KBR

Site Selection Study for Major WWTP Expansion

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Site Selection Report

Site Selection Report

Site Selection Study for Major WWTP Expansion

Prepared for:
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Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to document the site selection assessment process for the Major WWTP Expansion Study in accordance with the scope of services set out in the contract between KBR and Wide Bay Water ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from information provided by the client, information gathered from the public domain, data collected from site investigations and visual inspections and through discussions with individuals with information about the study. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to the existing treatment plans in Hervey Bay and the sewage and effluent reuse scheme provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
0	14.3.2018	Issued for use	Lachlan Carter	Garry Henderson	Dale DeKretser	Brenton Nichol
1	23.7.2018	Re issued for use	Lachlan Carter	Garry Henderson	Dale DeKretser	Brenton Nichol
2	9.10.2018	Re issued for use	Lachlan Carter	Garry Henderson	Dale DeKretser	Brenton Nichol

Contents

List of abbreviations

ACH Act	*Aboriginal Cultural Heritage Act 2003*
ADWF	Average Dry Weather Flow
AEP	Annual Exceedance Probability
Biosecurity Act	*Biosecurity Act 2014*
CA Act	*Civil Aviation Act 1998*
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CHP	Combined Heat and Power plant
CPM Act	*Coastal Protection and Management Act 1995*
CPM Regulation	Coastal Protection and Management Regulation 2017
DAMS	Development Assessment Mapping System
DEE	Department of the Environment and Energy (Cth)
DES	Department of Environment and Science
DLA	Designated Landscape Area
DNRME	Department of Natural Resources, Mines and Energy
EA	Environmental Authority
ED	Equivalent Dwelling (2.3 EP to every 1 ED)
Electricity Act	*Electricity Act 1994*
EO Act	*Environmental Offsets Act 2014*
EP	Equivalent Person
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FCRC	Fraser Coast Regional Council
FCPS	Fraser Coast Planning Scheme 2014
GIS	Geographical Information System
GL	Gigalitre
ha	hectare
KBR	Kellogg Brown & Root Pty Ltd
L/s	litres per second

Land Act	*Land Act 1994*
LG Act	*Local Government Act 2009*
LL1	Local Law No. 1 (Administration) 2011
LL4	Local Law No. 4 (Local Government Controlled Areas, Facilities and Roads) 2011
LT Act	*Land Title Act 1994*
m	metres
mBGL	metres Below Ground Level
MEDLI	Model for Effluent Disposal using Land Irrigation
mg/L	milligrams per litre
ML	Megalitre
ML/d	Megalitres per day
mm	millimetre
MNES	Matters of National Environmental Significance
N	Nitrogen
NC Act	*Nature Conservation Act 1992*
NT Act	*Native Title Act 1993 (Cth)*
P	Phosphorous
PAWC	Plant Available Water Capacity
PDF	Peak Daily Flow
PDWF	Peak Dry Weather Flow
PFD	Process Flow Diagram
pH	Potential of hydrogen
Planning Act	*Planning Act 2016*
Planning Regulation	Planning Regulation 2017
PWWF	Peak Wet Weather Flow
QGSO	Queensland Government Statistician's Office
QPS	Queensland Police Service
RSCHA	Registered Study Cultural Heritage Area
SARA	State Assessment and Referral Agency
SLL1	Subordinate Local Law No. 1 (Administration) 2011
SPP 2017	State Planning Policy 2017
SPPIMS	State Planning Policy Integrated Mapping System
STP	Sewage Treatment Plant
SWD	Soil Water Deficit
TAEG	Tailored Assistance Employment Grant
Telecommunications Act	*Telecommunications Act 1997* (Cth)

TI Act	*Transport Infrastructure Act 1994*
TORUM Act	*Transport Operations (Road Use Management) Act 1995*
t/yr	Tonnes per year
TSS	Total Suspended Solids
VM Act	*Vegetation Management Act 1999*
WBW	Wide Bay Water
WSSR Act	*Water Supply (Safety and Reliability) Act 2008*
WWTP	Wastewater Treatment Plant

Summary

An assessment of the Hervey Bay sewerage and treated effluent management system was undertaken to identify a preferred site for augmentation to cater for the planned increase in network growth. The purpose of this study was to identify which of the existing Wastewater Treatment Plants (WWTP) (Pulgul or Nikenbah) should be targeted for augmentation to service the projected growth in the Hervey Bay catchment. A plant upgrade of around 10,000 equivalent dwellings (ED) is required to accommodate the anticipated increase in wastewater loads.

This study involved a number of targeted assessments ranging from effluent reuse and irrigation field sustainability, to an outfall assessment of effluent discharge. The outcomes of these investigations were used to refine a long list of options for site expansion and effluent management. Key assessments undertaken as part of this process involved:

- development of a whole of effluent reuse scheme water balance model
- targeted agronomic assessment within existing and future irrigation fields to determine field sustainability
- development of soil water and soil nutrient models for all Wide Bay Water (WBW) irrigation fields
- documentation of the effluent reuse and discharge assessment.

The approach to effluent reuse model development and the agronomic assessment were presented and discussed in a workshop with WBW, with the analysis documented in the Effluent Reuse and Discharge Assessment report (KBR 2018a). A summary of these assessments is provided in this report. The key finding of this assessment was that soils at the WBW plantations are clay dominant and retain phosphorous in the soil profile. Nutrients are not predicted to be a limiting factor to future irrigation potential, however other constraints such as poor drainage and effect on soil structure are the major risks.

The purpose of the effluent reuse model was to assess the performance of the reuse scheme in terms of irrigation application and releases to the environment. Condition WT2-9 of the site's EA requires 90% of the ADWF is irrigated to land and less than 10% ADWF is released to waters. The model indicated the existing scheme achieves this 90% ADWF reuse for 5 years in every 10 years. This suggests that theoretically WBW would not meet the EA requirements for 50% of the years under the current effluent loading rate.

To arrive at the preferred site for capacity increase, a multiple criteria assessment (MCA) process was used in a workshop setting with key WBW personnel. The MCA process involved assessment of six combinations of wastewater treatment and effluent management options as outlined below:

1. Nikenbah WWTP Trickling Filter Upgrade with expanded irrigation

2. Nikenbah WWTP Duplication with expanded irrigation
3. Pulgul WWTP External Nitrification Upgrade with outfall and expanded irrigation
4. Pulgul WWTP External Nitrification Upgrade with outfall
5. Pulgul WWTP Membranes Upgrade with outfall and expanded irrigation
6. Pulgul WWTP Membranes Upgrade with outfall.

The MCA used a scoring system to rank the preferred option against five key evaluation criteria (technical risk, asset resilience and longevity, environment, community/social and safety). Weightings for the evaluation criteria were based on internal stakeholder criteria and the final weightings were determined as an average of this. The score from the MCA process, along with the NPV of the option was used to determine a value for money score. The preferred option identified from this process was membrane augmentation to the Pulgul WWTP, with outfall and expanded irrigation for treated effluent management (Option 5).

The selected option was developed further to produce a concept level design, including PFD, equipment list and ±30% level cost estimate.

1 Introduction

1.1 BACKGROUND

By year 2022 it is projected that the Hervey Bay sewerage scheme will exceed the treatment capacity and an upgrade to either Pulgul or Nikenbah WWTP will be required to accommodate the planned increase in wastewater loads. To service the projected increase in loads, an upgrade of around 10,000 ED is required. This upgrade will increase the volume of treated effluent requiring management.

The existing Hervey Bay effluent reuse scheme is comprised of the three wastewater treatment plants, several effluent storage dams, an effluent distribution pipe network and pump stations, and a hardwood plantation irrigation scheme managed by Wide Bay Water (WBW). The scheme also incorporates reuse by private users which includes irrigation for predominantly sugar cane crops and turf farms, and water offtakes for dust suppression.

WBW commissioned Kellogg Brown & Root Pty Ltd (KBR) to undertake a site selection study to identify the preferred site for the capacity increase. The aim of this study was to identify which of either Pulgul WWTP or Nikenbah WWTP should be targeted for augmentation to service the projected growth in the Hervey Bay catchment, and to identify an approach to effluent management.

1.2 STUDY COMPONENTS

This study involved a number of components including assessment of:

- the existing wastewater collection network and projected growth areas
- wastewater treatment technologies
- odour generated by the augmentation
- biosolids management
- effluent reuse and irrigation field sustainability
- outfall assessment of effluent discharge
- the existing effluent reuse scheme to enable development of a water balance model
- existing and future irrigation fields to determine field sustainability and to enable development of soil water and soil nutrient models for all WBW irrigation fields
- combinations of wastewater treatment and effluent management options using a multiple criteria analysis (MCA) approach to arrive at a preferred option.

1.3 REPORT PURPOSE

The purpose of this report is to document the site selection study for a major WWTP expansion undertaken by KBR for WBW.

It is intended that this report be used to assist WBW gain internal approval from Council. This will enable the next stage of the project (detailed design and environmental approvals) to commence.

2 Existing network and growth

2.1 EXISTING CATCHMENTS

The Hervey Bay sewerage scheme consists of three sewer catchments:

- Pulgul catchment
- Eli Creek catchment
- Nikenbah catchment.

Each of the catchments is serviced by the WWTP of the same name. Figure 2.1 shows the boundaries of each of these catchments as well as the location of each WWTP.

Table 2.1 outlines the hydraulic capacities and loadings for each catchment extracted from the 2015 Fraser Coast Sewerage Strategy.

Table 2.1 Capacities and current loading for WBW WWTPs

Catchment	Hydraulic Capacity		Current Loading (2016)
	ED	[2] ML/day	[2] ML/day
Nikenbah	10,667	4.8	3.2
Pulgul	9,720	4.4	4.4
[1] Eli Creek	10,000	4.5	2.7

[1] Eli Creek biological capacity is 7,500 ED

[2] ADWF

Figure 2.1 shows an outline of the Hervey Bay Sewerage Scheme, including the three catchments and treatment plants, pump stations, rising mains and gravity mains.

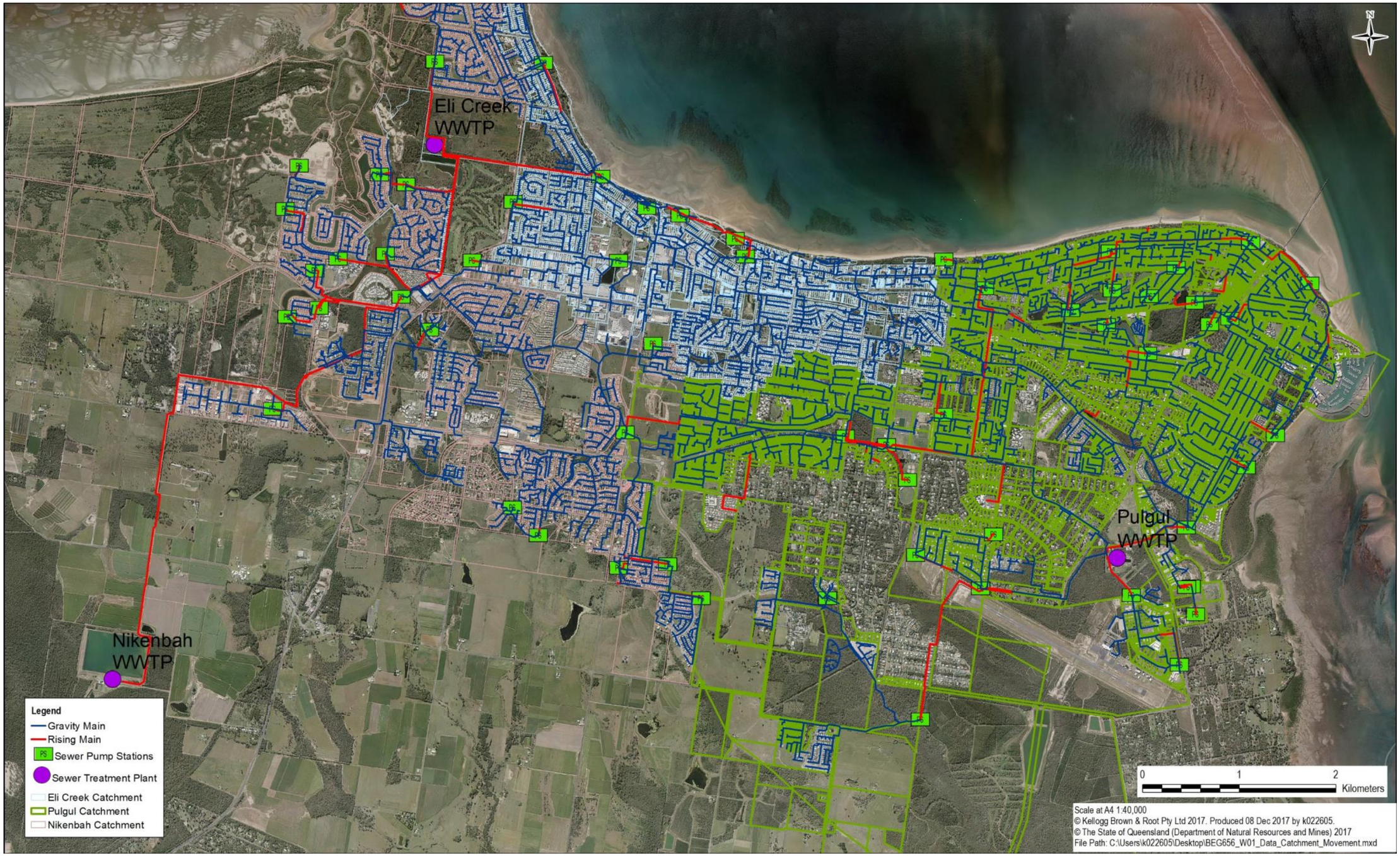


Figure 2.1 Existing Hervey Bay Sewerage Network

The Hervey Bay Sewerage Scheme population is predicted to increase by a total of 12,400 ED by 2031. Table 2.2 outlines the expected growth numbers for each catchment with the current catchment boundaries remaining unchanged. The figures in this table are based on population growth predictions provided by WBW in October 2016.

