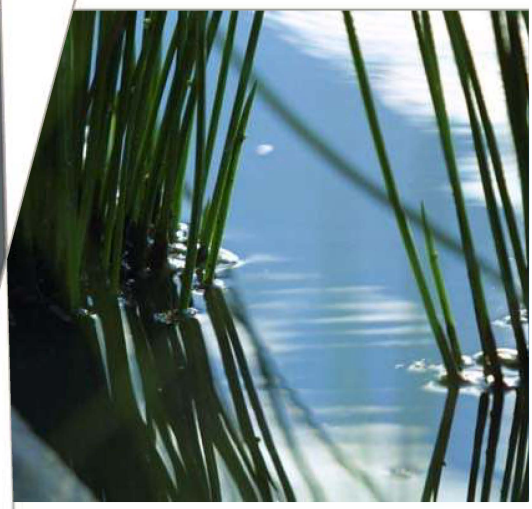
Stormwater Management Plan: Response to Request for Information

Cedar Grove Wastewater Treatment Plant

764015_LS009



Prepared for
Logan Water Infrastructure Alliance

4 May 2018

Cardno
Shaping the Future

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Document Information

Prepared for	Logan Water Infrastructure Alliance
Project Name	Cedar Grove Wastewater Treatment Plant
File Reference	R1V5_SMP
Job Reference	764015_LS009
Date	4 May 2018
Effective Date	4 May 2018
Date Approved:	4 May 2018

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	6 September 2017	R1V1_SMP	Geordi Paxton	Helen Doherty
2	14 September 2017	Final	Geordi Paxton	Helen Doherty
3	12 February 2018	Updated to address EDQ RFI- for internal review	Peter Comino	Helen Doherty
4	1 March 2018	Updated for issue to EDQ	Peter Comino	Helen Doherty
5	4 May 2018	Final	Peter Comino	Helen Doherty

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1 Overview

1.1 Introduction

This Stormwater Management Plan (SMP) has been prepared by Cardno, specialist hydrologic, hydraulic and water quality consultants for the proposed Cedar Grove Wastewater Treatment Plant development on Cedar Grove Road, Cedar Grove. The site location is shown on Figure 1.

This report includes an analysis of stormwater management for the proposed buildings within Stage 1 including stormwater quality and quantity analysis.

The assessment is in accordance with the following policies and guidelines:

- *'State Planning Policy',* Department of Infrastructure, Local Government and Planning (DILGP), July 2017.
- *MUSIC Modelling Guidelines'*, Water by Design, SEQ Healthy Waterways Partnership 2010.
- *'Water Sensitive Urban Design Technical Design Guidelines for South East Queensland',* Healthy Waterways, June 2006.
- *'Queensland Urban Drainage Manual',* Department of Natural Resources and Water (DNRW), 2016.

1.2 RFI and Response

This report also addresses the following two items of the Request for Information (RFI) from the DILGP dated 31st October 2017, listed below together with response statements.

Site Based Stormwater Management Plan

1. The submitted Stormwater Management Plan (SMP) does not adequately address the quality of stormwater to be discharged to the weir pool. In particular, the SMP addresses *Table B: Post construction phase – stormwater management design objectives* in the State Planning Policy (SPP). However, it does not address the SPP State Interest for Water Quality and Seqwater Development Guidelines, as it relates to the drinking water catchment. The report should consider diverting stormwater to a discharge point below the weir pool. If this is not the viable, the applicant must consider the Drinking Water Environmental Values (EVs) specified in the Environmental Protection (Water) Policy 2009 for the Logan River. Additionally, the recently released SPP Guidance Material for Water Quality provides further guidance in relation to stormwater impacts to drinking water quality.

   Response:
   The proposal already comprises the diversion of all effluent discharge including peak flows from the WWTP to below the weir pool. Stormwater which has the potential to come in contact with sewage or effluent is treated as effluent and will be treated along with sewage and discharged below the weir. Stormwater from areas other than the wetlands and WWTP is discussed further within Section 4.1 of this report in subsections titled "SPP State Interest for Water Quality" and "Seqwater Development Guidelines".

2. Reference is made to the proposed minimum design storm events specified in Table 3.1 of the submitted Stormwater Management Plan as it relates to *Part 2: Construction phase – stormwater management design objectives for temporary drainage works* in the SPP. The minimum design stormwater event should be amended to reflect the section titled, *where located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure*, given the immediate proximity to the weir pool.

   Response: A 10 year ARI design event has been selected and this is consistent with the latest SPP dated 2017. Refer to the new sub-section within Section 3.1 of this report titled "State Planning Policy (DSDIP, July 2017).

2 Site Description and Proposed Development

2.1 Site Description

The site is located off Cedar Grove Road, Cedar Grove and is bordered by Dennis Road to the east and the Logan River to the north and west. The development is situated on Lots 1-5 RP25779 and Lot 66 W3 123. Figure 1 displays the site locality.

The site is approximately 204 ha and is currently utilised for agricultural purposes. During major flooding events, significant inundation occurs within the lot boundary from the adjacent Logan River. The proposed WWTP will be developed on the elevated hill formation at the centre of the site. This area is above the 0.5% AEP inundation area, as shown on Council's flood mapping. A plan showing the location of the proposed development and the 0.5% AEP inundation extent is contained in Appendix A.

2.2 Proposed Development

The development consists of a Wastewater Treatment Plant and associated structures and infrastructure. The development footprint is approximately 1.3 ha, in addition to a wetland footprint of approximately 10haand the developed area is located in the central area of the site on the elevated hill formation so as to remain above the Logan River flood level defined by the Logan City Council (Council). The remainder of the site is to remain undeveloped.

A layout of the proposed development is provided in reference drawing ref. LS303-00-S-SKE-CI-8500, a copy of which is contained in Appendix B.

The particular details of the stormwater runoff during construction and operational phases comprises the following:

- The current proposal comprises Stages 1 only, which comprises admin/control buildings, roadways and parking (referred to herein as Catchment A) at the western side of the site; wastewater treatment process and a number of artificial constructed wetlands either side of the ridgeline within the centre of the site(referred to herein as Catchment B).
- Drainage from the process areas of the site (Refer Figure 2- Catchment B) will drain to a sump which will be returned to the inlet works of the WWTP and treated as effluent. These areas will not receive any external catchment inflows.
- During the operational phase, the wetlands will be bunded, so that they will not receive any external catchment inflows, nor release any effluent outflows to the drainage systems or the river other than through the approved discharge point; and
- There are no external sub-catchments entering any of the proposed works. Therefore, the bioretention system for Catchment A will only need to cater for the immediate site works.

