ATC WILLIAMS

REPORT

BRISBANE CITY COUNCIL

Willawong and Resource Recovery Centre

Stormwater Quality and Quantity Report

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1 INTRODUCTION

1.1 Background

This report was prepared by ATC Williams on behalf of Brisbane City Council to detail the Stormwater Quality and Quantity Management Strategy for the proposed the expansion of the green waste recycling hardstand area at the Willawong Resource Recovery Centre (RRC). The report was prepared as supporting information for the associated Development Application.

The report outlines the design considerations, assessment approach and outcomes for the measures proposed for management of stormwater runoff from the expanded green waste hardstand area, including the measures for capturing, conveying and treating stormwater runoff.

1.2 Site Locality

The Willawong RRC is located at 360 Sherbrooke Road, Willawong, QLD 4110 (Lot 24 on SP 245490) within the Brisbane City Council (BCC) Local Government Area (LGA). The site area is approximately 180,400 m^2 (from Brisbane City Plan 2014 property Lot Report). The site is bounded by Camden Road to the north and east and Sherbrooke Road to the west. The closed Willawong Landfill is adjacent to the site, on the western side of Sherbrooke Road.

The existing green waste hardstand area and proposed expansion are located on the western side of the site, adjacent to Sherbrooke Road.

A site locality map is indicated as **Diagram 1**:

DIAGRAM 1 - SITE LOCALITY MAP

(Source Queensland Globe)

1.3 Site Description

The Willawong RRC provides essential waste disposal and resource recovery services for Brisbane City Council residents, featuring dedicated drop-off zones for general waste, green waste, and recyclables.

Infrastructure at the facility includes sealed access roads, hardstand areas for storage and processing of materials, a resource recovery hall, a residual waste transfer station and ancillary staff and operational buildings. As a key asset servicing Brisbane's southern suburbs, the centre is integral to achieving Council's broader public health, waste diversion and sustainability targets.

2 PREVIOUS ASSESSMENTS

In 2023, Bligh Tanner prepared a Stormwater and Flooding Investigation to support a Development Application by BCC for a then-proposed expansion of food waste recycling capabilities at the Willawong RRC. The food waste recycling facility is no longer being proposed by BCC, and the currently proposed expansion of the green waste hardstand generally occupies the same area of the facility.

The previous stormwater and flooding investigation assessed existing site conditions within the area of the proposed development, with a specific focus on stormwater quality and flood risk. The report provided key recommendations for integration into the design development phase of the project.

The stormwater investigation focused on relevant technical standards, hydraulic behaviour, and existing site infrastructure. This assessment informed recommendations for the design of treatment ponds, sediment traps, primary treatment devices, open channels, and swales. Additionally, the report outlines flood assessment results and associated mitigation requirements.

Subsequent to the investigation, Bligh Tanner developed a Flood Impact Assessment and Stormwater Management Plan in connection with the same development. It included stormwater drainage, flood modelling methodology, case study and stormwater management (quality and quantity).

The key findings from the previous work that are relevant to the currently proposed development are as follows:

1. Brisbane river flood:
    - The proposed site remains protected from Brisbane River flooding during the 1% AEP and 0.5% AEP events.
    - A more severe 0.2% AEP event would impact the site, with flood depths significantly increasing. Specifically, depths along the proposed new road pavement east of Sherbrooke Road are expected to range from 0.1 m to 1.0 m.
    - Flood levels are projected to rise by 0.1 m to 2.0 m around Camden Road, extending toward the woodland. In certain isolated spots within the woodland, the maximum water level may reach an elevation of RL20.0 m.
    - Flood depths between 1.5 m and 2.0 m are anticipated at the Sherbrooke Road entrance to the existing facilities.
    - The proposed new sealed hardstand will remain protected during flood events as the flow path is diverted around the hardstand area.
2. Overland flow flood:
    - Results indicate the site is affected by overland flow during a 0.5 EY (2-year) event. Flood depths across the proposed road pavement are expected to range from 0.1 m to 1.0 m, extending from the north to the south of the site.
    - Flood depths are projected to peak at approximately 1.5 m within the proposed road pavement area and reach up to 2.0 m along the existing warehouse and material storage facilities for events ranging from 20% to 0.2% AEP.
    - Within the 20% to 0.2% AEP range, the flood extent widens across the proposed road pavement and existing facilities, spreading from the centre of the site toward the east.
    - The overland flow path bypasses the new sealed hardstand, ensuring it remains protected during the heavy rainfall event.
3. Existing drainage:
    - The majority of the site's stormwater runoff is directed toward an open channel located to the northwest via a system of box and pipe culverts. This channel subsequently discharges into the King Avenue Park wetlands, which eventually overflows into Blunder Creek.

3 PROPOSED DEVELOPMENT

The proposed development involves upgrades and improvements to the existing green waste hardstand area to provide additional hardstand area for the receival, preprocessing and removal of green waste aligning with broader Council resource recovery and landfill diversion targets and increase operational flexibility to reduce people and plant interactions and provide additional internal queuing space.

The upgrades and improvements broadly include the following:

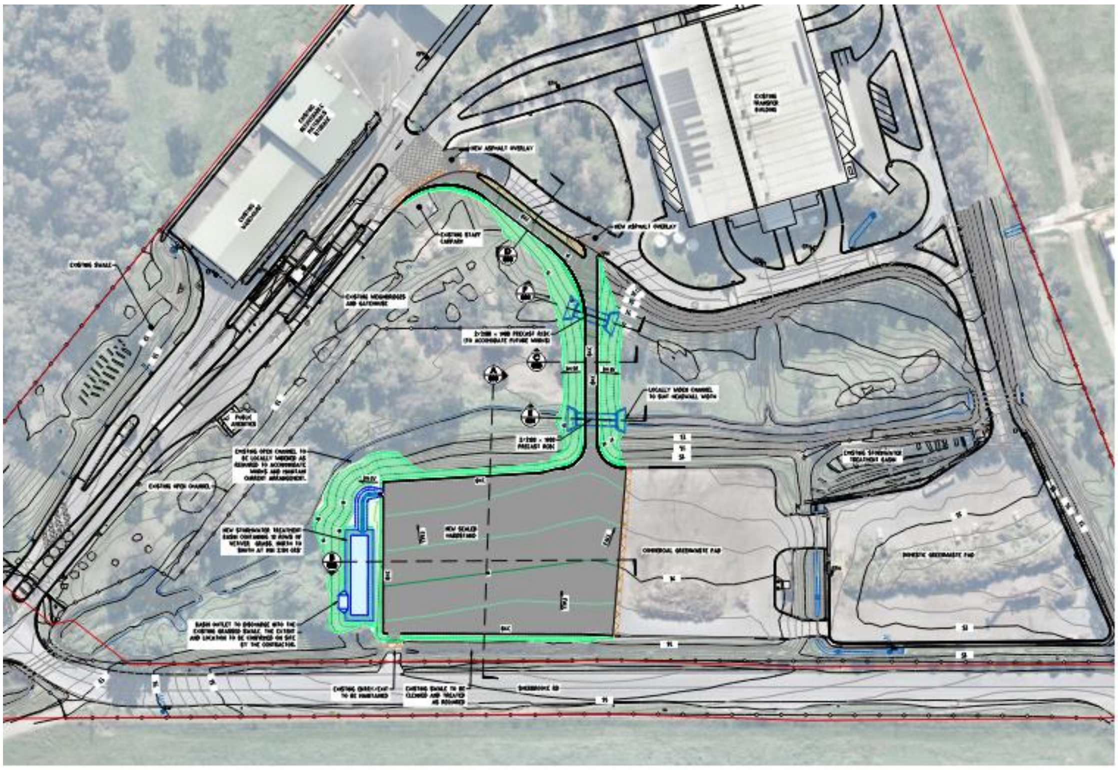
- Provision of a new road pavement connecting the existing ring road to the southern green waste pad, providing one way traffic through the green waste pad.
- Design and integration of the pavement tie-in with the existing green waste pad.
- Landscaping of areas immediately adjacent to the new pavement.
- Construction of new kerbing along both the existing and proposed road alignments.
- Provision of a new spillway, drain and bioretention pond adjacent to the new sealed hardstand.