Table 2.2 Population Growth Values (data provided October 2016)

Catchment	Population at 2016 (ED)	Population growth between 2016 and 2031 (ED)	Population growth between 2031 and Ultimate (ED)
Nikenbah	7,079	4,900	2,100
Pulgul	9,720	5,500	6,100
Eli Creek	8,010	2,000	1,300
Total:	24,809	12,400	9,500

Figures 2.2 and 2.3 demonstrate where in each of the catchments growth is predicted to occur. Figure 2.2 shows growth between 2016 and 2031, and Figure 2.3 shows growth between 2031 and ultimate population forecasts.

The site selection study (and subsequent costing) was undertaken based on the October 2016 population growth data provided by WBW. Updated population data reflecting the recent development and growth in the Nikenbah area has since become available, however has not been used in this site selection study. A summary of this updated data (provided by WBW in February 2018) is shown in Table 2.3.

When compared against the population data used in this site selection study (October 2016), additional growth (2,100 ED) is forecast in the Nikenbah catchment, whereas Pulgul and Eli Creek population growth estimates are comparable across both data sets. The revised population growth data set shows a 1,700 ED increase across the three catchment areas.

Table 2.3 Revised Population Growth Values (data provided February 2018)

Catchment	Population growth between 2016 and 2031 (ED)
Nikenbah	7,000
Pulgul	5,100
Eli Creek	2,000
Total:	14,100

WBW has recently compared the projections described above to updated population growth figures from the Queensland Government Statistician's Office (QGSO). Over the planning horizon to year 2031, the QGSO data shows a lower growth rate across the Hervey Bay region when compared to WBW projections.

In terms of forecast total ED within the region in year 2031, the latest QGSO data predicts a collection network of around 35,000 ED, which is approximately 10,000 ED less than the WBW projections. Furthermore, the QGSO extended growth forecast to year 2041 (approximately 40,000 ED) is also less than the WBW projections to year 2031. The QGSO growth figures suggest that the need for further WWTP upgrades (in addition to the upgrade requirements assessed in this study) may not be required until sometime after 2031. This conclusion is subject to periodic review to confirm the validity of this growth projection data. Project growth in the catchments using the recent population data is spatially presented in Figure 2.4 (2016–2031 growth) and Figure 2.5 (2031–ultimate).