Hence the proposed development can be summarised as follows:

- Stormwater runoff from the site discharging to the upstream side of the weir will consist only of discharges from the undeveloped areas plus catchment A. This comprises typical urban/rural development works.
- Catchment B comprising the wetlands and the WWTP will be discharged to the river downstream of the weir via the authorised discharge point.

3 Stormwater Quality – Construction Phase

3.1 Water Quality Objectives

3.1.1 State Planning Policy (DILGP, July 2017)

The *State Planning Policy (DILGP, July 2017)* provides the following construction stormwater management design objectives.

Table 3-1 Construction Phase Design Objectives for Urban Stormwater Management

Issue	Desired outcomes
Drainage Control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2). 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3).
Erosion Control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective short-term stabilisation.
Sediment Control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 metres^2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway Stability and Flood Flow Management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

3.1.2 Temporary Drainage Works

Appendix 2, Part 2 of the SPP dated July 2017 requires that for temporary drainage works, the minimum design storm event is the 10 year ARI event, (where located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure).

This performance criteria has been allowed for by way of bunding to contain the storm runoff volume of a 10 year ARI storm event, proposed for all components of the site during the construction process.

3.2 Management Plan

During the construction phase, the potential exists for increases in the amount of pollutants, particularly sediment to be exported from the site. It is expected that the construction phase works will comprise of removal and stock piling of topsoil and existing vegetation, bulk earthworks (including the construction of sediment basins), final site trimming and profiling and landscaping and associated drainage.

The pollutants that are to be managed during the construction phase include:

- Litter;
- Sediment; and
- Hydrocarbons (oils and greases).

During the construction stage the management of stormwater runoff from the exposed earthworks surfaces will be based on containment, diversion and retention. Throughout the stages of construction these will include:

- Erosion controls such as sediment fences surrounding stripped earth.
- Sediment fences surrounding stockpiles of soil and debris.
- Construction of perimeter bunding at the toe and/or top of the earthworks batters.
- Catch drains, including check dams, through the site to catch and direct runoff to sediment sumps.
- The containment of runoff from the site into temporary sediment basins.

Plate 6-1 – Sediment Fences

Plate 6-2 – Catch Drain

Plate 6-3 – Sediment Basin

During this period, an Erosion and Sediment Control Plan will be required as part of the overall Environmental Management Plan prepared for the construction phase. It is considered that the completion of construction activities in accordance with an Erosion and Sediment Control Plan (ESCP) developed using the following guidelines will minimise the nature of any adverse impacts during the construction phase. The ESCP would apply throughout the entire construction period.

It is suggested that the requirement to submit an ESCP to Council for approval as part of any subsequent Operational Works application over the site be made a condition of the approval issued for the development. The ESCP must:

- Be prepared by a suitably qualified and experienced professional;

- Be consistent with the Council's Planning Scheme Policy and current best management practice guidelines (such as the IECA Best Practice Erosion and Sediment Control);
- Prescribe non-structural controls where applicable, such as minimising the extent and duration of soil exposure, staging the works, identifying areas for protection and delaying clearing until construction works are imminent;
- For each stage of works detail the types, location, sequence and timing of measures and actions to effectively minimise erosion, manage flows and capture sediment;
- Be consistent with current best management practice standards, taking into account all environmental constraints including erosion hazard, season, climate, soil and proximity to waterways; and
- Be prepared to a sufficient standard and level of detail.

The water quality objectives listed in Table 3-1 will apply to the construction phase of the project.

4 Stormwater Quality – Operational Phase

4.1 Water Quality Objectives

4.1.1 State Planning Policy (DSDIP, April 2016)

The site will ultimately drain into the Logan River, which is located immediately north of the proposed development. Taking into consideration the importance of these downstream receiving waters, the purpose of this Stormwater Management Plan (SMP) is to ensure that no detriment to the downstream environment is caused by the proposed development. To this end, Water Quality Objectives (WQOs) have been nominated for the project.

The *State Planning Policy (DSDIP, April 2016)* provides the following operational stormwater management design objectives. These are in accordance with Council's *'Section 13.1 - Stormwater Quality Management Guidelines'.*

Table 4-1 Post-Construction Phase Design Objectives for Urban Stormwater Management

Criterion	Design Objective
Stormwater Quality Management	The development is required to achieve the following minimum reductions in total pollutant load, compared with that in untreated stormwater runoff, from the developed part of the site: ▪ 80% reduction in total suspended solids ▪ 60% reduction in total phosphorus ▪ 45% reduction in total nitrogen ▪ 90% reduction in gross pollutants
Waterway Stability Management	Limit the post-development peak one-year average recurrence interval (ARI) event discharge within receiving waters to the pre-development peak.

The intent of the **Stormwater Quality Management** criterion is to reduce the impact of urban development on pollutant loads discharged to receiving waters by achieving the above minimum reductions in total pollutant load compared with that of untreated stormwater runoff.

The required level of pollutant removal is in accordance with the requirements of the Logan Planning Scheme.

The intent of the **Waterway Stability Management** criterion is to reduce the impact of urban development on channel bed and bank erosion by limiting the post-development one year average recurrence interval event discharge within the receiving waters to the pre-development peak.

4.1.2 SPP State Interest Guidance Material

Following the enactment of the Planning Act 2016, the *State Planning Policy –State Interest Guidance Material- Water Quality* (July 2017) was issued.

It is recognised that:

- both the *Planning Act* and the State interest guideline post-date the application lodged with EDQ for Material Change of Use for the Cedar Grove WWTP Stage 1.
- The State interest guideline is focussed on assisting local governments when making or amending a local planning instruments, rather than acting as a compliance benchmark for development.

Nevertheless the content of the guideline has been considered in the context of the Cedar Grove WWTP. Most notably, the guideline provides example codes for a water resources overlay. Included in this example code is AO8.3 as an acceptable outcome for compliance with PO8 (manage stormwater during operational stages to protect drinking water supply environmental values and facilitate the achievement of water quality objectives for receiving waters):

- 85% reduction in total suspended solids
- 65% reduction in total phosphorus
- 45% reduction in total nitrogen
- 95% reduction in gross pollutants.

4.1.3 Seqwater Development Guidelines: Development Guidelines for Water Quality Management in Drinking Water Catchments (2012)

Section 4 "Water Quality Management Guidelines" seeks to provide guidance on a common set of water quality management issues that affect all development in the catchments.

Element 1 deals with on-site wastewater Treatment and Effluent Disposal. Section 4.2 of that Guideline titled "On-Site Wastewater Treatment and Effluent Disposal" states that it:

" applies to any land use, development or activity that involves the treatment of sewage (also 'blackwater'). Typically this Element will apply to on-site wastewater treatment and effluent disposal systems designed for a single dwelling, but will also apply to systems designed for up to 20 EP (equivalent persons) which are not regulated by the Department of Environment & Resource Management (DERM) as an Environmentally Relevant Activity."