3.1 Construction Approach

The proposed development will be carried out in three stages as follows:

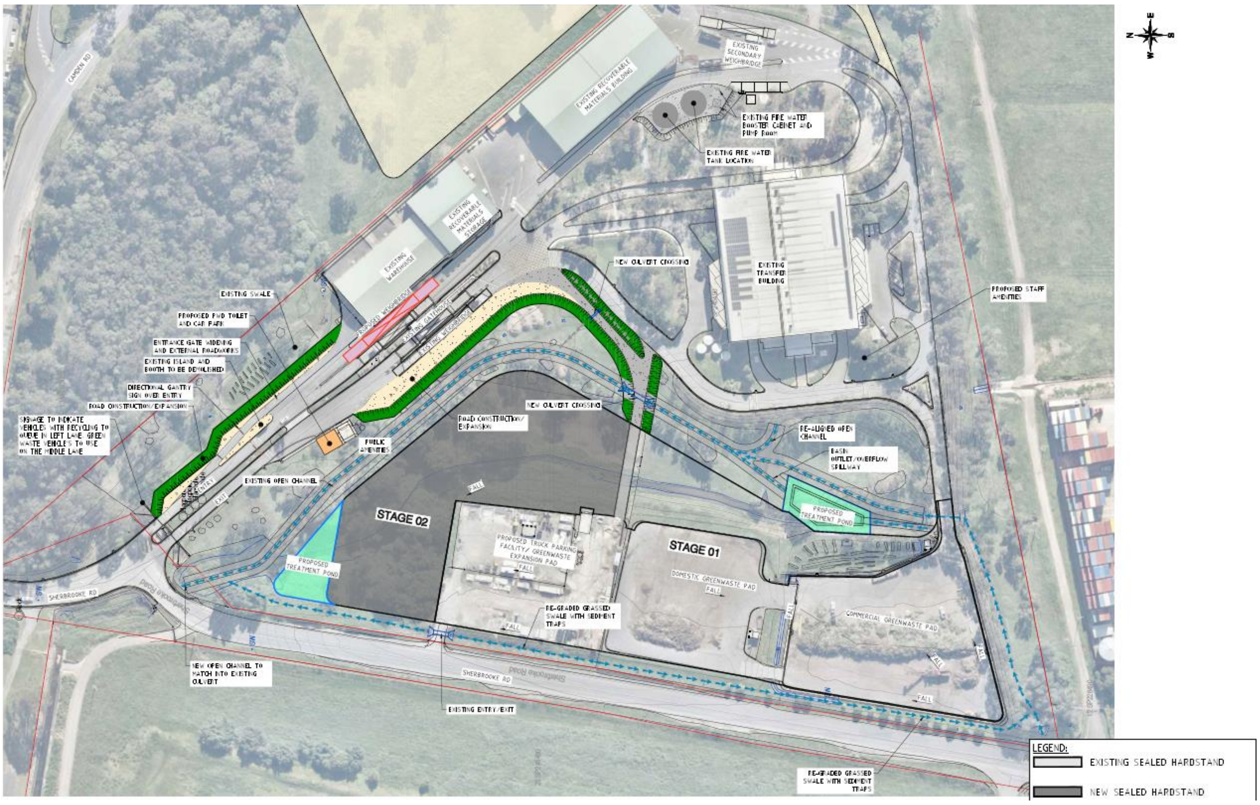
- **Stage 1**

DIAGRAM 2 – GREEN WASTE EXPANSION STAGE 1



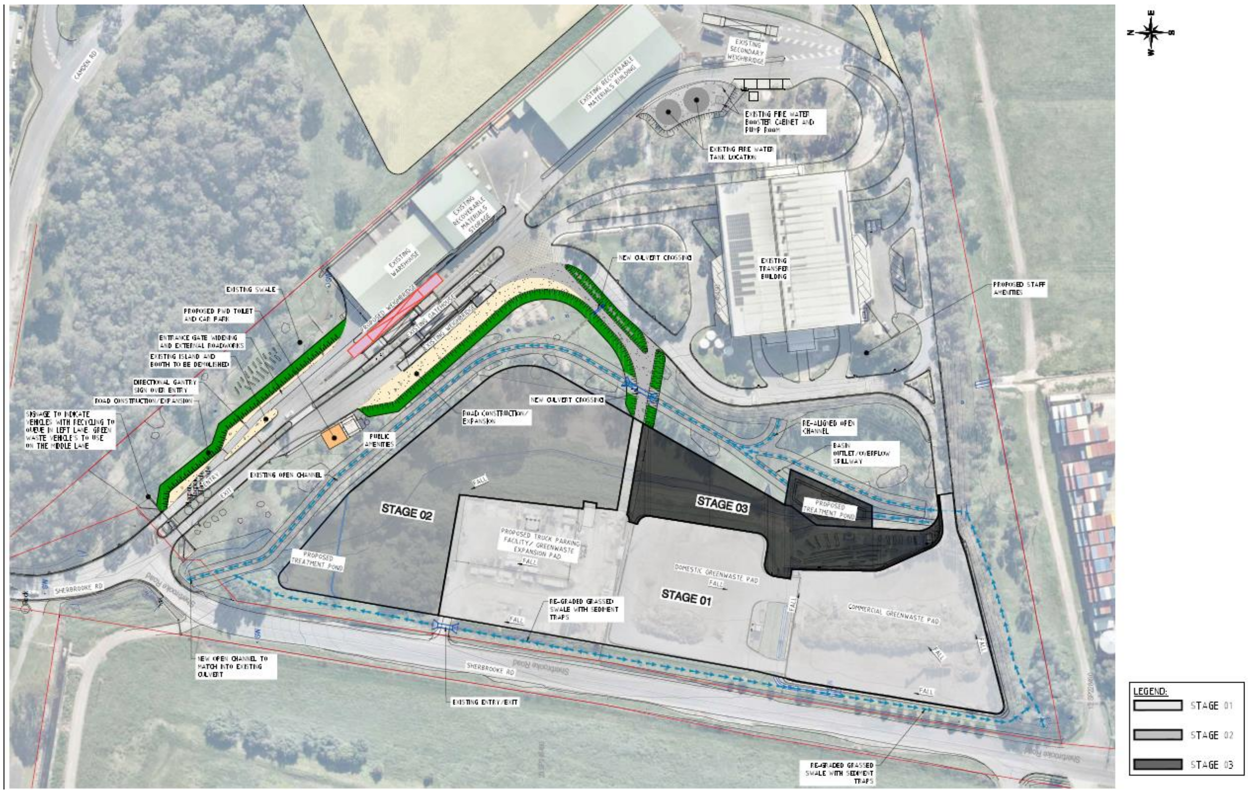
- **Stage 2**

DIAGRAM 3 – GREEN WASTE EXPANSION STAGE 2



- **Stage 3**

DIAGRAM 4 - PROPOSED DEVELOPMENT PLAN (FINAL STAGE)



Refer to **Appendix A** for Roadworks and Drainage Plans for all stages.

