

TECHNICAL MEMO



Project: 16-002518 Teviot Village

Date: 29 May 2020

Our Ref: 18-001032_TM_01

Subject Site: Teviot Village

1 INTRODUCTION

Calibre previously prepared the *Concept Stormwater Management Plan and Flood Investigation* (16-002518-02A, December 2016) to support the proposed Teviot Village subdivision development located at Pub Lane, Greenbank within the Economic Development Queensland (EDQ) Greater Flagstone Priority Development Area (PDA). The *Concept Stormwater Management Plan and Flood Investigation* (December 2016) was approved by EDQ on 22 June 2017 as part of the development site approval.

It is highlighted in the approved *Concept Stormwater Management Plan and Flood Investigation* (December 2016) that updates to the MUSIC modelling to reflect possible amendments to the site layout and stormwater drainage strategy, including splits of filter areas in multiple bio-retention basins, were to be completed as necessary.

As such, since the completion of the 2016 study a number of factors have necessitated the updating of the proposed stormwater quality management strategy, including:

- An updated Overall Plan of Subdivision (Refer to **Attachment 1**) with the amended plans recently approved by EDQ on 24 October 2019;
- Recently completed earthworks design for the updated development layout which has dictated an amendment to the drainage strategy as well as providing greater accuracy in determining suitable locations and sizes of treatment devices in the study area; and,
- Revised parameters for the configuration of bio-retention treatment nodes in MUSIC modelling, in accordance with the Healthy Land and Water *MUSIC Modelling Guidelines* (2018).

This Technical Memorandum (TM) has been prepared to document the required MUSIC model updates and any subsequent revision of the proposed stormwater quality treatment measures to incorporate these changes and to confirm that runoff discharging from the site will still meet the required Water Quality Objectives (WQOs).

This TM will provide a brief background of the site and its drainage characteristics before describing the updated Stormwater Quality Management Plan and associated MUSIC Modelling.

**PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL**

Approval no: DEV2017/831

Date: 18 December 2020



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2 SITE CHARACTERISTICS

2.1 Location

The site is located in the Logan City Council (LCC) local government area, within the EDQ Greater Flagstone PDA. **Figure 1** provides an aerial view of the site, which encompasses an area of approximately 153ha. Prior to any development on site, the real property description was Lot 9968 on SP163061. The site is bound by the Brisbane to Sydney Railway line to the east, the Teviot Downs soccer club to the west and rural residential properties along the northern and southern boundaries.

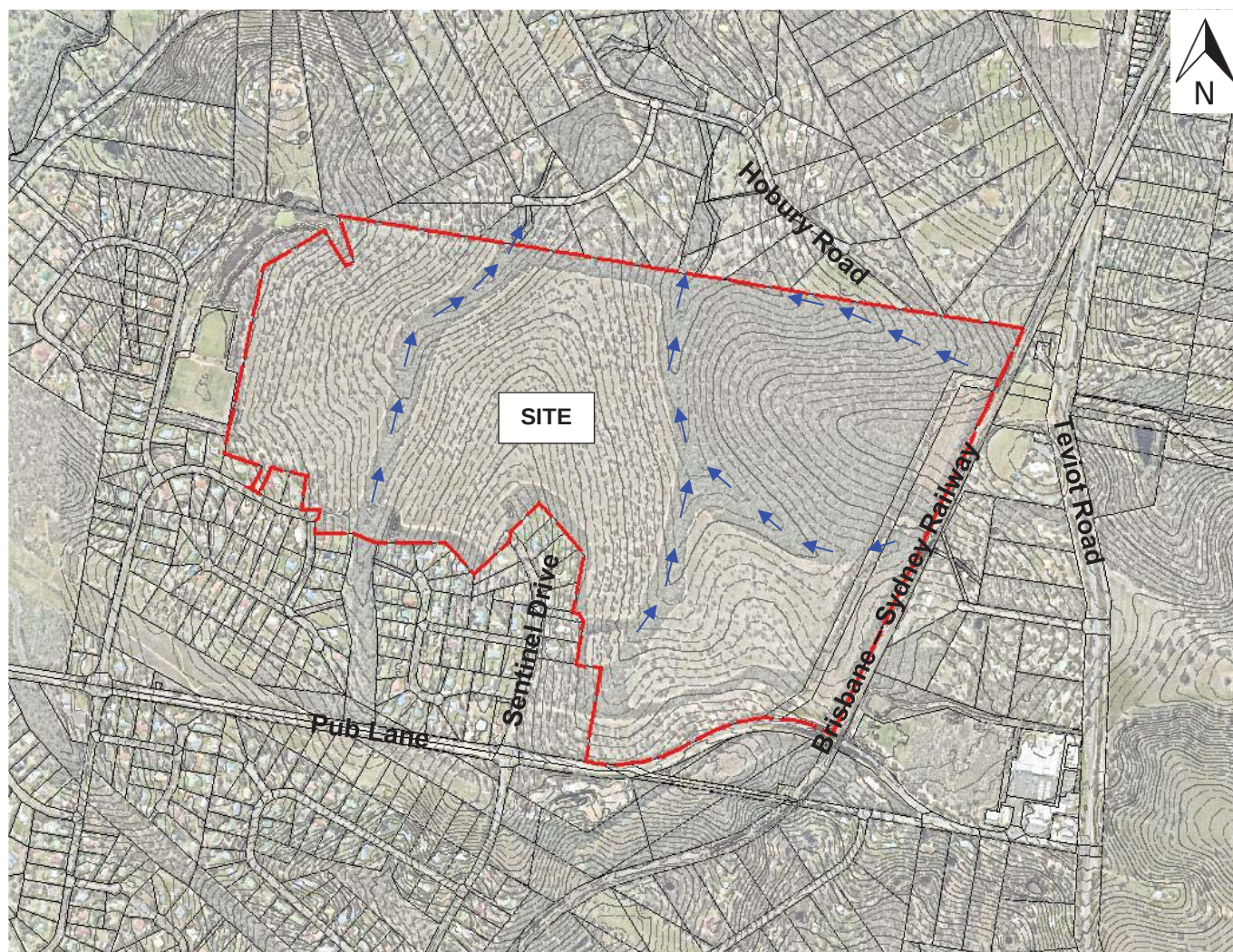


Figure 1: Site Location (Source: Nearmap)

2.2 Land Use

The existing site is undeveloped with multiple drainage corridors and vegetation as illustrated in **Figure 1**. Easements for wet and dry utilities traverse the eastern boundary of the site.