The proposed WWTP does not meet any of the descriptions listed, in that it is a WWTP of significantly larger capacity, with no on-site disposal, and all effluent discharged downstream of the discharge weir, therefore Element 1 is not relevant to the application.

Element 5 deals with Water Sensitive Urban Design (WSUD) and Stormwater/Runoff Management. Table 8 of that guideline states the outcome and measures that are required specifically in relation to WSUD. These are listed below in Table 4-2 together with a column describing how compliance has been achieved.

Table 4-2 Compliance with SEQ Drinking Water Guidelines in regard to WSUD

Outcome ID.	Specific Outcomes	Measures	Compliance
S21 to S24	**Site Based Stormwater Quality (and Runoff) Management Plan** A Site Based Stormwater Quality Management Plan including water quality objectives, design, maintenance, monitoring and operation of all measures, is prepared for all High Risk Developments	M21.1 A Site Based Stormwater Management Plan (SBSMP) is prepared that addresses all Specific Outcomes of this Element and is relevant to the particular land use, development and/or activity. M21.2 The SBSMP is prepared and signed-off by a suitably qualified and experienced engineer. M21.3 The SBSMP establishes that erosion, sediment and stormwater quality are controlled at each stage of construction to prevent off-site movement of pollutants in compliance with the results from assessments described under Specific Outcome S23 and the requirements outlined in any published Council/ Government guideline, manual and the like. M21.4 The SBSMP ensures that stormwater management measures will be installed and maintained by suitably qualified professionals. M21.5 The SBSMP demonstrates that any revegetation, measures, devices and systems will be self-regulatory and low maintenance such that provision for a regime approved by a local government is not necessary.	Compliant This has been complied with by provision of this report. Demonstrated compliance with the local authority's WSUD performance criteria is shown in Section 4.2
S22	**Site Characteristics** Site characteristics are understood in order to determine the appropriate stormwater management approach relevant to the land use, development and/ or activity	M22.1 An assessment of site characteristics is undertaken that demonstrates an appropriate approach to preventing disturbance	Compliant This SBSMP takes account of the site characteristics in the sizing and design of stormwater controls. A separate construction phase ESSCP will be developed to manage stormwater generated during the construction phase as specified in Section 3.2
S23	**Stormwater/Runoff Management Capacity** Development capacity is limited to a type, amount and location for which likely stormwater pollutants from construction and operation can be captured and treated on-site through best practice stormwater quality control measures, including retention and detention as appropriate to the site and the land use.	M23.1 Scale, location and intensity of land uses, development and activities are such that the sizing of stormwater management measures can be accommodated wholly within the site. (Note the 'measures' includes a range of features and devices including basins, swales, traps, buffer strips, wetlands etc.) M23.2 Scale, location and intensity of land uses, development and activities are such that all adverse water quality impacts can be mitigated onsite. M23.3 Land area is set aside for the appropriately sized stormwater mitigation measures.	Compliant All stormwater management devices are located within the site.

Outcome ID.	Specific Outcomes	Measures	Compliance
S24	**Stormwater Management Measures** Stormwater management measures for construction and operation are appropriate to water quality, drainage, flooding and waterway corridor issues in the catchments, catchment areas identified in any Council plans/strategies, or any endorsed catchment management plan.	M24.1 Stormwater management measures are selected, and the overall stormwater management system designed and certified by a suitably qualified and experienced professional as being appropriate to the site in terms of soil type, landform and ecological characteristics, using results of the assessment for Specific Outcome S22, and recognised, locally accepted hydrological, hydraulic, hydrogeological, soil, water quality and biological data and design methodologies. M24.2 Designs should stipulate pollutant removal performance, maintenance requirements and responsibility for the overall stormwater management system, as well as stipulate the type, location, installation, pollutant removal performance and maintenance requirements for each stormwater management measure. M24.3 Stormwater management measures and the overall stormwater management system is designed and engineered for a range of storm events in compliance with published local or State objectives. M24.4 Stormwater management measures and the overall stormwater management system demonstrate diversion of clean runoff around the problem areas listed in Specific Outcome S22 to stable areas and the rehabilitation/maintenance of such areas with deep-rooted vegetation or other appropriate ground cover. M24.5 Stormwater management measure principally rely on non-mechanical management measures. M24.6 Stormwater management measures principally rely on non-structural management measures (such as grass swales, infiltration areas, revegetated areas and the like) in situations where they offer better solutions than structural measures. M24.7 Stormwater management measures should be integrated into the overall design and landscaping of the site. M24.8 Stormwater management measures for construction are used in locations where they remain in place for the duration of development works and/or where permanent stormwater controls will eventually be incorporated. M24.9 Where permanent stormwater quality management measures are required (structural and non-structural), such are selected, constructed and maintained in accordance with local government requirements, manuals, guidelines and the like with location and installation undertaken to prevent erosion or contamination of runoff and as appropriate to the existing and proposed features of the site. M24.10 Selection, design and installation of stormwater management measures should reflect the following principles: a) Minimise areas subject to disturbance; b) Maintain maximum protective vegetation using selective clearing where appropriate, with retention of native vegetation to maximise infiltration; c) Minimise the area of impervious surfaces and compacted soils; d) Ensure that contaminated areas, exposed sites, unstable areas and areas with contaminated wash water are isolated with clean runoff diverted around such area without causing scouring or concentrated flows; e) For clean runoff (including roof water), use of surface design to slow overland flow velocity and to encourage maximum soakage and	Compliant This SBSMP takes account of the site characteristics in the sizing and design of stormwater controls. A separate construction phase ESSCP will be developed to manage stormwater generated during the construction phase as specified in Section 3.2. Demonstrated compliance with the local authority's WSUD performance criteria is shown in Section 4.2