4 STORMWATER QUANTITY ASSESSMENT

4.1 Background

The expansion of the new sealed hardstand and road pavement has the potential to increase pollutant loads in stormwater runoff reaching the receiving environment. Additionally, the expansion of the green waste pad will increase the site's impervious area, raising the risk of increased stormwater runoff into the existing drainage network. Consequently, a review of the proposed drainage network is proposed to ensure they are adequate to accommodate the additional flow discharging into the existing drainage system.

4.2 Climate

The site is situated within the Brisbane region of Southeast Queensland. The local climate is characterised by a distinct wet season between November and March, with significantly lower rainfall depths recorded throughout the remainder of the year. Rainfall Intensity Frequency Duration (IFD) data has been obtained from the Bureau of Meteorology's 'Design Rainfall Data System (2016)' and is reproduced in **Table 1**.

TABLE 1 - INTENSITY FREQUENCY DURATION DATA (MM/HR)

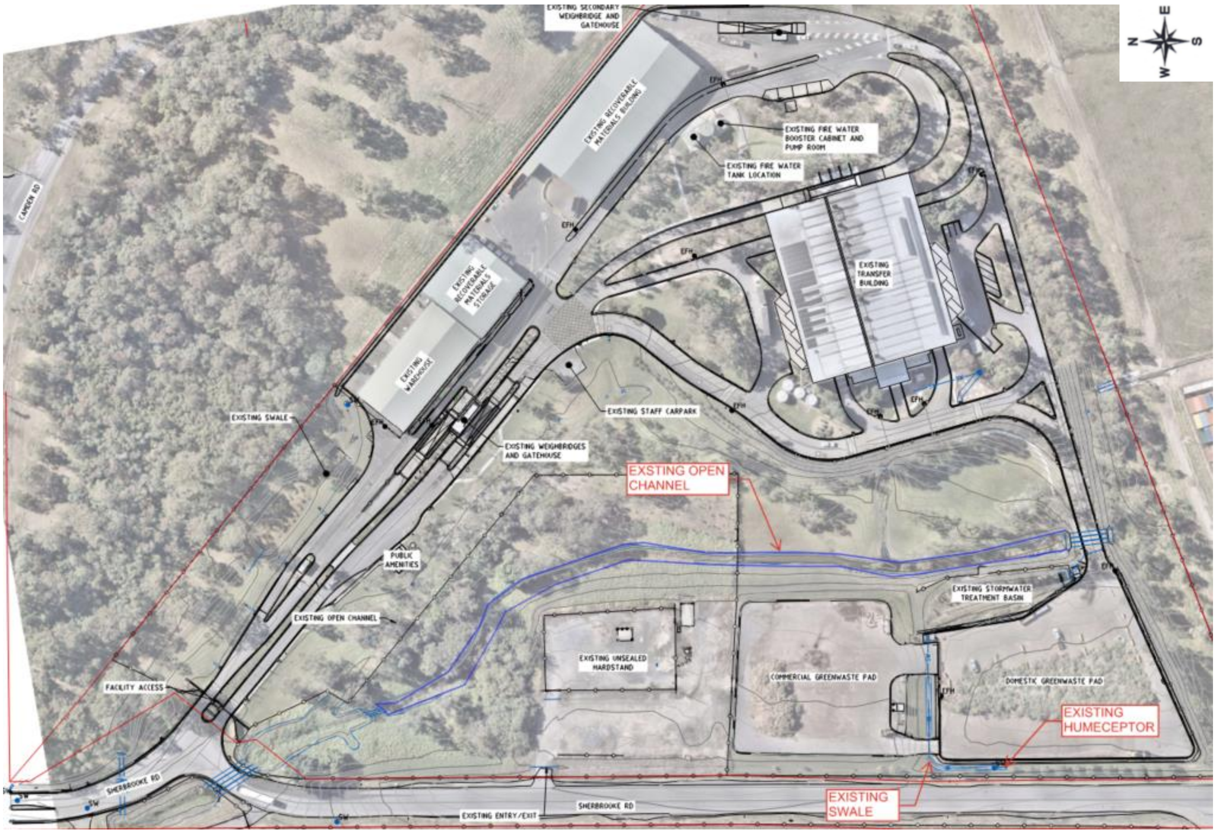
Annual Exceedance Probability (AEP)							
Duration	**63.20%**	**50%**	**20%**	**10%**	**5%**	**2%**	**1%**
1 min	151	171	236	279	321	376	417
2 min	124	141	197	235	274	326	367
3 min	117	133	184	220	255	303	340
4 min	112	127	175	209	242	285	318
5 min	107	122	168	199	230	270	301
10 min	**88.1**	**100**	**138**	**162**	**186**	**217**	**241**
15 min	74.6	84.9	117	138	158	184	204
20 min	64.8	73.7	101	120	137	161	178
25 min	57.3	65.3	89.9	106	122	143	159
30 min	51.6	58.7	80.9	95.9	110	130	144
45 min	40	45.5	62.9	74.8	86.5	102	114
1 hour	33	37.5	52	62	71.9	85.2	95.5
1.5 hour	24.9	28.3	39.4	47.1	54.8	65.3	73.6
2 hour	20.3	23.1	32.2	38.6	45	53.8	60.8
3 hour	15.3	17.4	24.2	29.1	34	40.9	46.4
4.5 hour	11.5	13.1	18.3	22	25.8	31.1	35.4
6 hour	9.48	10.8	15	18.1	21.3	25.7	29.3
9 hour	7.24	8.24	11.5	13.9	16.4	19.8	22.6
12 hour	5.99	6.84	9.61	11.6	13.7	16.6	19
18 hour	4.61	5.27	7.46	9.04	10.7	13	14.9
24 hour	3.82	4.38	6.24	7.59	8.98	11	12.6

4.3 Topography and Drainage

The facility benefits from two separate networks for surface water management and treatment that amalgamate local to the facilities entry prior to discharging into the offsite drainage network. The

Resource Recovery Area, and north-eastern portion of the ring road are directed towards a series of swales and culverts on the north-eastern boundary of the facility prior to entering the treatment basin and discharging off site local to the site access. The remaining areas on site area directed, through a series of drains, swales and culverts towards the existing open channel, flowing south to north prior to discharging off site local to the site access. The existing green waste pad is directed through a treatment basing on the south-eastern corner of the hardstand area prior to entering the aforementioned open channel. Reference is made to **DIAGRAM 5** for existing arrangement.