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The proposed development will consist of predominately urban residential land use, with open space areas, parks and sports fields to be provided in conjunction with general retention of the existing drainage corridors.

2.3 Existing Topography & Site Drainage

The existing topography of the site varies from RL 75.5m AHD at Sentinel Drive in the south to RL48.25m AHD at the northern property boundary. Under existing conditions, two drainage corridors traverse the site from south to north as shown in **Figure 1**. There are a number of local gullies within the site that connect to these main drainage paths. The site ultimately discharges to Oxley Creek downstream of New Beith Road.

Prior to any development occurring on site, there was no municipal drainage infrastructure or private underground stormwater pipes on the site. The runoff under these pre-development conditions follows the natural topography and drains to the north.

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3 STORMWATER QUALITY MANAGEMENT

In accordance with the *State Planning Policy* (2017), new developments in Queensland are to provide stormwater quality treatment to meet relevant Water Quality Objectives (WQOs). Water quality modelling was undertaken using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model, developed by the Cooperative Research Centre for Catchment Hydrology (CRCCH). MUSIC enables the user to conceptualise the transfer of pollutants through a stormwater drainage system and provides an aid in quantifying the effectiveness of the proposed stormwater quality treatment measures.

As stated earlier, the purpose of this Technical Memorandum is to update the MUSIC model based on the revised site layout and adjustments to the stormwater quality management strategy to ensure that the development will still satisfy the load reduction WQOs as presented in **Table 1** below.

Table 1: Load Reduction Water Quality Objectives*

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

* Adopted from Logan City Council's *Stormwater Quality and Flow Management Guidelines* (2013) and *State Planning Policy* (2017).

3.1 Pollutants of Concern

Typical key pollutants expected to be generated during the operational (post-construction) phase of the planned development are listed as follows, with those presented in capitals being the key pollutants to be targeted for treatment:

- LITTER/GROSS POLLUTANTS
- SEDIMENT
- Oxygen demanding substances (possibly present)
- NUTRIENTS (PHOSPHOROUS AND NITROGEN)
- Pathogens / faecal coliforms
- Hydrocarbons
- Heavy metals (often associated with fine sediment)
- Surfactants
- Organochlorines & organophosphates
- Thermal pollution
- Ph altering substances

Only the key pollutants will be further addressed in this report; however, the treatment train developed will adequately mitigate the other pollutant loads. As heavy metals will predominately be associated with fine sediment, controls proposed to reduce total suspended solids will also adequately reduce loads of heavy metals.

3.2 Stormwater Quality Management Strategy

The previous study proposed a number of Stormwater Quality Improvement Devices (SQIDs) to treat runoff from the development, including bioretention basins located along the perimeter of each drainage corridor, and at-source bioretention pod systems integrated within road reserves. This study aims to assess and adjust the proposed treatment measures to ensure compliance with the required WQOs.

Due to the site having multiple discharge locations, assessment of stormwater quality has been undertaken separately for runoff discharging from the western drainage corridor and runoff discharging from the eastern drainage corridor, as well as a final assessment at the final receiving point in the study area. The subsequent sections from herein discuss the modelling of the abovementioned SQIDs using MUSIC.

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3.3 MUSIC Modelling Methodology

This study has incorporated the required changes to the previous MUSIC model, namely to reflect the current earthworks design and the revised site layout detailed in the EDQ approved Change to a PDA Development Approval (dated 25 October 2019), as well as updating of stormwater quality catchment and source node details in accordance with the Healthy Land and Water's *MUSIC Modelling Guidelines (2018)*. Changes to the size and location of certain bio-retention basins and bio-retention pods were made where appropriate to align with the updated drainage strategy, with other treatment measures such as bio-retention swales and vegetated swales incorporated into the treatment train where necessary. Refer to Drawing No. **18-001032-SK01** in **Attachment 2** for the stormwater quality catchment delineation and proposed treatment locations.

The MUSIC model layout is provided in **Attachment 3**. The following sections discuss the general model configuration and applied model updates.

3.3.1 Meteorological Data

As per the previous model, six-minute pluviographic data was sourced from the eWater website for Greenbank Thompson Road (Station No. 040659). In accordance with Table A1.1 from *MUSIC Modelling Guidelines (2018)*, the 10-year period from 1 January 1980 to 31 December 1989 has been adopted for the rainfall duration. The mean annual rainfall for this period based on 6-minute pluviograph data is 745mm.

3.3.2 Source Nodes

Source nodes represent catchment areas for MUSIC modelling purposes. The split catchment approach has been used in accordance with the *MUSIC Modelling Guidelines (2018)*, which divides each catchment into three types of surfaces: Roof, Road and Ground. Refer to Calibre Consulting Drawing No. **18-001032-SK01** in **Attachment 2** for MUSIC modelling catchment delineation.

Rainfall-runoff and pollutant export parameters were assigned for the different land use areas in accordance with Table A1.2 and Table 3.9 of the *MUSIC Modelling Guidelines (2018)*.

The following fraction impervious assumptions have been adopted in accordance with Table 3.7 of the *MUSIC Modelling Guidelines (2018)*. These values generally align with HWMC's *Stormwater Management Plan* (Report No. J00110R1V2 dated 5 July 2012).

Table 2: Land Use Fraction Impervious Values (Source: HWMC, 2012)

Land Use	Fraction Impervious
Roof	100%
Road Reserve	70%
Ground (includes park areas)	25%

The source node parameters that were applied in the MUSIC modelling are presented in **Table 3**. Refer to **Attachment 3** for MUSIC model details. It is noted that only the development footprint areas have been included in the MUSIC analysis. Undeveloped areas, particularly those within the drainage corridors and upstream external catchments have been excluded from the MUSIC analysis.