Outcome ID.	Specific Outcomes	Measures	Compliance
		infiltration (except in unstable areas); f) Protect natural stormwater flow paths; g) Prevent any effluent from overflow at any stage in its treatment and disposal process (including effluent from sewage treatment and other effluent producing land uses); h) Intercept and treat runoff and sediment from road ways and other impervious surfaces at the point of source to prevent oil, grease, chemicals, silt, trace metals, nutrients such as phosphorus and nitrogen and other contaminants from entering the environment; i) Use filter strips at the point of erosion source and at stormwater discharge points; j) Prevent any clearing or earthworks in riparian lands or within sensitive areas; k) Establish where erosion, sediment and flow control devices should be used and the most effective devices in the circumstances (including storm events) which should be installed at the source to improve water quality; l) Re-establish vegetation and stabilise as soon as practical on areas that have been disturbed using stripped soils and vegetation consistent with native species in the area or appropriate to the soil types and climatic conditions; and m) Provide for maximised on-site stormwater reuse, rainwater storage and the like	
S25	**Erosion and Sediment Control Plan** Where land uses, development or activities involve any earthworks, roadworks and building works, appropriate practices, procedures and devices are identified in an Erosion and Sediment Control Plan.	M25.1 The Erosion and Sediment Control Plan (ESCP) is prepared and signed-off by a suitably qualified and experienced professional.	Compliant. An ESCP will be prepared to manage stormwater during the construction phase. As specified in Section 3.2.
S26	**Outcomes of Stormwater/Runoff Management** Stormwater management does not cause an adverse impact on flooding, drainage or water quality.	M26.1 Land uses, development, activities and stormwater management ensure: a) No increased peak discharges outside the boundaries of the site; b) No increased flood levels or volumes outside the boundaries of the site; c) No adverse impacts of flooding on developed or developable areas; d) No increased erosion potential on or outside the boundaries of the site; e) No adverse impacts on water quality outside the boundaries of the site; and f) No damage or erosion of waterways.	Compliant This has been complied with by provision of this report. Demonstrated compliance is shown in Section 5.
S26	**Water Quality Monitoring** Stormwater management does not cause an adverse impact on flooding, drainage or water quality.	M27.1 Site specific discharge is monitored annually through approved testing under the DERM Monitoring & Sampling Manual 2009, or the Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC, 2000) for land uses, development and activities: a) In or within 100 metres of riparian land; b) That significantly increase impervious surface areas; or c) On areas with potential to contaminate or increase runoff. M27.2 Reporting is sent to the local government establishing that agreed water quality parameters are being fulfilled. Where problems are reported, appropriate techniques are	Compliant Water quality monitoring is required as part of the environmental authority to discharge to the Logan river. Monitoring parameters include bacteriological and nutrient analysis.

Outcome ID.	Specific Outcomes	Measures	Compliance
		implemented immediately at the expense of the owner to ensure that standards can be met. M27.3 Site Based Stormwater Management Plans for High Risk development provides for annual monitoring of revegetation areas and other approved devices, measures and systems by proponents, or, at the owners expense, the local government, to ensure their effectiveness in capturing and treating stormwater quality to an agreed discharge level. Maintenance is outlined in the Plan with provision to use local resources, and clear procedures to address poor operations. (Refer to Section 6 of these Guidelines regarding Environmental Management and monitoring)	

4.2 Pollutant Impact Assessment

A detailed pollutant export analysis was carried out using eWater's Model for Urban Stormwater Improvement Conceptualisation (MUSIC) v6.2.0. MUSIC is a computer software program released by eWater for load based water quality analysis and is based on their current research. To assist Council in their assessment of this proposal, all assumptions and modelling techniques are clearly stated in this document. The analysis has been carried out in accordance with the latest pollutant guidelines and data as defined in:

> MUSIC Modelling Guidelines Version 1.0 – 2010', Water by Design (WBD), 2010;

> 'MUSIC by eWater User Manual', eWater, 2012;

> Water Sensitive Urban Design Technical Design Guidelines for South East Queensland', Healthy Waterways, 2006.

4.2.1 Meteorological Data and Rainfall Runoff Parameters

A 6 minute time step was adopted to allow for accurate modelling of treatment measures. The 6 minute rainfall data used in the MUSIC model was sourced from the Bureau of Meteorology (BoM). Data from the nearest weather station with 10 years' continuous records, being BoM's 'Greenbank Thompson Rd' (no. 40659) was adopted, with the time period being 1980-1989, as recommended in the MUSIC Modelling Guidelines. Details of the meteorological data used for modelling are provided in Table 4-3.

Table 4-3 MUSIC Model Meteorological Data and Rainfall-Runoff Parameters

Parameter	Source/Data
Rainfall station	*Greenbank Thompson Rd – No. 40659*
Time step	*6 minute*
Modelling period	*1/01/1980 – 31//12/1989*
Mean annual rainfall (mm)	*784*
Evapotranspiration	*Table 3.1 - MUSIC Modelling Guidelines V1.0*
Rainfall runoff parameters	*Table 3.7 – MUSIC Modelling Guidelines V1.0*
Pollutant export parameters	*Industrial Split Catchments (Table 3.8 - Music Modelling Guidelines V1.0)*

4.2.2 Catchment Composition

As stated in Section 1, the water quality treatment device for the buildings will only need to cater for the administration/control buildings, roadways and parking areas. Effluent treatment areas are managed separately and these areas will not be discharging any stormwater to the environment, as all stormwater will be treated via the WWTP treatment train.

Similarly, the proposed wetlands are not analysed in regard to water quality as they are bunded and do not receive rainfall runoff from external catchments. Their effluent comprises only treated water which is addressed in other reports relating to wastewater treatment. In particular, the potential impacts associated with the quality of water discharged from the wetlands are addressed in the *Planning Assessment Report Priority Development Area: Development Application For Material Change Of Use* (Logan WIA January 2017) and *Logan Priority Development Area Catchment and Receiving Environment Modelling* (BMTWBM, January 2017), which were submitted to EDQ as part of the original development application package for the site.

A split land use catchment breakdown was adopted in the MUSIC model. Source nodes were constructed in accordance with the MUSIC Modelling Guidelines. Details of the catchment breakdown and source nodes are provided in Table 4-4 with the details presented on Figure 2. The proposed development consists of two primary catchments. Catchment A reflects the portion of the site which will be graded to drain to the bio-retention system for treatment. Catchment B represents the remainder of the site which is to be contained with bunding and treated via the plants' onsite treatment devices. The bio-retention basin shall be sized to provide sufficient pollutant removal from Catchment A runoff to allow the pollutant reduction goals to be achieved.

Table 4-4 MUSIC Model Catchment Breakdown

MUSIC Node	Description	Area (ha)	Land Use	Imperviousness (%)
Catchment A.1 – Roof	Combined roof area of onsite infrastructure that drains onto road.	0.050	Industrial – Roof	100
Catchment A.2 – Road	Combined area of internal roads.	0.255	Industrial – Road	100
Catchment A.3 – Ground	Combined area of grasses ground area that drains to basin	0.590	Industrial – Ground	10
TOTAL		0.895		

4.2.3 Treatment Device Design

As stated above, the design allows for the isolation of a portion of the site (Catchment B) due to the potentially high loading associated with these areas generated from the operation of the plant. Runoff from these areas is to be captured and returned to the treatment plants' onsite devices.