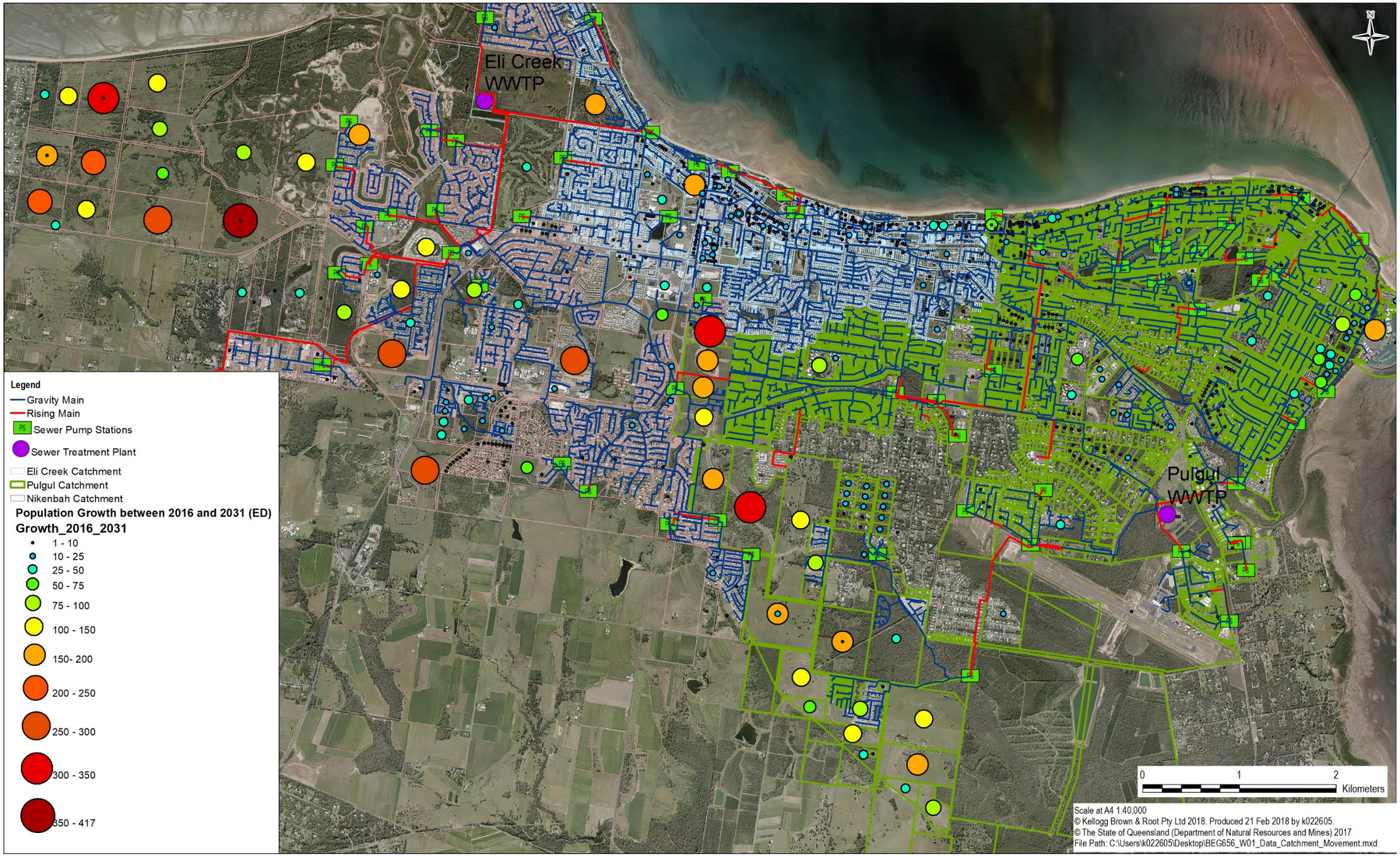


Figure 2.2 Network Growth between 2016 and 2031

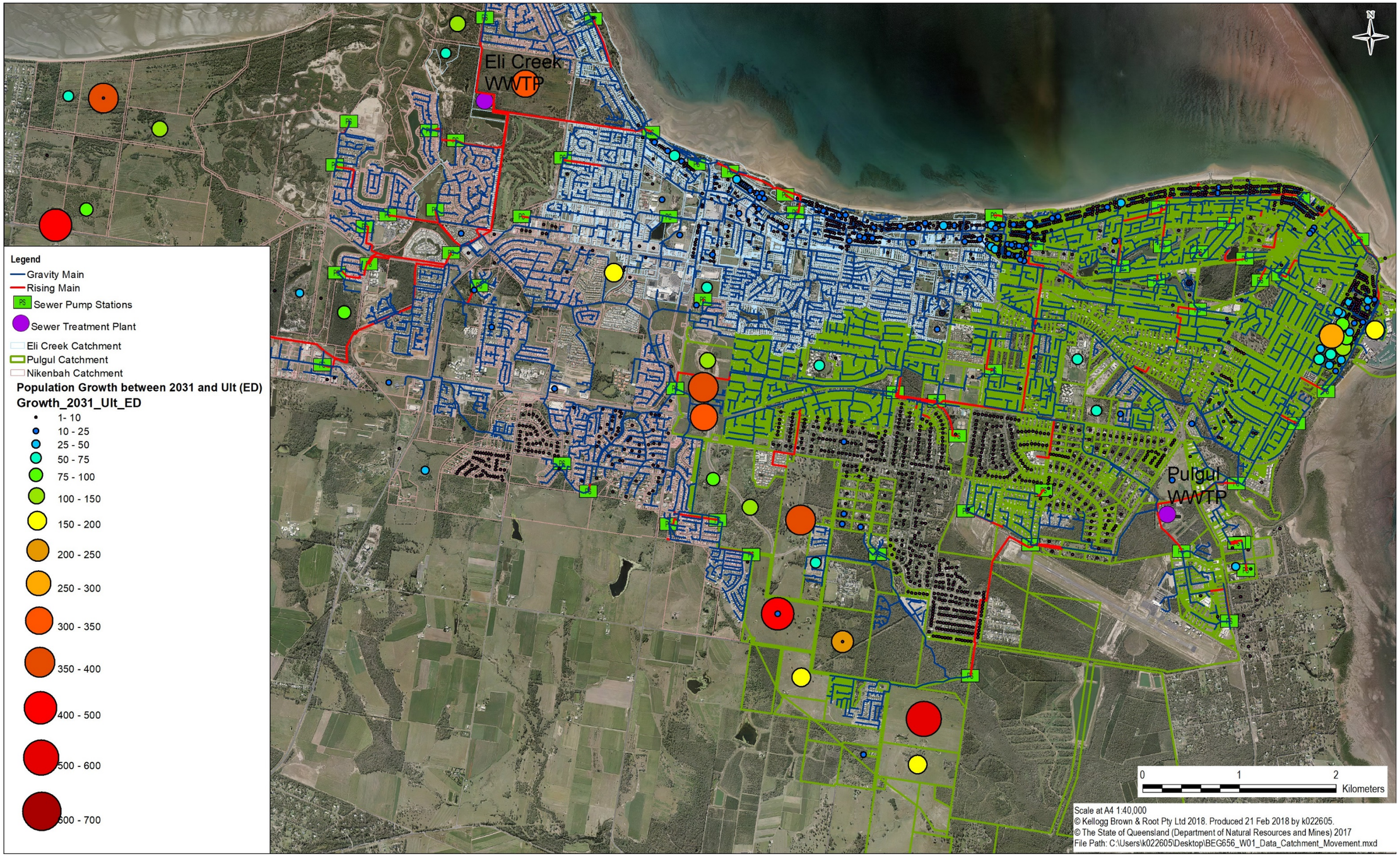


Figure 2.3 Network Growth 2031 to Ultimate Growth Predictions

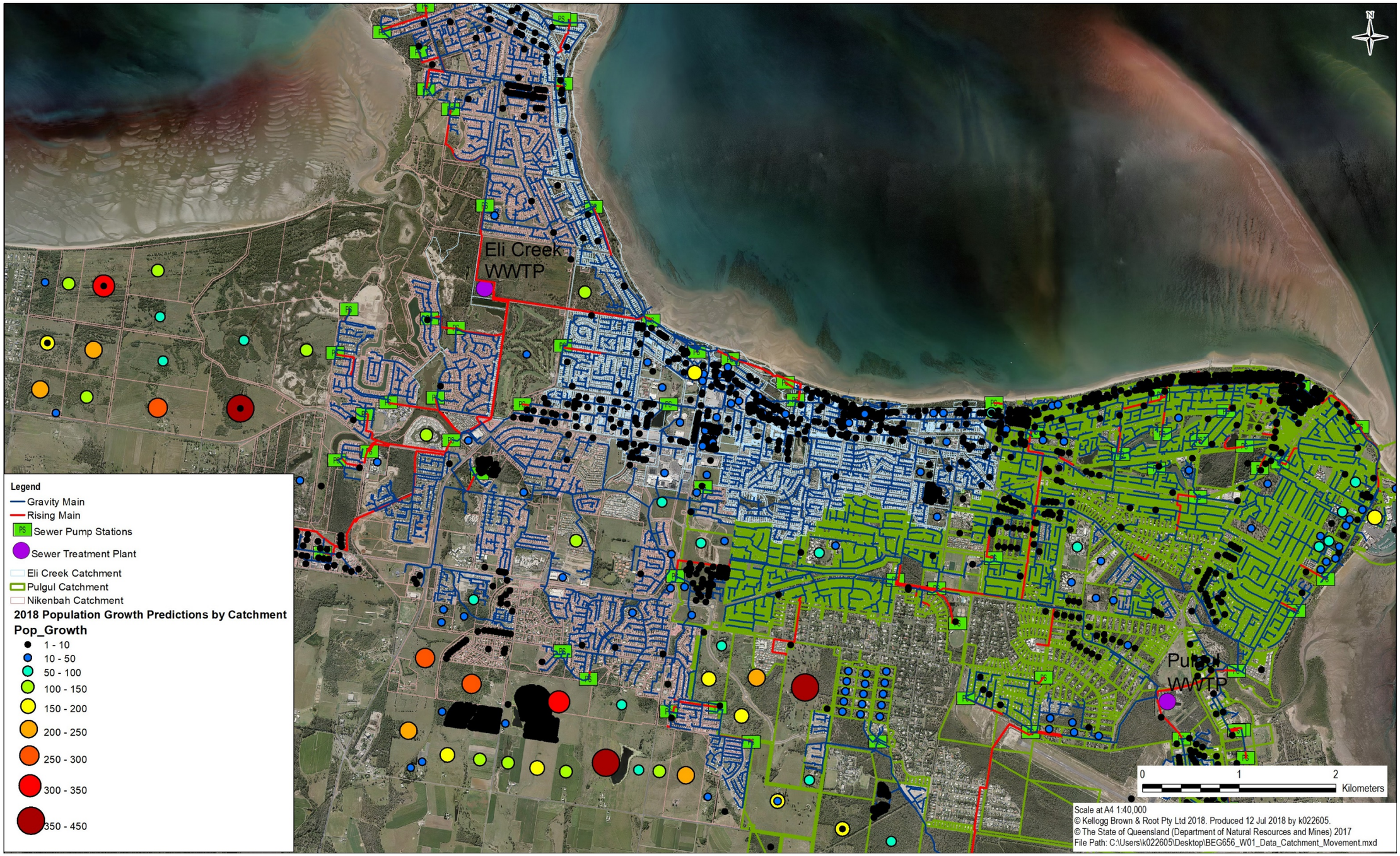


Figure 2.4 Updated 2016 to 2031 Growth Predictions

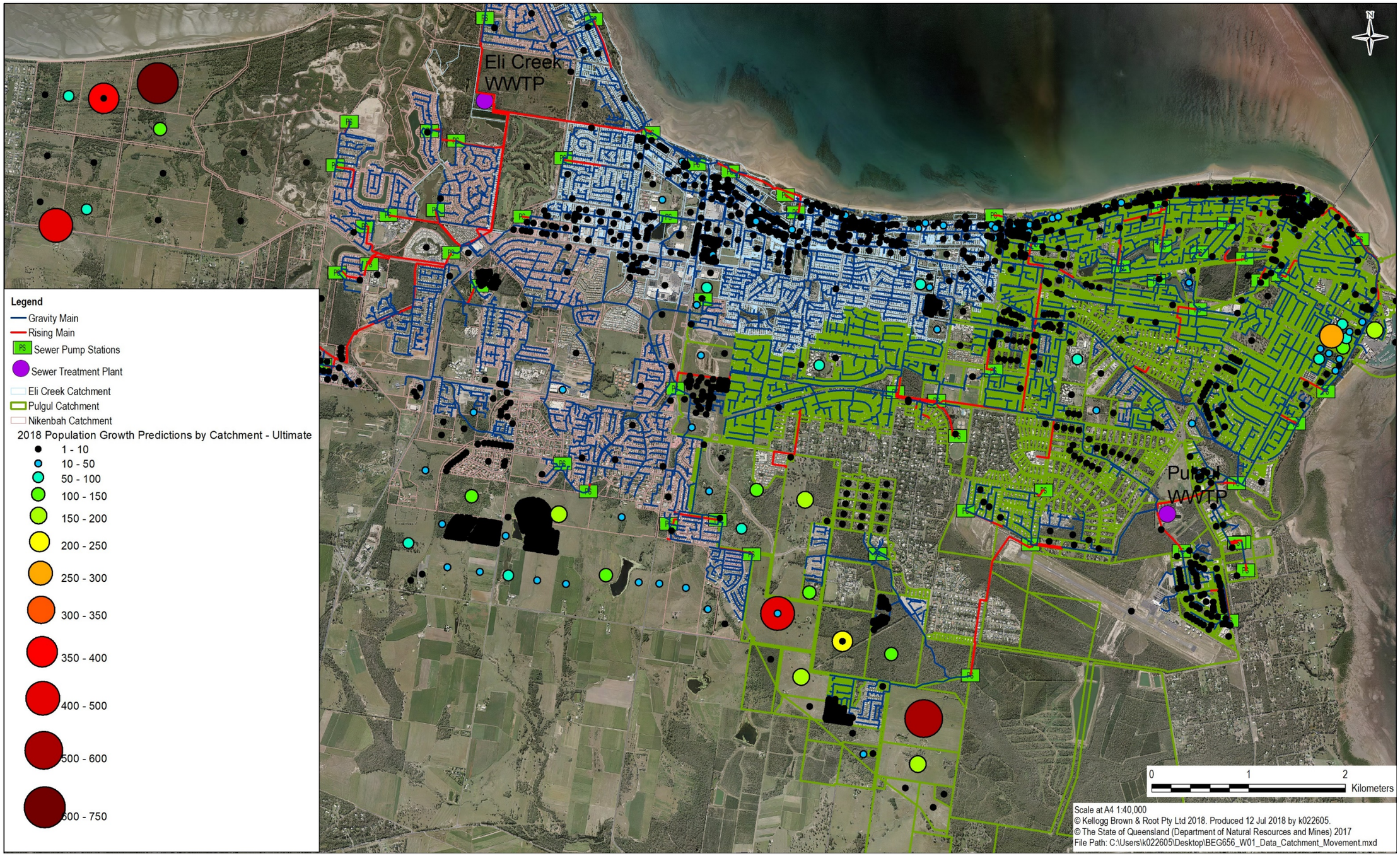


Figure 2.5 Updated 2031 to Ultimate Growth Predictions

3 Effluent reuse and discharge summary

An assessment of effluent reuse and environmental discharges associated with the scheme was undertaken. The purpose of the effluent reuse and discharge assessment was to represent the performance of the existing scheme using water balance tools GoldSim and Model for Effluent Disposal using Land Irrigation (MEDLI). This assessment identified options to accommodate the projected increase in effluent generation of 10,000 equivalent dwellings (ED) over a 15 year planning horizon.

As part of the effluent reuse and discharge assessment the following considerations were addressed:

- geology and soil characteristics
- irrigation areas including vegetation type
- effluent quality
- environmental releases
- effluent quantity
- climate effects including rainfall and evaporation
- storage capacity and transfers.

3.1 BACKGROUND

The Hervey Bay sewerage scheme treats all residential, commercial and industrial waste produced within the Eli Creek catchment, Nikenbah catchment and Pulgul catchment. The scheme is currently preparing for a major capacity upgrade (to cater for population growth in Hervey Bay) of 10,000 equivalent dwellings (ED) at one of the existing sites. The Environmental Authority (EA) pertaining to the scheme requires effluent reuse of approximately 90% of ADWF at Eli Creek and Pulgul and 100% of ADWF at Nikenbah. Effluent is used for irrigation of golf courses, sugar cane plantations, turf, sporting fields and FCRC owned tree plantations.

There are three WWTPs which contribute to the Hervey Bay effluent reuse scheme including Eli Creek WWTP, Nikenbah WWTP and Pulgul WWTP. Eli Creek WWTP and Pulgul WWTP also release to the environment, however Nikenbah WWTP treats and reuses all inflows. During wet weather events, if the reuse capacity of Nikenbah is exceeded sewage is diverted to Eli Creek WWTP for treatment and discharge to Eli Creek. Therefore the existing Pulgul Creek and Eli Creek release conditions and constraints were assessed as part of the effluent reuse scheme assessment.

3.2 EXISTING SCHEME

The existing reuse scheme has effluent inflows from three WWTPs including Eli Creek WWTP, Nikenbah WWTP and Pulgul WWTP. Eli Creek WWTP and Nikenbah WWTP flow to the Nikenbah Storage and during periods when Nikenbah Storage is at capacity, effluent is transferred to the storages at Pulgul, Bunya and Vanderwolf Plantations. Pulgul WWTP transfers to Pulgul Dam, Cane Dam 1 and Cane Dam 2. A schematic of the effluent reuse scheme showing the WWTPs, storages, plantations, discharge points and third party users is included as Figure 3.1. The key elements of the scheme are represented spatially in Figure 3.2.

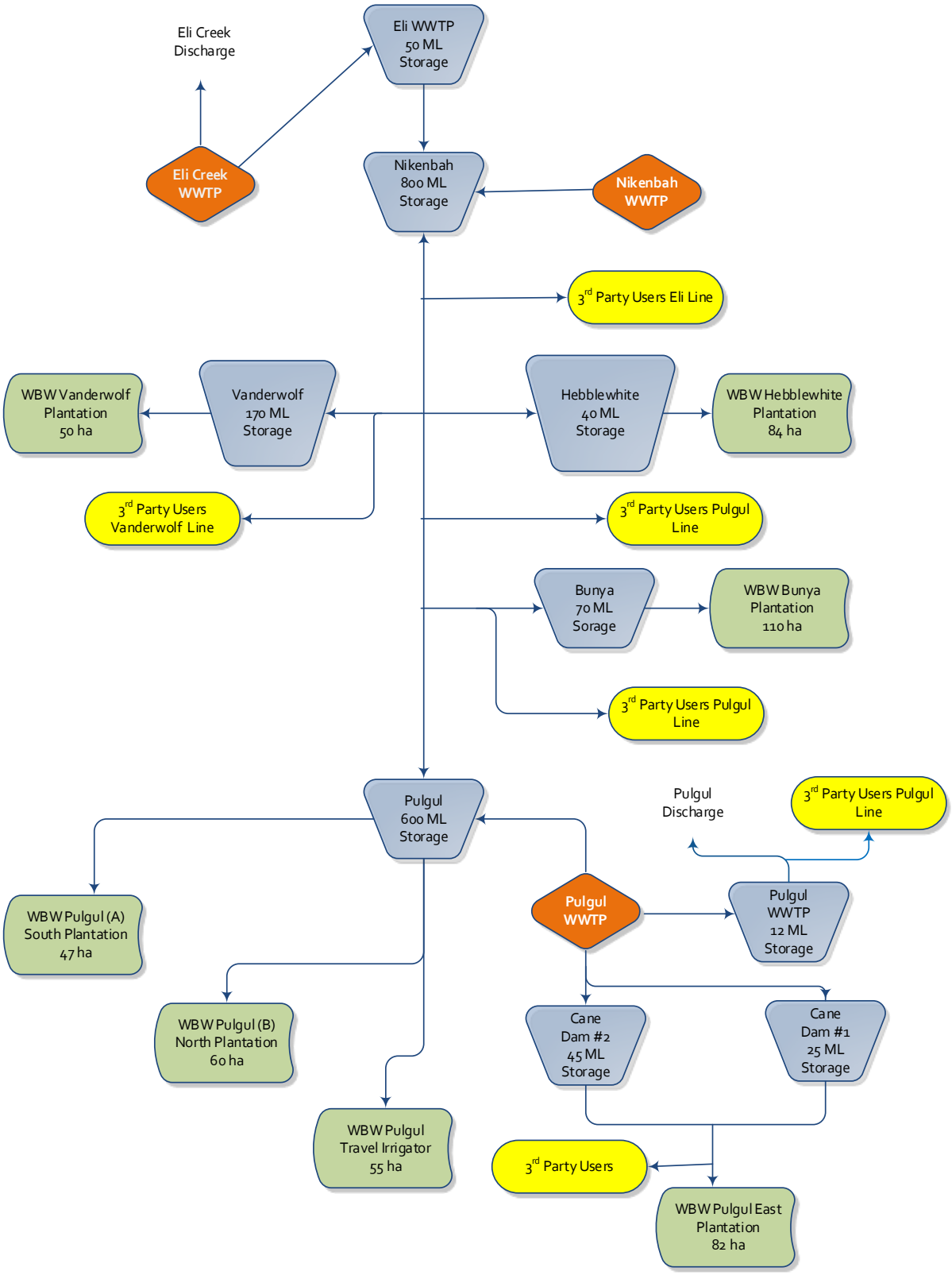


Figure 3.1 Schematic of WBW Hervey Bay effluent reuse scheme

Figure 3.2 Hervey Bay effluent reuse scheme

3.2.1 Existing treatment plants

The Eli Creek WWTP is located west of its wastewater catchment near the Hervey Bay Golf Club. The plant has a nominal biological capacity of 7,500 Equivalent Dwellings (ED). Prior to completion of the Nikenbah WWTP the Eli Creek WWTP was at capacity, however it is currently operating at approximately 70% capacity.

Pulgul Waste Water Treatment Plant (WWTP) is located on Cicada Lane approximately 1.2 km north of Hervey Bay airport and is one of the main treatment plants servicing Hervey Bay township. The plant currently services a catchment of around 10,000 ED. The treated effluent from the Pulgul WWTP is transferred to the plantation storage lagoon or it is discharged to Pulgul Creek.

Nikenbah WWTP is located on Piggford Lane 6.3 km south west of Pialba. The plant currently services a catchment of approximately 7,000 ED. Currently the treated effluent from the Nikenbah WWTP is entirely reused in the scheme and there is no capacity to directly discharge to the environment (other than irrigation) from this plant.

3.2.2 WWTP loading

The current system capacities and loadings of the three treatment plants within the scheme are outlined in Table 3.1.

Table 3.1 System capacity

Treatment plant	Hydraulic Capacity		Current Loading (2016)
	ED	[2] ML/day	[2] ML/day
Nikenbah WWTP	10,667	4.8	3.2
Pulgul WWTP	9,720	4.4	4.4
[1] Eli Creek WWTP	10,000	4.5	2.7

[1] Eli Creek has a Biological Capacity of 7,500ED

[2] ADWF

The Nikenbah WWTP and Eli Creek WWTP are currently working below capacity however the Pulgul WWTP is currently working at maximum capacity. There is high correlation between sewage inflows to the Pulgul WWTP and rainfall events which indicates there is a high amount of inflow and some infiltration into the reticulation system. The peak wet weather flow (PWWF) to the Pulgul plant ranges between 4 and 5 times ADWF.

3.2.3 Effluent production

The annual effluent production between 2011 and 2015 from the Pulgul WWTP, Eli Creek WWTP and Nikenbah WWTP is presented in Table 3.2. Data was taken from flow meters located at the outlet of each WWTP.

Table 3.2 Annual effluent production between 2011 and 2015

Year	Pulgul WWTP		Eli Creek WWTP		Nikenbah WWTP	
	Annual total (ML)	Annual daily average (ML/d)	Annual total (ML)	Annual daily average (ML/d)	Annual total (ML)	Annual daily average (ML/d)
2011/12	2,362	6.5	1,200	3.3	1,194	3.3
2012/13	2,173	6.0	1,107	3.0	1,154	3.2
2013/14	1,484	4.1	940	2.6	1,019	2.8
2014/15	1,215	3.3	968	2.7	1,106	3.0

The metered data indicates effluent production has generally decreased across all WWTPs between 2011 and 2015. The decrease in effluent production is likely due to drier conditions and infiltration reduction works such as sewer relining.

3.2.4 Irrigation areas

The scheme provides irrigation to private sugar cane plantations, golf courses, sporting fields, turf and WBW irrigation areas (predominantly hardwood tree plantations with some pasture vegetation). Figure 3.3 summarises the fractions of vegetation type within the scheme. The figure indicates the predominant vegetation type across the approximately 1,557 ha of irrigation is privately owned sugar cane (approximately 905 ha or 56% of the total irrigation area). WBW plantations cover approximately 31% or around 460 ha of the total irrigation area. Of this 460 ha, 55 ha relates to the pasture strips within the Pulgul irrigation area. Other crops such as turf, flowers and pasture make up the remaining 13% of the total irrigation area.