DIAGRAM 5 - EXISTING GREEN WASTE PAD DRAINAGE



4.4 Catchments

4.4.1 Predevelopment Catchments

Existing catchment areas are shown in **DIAGRAM 6** and are summarised in **Table 2**:

DIAGRAM 6 - EXISTING CATCHMENT AREAS

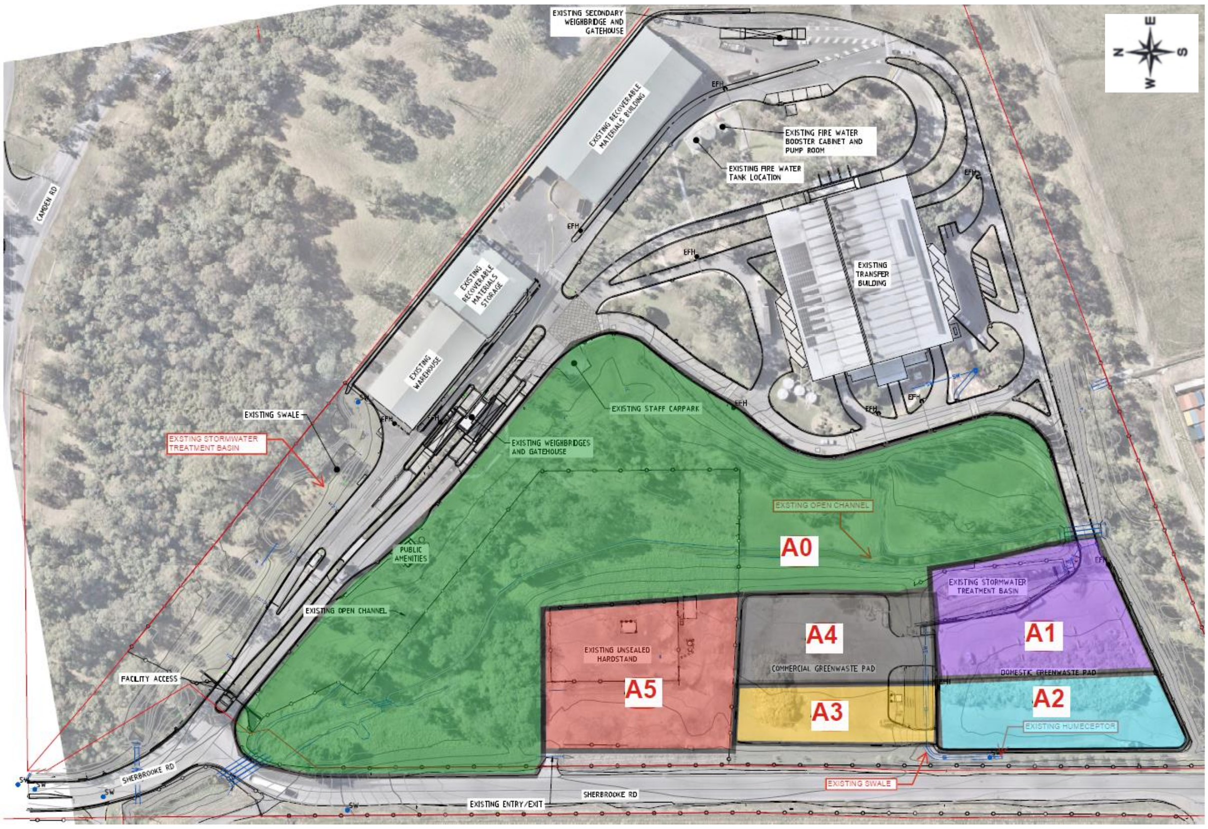


TABLE 2 – PRE-DEVELOPMENT CATCHMENTS

Stage	Land Area (ha)	% Impervious	Total Area Imp (ha)
Pre-development – Catchment A0	3.38	0%	0
Pre-development – Catchment A1	0.40	80%	0.32
Pre-development – Catchment A2	0.30	100%	0.30
Pre-development – Catchment A3	0.29	75%	0.22
Pre-development – Catchment A4	0.40	75%	0.30
Pre-development – Catchment A5	0.40	50%	0.20
Total	**5.17**	**26%**	**1.34**

4.4.2 Post Development Catchments

The staged developed catchment areas are shown in **DIAGRAM 7** and summarised in **Table 3**. The Stage 2 catchment A8 and Stage 3 catchment A9 are parts of the prior stage catchment A0.

DIAGRAM 7 – STAGE 1 DEVELOPMENT CATCHMENT AREA

TABLE 3 - PROPOSED DEVELOPMENT CATCHMENTS

Stage	Catchment	Catchment Type	Node Type	Area (ha)	% Impervious	Total Area (ha)
Stage 1	A0	Woodland	Agricultural	3.29	0%	0
	A1	Hardstand	Industrial – Ground Level	0.40	80%	0.32
	A2	Hardstand	Industrial – Ground Level	0.30	100%	0.30
	A3	Hardstand	Industrial – Ground Level	0.29	75%	0.22
	A4	Hardstand	Industrial – Roads	0.40	75%	0.30
	A5	Hardstand	Industrial – Ground Level	0.40	100%	0.40
	A6	Hardstand	Industrial – Roads	0.028	100%	0.028
	A7	Hardstand	Industrial – Roads	0.064	100%	0.064
Stage 1	**Total**	**Hardstand**	**-**	**5.17**	**32%**	**1.63**
Stage 2	A0	Woodland	Agricultural	2.37	0%	0

Stage	Catchment	Catchment Type	Node Type	Area (ha)	% Impervious	Total Area (ha)
	A1	Hardstand	Industrial – Ground Level	0.40	80%	0.32
	A2	Hardstand	Industrial – Ground Level	0.30	100%	0.30
	A3	Hardstand	Industrial – Ground Level	0.29	75%	0.22
	A4	Hardstand	Industrial – Roads	0.40	75%	0.30
	A5	Hardstand	Industrial – Ground Level	0.40	100%	0.40
	A6	Hardstand	Industrial – Roads	0.028	100%	0.028
	A7	Hardstand	Industrial – Roads	0.064	100%	0.064
	A8	Hardstand	Industrial – Ground Level	0.92	90%	0.83
Stage 2	**Total**	**-**	**-**	**5.17**	**48%**	**2.46**
Stage 3	A0	Woodland	Agricultural	1.99	0%	0
	A1	Hardstand	Industrial – Ground Level	0.40	80%	0.32
	A2	Hardstand	Industrial – Ground Level	0.30	100%	0.30
	A3	Hardstand	Industrial – Ground Level	0.29	75%	0.22
	A4	Hardstand	Industrial – Roads	0.40	75%	0.30
	A5	Hardstand	Industrial – Ground Level	0.40	100%	0.40
	A6	Hardstand	Industrial – Roads	0.028	100%	0.028
	A7	Hardstand	Industrial – Roads	0.064	100%	0.064
	A8	Hardstand	Industrial – Ground Level	0.92	90%	0.83
	A9	Hardstand	Industrial – Ground Level	0.38	100%	0.38

Stage	Catchment	Catchment Type	Node Type	Area (ha)	% Impervious	Total Area (ha)
Stage 3	**Total**	**-**	**-**	**5.17**	**55%**	**2.84**

4.5 Pre-development hydrology

Peak flow estimates were calculated using the Rational Method for a range of design storm events in accordance with Australian Rainfall and Runoff (ARR 2019). Storm events from the 1-year (C1) to the 100-year (C100) Average Recurrence Interval (ARI) were assessed using rainfall intensities derived from the ARR DataHub. A storm duration corresponding to the catchment's time of concentration was adopted to ensure coincidence between peak rainfall intensity and peak catchment response. The assumptions and procedures used to determine the parameters within the Rational Method are outlined below.

The following coefficients of runoff were used for the pre-development based on fraction impervious of 0.26 as annotated within **Table 2** above, this catchment is referenced Catchment A.

TABLE 4 - EXISTING RUNOFF COEFFICIENT AND CATCHMENT DETAILS

Runoff Coefficients							
Catchment	**C1**	**C2**	**C5**	**C10**	**C20**	**C50**	**C100**
A	0.57	0.61	0.68	0.72	0.75	0.82	0.86
ARI Rainfall Intensity (mm/hr)							
Catchment	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
A	88.1	100	138	162	186	217	241
Flow Rates (m^3/s)							
Catchment	**Q1**	**Q2**	**Q5**	**Q10**	**Q20**	**Q50**	**Q100**
A	0.72	0.87	1.35	1.66	2.01	2.56	2.97

4.6 Post-development hydrology

The following coefficients of runoff were used for the post-development based on fraction impervious of 0.32 (Stage 1), 0.48 (Stage 2) and 0.55 (Stage 3) as annotated within **Table 3** above, these catchments are referenced Catchment B, C and D respectively.