The treatment for the remainder of the site (Catchment A), will be provided by a bio-retention basin located in the north-east corner of the development footprint. This system will utilise an appropriate filter medium and maximise stormwater retention. This will allow the stormwater to pass through a filter and a biofilm medium prior to discharge. The systems will improve the water quality by removing:

> Gross pullutants

> Suspended solids

> Nutrients; and

> Metals.

The adopted location of the bio-retention area is shown in Figure 2. Design details for the proposed bio-retention treatment are outlined in Table 4-5.

Table 4-5 Bio-Retention Design Parameters

Design Parameter	Value	Units
Filter Area	90	m^2
Filter Depth	0.5	m
Extended Detention Depth	0.3	m
Saturated hydraulic conductivity	180	mm/hr
TN content of filter media	400	mg/kg
Orthophosphate content of filter media	50	mg/kg

Based on the site layout provided by LWIA, the basin has been designed with a 17m x 21m footprint, battering to a depth of 1m and base area of 8.8m x 13m, which provides a filter area of 114 m^2.

4.2.4 Water Quality Modelling Results

The performance of the proposed treatment measure was determined by comparing the annual pollutant export load of the mitigated scenario incorporating treatment to the same catchment with no treatment.

Table 4-6 below shows the quantities, in kilograms each year, of pollutant exported from the site in the unmitigated and with treatment situations, and the percentage reduction afforded by the treatment device.

Table 4-6 Annual Pollutant Load Reductions

Pollutant	Proposed without treatment (kg/yr)	Proposed with treatment (kg/yr)	Reduction Achieved (%)	Target Reduction (%)
Total Suspended Solids	1040	151	85.5	85
Total Phosphorus	2.3	0.758	67.1	65
Total Nitrogen	9.8	4.92	49.5	45
Gross Pollutants	73.2	0	100	95

Plate 4-1 displays the MUSIC model node setup adopted to represent the proposed water treatment plant.

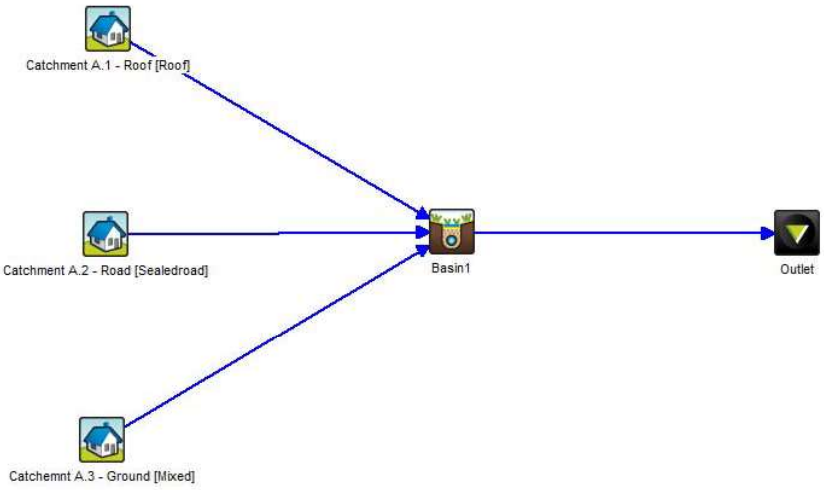

Plate 4-1

As shown in Table 4-6 the proposed bio-retention basin will adequately reduce pollutant load exports to meet the adopted Water Quality Objectives.

5 Stormwater Quantity

In order to confirm that no increase in discharge is caused by the proposed development a Watershed Bounded Network Model (WBNM model) was created for the pre, post and mitigated development scenarios. The model takes into account a number of AEP events (1% to 63%) and a range of storm durations.

The existing scenario WBNM model was validated against a Rational Method calculation in accordance with the Queensland Urban Drainage Manual (QUDM).

It was assumed that the site will be graded to drain towards the onsite bio-retention basin with the exception of the specified bunded areas. The development footprint was therefore treated as a single catchment, discharging into the bio-retention basin. The solar panel areas and driveway to the site were omitted from the model as their minimal increase in discharge is considered negligible. Table 5-1 below provides the pre and post-developed catchment details.

Table 5-1 WBNM Catchment Details

Catchment Parameter	Pre-Developed	Post Developed
Area (ha)	1.39	1.04
Fraction Impervious (%)	0.00	80.00
Initial Losses (mm)	0.00	0.00
Continuing Losses (mm/h)	2.50	2.50

In order to ensure no increase in site discharge is caused by the proposed development, local detention will be provided by the proposed bio-retention basin as detailed previously. The basin has been designed with three 375mm outlet pipes elevated at 0.3m above the base of the basin to achieve the required extended detention depth for the bioretention system as the two devices will be co-located. The maximum required storage volume in the 1% AEP event is 158 m^3 at a depth of 0.9m in the basin.

These detention measures have been incorporated into the post-development WBNM in order to accurately portray the ultimate hydrology of the site.

Table 5-2 WBNM Results

AEP (%)	Pre-Development Discharge (m^3/s)	Post-Development Discharge (m^3/s)	Impact (Pre vs Post) (m^3/s)	Mitigated Development Discharge (m^3/s)	Impact (Mitigated Vs Post) (m^3/s)
1	0.75	0.76	0.01	0.60	-0.15
2	0.66	0.68	0.02	0.54	-0.12
5	0.61	0.63	0.02	0.48	-0.12
10	0.52	0.55	0.03	0.44	-0.08
18	0.45	0.49	0.04	0.40	-0.05
39	0.34	0.39	0.05	0.32	-0.02
63	0.26	0.30	0.04	0.24	-0.02

As shown in Table 5-2 with the proposed detention measures in place, the development will not produce an increase in flows at the discharge point of the site. This table also shows that the waterway stability criteria has been met as the 63% AEP event peak flows are not increased as a result of the proposed development.

It can be noted that it is possible that other outlet/storage combinations will also achieve the same outcome. The calculations conducted to date demonstrate that compliance can be achieved within the footprint available. Different pipe outlet configurations can be explored during detailed design if necessary.

Figure 2 details the discharge location of the site.

6 Conclusion and Responses to RFI

A Stormwater Management Plan has been prepared for the Cedar Grove Wastewater Treatment Plant.

It is proposed to treat runoff from the site by the inclusion of a bio-retention system in the north-eastern corner of the site. Detailed modelling of the system has indicated that the bio-retention basin will allow the water quality objectives adopted for the site to be achieved.

A WBNM model has been developed to analyse the stormwater quantity impacts of the site. Results of the model indicate that the proposed detention measures will adequately mitigate the increase in flow caused by the development such that no adverse impacts will be produced downstream of the site.