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Table 3: MUSIC Source Nodes

Catchment	Total Area (ha)	Roof (ha)	Road (ha)	Ground (ha)
6C	0.830	0.258	0.292	0.280
6B	8.671	2.795	2.711	3.165
5A	9.227	2.516	2.942	3.769
5B	8.740	2.237	2.382	4.121
7B3	2.037	0.646	0.704	0.687
7B2	3.606	1.291	1.179	1.136
7B1	4.766	1.592	1.556	1.618
12B1	0.641	0.194	0.264	0.183
12B2	1.674	0.581	0.601	0.492
12B3	3.217	1.226	1.035	0.956
12B4	2.056	0.667	0.698	0.691
11B4	0.905	0.087	0.277	0.541
11B1	3.170	0.732	1.044	1.394
11B2	2.363	0.646	0.696	1.021
11B3	4.893	1.570	1.358	1.965
9A	5.762	1.398	1.845	2.519
11D3	3.425	1.076	1.304	1.045
11D2	4.700	1.462	1.731	1.507
11D1	3.940	1.335	1.465	1.140
14C	5.437	2.066	1.461	1.910
14B	3.086	1.161	0.909	1.016
11C	5.577	1.527	1.935	2.115
12C1	2.131	0.645	0.839	0.647
12C2	4.432	1.527	1.643	1.262
20B1	2.613	0.968	0.811	0.834
20B2	5.742	2.108	1.561	2.073
TOTAL	103.641	32.311	33.243	38.087

3.3.3 Drainage Links

Default drainage link settings have been adopted for the model. As stated in Section 4.1.2 of *MUSIC Modelling Guidelines (2018)*, MUSIC's default settings do not apply flow routing, assuming all flows and pollutants from the catchment arrive at the treatment node at the same time. This is a conservative approach.

3.3.4 Treatment Nodes

Bioretention filter areas that were applied in the MUSIC modelling are presented in **Table 4**. During detailed design, pre-treatment in accordance with Table 13 of the *Bioretention Technical Design Guidelines (2014)* will be provided in addition to the filter areas specified.

If required, bioretention filter areas presented below may be proportionally split into multiple treatment devices within the catchments as necessary to achieve the total area required. Detailed designs of the respective stages will assess the suitability and need to split treatment devices if required. The following **Table 4** provides the detailed filter area of bioretention treatments in each catchment.

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Table 4: Bioretention Filter Areas

MUSIC Catchment	Total Bioretention Pod Filter Area (m ²) #	End-of line Bioretention Basin Filter Area (m ²) ##	Bio Swale Filter Area (m ²)
6C	120	350	0
6B	485		0
5A	358	350*	0
5B	304	650*	0
7B3	0		0
7B2	290		0
7B1	293		0
12B1	52.5	300*	0
12B2	114		0
12B3	224		0
12B4	22		0
11B4	74		0
11B1	125	0	120
11B2	85	0	99
11B3	175	0	0
9A	359	0	0
11D3	37.5	560	0
11D2	263	0	0
11D1	224	371	0
14C	234	500*	0
14B	200	200*	0
11C	225	400*	0
12C1	92.5	380*	0
12C2	54	200*	0
20B1	239	350	0
20B2	399		0
Total	5048.5	4611	219

Note 1: The filter areas of the bioretention pods have been combined within each catchment. ## Note 2: In some catchments, the 'end-of-line' bio-retention basins do not accept runoff from the entire sub-catchment and some areas may drain directly to the drainage corridors bypassing the respective bio-retention basins. This is detailed in the MUSIC model.

* Note 3: The filter media depth of these bioretention basins are 400mm. The remaining bioretention basins have filter depths of 500mm.

The following parameters were applied consistently across all bioretention pod nodes:

- 500mm filter media depth;
- 100mm ponding extended detention depth;
- 30mg/kg filter media Orthophosphate content;
- 400mg/kg filter media TN content; and
- 200mm/hr filter media saturated hydraulic conductivity.

The following parameters were applied consistently across all bioretention basin nodes:

- 400mm/500mm filter media depth (refer Table 4 above);

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- 300mm ponding extended detention depth;
- Overflow weirs were modelled as 10% of the filter area;
- 30mg/kg filter media Orthophosphate content;
- 400mg/kg filter media TN content; and
- 200mm/hr filter media saturated hydraulic conductivity.

The following parameters were applied consistently across all bioretention swale nodes:

- 500mm filter media depth;
- 0mm ponding extended detention depth;
- 30mg/kg filter media Orthophosphate content;
- 400mg/kg filter media TN content; and
- 200mm/hr filter media saturated hydraulic conductivity.

3.4 MUSIC Modelling Results

Results for the proposed stormwater quality management strategy are presented in **Table 5**, **Table 6** and **Table 7**.

Table 5: MUSIC Model Results for Final Receiving Node

Description	TSS	TP	TN	GP
WQO (%)	80	60	45	90
Source Loads (kg/yr)	90000	178	983	13200
Residual Loads (kg/yr)	17600	53.6	538	320
Load Reduction Achieved (%)	80.5	69.9	45.3	97.6
Load Reduction Achieved > WQO?	YES	YES	YES	YES

Table 6: MUSIC Model Results for Eastern Drainage Corridor

Description	TSS	TP	TN	GP
WQO (%)	80	60	45	90
Source Loads (kg/yr)	57600	113	630	8420
Residual Loads (kg/yr)	11300	34.4	346	320
Load Reduction Achieved (%)	80.4	69.7	45	96.2
Load Reduction Achieved > WQO?	YES	YES	YES	YES

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Table 7: MUSIC Model Results for Western Drainage Corridor

Description	TSS	TP	TN	GP
WQO (%)	80	60	45	90
Source Loads (kg/yr)	32500	64.6	353	4760
Residual Loads (kg/yr)	6270	19.2	192	0
Load Reduction Achieved (%)	80.7	70.2	45.8	100
Load Reduction Achieved > WQO?	YES	YES	YES	YES

The above results demonstrate that the proposed stormwater quality management strategy achieves the WQOs required under the SPP (2017).