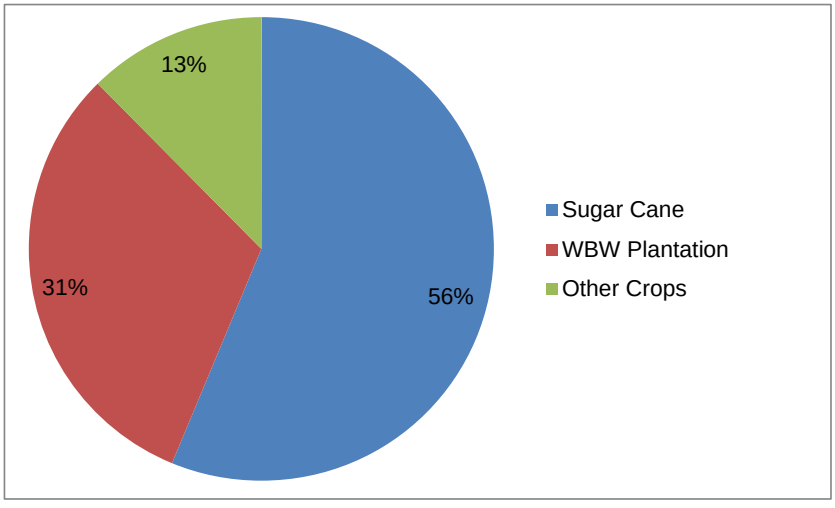


Figure 3.3 Summary of vegetation types within the scheme

There are various flow meters across the effluent reuse scheme which record effluent production, irrigation usage and environmental releases. There are meters located at the outlet of each WWTP, at the outlet of the environmental release locations, and at the inlet to each irrigation area (including private and WBW irrigation areas). The volume of effluent transferred to storages, recorded at the outlet of each WWTP is presented in Table 3.3.

Table 3.3 Annual Effluent Reuse

Year[a]	Pulgul WWTP (ML)	Eli Creek WWTP (ML)	Nikenbah WWTP (ML)	Total effluent transferred (ML)	Total rainfall (ML)[b]
2011/12	1,290	361	1,194	2,845	841
2012/13	1,375	723	1,154	3,252	591
2013/14	1,484	940	1,019	3,443	289
2014/15	1,215	842	1,106	3,163	492

(a) Data has been taken between 1 July and 30 June of each year.

(b) Calculated based on rainfall records and storage surface area.

3.2.5 Environmental releases

The annual environmental release from Pulgul WWTP and Eli Creek WWTP between July 2011 and June 2015 is presented in Table 3.4. Annual environmental releases are permissible releases which follow the EA licence conditions of the site. The scheme also has overflows from the Pulgul Storage Lagoon which are not recorded as part of the environmental releases in Table 3.4. The table presents the metered data recorded at the outlet of each WWTP.

Table 3.4 Annual environmental releases using WWTP meters

Year	Pulgul WWTP (ML)	Eli Creek WWTP (ML)	Total releases (ML)
2011/12	1,072	839	1,911
2012/13	798	384	1,181
2013/14	0	0	0
2014/15	0	126	126

The annual environmental release data suggests total releases have significantly decreased since 2011 with no releases recorded during 2013/14.

3.3 APPROACH

The approach to assess the effluent reuse scheme and environmental discharge was to develop a tool to predict scheme performance with projected wastewater loading. The tool was based on a water balance of the scheme using GoldSim and MEDLI software. The water balance incorporated all aspects of the scheme. The major inflows and outflows of the water balance included:

- rainfall and evaporation
- WWTP inflow
- storage transfers
- irrigation demand
- environmental releases.

The GoldSim model schematic is presented in Figure 3.4.

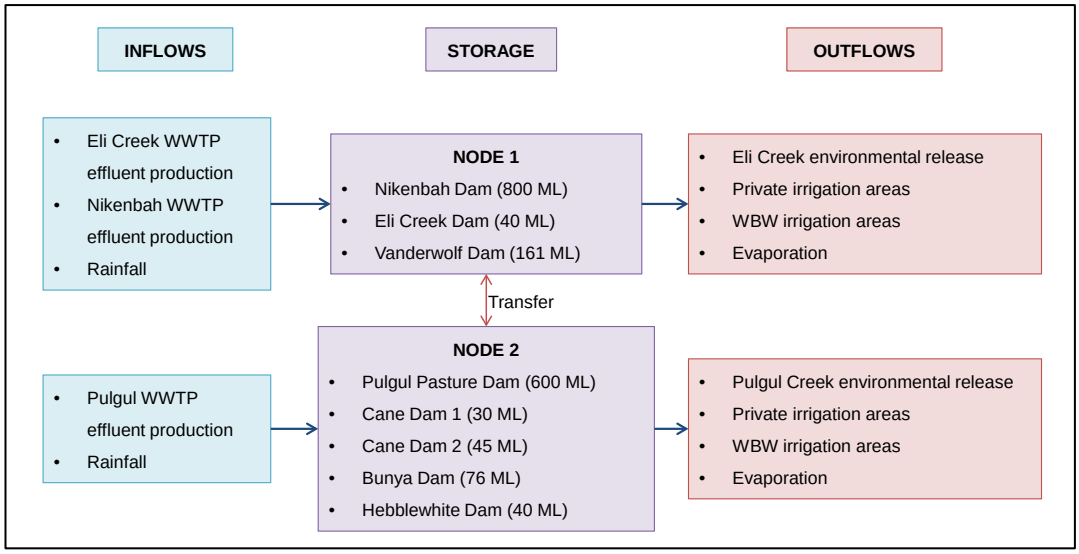


Figure 3.4 Water balance schematic in GoldSim

3.3.1 Rainfall and evaporation

Rainfall and evaporation were applied to the ponded surface of the storages and was calculated on a daily time step. Daily synthetic climate data from DataDrill was generated from observed data (Bureau of Meteorology weather stations) using a grid based interpolation approach. DataDrill synthetic data for the scheme was generated using coordinates 25.35°S and 152.85°E.

A summary of the monthly average climate data over the calibration period is shown in Table 3.5. Over the period, annual average rainfall was 1,087 mm whereas annual average evaporation was 1,688 mm, resulting in a net annual average evaporation of 601 mm.

Table 3.5 Monthly average climate data over the calibration period (July 2011 to June 2015)

Climate input	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	216	153	150	74	78	91	40	74	18	37	41	115
Evaporation (mm)	185	173	153	123	94	77	85	99	141	168	194	196
Minimum temperature (°C)	21.8	21.2	20.4	17.4	13.8	12.6	9.9	10.5	13.1	15.7	18.7	19.7
Maximum temperature (°C)	30.3	29.9	29.1	27.1	24.1	22.1	21.6	22.8	24.9	26.7	28.7	29.5
Solar Radiation ($MJ/m^2/day$)	21.0	20.4	18.4	16.9	14.3	11.5	14.0	17.1	20.8	22.9	24.3	22.9

3.3.2 WWTP inflow

WWTP inflow on any given day was predicted by applying a relationship between antecedent rainfall, soil moisture storage and groundwater level over a 127 year period (between 1889 and 2016). Rainfall data was provided by Datadrill between 1889 and 2016. The best relationship was found to occur with 30 day antecedent rainfall. Groundwater levels were predicted using the empirical Saturated Volume Fluctuation

method groundwater model. The model was calibrated using groundwater level fluctuations recorded by DNRM (now Department of Natural Resources, Mines and Energy - DNRME) between 2006 and 2016.

Soil moisture storage was simulated by applying a bucket method which applies rainfall to a surface storage and allows 'rapid' and 'slow" discharge from the storage. 'Rapid' and 'slow' discharge parameters 'were derived through a calibration process. A three bucket model was adopted.

Calibration of the WWTP inflow model was undertaken over the period daily metered data was available (2011 to 2015). Figures 3.5 to 3.7 show the probability of exceedance curves which compare the modelled and metered WWTP inflows, and reveal a good fit between the modelled and metered WWTP inflow.

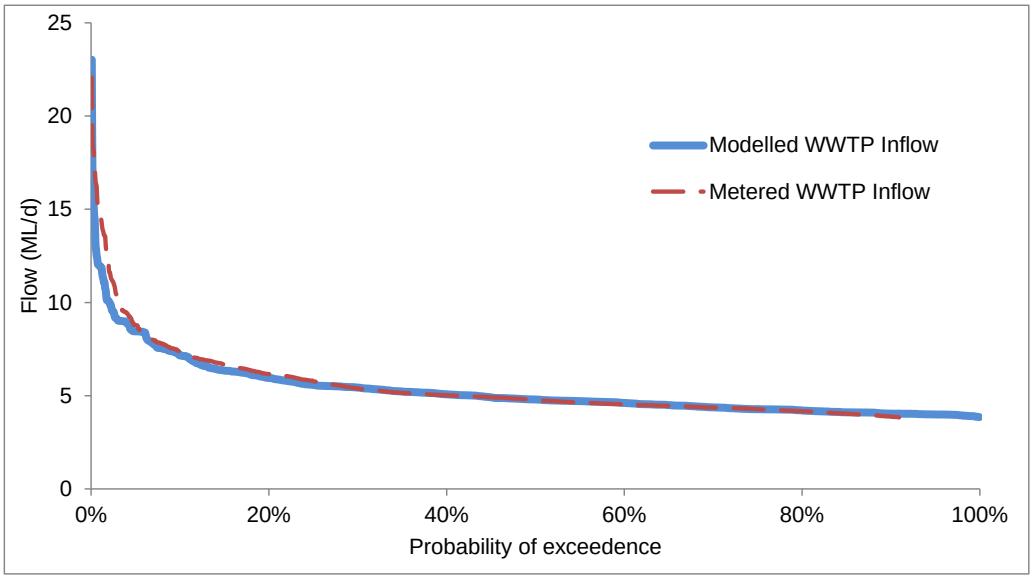


Figure 3.5 Pulgul WWTP inflows

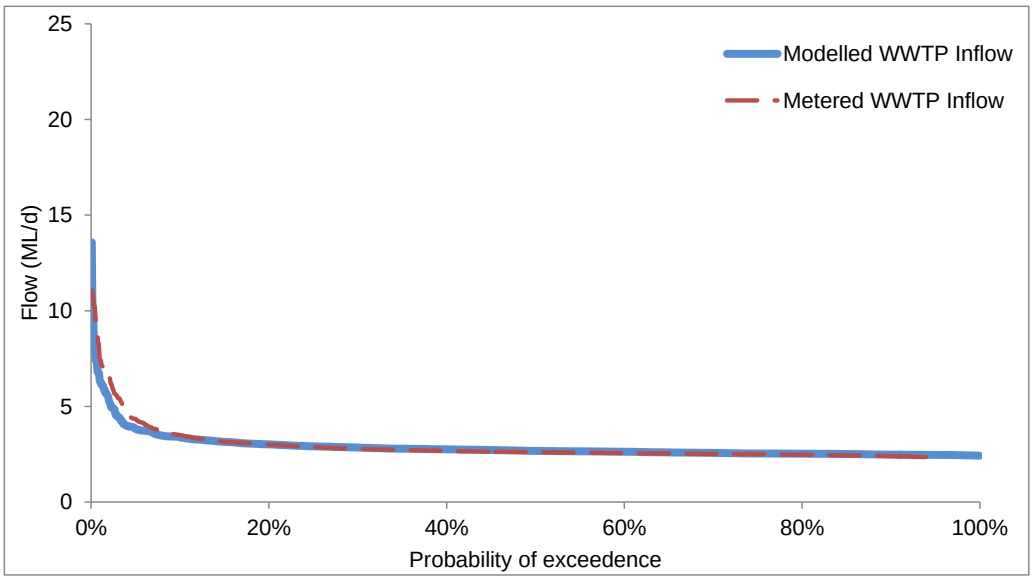


Figure 3.6 Eli Creek WWTP inflows

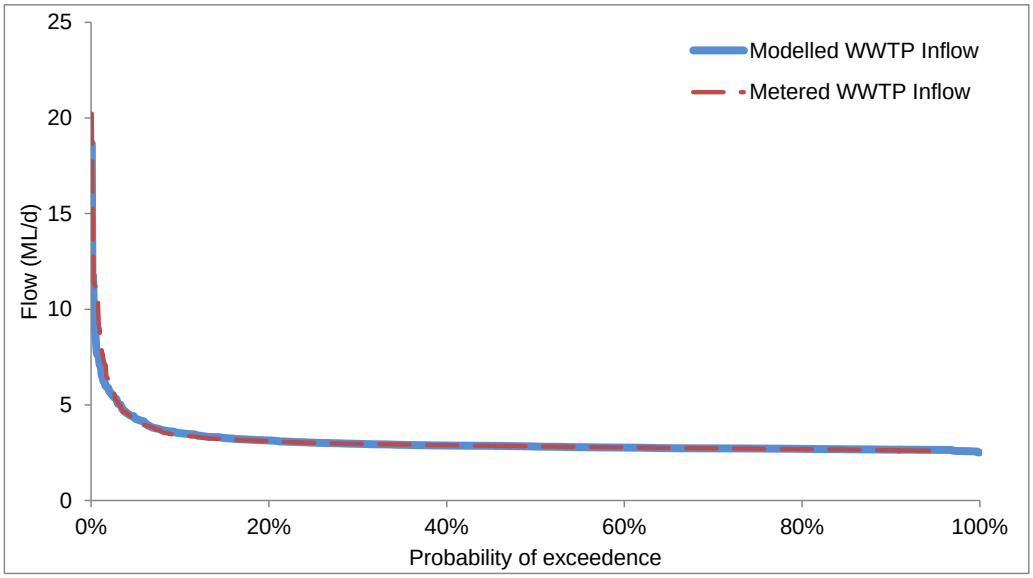


Figure 3.7 Nikenbah WWTP inflows

3.3.3 Irrigation demand

Irrigation demand was derived using MEDLI, which is the industry standard effluent irrigation model developed by the Department of Science, Information, Technology and Innovation (DSITI). MEDLI can be used to predict the fate of water and nutrients in an effluent irrigation scheme on a daily time step by using a series of inputs including climate data (rainfall, pan evaporation, minimum and maximum temperature and solar radiation), effluent quality and quantity, soil profile type, vegetation type, irrigation area and scheduling.