TABLE 5 - STAGE 1 HYDROLOGY

Runoff Coefficients							
Catchment	**C1**	**C2**	**C5**	**C10**	**C20**	**C50**	**C100**
B	0.58	0.62	0.69	0.73	0.77	0.84	0.88
ARI Rainfall Intensity (mm/hr)							

Catchment	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
B	88.1	100	138	162	186	217	241
Flow Rates (m^3/s)							
Catchment	Q1	Q2	Q5	Q10	Q20	Q50	Q100
B	0.74	0.89	1.38	1.70	2.05	2.62	3.03

TABLE 6 - STAGE 2 HYDROLOGY

Runoff Coefficients							
Catchment	C1	C2	C5	C10	C20	C50	C100
C	0.62	0.65	0.73	0.77	0.81	0.89	0.92
ARI Rainfall Intensity (mm/hr)							
Catchment	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
C	88.1	100	138	162	186	217	241
Flow Rates (m^3/s)							
Catchment	Q1	Q2	Q5	Q10	Q20	Q50	Q100
C	0.78	0.94	1.45	1.79	2.16	2.76	3.20

TABLE 7 - STAGE 3 HYDROLOGY

Runoff Coefficients							
Catchment	C1	C2	C5	C10	C20	C50	C100
D	0.63	0.67	0.75	0.79	0.83	0.91	0.95
ARI Rainfall Intensity (mm/hr)							
Catchment	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
D	88.1	100	138	162	186	217	241
Flow Rates (m^3/s)							
Catchment	Q1	Q2	Q5	Q10	Q20	Q50	Q100
D	0.80	0.96	1.48	1.83	2.21	2.82	3.27

TABLE 8 - SUMMARY OF DEVELOPMENT HYDROLOGY

Flow Rates (m^3/s)							
Catchment	Q1	Q2	Q5	Q10	Q20	Q50	Q100
A (Existing)	0.72	0.87	1.35	1.66	2.01	2.56	2.97
B (Stage 1)	0.74	0.89	1.38	1.70	2.05	2.62	3.03
% Increase	2%	2%	2%	2%	2%	2%	2%
C (Stage 2)	0.78	0.94	1.45	1.79	2.16	2.76	3.20
% Increase	8%	8%	8%	8%	8%	8%	8%
D (Stage 3)	0.80	0.96	1.48	1.83	2.21	2.82	3.27
% Increase	10%	10%	10%	10%	10%	10%	10%

4.7 Conclusion

As annotated in Section 4.5 and Section 4.6 above, the maximum pre-development flow for site was calculated at 2.97 m3/s for the 100 year ARI. It is demonstrated that an increase in impermeable area of 6% for Stage 1 and 22% for Stage 2 and 29% for Stage 3 results in a negligible impact on the peak flow of 0.06 m3/s or a 2% increase in maximum flow rate for Stage 1. Hence no additional attenuation of peak flows is proposed in the Stage 1 works.

The impacts on the latter stages are 0.26m3/s or 8% increase for Stage 2 and 0.3m3/s or a 10% increase for Stage 3. It is proposed to reconfigure the existing open channel while realigning to accommodate the latter stages and new ponds to provide additional attenuation to mimic the current pre-development flow for the facility.

5 STORMWATER QUALITY ASSESSMENT

5.1 Background

The expansion of the new sealed hardstand and road pavement has the potential to increase pollutant loads of sediment and nutrients in stormwater runoff reaching the receiving environment. Consequently, a review of the proposed treatment measures is proposed to ensure they are adequate to accommodate the additional loading and limit pollutants discharging into the existing drainage system.

This section outlines the anticipated pollutant generation streams arising from the proposed development. It details the treatment measures required to satisfy the State Planning Policy (SPP) water quality objectives, specifically regarding Total Suspended Solids (TSS), Total Phosphorus (TP), and Total Nitrogen (TN), as well as the Department of Environment and Science (DES) Environmental Authority requirements.

5.1.1 Key Assumptions

- All catchments grade towards the appropriate treatment devices,
- This assessment addresses the proposed development as outlined in the drawing package within **Appendix A**,
- Treatment devices were installed and constructed as per the previous design drawings.

5.2 Construction Phase

During construction, water quality will be managed through implementation of controls through a Erosion and Sediment Control Plan (CESCP) produced by the contractor. The potential impacts on water quality during the construction phase of the development are likely to be:

- Elevated suspended solids and turbidity in stormwater runoff
- Hydrocarbon pollutants, primarily from vehicles used
- Generation of toxic materials such as concrete runoff

Potential impacts associated with contamination from spills and leaks will be managed in accordance with the mitigation measures detailed in the CESCP. The following objectives will be applied to ensure that stormwater is managed to protect the existing nearby water quality during the construction phase:

- The integration of permanent and temporary water quality control measures into the design
- Reduce the potential for erosion and subsequent sedimentation

A detailed Erosion and Sediment Control Plan must be prepared by a suitably qualified person as part of the construction phase to identify the key requirements for the building works phase of the development to ensure materials that may contaminate waters are not released to any waters either in a direct or indirect manner as a result of construction activities.

5.3 Operational Phase

5.3.1 Water Quality Objectives

The Brisbane City Council Subdivision and Development Guidelines (2008) and broader Brisbane City Plan (2014) require that stormwater pollutants be appropriately mitigated before being discharged into receiving waterways in order to protect the Environmental Values (EVs) and Water Quality Objectives (WQO) identified for those waterways. Where specific EVs and WQOs have been established under Schedule 1 of the Environmental Protection Policy (Water and Wetland Biodiversity) 2019, these take precedence over Council's default objectives.

EVs for water are the qualities that make it suitable for supporting aquatic ecosystems and human water uses. These qualities need to be protected from the effects of habitat alteration, waste releases, contaminated run-off and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use. Whereas WQOs are long-term goals for water quality management. They are measures, levels or narrative statements of indicators of water quality that protect EVs.

5.3.2 Target Pollutant Reductions

Specific objectives outlined in the State Planning Policy (April 2017) apply to the proposed green waste hardstand expansion, as the development constitutes a Material Change of Use for an urban purpose involving an area greater than 2,500 m², with more than 25% of the developable area being impervious.

The mean annual load reduction targets outlined below are to be achieved through the assessment of the post-development treatment train for the subject site. These targets are in addition to, and do not replace, the requirements of the site's Environmental Authority (EA), which must also be satisfied as part of the proposed expansion, reference is made to **Table 9** below.

- **80% reduction in Total Suspended Sediment (TSS);**
- **60% reduction in Total Phosphorus (TP);**
- **45% reduction in Total Nitrogen (TN); and**
- **90% reduction in Gross Pollutants (sized 5 mm or greater).**

TABLE 9 - CURRENT EA WATER QUALITY RELEASE LIMITS

Quality Characteristic	Release Limit* at W2
pH	6.5 – 9.0
Electrical Conductivity (EC) uS/cm	1,500 maximum
Dissolved Oxygen (mg/L)	4 minimum
Total Suspended Solids (mg/L)	50 maximum

5.4 MUSIC Model Inputs

To assess the quantities of pollutants discharging from the site, the water quality modelling package MUSIC v6.3.0 has been adopted. Input parameters for a 'Commercial and Industrial' land use have been adopted from Water by Design's MUSIC Modelling Guidelines for the Brisbane City Council area, as per **Table 10** and **Table 11**.