3.5 Summary of Updates

As demonstrated in the previous section, the updated stormwater quality management strategy achieves the WQOs required under the SPP (2017). Notable amendments to the proposed treatment system include:

- Bio-retention Pod locations and respective areas have been amended to suit the updated subdivision layout and recently completed overarching earthworks design (surface grading) for the estate.
- 'End-of-Line' Bio-retention Basin locations and associated filter media areas have also been amended to reflect the earthworks design and other site constraints including areas of retained remnant vegetation within the drainage corridors. Updates to bio-retention basins, and associated filter media areas, have included:
 - Catchment 5A filter media area augmentation from 250m² to 350 m²
 - Removal of Catchment 5B bio-retention basin with runoff from this catchment to drain to the Catchment 7B1 bio-retention basin for stormwater quality treatment
 - Catchment 6B/C filter media area augmentation from 250 m² to 350 m²
 - Catchment 7B1 filter media area augmentation from 280 m² to 650 m²
 - Catchment 12B2 filter media area reduction from 600 m² to 300 m²
 - Addition of bio-retention basin with filter media area 500 m² to Catchment 14C in lieu of draining to Catchment 11D1 bio-retention basin
 - Catchment 11D1 filter media area reduction from 800 m² to 371 m²
 - Catchment 11D3 filter media area augmentation from 400 m² to 560 m²
 - Catchment 12C1 filter media area reduction from 400 m² to 380 m²
 - Addition of bio-retention basin with filter media area 200 m² to treat part of Catchment 12C2 where bio-pods are not achievable and avoid draining to Catchment 12C1 bio-retention basin for treatment
 - Addition of bio-retention basin with filter media 350 m² to Catchment 20B1 (to treat runoff from Catchments 20B1 and 20B2) in lieu of draining to Catchment 12C1 bio-retention basin.
 - Catchment 11C filter media area augmentation from 100 m² to 400 m²
 - Addition of bio-retention basin with filter media area 200 m² to Catchment 14B in lieu of draining to Catchment 11C bio-retention basin.
- Adjustments to some 'end-of-line' bio-retention filter media depths.
- A bio-retention swale has been incorporated for Catchment 11B along the catchment boundary with the drainage corridor to the east to treat runoff in lieu of draining north to the Catchment 12B2 bio-retention basin.
- Vegetated swales have also been incorporated to provide additional stormwater quality treatment.

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4 CONCLUSION

This Technical Memorandum has addressed the updated stormwater quality treatment methodology and drainage strategy for the proposed development to reflect the revised subdivision layout, recently completed site-wide earthworks design and the revised parameters for the configuration of treatment nodes in MUSIC modelling.

Through MUSIC modelling, it has been demonstrated that the updated stormwater quality management strategy for the proposed development comprising at source bioretention pods, 'end-of-line' bio-retention basins, bio-retention swales and vegetated swales provides sufficient stormwater quality treatment to satisfy the Water Quality Objectives stipulated in the State Planning Policy (2017).

If you have any additional queries please don't hesitate to contact the undersigned.



Andrew Voutsis (RPEQ 19033)

Senior Engineer - Water and Environment– Brisbane

ATTACHMENTS:

Attachment 1 Proposed Development Layout

Attachment 2 Concept Stormwater Quality Management Strategy

Attachment 3 MUSIC Modelling Details

TEVIOT VILLAGE

Attachment 1

Proposed Development Layout



Yield Breakdown				
Residential Allotments	Typical Allotment Size		Overall	
	Dimensions	Area	Lots	%
28m Deep Allotments				
Villa Allotment	10.5 x 28m	294m ²	55	4%
Premium Villa Allotment	12.5 x 28m	350m ²	252	17%
Courtyard Allotment	14 x 28m	392m ²	201	13%
Premium Courtyard Allotment	16 x 28m	448m ²	66	4%
Sub Total 28m Deep Allotments			574	38%
30m Deep Allotments				
Villa Allotment	10.5 x 30m	315m ²	60	4%
Premium Villa Allotment	12.5 x 30m	375m ²	338	23%
Courtyard Allotment	14 x 30m	420m ²	287	19%
Premium Courtyard Allotment	16 x 30m	480m ²	88	6%
Traditional Allotment	20 x 30m	600m ²	3	0%
Sub Total 30m Deep Allotments			776	52%
32m Deep Allotments				
Villa Allotment	10.5 x 32m	336m ²	13	1%
Premium Villa Allotment	12.5 x 32m	400m ²	40	3%
Courtyard Allotment	14 x 32m	448m ²	61	4%
Traditional Allotment	20 x 32m	640m ²	1	0%
Premium Traditional Allotment	22 x 32m	704m ²	5	0%
Sub Total 32m Deep Allotments			120	8%
Lifestyle Allotments				
Lifestyle Allotment	n/a	800 - 1999m ²	7	0%
Premium Lifestyle Allotment	n/a	2000m ² +	25	2%
Sub Total Lifestyle Allotments			32	2%
Total Residential Allotments			1502	100%
Super Lots				
Service Allotments			3	

Land Use	Overall	
	Area	%
Area of Subject Site	149.9711 ha	100.0%
Saleable Area		
Residential Allotments	68.6868 ha	45.8%
Balance Allotments (Future Mixed Density)	—	0.0%
Service Allotments	0.2075 ha	0.1%
Total Area of Allotments	68.8943 ha	45.9%
Road		
Local Roads	24.8021 ha	16.5%
Collector Roads	4.8079 ha	3.2%
Trunk Collector Roads	2.2448 ha	1.5%
Total Area of New Road	31.8548 ha	21.2%
Open Space		
District Sports Park	2.8256 ha	1.9%
Linear Open Space (Active)	13.8041 ha	9.2%
Linear Open Space (Conservation)	19.6081 ha	13.1%
Neighbourhood Recreation Park	1.5956 ha	1.1%
Pedestrian Linkage / Landscape Treatment	0.8221 ha	0.5%
Existing Easement	10.5665 ha	7.0%
Total Open Space	49.2220 ha	32.8%