The approach in developing the MEDLI models for the existing effluent irrigation scheme was to use MEDLI as a soil water balance assessment tool and calibrate the models against measured flow meter data. Individual MEDLI models were developed based on irrigation field location/flow meter location, vegetation type and soil profile type. Only one vegetation type and one soil type can be selected in each model. In some cases, multiple models were generated to reflect the different soil types across the same irrigation area. This is the case for the WBW Vanderwolf, Hebblewhite and Bunya plantations.

3.3.4 Storage transfers

There is a trunk effluent main connecting Nikenbah Storage Dam and Pulgul Storage Dam. This pipeline has a capacity of 12 ML/d.

Currently Nikenbah Dam transfers effluent to Pulgul Dam when Pulgul Dam has low effluent levels and Nikenbah Dam has sufficient volume. Pulgul Dam can also transfer to Nikenbah Dam during periods when Nikenbah Dam is running low and Pulgul Dam has sufficient volume, however historically this has had a low likelihood of occurring.

Storage transfers occur based on storage water levels and irrigation demand. Transfer rules were developed through a calibration process to best reflect metered data.

1. If Node 1 is below 30% capacity then Node 2 transfers 12 ML/d to Node 1 provided there is greater than 30% capacity in Node 2.
2. If Node 2 is below 30% capacity then Node 1 transfers 12 ML/d to Node 1 provided there is greater than 30% capacity in Node 1.

3.3.5 Environmental releases

Currently treated effluent is released to Eli Creek and Pulgul Creek during periods of wet weather when both storage dams are at capacity and as required during periods of low irrigation usage. Decisions around environmental releases are made based on weather, irrigation demand, storage water levels and compliance to EA conditions. Environmental releases are therefore highly variable over time and the release rules were developed through a calibration process to best reflect metered data.

The release rules were developed based on the relationship between metered WWTP effluent production and releases. Figure 3.8 shows the relationship between WWTP inflow and releases to the environment (based on metered data between 1/07/2011 and 30/06/2015).

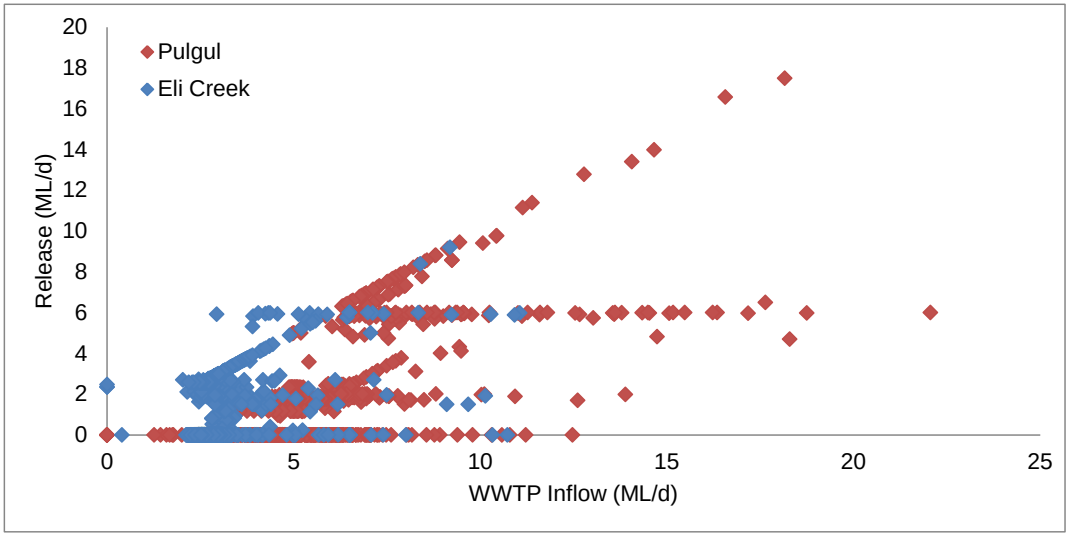


Figure 3.8 Historical relationship between environmental releases and WWTP effluent production

The metered data indicates a strong relationship between WWTP inflow and environmental releases, with elevated WWTP inflow triggering increased environmental releases. Analysis of this relationship was used to derive 'wet' and 'dry' weather release triggers as a function of ADWF. Table 3.6 summarises the environmental release triggers applied in the model.

Table 3.6 Environmental release triggers

	Wet weather release (ML/d)	Dry weather release (ML/d)	Wet weather flow release trigger rule
Pulgul	6.0	2.0	1.5 x ADWF (for 2016 ED trigger is 6.45 ML/d)
Eli Creek	6.0	2.75	1.5 x ADWF (for 2016 ED trigger is 3.45 ML/d)

(a) Calculated based on existing ADWF for each WWTP (refer to Table 3.1).

Environmental releases were represented by the following rules (derived through analysis of historical trends):

- Node 1 (Eli Creek WWTP)
  - if Node 1 reaches 1,000 ML (90% of total storage) and WWTP inflow is greater than the wet weather trigger then release 6 ML/d
  - if Node 1 reaches 1,000 ML (90% of total storage) and WWTP inflow is within the wet weather trigger then release 2.75 ML/d.

- Node 2 (Pulgul WWTP)
  - if Node 2 reaches 750 ML (90% of total storage) and WWTP inflow is greater than the wet weather trigger then release 6 ML/d
  - if Node 2 reaches 750 ML (90% of total storage) and WWTP inflow is within the wet weather trigger then release 2 ML/d.

Further optimisation of the release triggers could improve scheme performance with respect to overflow occurrence and irrigation usage, however this assessment was not undertaken as part of this project.

3.4 DEFINITION OF REUSE AND DISCHARGE OPTIONS

Potential options to cater for the predicted increase in ED were assessed using the water balance tool. The next expansion of the scheme is intended to cater for an additional 10,000 ED. Since the existing scheme is close to but not at capacity, this represents 12,400 ED above the 2016 population as shown in Table 3.7. The additional ADWF above existing (2016) flows is 4.4 ML/d.

Table 3.7 Predicted ED in each WWTP catchment in years 2016 and 2031

	Equivalent Dwellings (ED)		ADWF (ML/year)		Reuse target - 90%ADWF (ML/year)	
	2016	2031	2016	2031	2016	2031
Nikenbah	7,682	12,530	949	1,548	-	-
Pulgul	9,720	16,715	1,570	2,346	-	-
Eli Creek	7,229	9,262	840	1,076	-	-
TOTAL	26,095	38,507	3,359	4,971	3,023	4,474

The water balance model was used to forecast the performance of scheme upgrade options and identify potential impacts of population changes to the existing scheme.

The GoldSim forecast model was based on assessing 100 climate realisations over a 10 year period. The climate realisations are based on a long term historical dataset for the location spanning 1889—2017. Each realisation applied a different climate sequence that was used to derive the WWTP inflow time series.

The two approaches considered as part of the MCA were:

- expanding the reuse scheme (only applies to Nikenbah WWTP expansion)
- maintaining the existing reuse scheme and upgrading the existing environmental release at Pulgul.

Note that the approach involving upgrading the existing environmental release at Pulgul also considered opportunistic reuse (irrigation) by private users.

Other effluent reuse options may exist (such as supplementing raw water supply with improved quality effluent), however these options were ruled out during earlier project phases. As included in WBW (2015) one option identified involves potable reuse to dispose of effluent. This scenario involves a new treatment plant at Nikenbah to produce a higher quality effluent which would then be directed to Cassava Dam or Lake Lenthal for indirect potable reuse. A second option identified involves discharging the higher quality effluent via the Eli Creek release location until the process is proven, before being directed to the reticulation system for direct potable reuse. These options have been discounted to date to significant community and regulatory impediments as well as the current level of security of the water supply sources.

The aforementioned reuse options could potentially utilise existing infrastructure (such as the pipeline from Nikenbah to Cassava) however for this option to become feasible, the community will need to accept the indirect or direct potable reuse of effluent.

3.4.1 Reuse Scheme Expansion (Nikenbah)

This approach was assessed using the predictive water balance tool to determine the required additional irrigation area and storage to achieve the performance criteria. The performance criteria involved achieving 90% ADWF reuse of the expanded scheme and limiting overflows to the receiving environment (defined as 10% AEP of any overflow occurring). The requirement for additional irrigation area was modelled using the annual average irrigation application rate for hardwood plantation.

Irrigation application rate

The water balance model was updated to simplify the process of assessing the expanded scheme. The purpose of updating the water balance model was to adopt consistent long term irrigation application rates across all irrigation areas. This allowed comparisons between options to be clearer as irrigation rates are consistent across the entire scheme.

The adopted long term average irrigation rate of WBW hardwood applications was 5 ML/ha/year and for the private users the adopted application rate was 2.3 ML/ha/year. The updated long term irrigation rates were adopted in the model by factoring the existing irrigation application curves.

Confidence interval assessment

Combinations of different confidence intervals were assessed in order to develop the most appropriate risk profile for reuse scheme expansion. Confidence intervals are a range of values which are defined such that there is a specified probability that the value of a parameter lies within it. For example a 95% confidence interval suggests there is 95% probability of a value occurring within the specified parameters. Factors which affect confidence intervals include sample size and variability in the sample. The results of the confidence level assessment are documented in KBR (2018a).

The 90% confidence interval (or 10% AEP of failing to achieve the defined performance criteria) was adopted for the purpose of defining options for the MCA process.

Performance criteria

The scheme was assessed based on achieving specific performance criteria. The performance criteria aimed to achieve 90% ADWF reuse across the existing and expanded portion of the scheme while minimising overflows to the receiving environment. This assessment applied a wet weather trigger of 1.5 x ADWF and involved predictive simulation for two different criteria:

- 90% confidence (10% AEP) of not failing to achieve 90% ADWF reuse
- 90% confidence (10% AEP) of no overflow occurring.

This assessment provides guidance on what would be required from an infrastructure perspective regarding storage volume and irrigation area (for use in the MCA).

Results

The results of the modelling provided various combinations of additional irrigation area and storage volume which achieve the performance criteria of 90% ADWF reuse and no overflows with 90% confidence. These combinations were then applied to a cost function using unit rates provided by WBW as defined in Table 3.8.

Table 3.8 Estimated unit costs

Feature	Unit	Cost ($)
Storage construction	per ML	7,000
Land purchase	per ha	10,000
Plantation development cost	per ha	13,000

The results are included in the plot shown as Figure 3.9 which presents the following:

- total cost to upgrade the scheme
- volume of additional storage required (based on a defined irrigation area)
- area of additional irrigation required (based on a defined storage volume)
- cost of additional storage
- cost of additional irrigation area.

For example, the plot data shows that an additional irrigation area of 650 ha would require approximately an additional 6 GL of storage (costing around $58 million) to achieve the desired criteria. Conversely, a large area of additional irrigation (1,050 ha) could be combined with a moderate storage (2 GL), with a combined cost of around $39 million, to achieve the same criteria. The most economical option is highlighted with a black vertical line.

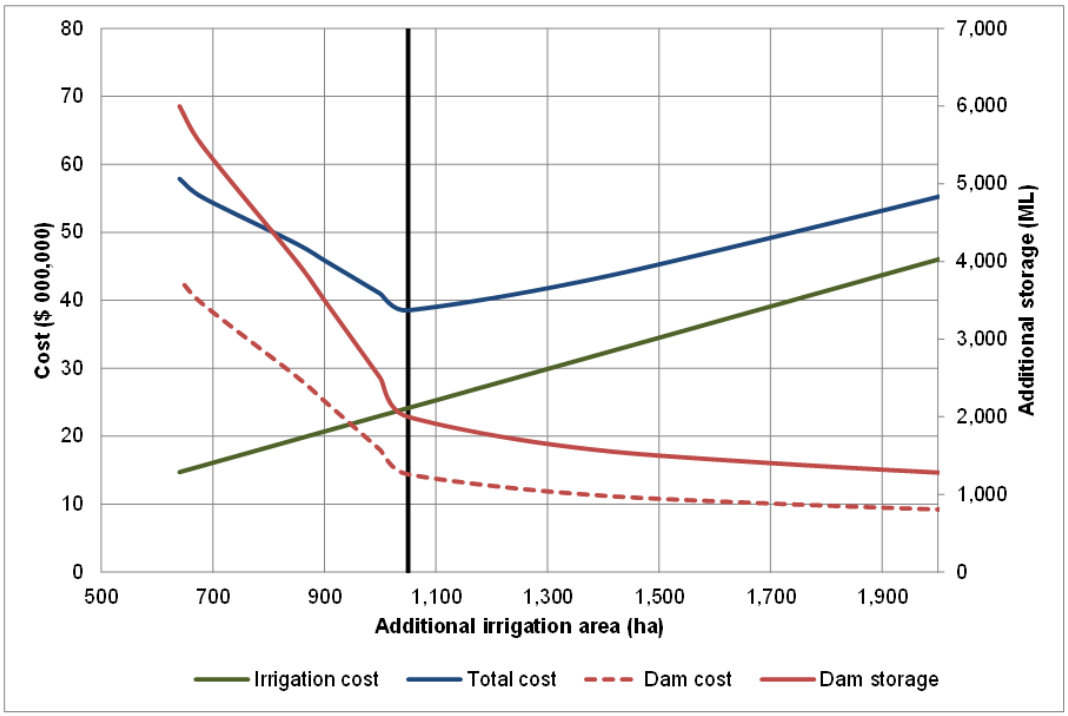


Figure 3.9 Results of reuse scheme expansion assessment

Opportunities to expand the existing reuse scheme to cater for part of the required 1,050 ha of additional irrigation area (in combination with a new 2 GL storage) have been identified. Note that although there is some potential to expand the existing WBW hardwood plantations within the lots currently owned by WBW (approximately 100 ha at Nikenbah and 80 ha at Vanderwolf) additional land will be required to cater for the projected increase in effluent production.