It is acknowledged that the following parameters are adopted by assessing the typical industrial and woodland areas within the existing site for pre- and post-development. It means that the green waste hardstand comprising stockpiles green waste material that is not specified as an input parameter in the MUSIC model. MUSIC model does not have suggested parameters for this type of catchment. Therefore, the model will not accurately simulate the high nutrient loadings expected from green waste runoff. A conservative and best practice approach to the treatment train has therefore been adopted based on experience with similar waste management facilities and historic water quality monitoring data for this facility. Moreover, operations are to limit green waste stockpiles being left longer than 3 weeks. This will reduce the risk of high nutrient leaching within the runoff that is discharged through the treatment train. Based on this approach, the treatment train outlined in **Section 5.5** is proposed.

TABLE 10 – INDUSTRIAL RAINFALL RUNOFF PARAMETERS

Parameter	Industrial Area
	Value
Rainfall Threshold	1 mm
Soil Storage Capacity	18 mm
Initial Storage	10%
Field Capacity	80 mm
Infiltration Capacity Coefficient A	243
Infiltration Capacity Coefficient B	0.6
Initial Depth (mm)	50
Daily Recharge Rate	0%
Daily Baseflow Rate	31%
Daily Deep Seepage Rate	0%

TABLE 11 - POLLUTANT EXPORT PARAMETER FOR INDUSTRIAL NODES (SPLIT LANDUSE)

Flow Type	Source	TSS* Log10 Values		TP* Log10 Values		TN* Log10 Values	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Industrial – Ground Level	0.78	0.45	-1.11	0.48	0.14	0.20
Stormflow		1.92	0.44	-0.59	0.36	0.25	0.32

*TSS = Total Suspended Soils, TP = Total Phosphorus, TN = Total Nitrogen

5.4.1 Rainfall Data

Rainfall data from the Brisbane Aero (Brisbane City Council East) station at a six-minute time step for the period of 01/01/1980 to 31/12/1989 has been incorporated into the model in accordance with Water by Design's MUSIC Modelling Guidelines for the Brisbane City Council area.

5.5 Treatment Train

5.5.1 Primary Treatment

Primary treatment devices target the removal of pollutants prior to the downstream treatment trains. In-ground proprietary stormwater treatment devices are useful for treatment of stormwater on sites that are constrained by available area for larger-scale vegetated stormwater treatment systems or where pre-treatment is required to remove sediments and oils. These devices are installed underground and target a range of pollutants in stormwater, including TSS, soluble heavy metals, hydrocarbons, oil and grease, and particulate bound nutrients.

An existing primary treatment device (HumeCeptor ST2) was installed adjacent the western corner of the existing domestic green waste pad. Approximately half of the stormwater runoff from the southern pad flows directly to this treatment device. This device is used to pre-treat the stormwater prior to discharge to the existing stormwater treatment basin.

The secondary primary treatment consists of a swale drain and grit pits installed at the outlet of the Humeceptor, which runs along the edge of the hardstand areas and conveys runoff to the existing bioretention basin.

Reference is made to

DIAGRAM 8 below and **Appendix B** for the associated datasheets.

DIAGRAM 8 – HUMECEPTOR ST5

Table 2 – HumeCeptor® model range and details

HumeCeptor® model	Pipe diameter (mm)	Device diameter (mm)	Depth from pipe invert* (m)	Sediment capacity (m³)	Oil capacity (l)	Total storage capacity (l)
STC 2 (inlet)	100 - 600	1,200	1.7	1	350	1,740
STC 3			1.68	2		3,410
STC 5		1,800	2.13	3	1,020	4,550

Figure 9 – HumeCeptor® components

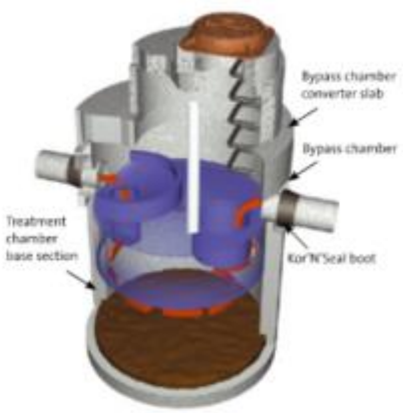
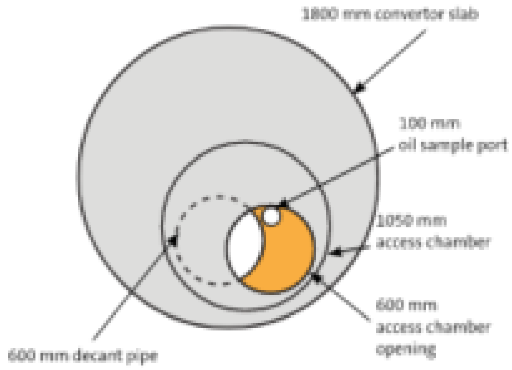


Figure 10 – Component alignment - Plan view



5.5.2 Secondary Treatment – Bioretention Basin

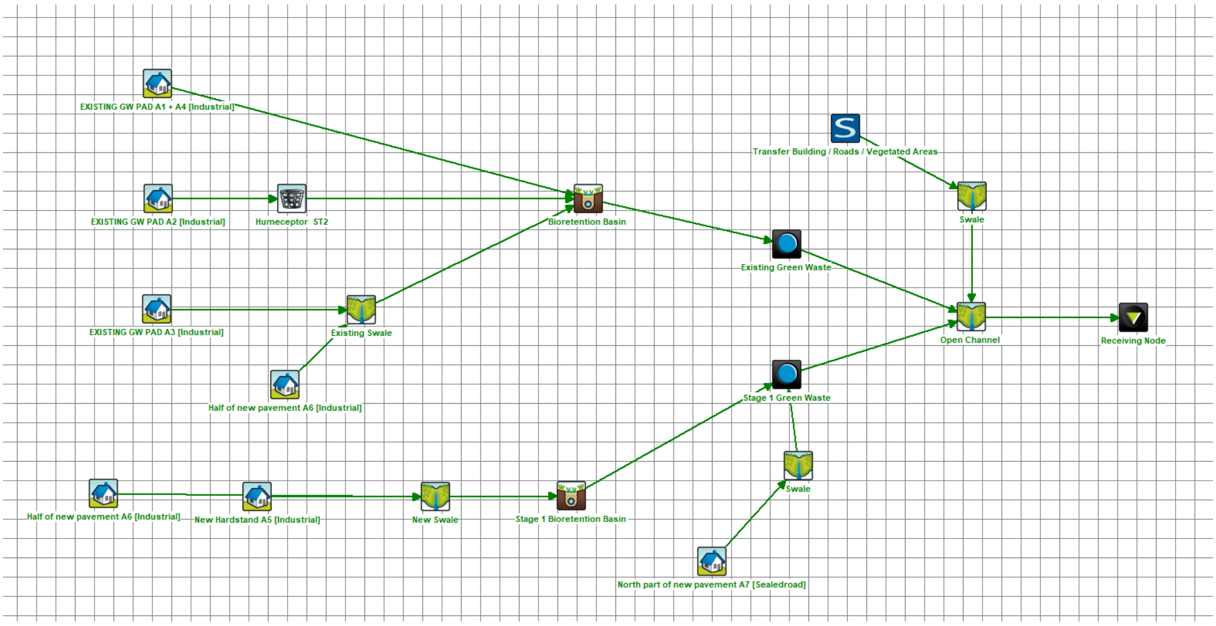
A new stormwater treatment basin incorporating continuous rows of vetiver grass is proposed to be installed adjacent the Stage 1 hardstand expansion. An existing stormwater treatment basin is located to the south, adjacent to the domestic green waste pad on the southern side. Stormwater will flow through a series of swale drains prior to entering these bioretention basins that capture runoff from both the pre and post developed hardstand areas. Reference is made to **Appendix C** for the basin design parameters.