REVISION
A: 06/03/2017 - Council feedback amendments
B: 02/08/2017 - Layout and POD amendments
C: 28/08/2017 - Amend Stages 20 - 25
D: 14/09/2017 - Amend Stage 17 POD
E: 19/09/2017 - Amend Stage 1 POD
F: 27/11/2017 - Sub-stage Stage 3 & 18 POD
G: 10/01/2018 - Sub-stage Stage 3
H: 28/02/2018 - Amend Stage 3
I: 16/09/2019 Amend Stages 7A/B & 18/19

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.
Dimensions have been rounded to the nearest 0.1 metres.
Areas have been rounded down to the nearest 5m².
The boundaries shown on this plan should not be used for final detailed engineers design.
Source Information:
Site boundaries: Land Partners.
Adjoining information: DCDB.
Contours: Land Partners
Flood: BMD

CLIENT		VILLA GREEN PTY LTD
PROJECT		TEVIOT VILLAGE
Plan of Subdivision Ultimate Allotment Layout Combined Applications		
Date.	16 SEPTEMBER 2019	
Comp By.	WNW	
Checked By.	PHE	
DWG Name.	132965 ROL	
Job Ref.	132965	
Local Authority.	Economic Development Queensland	
Locality.	Teviot Downs	
Scale	1 : 2500	Sheet A1
Plan Ref	132965 – 26	Rev I

Legend

General

- Site Boundary
- Stage Boundary
- Indicative External Footpath
- Management Lot Area
- In-Line Bus Stop

Constraints

- 10m Protected Vegetation / Building Exclusion Zone Buffer in Allotment
- Retained Remnant Endangered Regional Ecosystem
- 33m Buffer to Remnant Endangered Regional Ecosystem
- 33m Bushfire Setback
- Drainage Centerline
- BMD Q100
- 50m Buffer to Sewer Pump Station