A recent study (Cardno, 2017) identified a number of private users along the proposed pipe alignment to the Cassava plantation located west of Nikenbah. Several potential users were identified, with a total

irrigation area of around 266 ha. Approximately 30% of the area identified is currently occupied by cane or pineapple plots, with the remainder identified as areas which could be converted into similar cropping types. When compared with hardwood plantation, these crops types have a much lower irrigation demand. For calculation purposes an average demand of 2.3 ML/ha/yr has been applied.

A study in 2011 (Water Strategies, 2011) identified an additional 319 ha near the Cassava Dam as being potentially suitable for conversion into an irrigated hardwood plantation. The existing non-remnant vegetation would need to be cleared and a hardwood plantation established. To account for features such as buffer strips along irrigation area boundaries and access tracks between plots, a 10% reduction factor has been applied to the actual land available, equating to a revised irrigation area of 287 ha. Land outside of the 319 ha identified contains high value vegetation which cannot be cleared.

In addition to the 266 ha of private user land and 287 ha of land near the Cassava Dam, an additional parcel of land will be required to cater for the additional flows. An area of around 950 ha has previously been identified by WBW as being potentially suitable for effluent reuse. This site is located approximately 10 km to the north west of the Cassava Dam. This opportunity will require a new pipeline to transfer treated effluent from the dam. This possible reuse site will be large enough if approximately 641 ha of hardwood plantation is established. This will require the acquisition of 705 ha of land on the basis that an additional 10% is required to account for buffer strips and access tracks etc. It is noted that some of the land identified north west of Cassava Dam is owned by Petersen Farms who have previously expressed interest in obtaining treated effluent for irrigating crops.

The location of the potential expansion opportunities is shown in Figure 4.1.

3.4.2 Additional Environmental Release (Pulgul) with Reuse

This approach involves increasing the volume of environmental release via outfall at Pulgul with opportunistic reuse (irrigation) by private users. As the existing Nikenbah effluent reuse and management process does not include an environmental release (outfall), this option only applies to upgrade of the Pulgul plant. This approach does not alter the function of the existing effluent reuse scheme.

To cater for the projected increase in treated effluent whilst maintaining the existing effluent reuse scheme, the permissible environmental releases at the existing Pulgul outfall will need to be adjusted by way of amendment to the EA. As noted previously, the current licence permits daily discharge of up to 2 ML/d during dry weather, and up to 6 ML/d on any one day. In addition, the licence requires that at least 90% of ADWF must be re-used annually.

The current outfall in Pulgul Creek is not in an ideal location in regards to mixing potential with the receiving waters of the Great Sandy Straits. A new outfall location which improves dispersion and mixing in the tidal zone will be required to ensure that the existing environmental values are maintained and that public health is not compromised with any new discharge location.

The approach to sizing of the new outfall pipeline is on the basis that flows can be discharged during significant wet weather periods. The sizing is based on 5 times the ADWF from the upgraded Pulgul WWTP. As growth in the Pulgul catchment is anticipated beyond the planning horizon of this study, the intent is for the new outfall to have capacity to cater for significant wet weather flows beyond year 2031. When compared to the existing outfall, a much larger outfall will be required (in the order of a DN900 pipe size).

During dry weather periods, it is assumed that the existing 12 ML storage at the Pulgul WWTP can be used to 'hold' flows until tidal conditions allow release via the ocean outfall. To allow larger releases during significant wet weather events, an assessment of storage and transfer requirements will need to be undertaken during future design phases of the project. Note that from a hydrodynamic perspective, the discharge windows during tidal cycles have been investigated, with outcomes presented in the Discharge at Marine Option Assessment report by Water Technology (2017).

In combination with the new outfall at Pulgul, privately operated dry land cropping plots (312 ha of predominantly sugar cane and pineapple) to the south of the WBW Vanderwolf plantation have been identified as a future reuse opportunity (WBW, 2016). This opportunity will require construction of a new pipeline. Increasing the volume of effluent reuse within the scheme will reduce the volume that is released to the environment via the new outfall.

Accounting for effluent reuse over the 312 ha of cropping land, the water balance model was used to understand how often (and to what capacity), the new Pulgul outfall would be utilised in an average year. The modelling results indicate that under the predicted future effluent inflow conditions a release from the outfall would occur on approximately 193 days (median value) in a typical year. In a wet year, the occurrence of a release via the outfall increases to around 268 days, and in a dry year, release occurrence would reduce to around 134 days.

Of the 193 days where releases are predicted to occur in a typical year, the most common release volume (more than 50% of release days) is between 2 and 3 ML/d. Releases of between 5 and 6 ML/d is predicted to occur on approximately 30 days in an average year. A representation of outfall utilisation (number of releases days for discharge bands) is shown is Figure 3.10.

The results presented in Figure 3.10 are based on the performance criteria included in Section 3.4.1, which permitted overflows from the system. In the scenario of no overflows from the system, the amount released during wet weather (on a given day) would be larger.

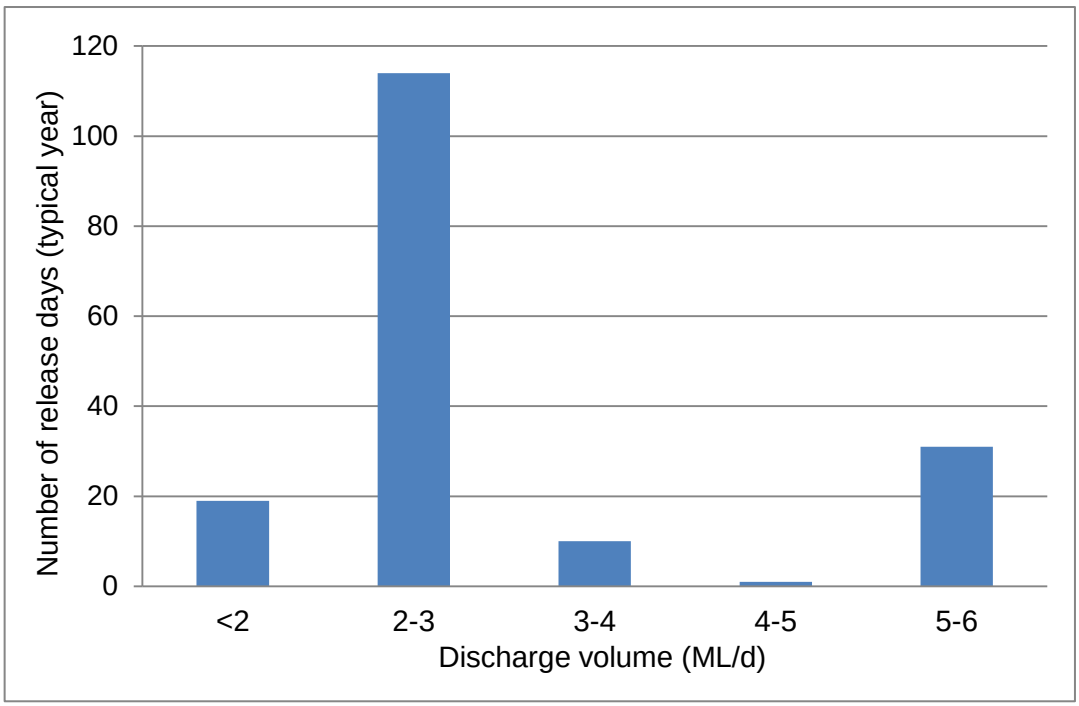


Figure 3.10 Representation of Pulgul outfall discharges in an average year (2031 flow case)

4 Site selection options summary

4.1 INTRODUCTION

Effluent management should be considered in two linked but separate parts, with part one being the process techniques used in the treatment of sewage and part two being the methods used in the reuse or disposal of treated effluent. A factor in the type of treatment process selected is the approach to effluent end use. For example, effluent disposal via outfall would require a higher quality effluent (lower nutrient concentrations) when compared with effluent reused in irrigation.

For this study, the options to manage treated effluent produced by the plant were defined as either effluent reuse (irrigation) or effluent disposal (outfall). These two approaches are currently used by WBW. Whilst there are other methods which can be used to manage treated effluent (e.g. use in industrial application, reinjection to groundwater etc.), irrigation and outfall were selected based on feasibility and existing system performance.

Eli Creek WWTP is not considered a viable site for augmentation for the purpose of this study due to the current treatment process, proximity to residential properties, limited land area and issues with effluent dispersion at Eli Creek.

4.2 OPTIONS DEVELOPMENT

The development of effluent management options involved identifying different combinations of plant location (Pulgul or Nikenbah), treatment type and approach to effluent reuse and / or disposal. To determine the 6 options to be progressed and assessed in the MCA, several initial options were developed for both treatment plant upgrade and effluent end use. The initial treatment plant upgrades identified were:

- Nikenbah Plant Duplication Upgrade
- Nikenbah Trickling Filter Upgrade
- Pulgul External Nitrification Upgrade
- Pulgul Membrane Upgrade.

The process upgrade options were selected to cover a diverse range of options. They were selected to provide different feasible technology options that allowed Wide Bay Water to achieve a variety of possible outcomes. The outcomes covered by the above options include:

- upgrade at Pulgul
- upgrade at Nikenbah
- low operation cost upgrade option
- low capital cost upgrade option.

Treated effluent management options considered for this process were:

- 100% re-use of new flows (irrigation only)
- partial re-use of new flows (irrigation and outfall)
- outfall of all new flows (outfall only).

These options cover all feasible options for treated effluent management. Note that not all options for effluent end use were determined to be feasible at all possible plant upgrade locations. For example, outfall was not considered feasible for the Nikenbah site due to location.

The treated effluent management options only considered what was to be done with the new flows produced by the upgrade. The existing re-use scheme (irrigation and outfall) would continue to operate and manage existing effluent flows.

The potential to reuse the new flows treated by the upgraded plant in an irrigation scheme has been assessed with results presented in Section 3. In addition to the water balance assessment of the outfall, a hydrodynamic assessment of the Pulgul outfall was undertaken by Water Technology. A range of flow scenarios were assessed (from 9 ML/d to 30 ML/d for continuous discharge and discharge during high tide only) for a new outfall location near the Urangan Marina. Results from this assessment were compared against the existing outfall scenario in Pulgul Creek.

The modelling showed that discharges from the marina outfall would be subjected to significantly higher dilution factors when compared against the same discharge rate and regime from the existing outfall in Pulgul Creek. Even a much higher discharge (30 ML/d) at the marina outfall (compared with 6 ML/d at the creek) is predicted to result in lower effluent concentrations within the intertidal areas around Pulgul Creek, however, a larger effluent plume is associated with this scenario.

If adopted as the preferred option, additional assessment would be required to confirm that this approach is acceptable from an environmental perspective. Full results from the hydrodynamic assessment are included in Water Technology (2017).

4.3 OPTIONS SELECTED FOR ASSESSMENT

Based on the initial options considered in Section 4.2, Table 4.1 outlines the options to be developed and assessed by the MCA. These options are shown spatially in Figure 4.1.

Table 4.1 Options selected for further development and assessment

Option	Process	End Use	Additional Storage[b]	Additional Irrigation area[a]
1	Nikenbah WWTP Trickling Filter Upgrade	Nikenbah Expanded Irrigation	1,810 ML	1,050 ha
2	Nikenbah WWTP Duplication	Nikenbah Expanded Irrigation	1,810 ML	1,050 ha
3[c]	Pulgul WWTP External Nitrification Upgrade	Pulgul Outfall + Expanded Irrigation	Accommodated within existing storages	312 ha sugar cane Vanderwolf Rd Private Users
4	Pulgul WWTP External Nitrification Upgrade	Pulgul Outfall	Not required	Not required
5[c]	Pulgul WWTP Membranes Upgrade	Pulgul Outfall + Expanded Irrigation	Accommodated within existing storages	312 ha sugar cane Vanderwolf Rd Private Users
6	Pulgul WWTP Membranes Upgrade	Pulgul Outfall	Not required	Not required

a 1,050 ha irrigation is for hardwood trees.
b 190ML of storage incorporated into existing dam at Cassava – otherwise 2,000 ML would be required
c Irrigation area applied (312 ha) for options 3 and 5 is for MCA costing purposes only. Any increase in irrigation area should have a net benefit across the community and assess environmental impacts.

Expansion of the effluent reuse scheme to private users near Vanderwolf Road has been identified as a potential reuse opportunity and has been included in the MCA for indicative NPV cost estimates. This does not mean that options 3 and 5 are constrained to the Vanderwolf Rd expansion. These options make provision for expansion of the reuse scheme whenever appropriate opportunities arise.