The two issues raised in the RFI are effectively addressed as outlined in the Section 1 of this report. This can be summarised as follows:

- Discharge from the wetlands and WWTP is via a pipe outlet which is located downstream of the weir to prevent any impacts on drinking water quality, with management of the stormwater generated from the site in accordance with SPP and Seqwater guidelines; and
- Selection of a 10 ARI design storm event, consistent with the latest SPP dated 2017.

Cedar Grove Wastewater Treatment Plant

FIGURES

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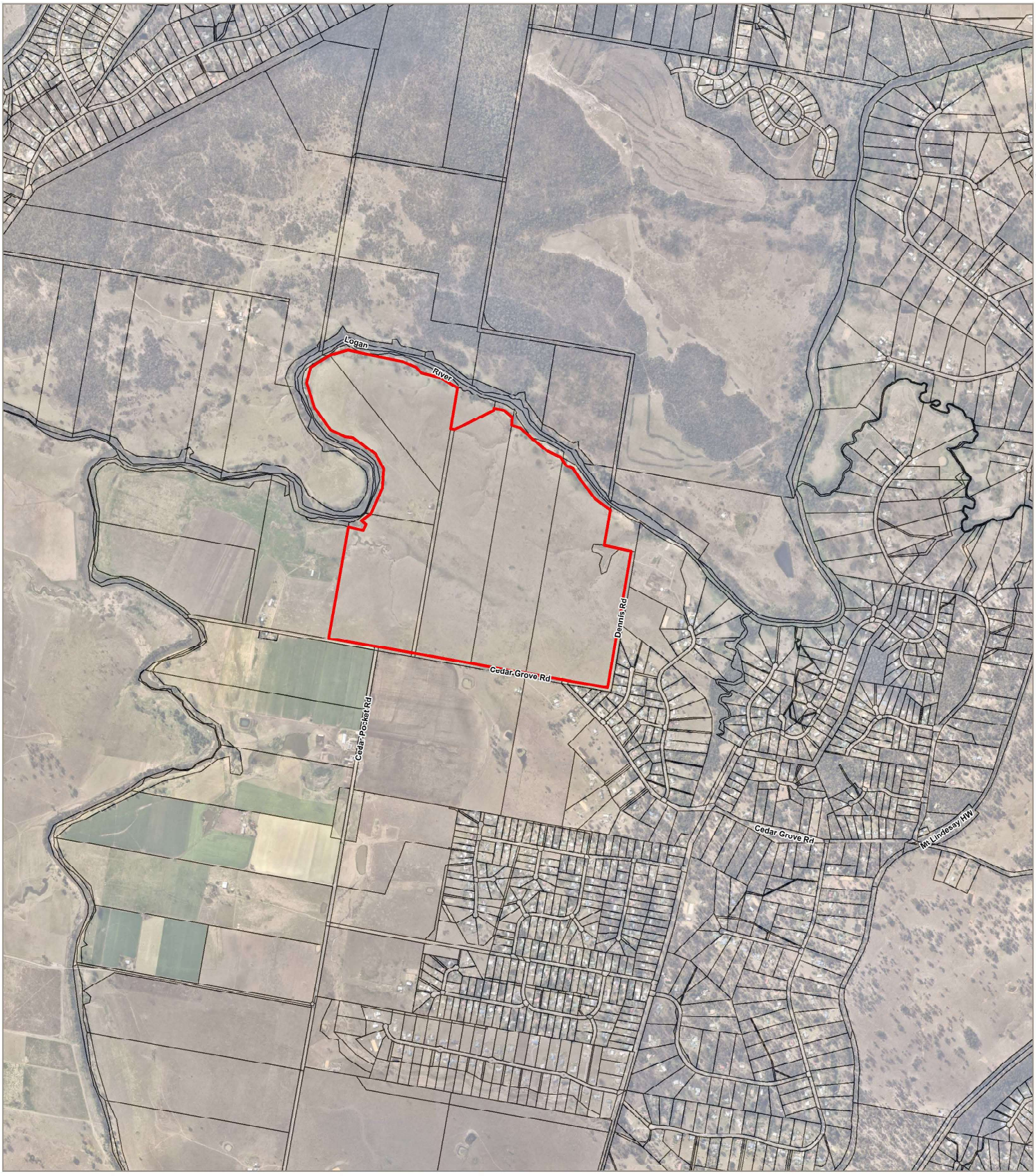

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Metres

N
W E
S

LEGEND

Lot Boundary

Figure 1

Site Locality

Cedar Grove WWTP

SHEET	A3
Project No:	764015_LS009
Date:	1/3/2018
Revision Number:	1
Designed by:	G.Paxton
Client Name:	Logan Water Infrastructure Alliance

Cardno
Shaping the Future

Cardno (QLD) Pty Ltd | ABN 57 051 074 992
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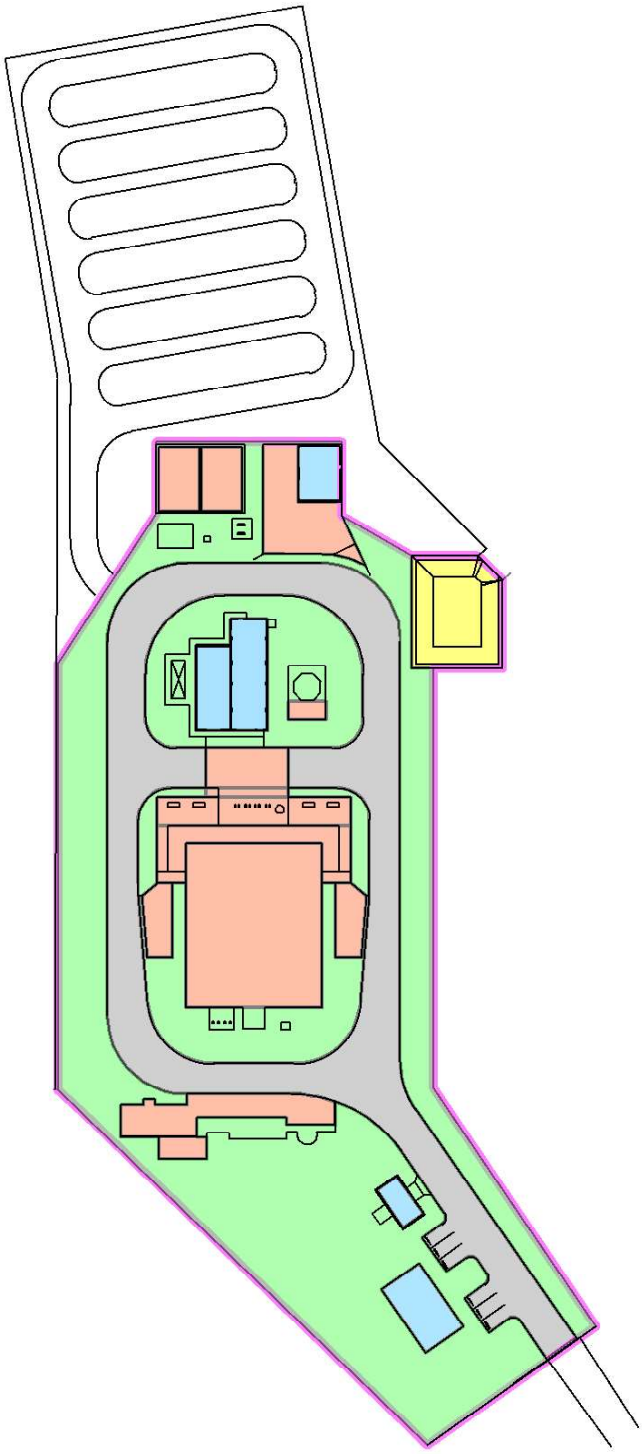