Scale 1: 2500 @ A1

0 20 40 60 80 100 120 140

RPS

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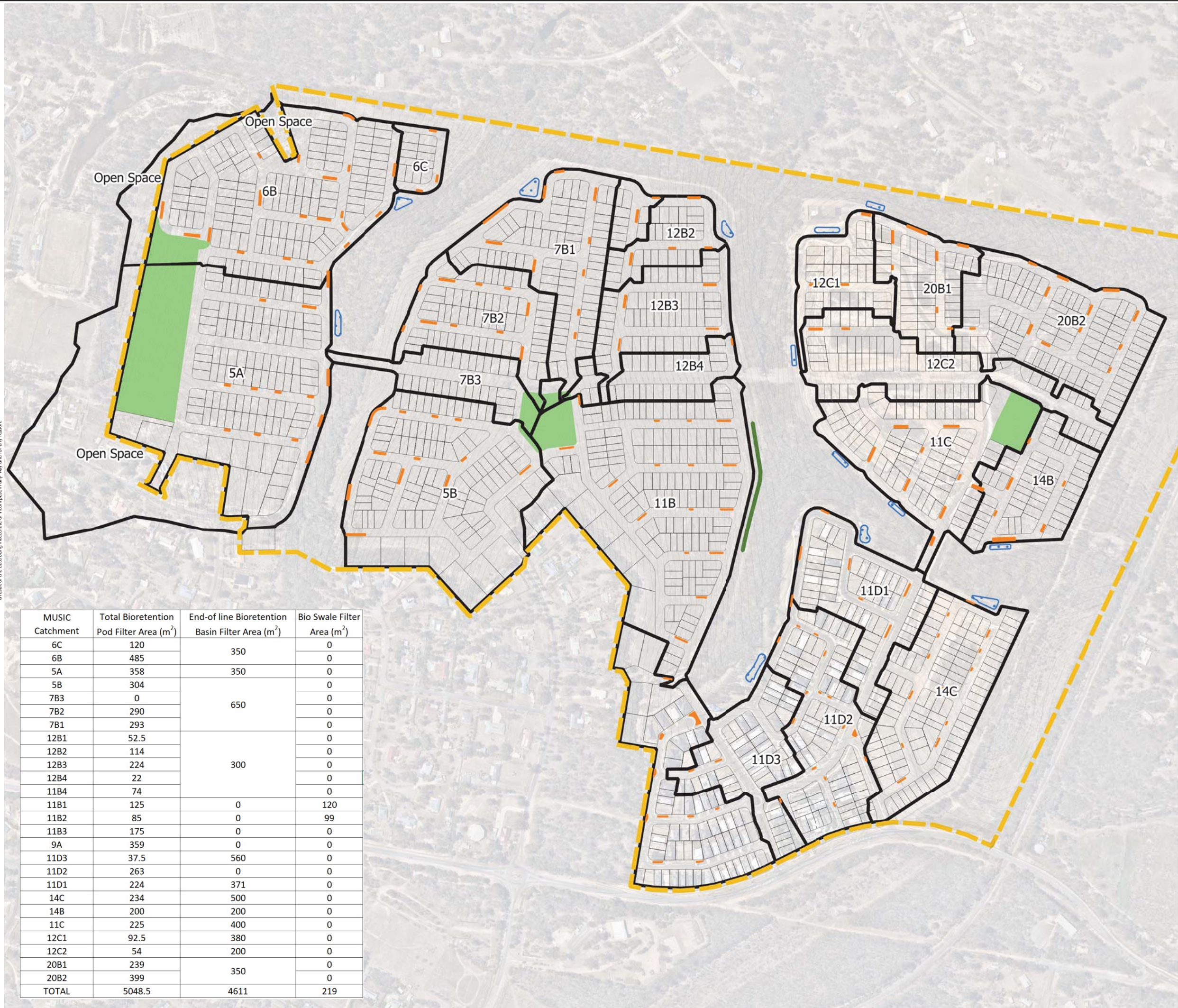
Yield Breakdown																															
Residential Allotments	Typical Allotment Size		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	Stage 11	Stage 12	Stage 13	Stage 14	Stage 15	Stage 16	Stage 17	Stage 18	Stage 19	Stage 20	Stage 21	Stage 22	Stage 23	Stage 24	Stage 25	Stage 26	Stage 27	Overall	
	Dimensions	Area	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Lots	%
28m Deep Allotments																															
Villa Allotment	10.5 x 28m	294m²	2	—	4	5	3	2	1	1	—	2	5	1	—	—	—	—	2	3	4	3	3	2	5	3	1	1	2	55	4%
Premium Villa Allotment	12.5 x 28m	350m²	7	3	9	7	13	14	5	8	10	8	17	9	9	11	—	8	9	16	10	10	5	4	7	11	13	4	25	252	17%
Courtyard Allotment	14 x 28m	392m²	14	2	14	6	9	14	3	9	10	8	12	7	2	4	—	2	3	3	11	4	6	6	8	7	12	3	22	201	13%
Premium Courtyard Allotment	16 x 28m	448m²	—	—	8	1	6	4	4	1	4	3	1	4	4	—	—	1	—	—	—	—	4	2	2	3	3	2	9	66	4%
Sub Total 28m Deep Allotments			23	5	35	19	31	34	13	19	24	21	35	21	15	15	—	11	14	22	25	17	18	14	22	24	29	10	58	574	38%
30m Deep Allotments																															
Villa Allotment	10.5 x 30m	315m²	—	5	1	4	3	4	—	2	5	—	4	—	—	1	—	1	4	4	4	3	3	—	7	5	—	—	—	60	4%
Premium Villa Allotment	12.5 x 30m	375m²	8	7	15	6	9	12	12	6	11	16	21	12	17	11	29	5	24	31	6	17	11	10	13	13	8	7	1	338	23%
Courtyard Allotment	14 x 30m	420m²	13	10	12	11	10	7	10	1	13	11	13	20	9	12	18	9	11	20	3	17	10	10	7	8	12	9	1	287	19%
Premium Courtyard Allotment	16 x 30m	480m²	7	3	3	2	7	4	5	2	3	6	2	4	4	3	1	6	5	—	2	5	6	1	2	2	2	1	—	88	6%
Traditional Allotment	20 x 30m	600m²	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	0%
Sub Total 30m Deep Allotments			31	25	31	23	29	27	27	11	32	33	40	36	30	27	48	21	44	55	15	42	30	21	29	28	22	17	2	776	52%
32m Deep Allotments																															
Villa Allotment	10.5 x 32m	336m²	1	4	—	—	—	—	2	4	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	13	1%
Premium Villa Allotment	12.5 x 32m	400m²	8	10	—	—	—	—	6	6	—	—	—	—	—	—	2	4	4	—	—	—	—	—	—	—	—	—	—	40	3%
Courtyard Allotment	14 x 32m	448m²	8	10	—	2	—	—	14	3	—	—	—	—	—	—	2	11	5	—	—	—	—	—	—	—	1	5	—	61	4%
Traditional Allotment	20 x 32m	640m²	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0%
Premium Traditional Allotment	22 x 32m	704m²	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	0%
Sub Total 32m Deep Allotments			17	24	—	3	—	—	22	13	—	—	—	—	5	—	4	17	9	—	—	—	—	—	—	—	1	5	—	120	8%
Lifestyle Allotments																															
Lifestyle Allotment	n/a	800 - 1999m²	1	—	—	1	—	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	0%
Premium Lifestyle Allotment	n/a	2000m² +	1	—	—	5	—	—	6	8	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	25	2%
Sub Total Lifestyle Allotments			2	—	—	6	—	—	6	8	—	—	—	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32	2%
Total Residential Allotments			73	54	66	51	60	61	68	51	56	54	75	57	60	42	52	49	67	77	40	59	48	35	51	52	52	32	60	1502	100%
Super Lots																															
Service Allotments			—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	3	
Land Budget																															
Land Use	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	Stage 11	Stage 12	Stage 13	Stage 14	Stage 15	Stage 16	Stage 17	Stage 18	Stage 19	Stage 20	Stage 21	Stage 22	Stage 23	Stage 24	Stage 25	Stage 26	Stage 27	No Stage	Overall		
	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	%	
Area of Subject Site	5.5029 ha	4.3959 ha	4.0067 ha	6.9458 ha	4.4666 ha	3.6972 ha	6.9330 ha	5.9512 ha	3.0552 ha	6.8379 ha	5.9157 ha	7.2230 ha	7.1035 ha	3.2853 ha	6.1451 ha	3.4219 ha	7.3960 ha	5.1972 ha	2.9495 ha	5.8304 ha	4.2210 ha	2.1231 ha	6.3346 ha	4.5031 ha	4.0524 ha	4.5144 ha	7.3602 ha	10.6023 ha	149.9711 ha	100.0%	
Saleable Area																															
Residential Allotments	3.5079 ha	2.3440 ha	2.8950 ha	3.3109 ha	2.4580 ha	2.4337 ha	4.2525 ha	3.9542 ha	2.2565 ha	2.3653 ha	2.9222 ha	2.3498 ha	4.1484 ha	1.7516 ha	2.1182 ha	2.1731 ha	2.8184 ha	2.9802 ha	1.6329 ha	2.5937 ha	1.9865 ha	1.4458 ha	1.9997 ha	2.1158 ha	2.1285 ha	1.3698 ha	2.3742 ha	—	68.6868 ha	45.8%	
Balance Allotments (Future Mixed Density)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0%
Service Allotments	—	—	—	—	—	—	—	—	—	—	—	0.0400 ha	—	—	—	—	0.0400 ha	—	—	—	—	—	—	—	—	—	0.1275 ha	—	—	0.2075 ha	0.1%
Total Area of Allotments	3.5079 ha	2.3440 ha	2.8950 ha	3.3109 ha	2.4580 ha	2.4337 ha	4.2525 ha	3.9542 ha	2.2565 ha	2.3653 ha	2.9222 ha	2.3898 ha	4.1484 ha	1.7516 ha	2.1182 ha	2.1731 ha	2.8584 ha	2.9802 ha	1.6329 ha	2.5937 ha	1.9865 ha	1.4458 ha	1.9997 ha	2.1158 ha	2.1285 ha	1.4973 ha	2.3742 ha	—	68.8943 ha	45.9%	
Road																															
Local Roads	1.2882 ha	0.6309 ha	1.1117 ha	0.8653 ha	0.7913 ha	0.5844 ha	1.4323 ha	1.1828 ha	0.7627 ha	1.2389 ha	0.9507 ha	1.0888 ha	1.0948 ha	0.8752 ha	1.0937 ha	1.0999 ha	1.0976 ha	0.9808 ha	0.5709 ha	1.0474 ha	0.1272 ha	0.4243 ha	0.7686 ha	0.8931 ha	0.8987 ha	0.7196 ha	1.1823 ha	—	24.8021 ha	16.5%	
Collector Roads	0.3356 ha	—	—	0.5959 ha	0.2360 ha	0.6791 ha	0.4180 ha	—	—	—	0.3386 ha	0.3230 ha	0.4983 ha	—	—	—	—	—	—	—	1.1304 ha	0.2530 ha	—	—	—	—	—	—	—	4.8079 ha	3.2%
Trunk Collector Roads	0.3712 ha	0.5916 ha	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.5914 ha	—	—	0.6208 ha	0.0698 ha	—	—	—	—	—	—	—	—	2.2448 ha	1.5%
Total Area of New Road	1.9950 ha	1.2225 ha	1.1117 ha	1.4612 ha	1.0273 ha	1.2635 ha	1.8503 ha	1.1828 ha	0.7627 ha	1.2389 ha	1.2893 ha	1.4118 ha	1.5931 ha	0.8752 ha	1.0937 ha	1.0999 ha	1.6890 ha	0.9808 ha	0.5709 ha	1.6682 ha	1.3274 ha	0.6773 ha	0.7686 ha								

TEVIOT VILLAGE

Attachment 2

Concept Stormwater Quality Management Strategy

While every care is taken to ensure the accuracy of data sourced through third parties, Calibre Professional Services Pty. Ltd. makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.



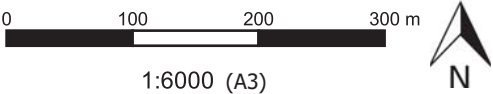
MUSIC Catchment	Total Bioretention Pod Filter Area (m ²)	End-of line Bioretention Basin Filter Area (m ²)	Bio Swale Filter Area (m ²)
6C	120	350	0
6B	485		0
5A	358		0
5B	304		0
7B3	0	650	0
7B2	290		0
7B1	293		0
12B1	52.5		0
12B2	114	300	0
12B3	224		0
12B4	22		0
11B4	74		0
11B1	125	0	120
11B2	85	0	99
11B3	175	0	0
9A	359	0	0
11D3	37.5	560	0
11D2	263	0	0
11D1	224	371	0
14C	234	500	0
14B	200	200	0
11C	225	400	0
12C1	92.5	380	0
12C2	54	200	0
20B1	239	350	0
20B2	399		0
TOTAL	5048.5	4611	219



LEGEND

- SITE BOUNDARY
- EXISTING CONTOURS
- PROPOSED DEVELOPMENT
- CATCHMENT BOUNDARY
- BIO BASIN
- BIO POD
- BIO SWALE
- PARK

NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH CALIBRE CONSULTING'S LATEST TECHNICAL MEMO NO. 18-001032_TM_01.
2. INFORMATION PRESENTED ON THIS DRAWING IS CONCEPT ONLY AND SUBJECT TO DETAILED DESIGN.



PROJECT:				
COVELLA STAGE 6				
CLIENT:				
VILLA GREEN				
DRAWING:				
CONCEPT STORMWATER QUALITY MANAGEMENT STRATEGY				
DRAWING NO.				ISSUE:
18-001032-SK01				A
ISS	BY	CHK	DATE	DETAILS
A	JC	MS	29.05.20	ORIGINAL

TEVIOT VILLAGE

Attachment 3

MUSIC Modelling Details

1. MUSIC NODES DETAILS

Catchment	Bio Pods?	Roof (ha)	Road (ha)	Ground (ha)	Bio Pod Area (m ²)	Bio Basin Area (m ²)	Swale Length (m)	Bio-swale Area (m ²)
6C	Yes	0.193	0.292	0.232	120	350		
	No	0.065	0.000	0.048				
6B	Yes	1.978	2.679	2.335	485			
	No	0.817	0.032	0.830				
5A	Yes	1.634	1.869	1.644	358	350		
	No	0.882	1.073	2.125				
5B	Yes	1.527	1.547	1.483	304	650		
	No	0.710	0.835	2.638				
7B3	Yes	-	-	-				
	No	0.646	0.704	0.687				
7B2	Yes	1.119	1.179	0.981	290			
	No	0.172	0.000	0.155				
7B1	Yes	1.312	1.541	1.340	293			
	No	0.280	0.015	0.278				
12B1	Yes	0.194	0.264	0.183	52.5	300		
	No	-	-	-				
12B2	Yes	0.473	0.466	0.392	114			
	No	0.108	0.135	0.100				
12B3	Yes	0.473	0.401	0.372	224		125	
	No	0.753	0.634	0.584				
12B4	Yes	0.172	0.227	0.175	22		60	
	No	0.495	0.471	0.516				
11B4	Yes	0.065	0.160	0.430	74			
	No	0.022	0.117	0.111				
11B1	Yes	0.323	0.322	0.267	125			120
	No	0.409	0.722	1.127				
11B2	Yes	0.280	0.277	0.224	85			99
	No	0.366	0.419	0.797				
11B3	Yes	0.989	0.717	0.958	175		24	
	No	0.581	0.641	1.007				
9A	Yes	0.860	1.606	1.219	331.3			
	No	0.473	0.096	0.672				
9A(Stg4)	Yes	-	0.143	-	27.7		20	

Catchment	Bio Pods?	Roof (ha)	Road (ha)	Ground (ha)	Bio Pod Area (m ²)	Bio Basin Area (m ²)	Swale Length (m)	Bio-swale Area (m ²)
	No	0.065	-	0.628				
11D3	Yes	0.215	0.427	0.202	37.5			
	No	0.151	0.001	0.175				
	Yes	0.710	0.876	0.668		560		
11D2	No	1.075	1.730	1.124	263			
	Yes	0.387	0.001	0.383				
11D1	No	0.409	0.290	0.358	50	371		
	Yes	0.237	0.282	0.231				
	No	0.538	0.892	0.396	174			
	Yes	0.151	0.001	0.155				
14C	No	1.011	0.691	0.880	179	500		
	Yes	0.452	0.367	0.513				
	No	0.602	0.402	0.516	55			
	Yes	0.001	0.001	0.001				
14B	No	1.075	0.866	0.900	200	200		
	Yes	0.086	0.043	0.116				
11C	No	0.947	0.969	0.898	225	400		
	Yes	0.580	0.966	1.217				
12C1	No	0.301	0.255	0.289	92.5	380		
	Yes	0.344	0.584	0.358				
12C2	No	0.344	0.236	0.321	54	200		
	Yes	1.183	1.407	0.941				
20B1	No	0.839	0.735	0.686	239	350		
	Yes	0.129	0.076	0.148				
20B2	No	1.613	1.223	1.525	399			
	Yes	0.495	0.338	0.548				
Total	-	32.311	33.243	38.087	5048.5	4611	229	219

Note: Roof area of each lot is based on 215m².

2. FRACTION IMPERVIOUS

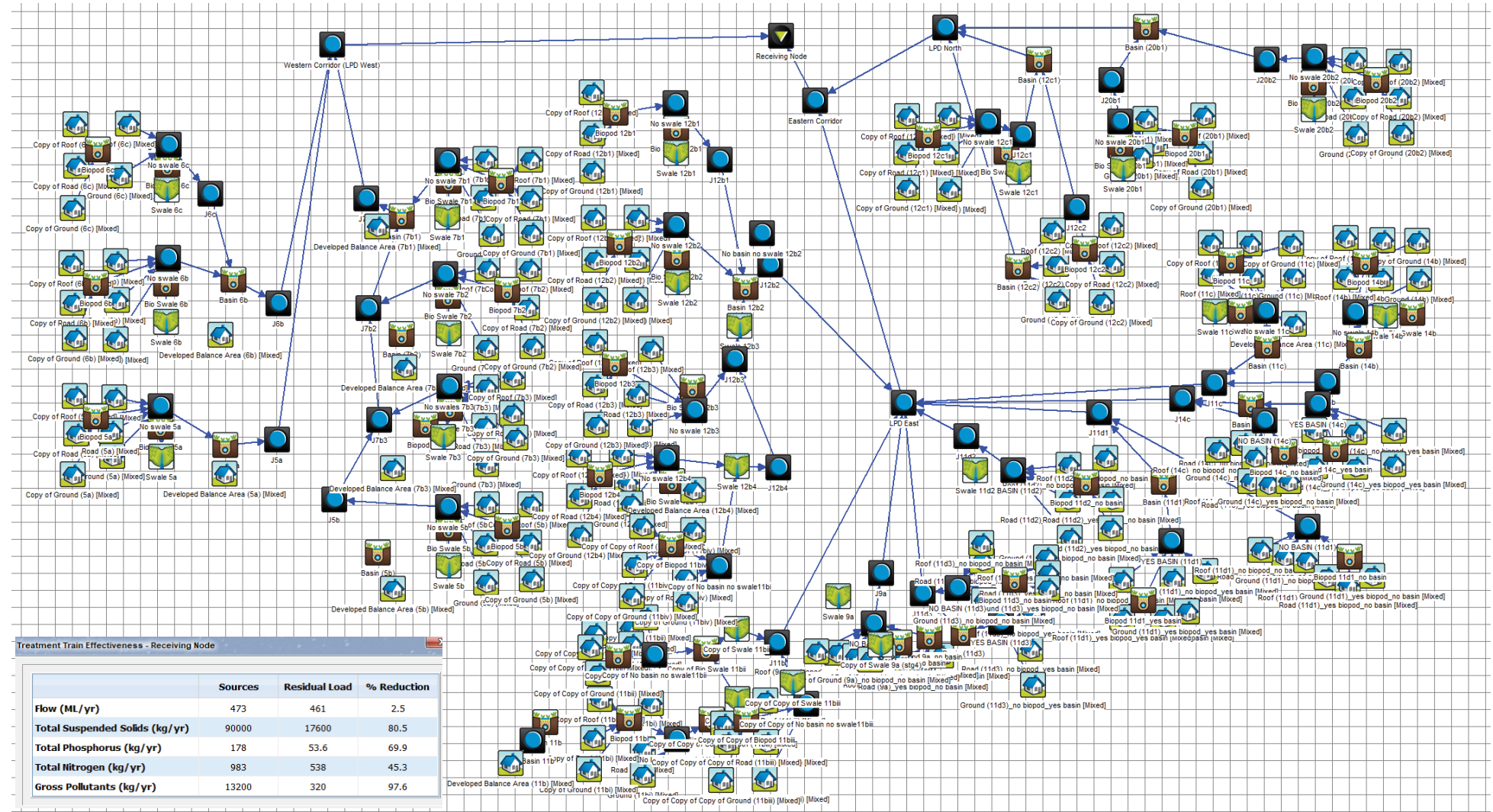
Land use	Road	Roof	Ground
Fraction Impervious	70%	100%	25%

3. MUSIC MODEL LAYOUT

File: 18-001032 Covella 20200528.sqz

Location: \\bncnas01.browncan.local\projects\18\001032 - Covella Stage 6\6 Model\SF\MUSIC\

Modeler: Kevin Clancy & Jingyi Chen



TECHNICAL MEMO