5.5.3 Tertiary Treatment

The existing open channel extends across the site from the southern boundary to the northern boundary (local to the site entry). To maintain the hydraulic capacity of the existing open channel a series of culvert shall be installed to facilitate stormwater conveyance beneath the proposed exit road. The location of existing open channel is shown in **DIAGRAM 5** above. MUSIC Modelling Results – Stage 1

This section outlines and interprets the MUSIC modelling results for the suitability of the existing stormwater treatment system to accommodate the proposed development. The typical treatment system layout is outlined in **DIAGRAM 9**.

DIAGRAM 9 - TREATMENT SYSTEM LAYOUT



All pollutant load reductions result are summarised in **Table 14**, **Table 12** and **Table 13** below and the MUSIC output within **Appendix C.**

TABLE 12 - POLLUTANT LOAD REDUCTIONS – EXISTING

Pollutant	Source Load	Residual Load	SEQ pollutant reduction (%)	Annual pollutant reduction efficiencies (%)
Total Suspended Solids (kg / year)	1010	128	80%	87.3%
Toral Phosphorus (kg / year)	3.13	0.675	60%	78.4%
Total Nitrogen (kg / year)	21.6	10.1	45%	53.4%
Gross Pollutants (kg / year)	264	0.413	90%	99.8%

TABLE 13 - POLLUTANT LOAD REDUCTIONS – STAGE 1

Pollutant	Source Load	Residual Load	SEQ pollutant reduction (%)	Annual pollutant reduction efficiencies (%)
Total Suspended Solids (kg / year)	553	25.9	80%	95.3%
Toral Phosphorus (kg / year)	1.46	0.206	60%	85.9%

Total Nitrogen (kg / year)	9.25	3.71	45%	59.9%
Gross Pollutants (kg / year)	118	0	90%	100%

TABLE 14 - POLLUTANT LOAD REDUCTIONS – OVERALL

Pollutant	Source Load	Residual Load	SEQ pollutant reduction (%)	Annual pollutant reduction efficiencies (%)
Total Suspended Solids (kg / year)	3160	749	80%	76.3%
Toral Phosphorus (kg / year)	9.5	4.99	60%	47.5%
Total Nitrogen (kg / year)	64.9	50.1	45%	22.8%
Gross Pollutants (kg / year)	382	0	90%	100%

In isolation **Table 12** and **Table 13** demonstrate that the current surface water treatment network and proposed treatment network can achieve compliance with the target pollutant removal efficiencies for TSS, TP, TN and Gross Pollutants (litter).

As summarised above, the proposed treatment train at the final treatment node (Bioretention Basin 1) demonstrates compliance with SEQ pollutant reduction targets.

However, when the whole site is considered, the model results in **Table 14** indicates the existing treatment train may be insufficient to effectively treat the existing transfer building and associated catchments. Considering this, the existing treatment train has been operating for over 10 years and there have been no documented exceedances of license conditions during this period.

As the MUSIC software package was developed to conceptualise and refine treatment trains at the planning and preliminary design phase, relying exclusively on its outcomes at detailed design does not guarantee outcomes against the SPP. As the existing operations have not recorded any events of exceedances, it can be inferred that the treatment train is more effective than the MUSIC modelling results indicate.

It is therefore proposed to review the efficiency of the treatment train in relation to the disturbed areas associated with the proposed works. This will demonstrate that there is no deterioration in the overall performance of the treatment system and that, at a macro level, compliance with existing licence conditions is maintained.

Bearing in mind the above, as outlined in **Table 13** above the proposed treatment train for the Stage 1 works complies with the SEQ pollutant reduction targets stated in **Section 5.3.2** and therefore considered suitable for implementation.

6 CONCLUSIONS

6.1 Stormwater Quantity

As annotated in **Section 4.5** and **Section 4.6** above, the maximum pre-development flow for site was calculated at 2.97 m^3/s for the 100 year ARI. It is demonstrated that an increase in impermeable area of 6% for Stage 1 and 22% for Stage 2 and 29% for Stage 3 results in a negligible impact on the peak flow of 0.06 m^3/s or a 2% increase in maximum flow rate for Stage 1. Hence no additional attenuation of peak flows is proposed in the Stage 1 works.

The impacts on the latter stages are 0.26m^3/s or 8% increase for Stage 2 and 0.3m^3/s or a 10% increase for Stage 3. It is proposed to reconfigure the existing open channel while realigning to accommodate the latter stages and new ponds to provide additional attenuation to mimic the current pre-development flow for the facility.

6.2 Stormwater Quality

Results of the MUSIC modelling demonstrate that the proposed development at the Willawong RRA can be undertaken and at the micro level **maintain compliance** with the SEQ pollutant reduction targets and BCC's EA. The existing stormwater treatment network was developed to include a sediment separator (Humeceptor GPT), existing swales and an open channel. For stage 1, the proposed arrangement benefits from the installation of two new sales and a new stormwater treatment basin to enable adequate treatment of the stormwater runoff from the additional paved hardstand areas planned for green waste processing.

Due to the requirement of extensive remodelling and alignment of the open channel, existing drainage routes and treatment systems the stormwater quality assessment for Stages 2 and 3 have not been undertaken in detail at this stage, however this will be undertaken in conjunction with the development of the associated stages.

6.3 Signoff

Eifion Rowlands

For and on behalf of

ATC Williams Pty Ltd

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- This report must be read in its entirety.
- This report has been prepared by ATCW for the purposes stated herein and ATCW's experience, having regard to assumptions that can reasonably be expected to make in accordance with sound professional principles. ATCW does not accept responsibility for the consequences of extrapolation, extension or transference of the findings and recommendations of this report to different sites, cases, or conditions.
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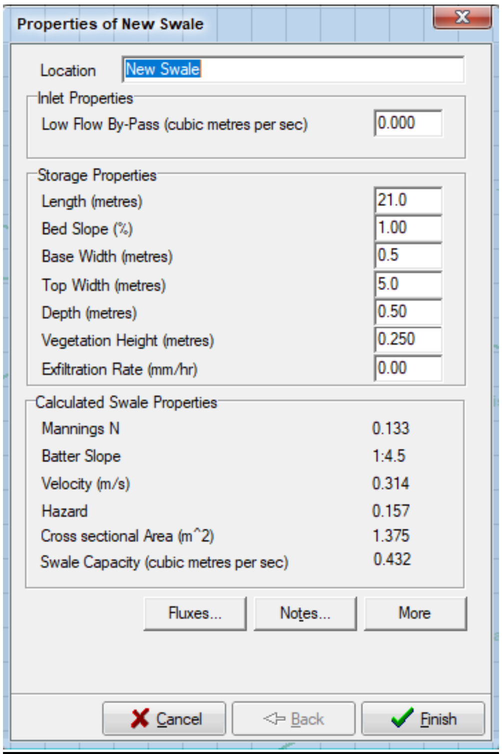
APPENDICES