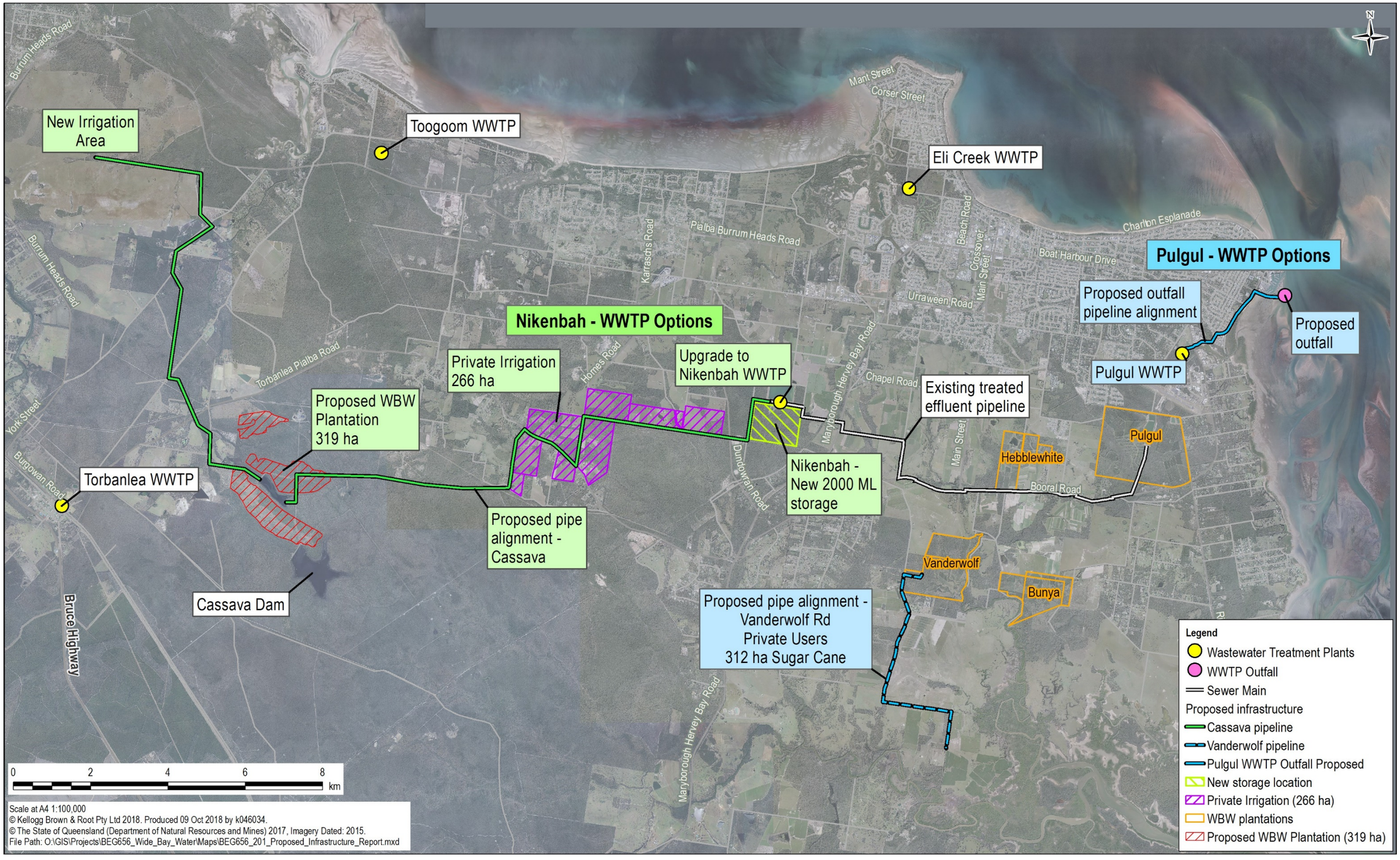


Figure 4.1 MCA reuse options spatial layout

4.4 OPTIONS PROCESS DESIGN

Concept level process design was undertaken for each of the 4 different process options. The aim of this design was to ensure that each of the options was feasible and enable a ±40% cost estimate to be completed.

For all of the options except the duplication of the Nikenbah WWTP, models were constructed in the software package Biowin provided by EnviroSim. The Biowin models were based on existing models that were provided by Wide Bay Water and edited to include the new proposed upgrades. These models were used to ensure that the proposed processes worked and to undertake concept level sizing of each of the required unit operations for the cost estimate.

For the purposes of the cost estimate, it was assumed that all options would be using aerobic digestion as their sludge treatment option. Assessment of possible anaerobic digestion and its associated costs will be undertaken on the selected option following the MCA.

4.4.1 Nikenbah Upgrade

Nikenbah WWTP Duplication

The Nikenbah WWTP was originally designed to be able to be expanded. There is room on the site for the current process to be duplicated twice. The proposed upgrade option is based on a single duplication of the existing plant facilities. A Biowin model for this option was not deemed necessary as this option is already in operation and the upgrade would have no impact on the existing process.

Figure 4.2 demonstrates a possible arrangement of the duplication of the plant on the Nikenbah site.

Figure 4.2 Nikenbah Duplication Site Layout

Nikenbah Trickling Filter

As an alternative option to the duplication of the Nikenbah site, a second process train, including a trickling filter plant, was proposed. This option has the advantage that it has a lower operating cost compared to the duplication of the plant, however it does not treat the water to the same quality as the MBR plant. It is

possible that this lesser quality water would be sufficient for re-use, and as Nikenbah has no outfall, this option was determined to be feasible for progressing to the MCA.

Figure 4.3 demonstrates a possible arrangement of the Nikenbah trickling filter on the Nikenbah site.

Figure 4.3 Nikenbah Trickling Filter Site Layout

4.4.2 Pulgul Upgrade

The Pulgul plant upgrade in both options maintains the existing oxidation ditch. A new inlet works is provided and will divert a near constant flow of 1.6 ML/d to the oxidation ditch to allow it to perform at its maximum potential.

The options are designed to make maximum use of the existing IDEA plant which in both options is converted to a continuous flow operation.

A hydraulic profile was not completed and all flow external to the existing plant are assumed to be pumped.

Pulgul External Nitrification

One of the options considered at the Pulgul site is external Nitrification. External nitrification can be used to increase the capacity of the existing intermittently decanted extended aeration (IDEA) lagoon. It achieves this by using trickling filters to nitrify, thereby leaving a larger volume of the existing lagoon to be used for denitrification. This does change the operation of the IDEA lagoon to no longer be operated as an IDEA lagoon. It is instead used as a large bioreactor. This requires the addition of membranes to separate the solids from the mixed liquor.

This option does not make any adjustment to the existing oxidation ditch process at Pulgul. The oxidation ditch continues to treat up to 1.6 ML per day as per its current operation.

Figure 4.4 demonstrates a possible site layout for external nitrification at Pulgul.

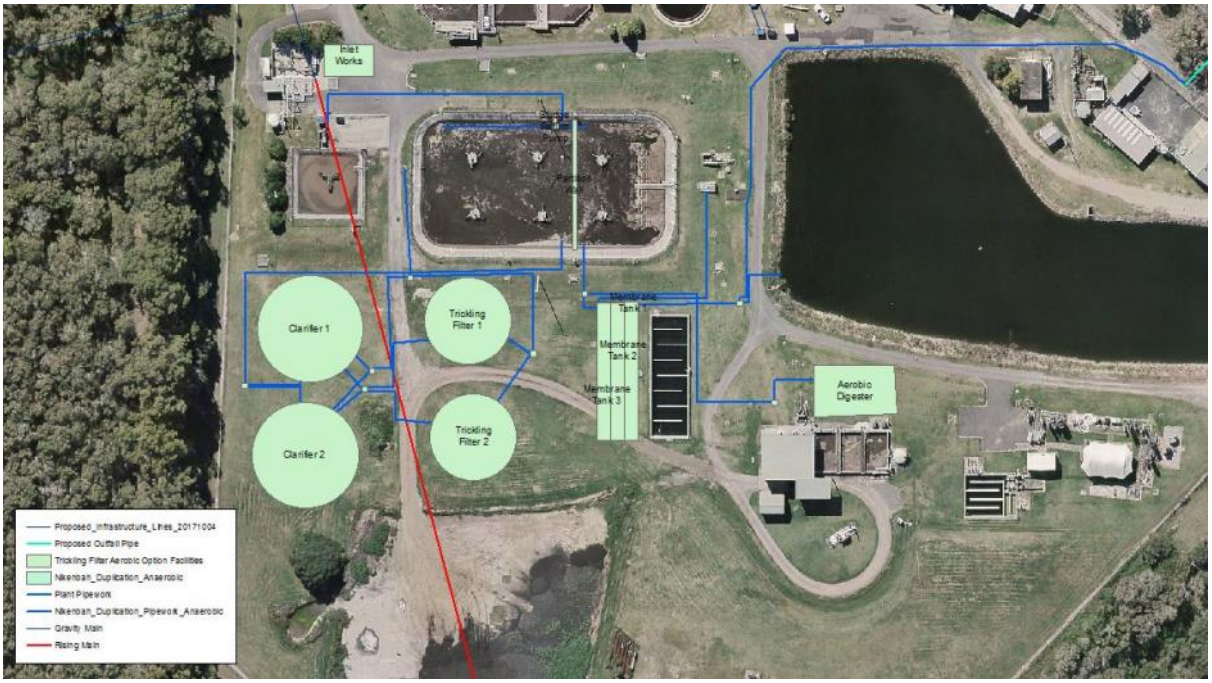


Figure 4.4 External Nitrification proposed layout at Pulgul.

Pulgul Membrane Bioreactor Upgrade

As Pulgul has difficulty with available space, an upgrade option with a small land foot print is to turn the Pulgul IDEA lagoon treatment train into a MBR process. The key ideas behind this process option involve changing the use of the existing treatment facilities and adding some new ones as follows:

- convert existing Bathurst Box to an anaerobic zone
- use two thirds the volume of the current IDEA lagoon as an anoxic zone
- use the remaining one third of the current IDEA lagoon as an aerobic zone with the existing surface aerators
- construct a new bioreactor to act as additional aerobic zone volume
- construction of new membrane tanks to achieve separation of solids from the mixed liquor.

As with the external nitrification process at Pulgul, this option makes no adjustment to the currently existing oxidation ditch. This continues treating up to 1.6 ML per day as per its capacity.

Figure 4.5 demonstrates a possible layout for the membrane bioreactor option at Pulgul.

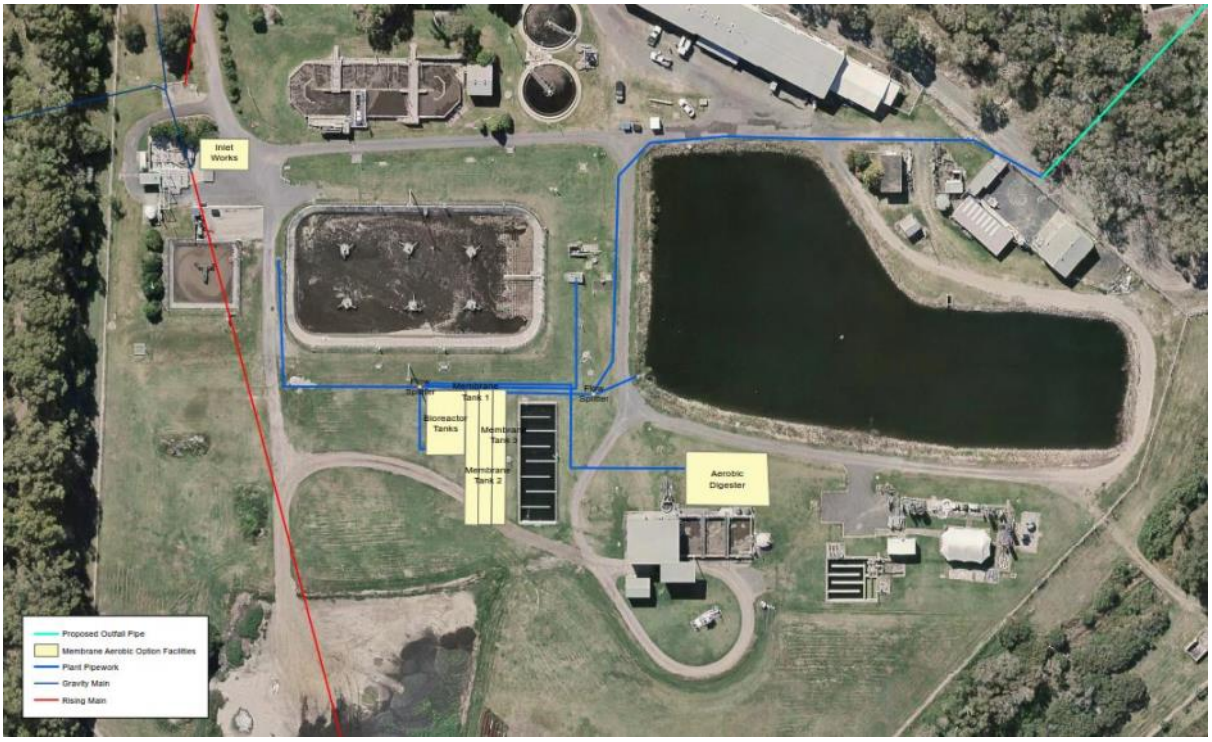


Figure 4.5 Membrane Bioreactor proposed upgrade Pulgul site.

5 Options cost estimate development

5.1 COST AND NPV SUMMARY

The capital cost and NPV of the six options identified is presented in Table 5.1.

Table 5.1 Options NPV Summary

Option	Capital Cost ($M)	NPV ($M)
Option 1: Nikenbah Trickling Filter with Expanded Irrigation	84.0	100.9
Option 2: Nikenbah Duplication with Expanded Irrigation	88.1	106.8
Option 3: Pulgul External Nitrification with Expanded Irrigation and Outfall	37.1	57.8
Option 4: Pulgul External Nitrification with Outfall	34.3	54.4
Option 5: Pulgul MBR with Expanded Irrigation and Outfall	30.4	51.4
Option 6: Pulgul MBR with Outfall	27.5	47.9

For NPV Calculations refer to Section 5.2.7.

5.2 BASIS OF ESTIMATES

KBR has developed 6 capital cost estimates based on a concept level design with a nominal accuracy of ±40%. The purpose of these estimates was to be used as inputs to an NPV which was to be used in an options selection workshop. A seventh estimate was then developed on the recommended option with a nominal accuracy of ±30%. The purpose for this option was for internal discussion and obtaining internal project buy-in.

5.2.1 Quantity Development

The estimate quantities for all 7 estimates are based on major equipment sizing calculated from Biowin models provided by WBW for the existing plants and modified by KBR to model the proposed upgrade options. The quantities calculated rely on the accuracy of these Biowin models.

The quantities for the re-use expansion or outfall are based on MEDLI and GoldSim modelling, and research into potential effluent re-use locations.

5.2.2 Rates Development

The rates for all 7 estimates are based on a combination of supplier budget level quotes and cost estimates undertaken for similar sized plant upgrades in Victoria with the last 2 years. The estimate is based only on the cost of the major equipment listed in Section 5.4, all other required equipment is accounted for via allowance percentages of the major equipment costs. The allowance percentages used are outlined in Table 5.2 and are based on water industry standards.