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Metres

N W E S

SHEET	A3
Project No:	764015_LS009
Date:	26/04/2018
Revision Number:	0
Designed by:	T.Shen
Client Name:	Logan Water Infrastructure Alliance

LEGEND

- Site Boundary
- Catchment A - Ground
- Catchment B - Bunded Area
- Catchment A - Roof
- Catchment A - Road
- Bio-retention Basin (Point of Discharge)

Figure 2

Catchment Plan

Cedar Grove Treatment Plant

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Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

Cedar Grove Wastewater
Treatment Plant

APPENDIX

A

FLOOD MAPPING

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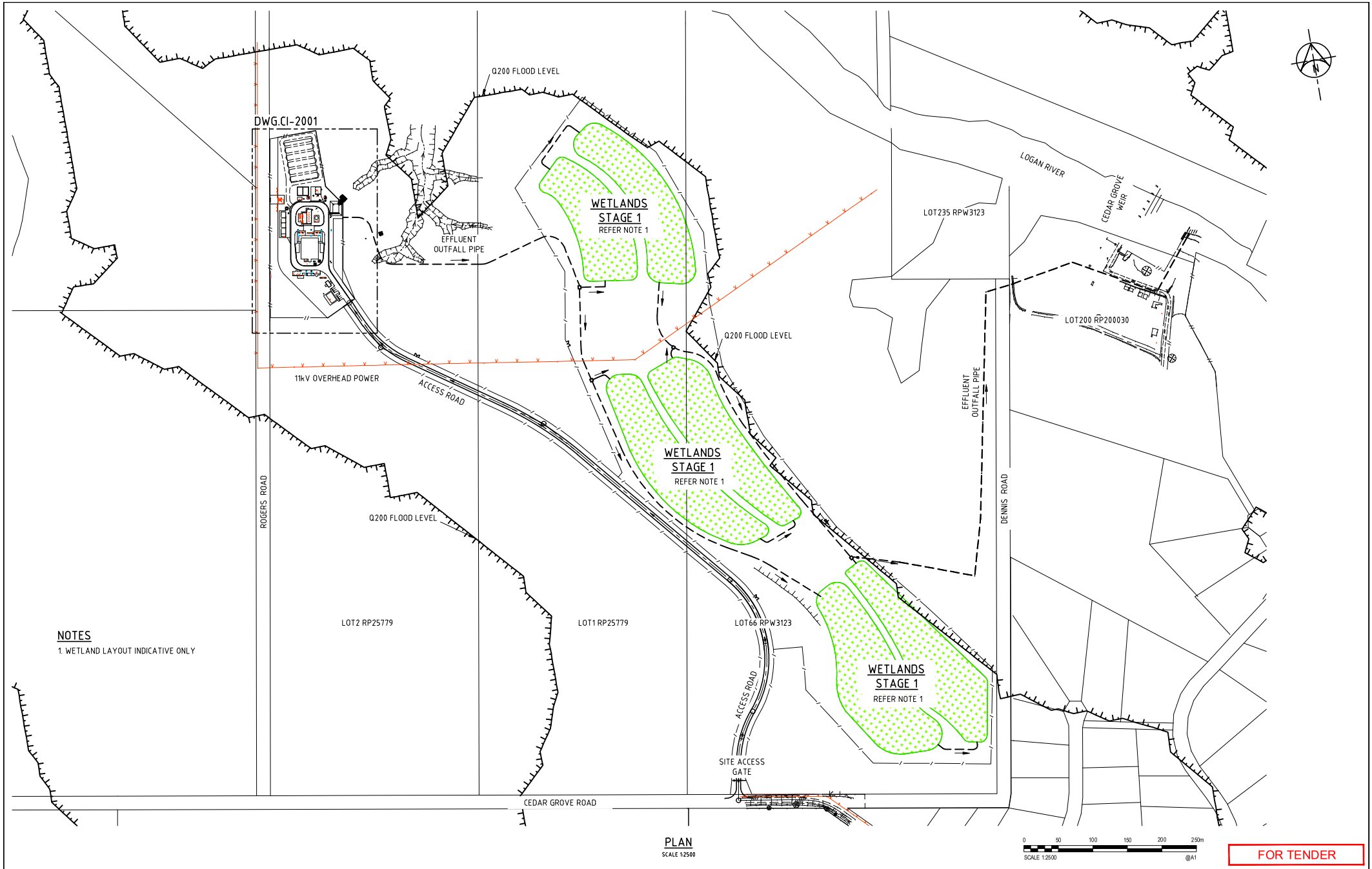

FOR TENDER

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C	ISSUE FOR 85% DOAR WORKSHOP	DG	GP		27/04/2018
B	ISSUE FOR TENDER	DG	GP	RS	11/10/2017
A	ISSUE FOR 60% DESIGN REVIEW	DG	GP	-	15/09/2017

DESIGNED BY: D. GRAY
DRAFTED BY: D. GRAY
DRAFTING CHECK BY: F. JESPERSEN
DESIGN CHECKED BY: G. PATTERSON
RPEQ
APPROVED BY: RPEQ

REFERENCES
PROJECT No.: LS303-01
FILE REFERENCE:
SHEET SIZE: A1
DATUM : AHD
GDA 94 ZONE 56.

LOGAN WATER INFRASTRUCTURE ALLIANCE

Proudly LOGAN CITY COUNCIL

PROJECT: CEDAR GROVE WWTP

DRAWING TITLE:
SITE WIDE SERVICES
STAGE 1 - 20,000 EP
OVERALL GENERAL ARRANGEMENT

DRAWING No. LS303-01-S-DWG-CI-2000
DESIGN COMPANY: CARDNO
REV. C
TECH SERVICES DRG No.

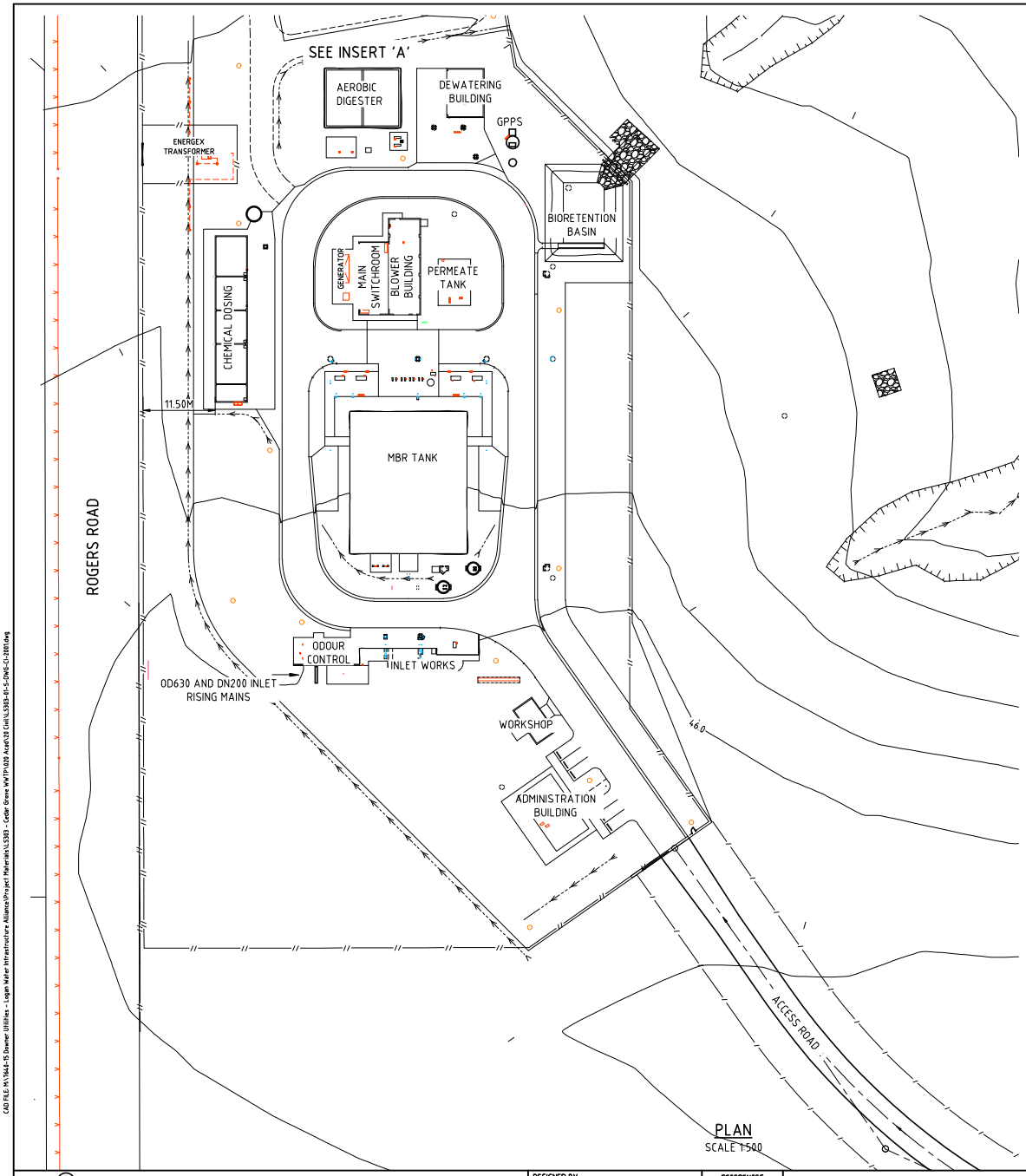
Cedar Grove Wastewater
Treatment Plant

APPENDIX

B

REFERENCE DRAWINGS

Cardno
Shaping the Future



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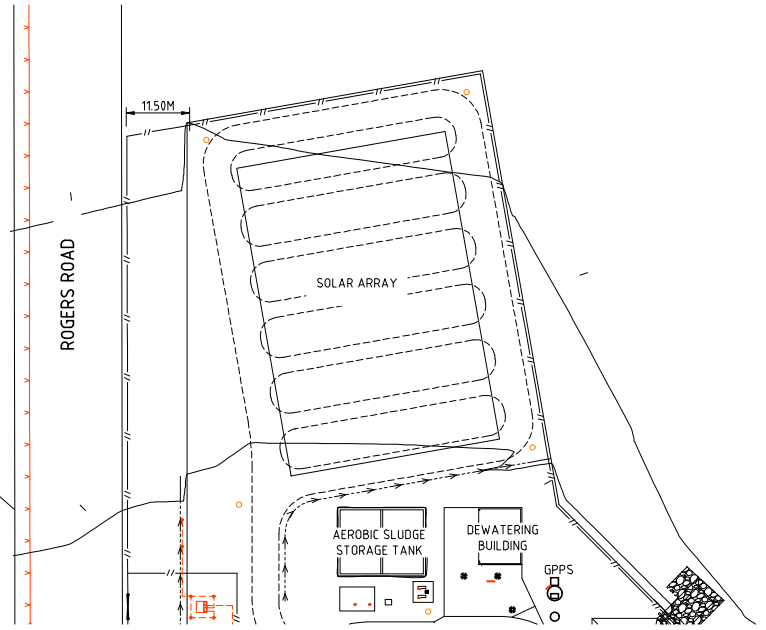

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DESIGNED BY: D. GRAY
DRAFTED BY: D. GRAY
DRAFTING CHECK BY: F. JESPERSEN
DESIGN CHECKED BY: RPEQ
G. PATTERSON
APPROVED BY: RPEQ

REFERENCES
PROJECT No.: LS303-01
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GDA 94 ZONE 56.

LOGAN WATER INFRASTRUCTURE ALLIANCE
Proudly LOGAN CITY COUNCIL

PROJECT: CEDAR GROVE WWTP
DRAWING TITLE: SITE WIDE SERVICES
STAGE 1 - 20,000 EP
GENERAL ARRANGEMENT PLAN
DRAWING No.: LS303-01-S-DWG-CI-2001
DESIGN COMPANY: CARDNO
REV.: C
TECH SERVICES DRG No.

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