APPENDIX A – CONCEPT DESIGN DRAWINGS

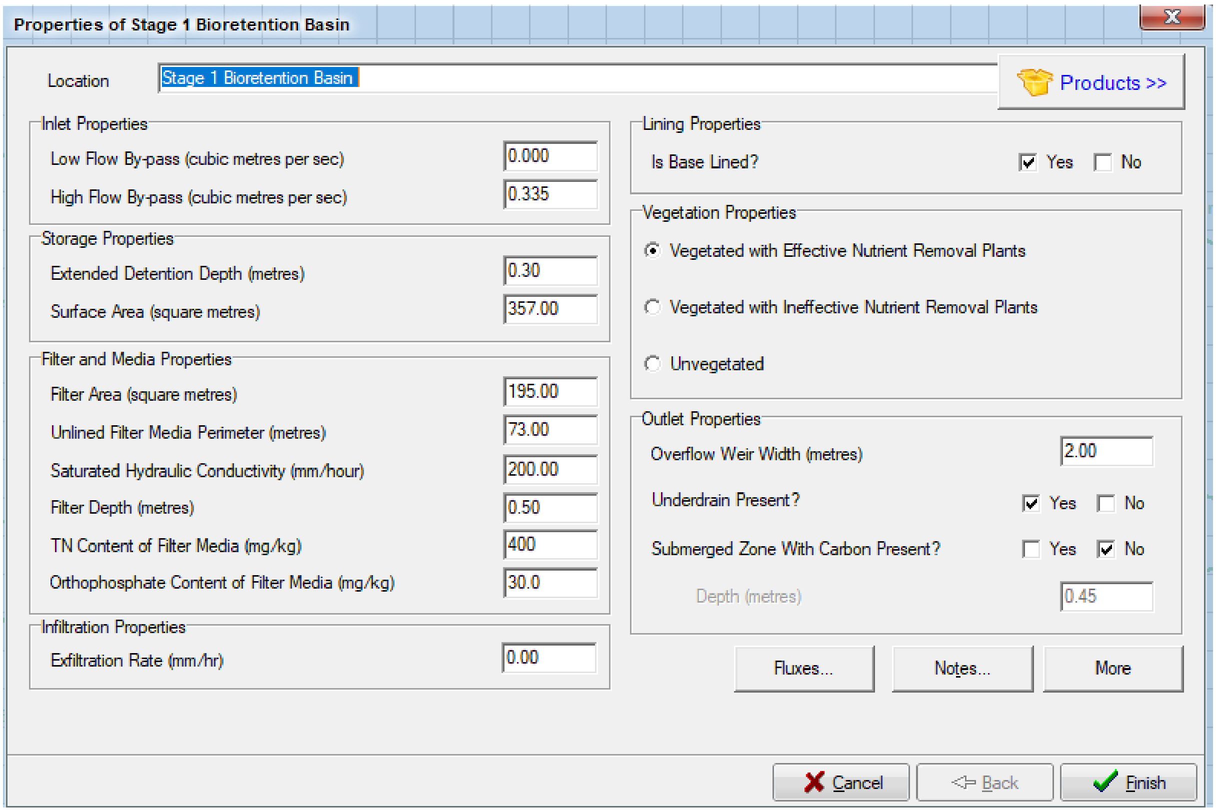
APPENDIX B – TREATMENT DEVICES

APPENDIX C – MUSIC OUTPUT

Proposed swale:



Proposed Bioretention Swale:



Overall:

Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	36.3	35.4	2.5
Total Suspended Solids (kg/yr)	3160	749	76.3
Total Phosphorus (kg/yr)	9.5	4.99	47.5
Total Nitrogen (kg/yr)	64.9	50.1	22.8
Gross Pollutants (kg/yr)	382	0	100

Existing Basin:

Treatment Train Effectiveness - Existing Green Waste

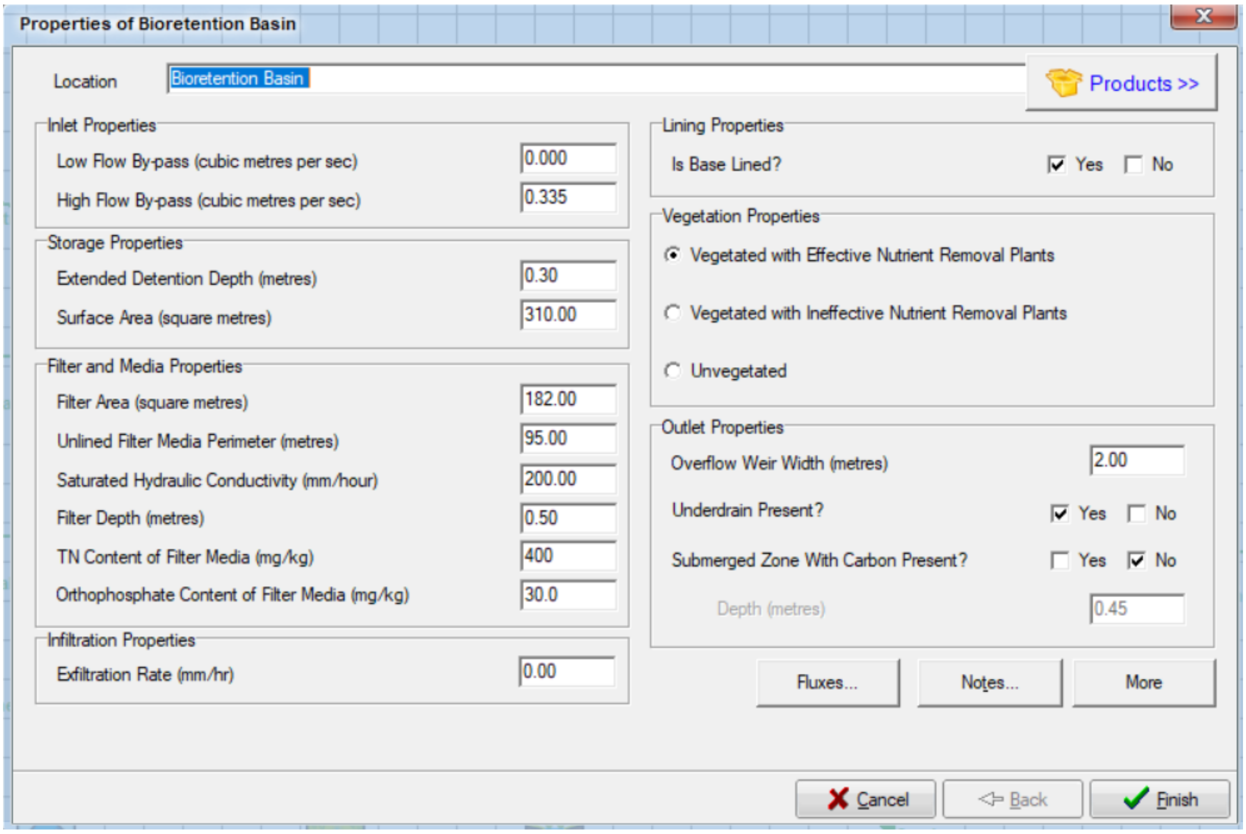
	Sources	Residual Load	% Reduction
Flow (ML/yr)	12.2	11.7	3.8
Total Suspended Solids (kg/yr)	1010	128	87.3
Total Phosphorus (kg/yr)	3.13	0.675	78.4
Total Nitrogen (kg/yr)	21.6	10.1	53.4
Gross Pollutants (kg/yr)	264	0.413	99.8

Stage 1:

Treatment Train Effectiveness - Stage 1 Green Waste

	Sources	Residual Load	% Reduction
Flow (ML/yr)	5.03	4.55	9.5
Total Suspended Solids (kg/yr)	553	25.9	95.3
Total Phosphorus (kg/yr)	1.46	0.206	85.9
Total Nitrogen (kg/yr)	9.25	3.71	59.9
Gross Pollutants (kg/yr)	118	0	100

Existing Bioretention Basin:



Existing Open Channel: