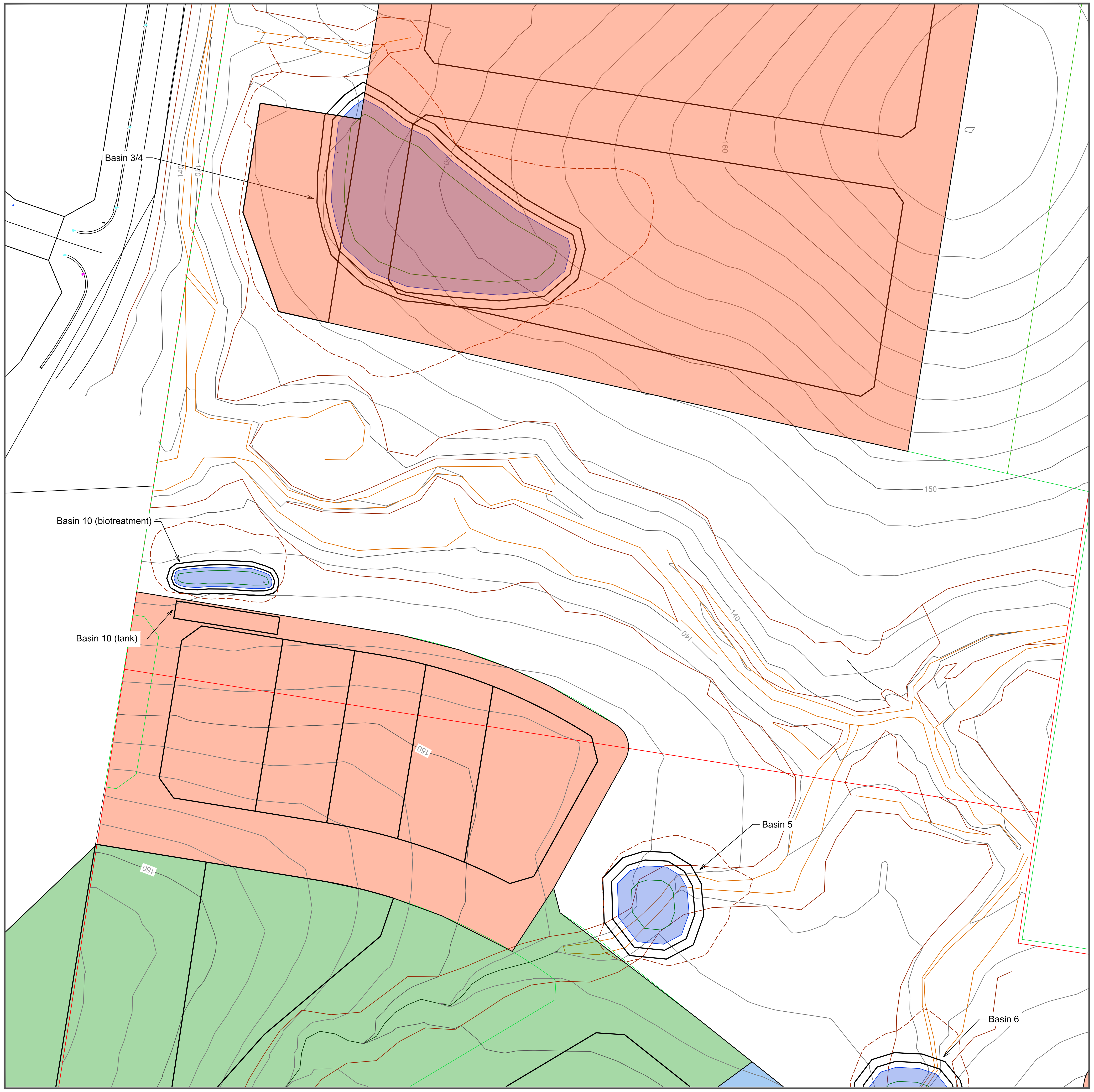
REV.

File ref: 220615-D004 Bruxner Plotted: 28/09/2022 6:14 AM



Detailed Layout - Basins 1 and 2

Scale @ A1 1:750



Detailed Layout - Basins 3/4, 5, and 10

Scale @ A1 1:750

15 0 15 30 45 60 75 1:750
METRES

REV	AMENDMENT	ISSUED	DATE

BARKER RYAN STEWART

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PLANNING PROPOSAL
1055 BRUXNER HIGHWAY, GOONELLABAH

Stormwater Management Plan
Basins 1-5 and 10 - Detailed Layouts

NORTH

Designed: JS
Drawn: CH
Checked: JS

Scales: @A1 Plan - Horiz. - Vert. - X-Sect. - Refer sheet

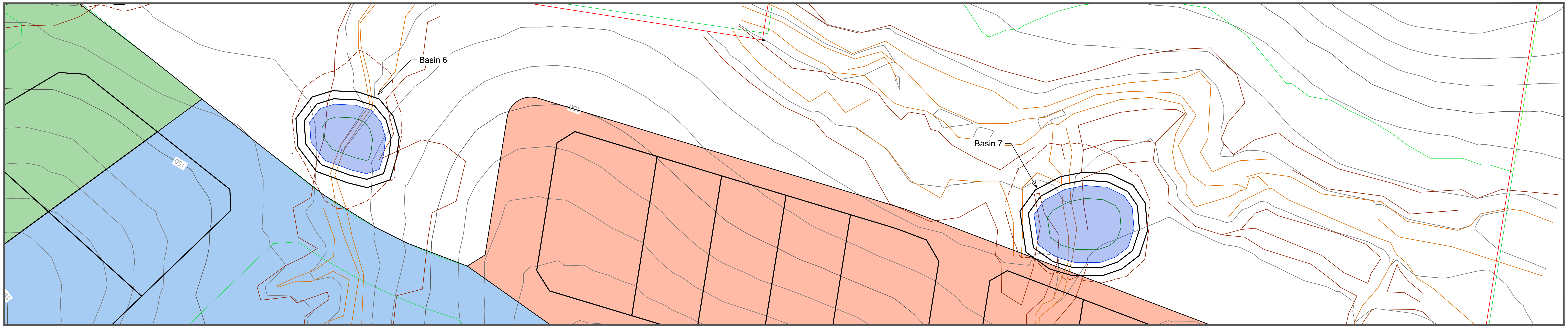
Datum: AHD

Plan No. 220615-01-003

File Ref. 220615-D004 Bruxner

REV.

File ref: 220615-D004 Bruxner Plotted: 28/09/2022 6:14 AM



Detailed Layout - Basins 6 and 7

Scale @ A1 1:750

Detailed Layout - Basins 8 and 9

Scale @ A1 1:750

15 0 15 30 45 60 75 METRES 1:750

File ref: 220615-D004 Bruxner Plotted: 28/09/2022 6:14 AM

REV	AMENDMENT	ISSUED	DATE

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PLANNING PROPOSAL
1055 BRUXNER HIGHWAY, GOONELLABAH

Stormwater Management Plan
Basins 6-9 - Detailed Layouts

NORTH

Designed: JS
Drawn: CH
Checked: JS

Scales: @A1 Plan - Horiz. - Vert. - X-Sect. - Refer sheet

Datum: AHD

Plan No. 220615-01-004

File Ref. 220615-D004 Bruxner

REV.