Table 5.2 Allowance Percentages

Allowance	Percentage of Material and Major Equipment Cost
Pipes and Fittings	5%
Electrical, Instrumentation and Control	20%
Structural Steel, Ladders, Walkways, Handrails	3%

5.2.3 Costs of Reuse Pipeline (Options 1 and 2)

The reuse pipeline is a major component of options 1 and 2. This pipeline was sized based on the following assumptions:

- pipeline operates 24 hours per day
- continuous, constant flow in pipeline
- pipe will be PE, PN16
- pipe velocity 1.5 m/s.

The reuse scheme requires two sections of pipe, the first between the Nikenbah treatment plant and the Cassava Dam, which requires 16.8 km of DN450 pipe. The second section of pipe is between the Cassava Dam and the potential new irrigation area to the north west, which requires 13 km of DN355 pipe.

The costs of these pipelines were based on the following assumptions:

- pipe installed in trench
- installed through paddocks and nature strips, with no reinstatement required.
- minimal pipe coverage, trench depth <1.2 m.

5.2.4 Costs of Vanderwolf Reuse Pipeline (Options 3 and 5)

The same assumptions as per section 5.2.3 were used for the calculation of the costs of the Vanderwolf Reuse Pipeline. The pipeline was required to be 6.9 km of DN125 pipe between the Vanderwolf storage and the irrigation area.

5.2.5 Indirect Costs

Table 5.3 outlines the indirect costs included within the estimate.

Table 5.3 Indirect Costs

Indirect Costs	Percentage of Total Estimate
Design / Engineering	2.5%
Design and Quantity Growth	3%
Construction and Management Fee	8%
Contingency (Applied to all direct and indirect costs)	25%

5.2.6 Operating Cost Development

The annual operating costs for the wastewater treatment augmentations in each option were developed using rates provided by Wide Bay Water for the following:

- chemical costs
- operations staff costs
- power costs
- sludge disposal costs.

The following maintenance costs were developed using a percentage of the capital cost for the commodity based on water industry standards:

- Mechanical – 4% p/a
- Electrical – 4% p/a
- Civil – 1% p/a.

The following key assumptions have been made with regard to the operational costs of the reuse scheme:

- only maintenance costs have been included
- Operating costs and the sale of water and hardwood shall offset each other enough that any difference of one over the other would be minimal compared to other expenses and are therefore not included.

5.2.7 NPV Development

A net present value (NPV) was developed for each option. The following assumptions were made in the development of the NPV:

- Discount factor of 4.5% as provided by WBW.
- Timeframe of 16 years from 2018—2034. This is when the next plant upgrade is predicted to be required.
- Capital costs of treatment plant incurred over 2 years between 2018 and 2019.
- Capital costs of effluent disposal incurred over 3 years, 2020, 2021, and 2026 to provide growth as the additional reuse capacity is required.
- Costs of catchment boundary changes incurred as per Catchment Boundary Change report provided by WBW.
- Price of land over time treated in accordance with estimating standards. Land costs were not appreciated or depreciated.
- Sale of the land asset at the end of the NPV was not included in this assessment.

5.3 ESTIMATE SCOPE

Table 5.4 summarises the items included in each estimate. The full itemised list for each option can be found in Appendix F.

Table 5.4 Estimate Scope

Option	New Inlet Works	Clarifiers	Trickling Filters	Humus Tank	Membranes	Bioreactor Tanks	Odour Control	Chemical Dosing	Aerobic Digester	Chlorine Contact Tank	Outfall	Minor Reuse Expansion	Major Reuse Expansion
1	X	X	X	X				X	X	X			X
2	X				X	X		X	X				X
3	X	X	X	X	X			X	X		X	X	
4	X	X	X	X	X			X	X		X		
5	X				X	X		X	X		X	X	
6	X				X	X		X	X		X		

5.4 OPTIONS SELECTION CAPITAL COST BREAKDOWN

A contingency of 25% has been applied to these costs based on guidance for a class 4 estimate from the American Association of Cost Engineering. This estimate was determined to be a class 4 estimate based on the level of design performed.

The below tables (Table 5.5 to Table 5.16) include the cost estimates for all six options considered in the MCA process. For the selected option, a refined estimate has been prepared and included in Section 10.6.

5.4.1 Option 1 – Nikenbah Trickling Filter with Expanded Irrigation

Table 5.5 Option 1 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet Works	1.67
Clarifiers	5.55
De-nitrification Tank	0.55
Trickling Filters	4.56
Humus Tanks	3.59
Chlorine contact tank	0.28
Aerobic digester	1.65
Chemical Dosing Systems	0.18
Expansion of the re-use scheme to handle all new flows	56.2
Indirect Costs	9.76
Total	84.0

Table 5.6 Option 1 estimate breakdown (expanded irrigation)

Cost type	Cost ($ M)
Land acquisition	8.8
Plantation	15.1
Water storage	15.8
Pipe DN450	9.6
Pipe DN355	5.2
Pumps	0.1
Fittings	0.8
Instrumentation and control	0.8
Total	56.2

5.4.2 Option 2 – Nikenbah Duplication of Existing MBR with Expanded Irrigation

Table 5.7 Option 2 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet works	1.67
Membrane tanks with membrane cassettes	11.97
Bioreactor tank	4.04
Solids thickener	0.15
Odour control	1.73
Chemical dosing systems	0.43
Aerobic digester	1.65
Expansion of the re-use scheme to handle all new flows	56.2
Indirect Costs	10.26
Total	88.1

Table 5.8 Option 2 estimate breakdown (expanded irrigation)

Cost type	Cost ($ M)
Land acquisition	8.8
Plantation	15.1
Water storage	15.8
Pipe DN450	9.6
Pipe DN355	5.2
Pumps	0.1
Fittings	0.8
Instrumentation and control	0.8
Total	56.2

5.4.3 Option 3 – Pulgul External Nitrification with Expanded Irrigation and Outfall

Table 5.9 Option 3 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet works	1.67
Membrane tanks with membrane cassettes	12.37
Clarifiers	4.70
Trickling filters	3.50
Solids thickener	0.26
Odour control	1.73

Plant Area	Cost ($ M)
Chemical dosing	0.43
Aerobic digester	1.65
Effluent Disposal	6.34
Indirect Costs	4.41
Total	37.1

Table 5.10 Option 3 estimate breakdown (expanded irrigation and outfall)

Cost type	Cost ($ M)
Outfall pipe DN455	3.34
Outfall pumps	0.19
Reuse pipeline DN125	2.08
Reuse pumps	0.13
Fittings	0.3
Instrumentation and control	0.3
Total	6.34

5.4.4 Option 4 – Pulgul External Nitrification with Outfall

Table 5.11 Option 4 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet works	1.67
Membrane tanks with membrane cassettes	12.37
Clarifiers	4.70
Trickling filters	3.50
Solids thickener	0.26
Odour control	1.73
Chemical dosing	0.43
Aerobic digester	1.65
Effluent Disposal	3.91
Indirect Costs	4.08
Total	34.3

Table 5.12 Option 4 estimate breakdown (outfall)

Cost type	Cost ($ M)
Outfall pipe DN455	3.34
Outfall pumps	0.19
Fittings	0.19
Instrumentation and control	0.19
Total	3.91

5.4.5 Option 5 – Pulgul Membranes with Expanded Irrigation and Outfall

Table 5.13 Option 5 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet works	1.67
Membrane tanks with membrane cassettes	12.21
Bioreactor Tanks	2.43
Solids thickener	0.20
Odour control	1.81
Chemical dosing	0.5
Aerobic digester	1.65
Effluent Disposal	6.34
Indirect Costs	3.62
Total	30.4

Table 5.14 Option 5 estimate breakdown (expanded irrigation and outfall)

Cost type	Cost ($ M)
Outfall pipe DN455	3.34
Outfall pumps	0.19
Reuse pipeline DN125	2.08
Reuse pumps	0.13
Fittings	0.3
Instrumentation and control	0.3
Total	6.34

5.4.6 Option 6 – Pulgul Membranes with Outfall

Table 5.15 Option 6 estimate breakdown (plant area)

Plant Area	Cost ($ M)
Inlet works	1.67
Membrane tanks with membrane cassettes	12.21
Bioreactor Tanks	2.43
Solids thickener	0.20
Odour control	1.81
Chemical dosing	0.5
Aerobic digester	1.65
Effluent Disposal	3.72
Indirect Costs	3.27
Total	27.5

Table 5.16 Option 6 estimate breakdown (outfall)

Cost type	Cost ($ M)
Outfall pipe DN455	3.34
Outfall pumps	0.19
Fittings	0.19
Instrumentation and control	0.19
Total	3.91

5.5 QUALIFICATIONS, ASSUMPTIONS AND EXCLUSIONS

5.5.1 Qualifications and Assumptions

This estimate has been based on the following underlying assumptions:

- Estimate Base Date: All dollar amounts are in first quarter 2017 Australian dollars.
- Design, construction and equipment delivery activities will proceed under reasonable construction timeframes and no acceleration components will be introduced.
- Capital costs include implementation costs only from the commencement of detail design to construction completion.
- Required services are available at the site.

5.5.2 Exclusions

The following exclusions apply:

- Any possible upgrades to existing wastewater or effluent management infrastructure not specifically stated for each option.

- Any land acquisition required for the treatment plant expansion.
- Any possible upgrades to power supply substations or power supply to the WWTP site.
- Any potable water supply to the WWTP site.
- Owner's costs, normally expected to include:
  - owner's project management team
  - off-site project costs including any project or site office set up and operation
  - project computing requirements
  - community support and consultation
  - financing costs
  - sunk costs
  - operations staff training, recruitment and plant commissioning assistance.
- Initial geotechnical and surveying and associated consequential finding that will impact scope and quantities in estimate.
- No allowance for rock or acid sulphate soils or any other soil found to be contaminated.
- Provisions for extended period of industrial unrest or inclement weather.
- Escalation of costs from first quarter 2017.
- Goods and services tax (GST).

5.6 OPTIONS COST SUMMARY

A summary of the capital cost (and NPV) associated with each option is presented in Table 5.17.

Table 5.17 Option Cost Summary

Option	Capital Cost ($M)	NPV ($M)
Option 1: Nikenbah Trickling Filter with Expanded Irrigation	84.0	100.1
Option 2: Nikenbah Duplication with Expanded Irrigation	88.1	106.7
Option 3: Pulgul External Nitrification with Expanded Irrigation and Outfall	37.0	57.8
Option 4: Pulgul External Nitrification with Outfall	34.3	54.4
Option 5: Pulgul MBR with Expanded Irrigation and Outfall	30.4	51.4
Option 6: Pulgul MBR with Outfall	27.5	47.9
Client Chosen Option (Option 5): Pulgul MBR with Expanded Irrigation and Outfall*	27.5	N/A

* costing refined from previous estimate to reflect improved quantities

5.7 SOURCES OF PRICING INFORMATION

Tables 5.18 and 5.19 outline the breakdown in percentage of total cost of the plant, not including the reuse scheme or indirect costs that are from a given source. For example, Option 1 in Table 5.18 shows that 93% of the cost was based on quantities that were derived from a conceptual level design and 7% of the costs

were based on quantities that were derived from magnitude allowances. A definition for magnitude allowance is provided in the footnote for Table 5.18.

Option 1 in Table 5.19 shows that 32% of the costs are based on rates that have been derived from supplier budget level estimates (supplier quotation), 61% of the costs are based on rates derived from historical data and 7% of the costs are derived from rates that are based on magnitude allowances.

Table 5.18 Quantity Sources

Option	Conceptual Design	Preliminary Design	Magnitude Allowance*
Option 1	93%	0%	7%
Option 2	87%	0%	13%
Option 3	88%	0%	12%
Option 4	88%	0%	12%
Option 5	85%	0%	15%
Option 6	85%	0%	15%
Selected Option	0%	82%	18%

* Magnitude allowance definition: Costs bases on a percentage factor applied to either a specific discipline, plant area or combination of both. Percentage factors are determined based on typical contract values for construction of that type of plant.

Table 5.19 Rate Sources

Option	Budget Level Estimate	Historical Database	Magnitude Allowance*
Option 1	32%	61%	7%
Option 2	49%	38%	13%
Option 3	50%	38%	12%
Option 4	50%	38%	12%
Option 5	54%	31%	15%
Option 6	54%	31%	15%
Selected Option	23%	62%	15%

* Magnitude allowance definition: Costs bases on a percentage factor applied to either a specific discipline, plant area or combination of both. Percentage factors are determined based on typical contract values for construction of that type of plant.

The refined selected option has a higher percentage of historical database rates. This price is more refined than the previous estimate, as the changes from the original ±40% estimate to the new ±30% estimate improved the quantities regardless of the source of the rates. The capital cost of the selected option was significantly changed because of changes to the size of the outfall pipeline. This has introduced new rates to the estimate which has impacted the rate source breakdown.

5.8 COST BENCHMARKING

The capital cost for the chosen option was benchmarked against a similar plant based in Drouin Victoria which is approximately 90 km east of Melbourne. The cost of an upgrade to the Drouin plant was estimated in quarter 1 2017. The capacities of the upgrades and total prices are in Table 5.20.

Table 5.20 Cost Benchmarks

Plant	Upgrade Capacity	Capital Cost ($M)
Pulgul	4.4 ML/d	26.2
Drouin	4.2 ML/d	31.0

While the two plants are both regional plants, being upgraded to achieve treatment of similar additional capacities and are using the same treatment technology (MBR) the cost to upgrade the two plants varies because of the upgrade method. At Drouin the additional capacity is being achieved through a parallel treatment process, whereas at Pulgul the existing process is modified to increase capacity.

The biggest cost differentiator between the two plants is the reuse of the existing lagoon at Pulgul removing the need for construction of large bioreactor tanks. The Drouin plant upgrade also includes some additional scope including 2 new pump stations which are not in the scope for the upgrade at Pulgul.

6 Multiple criteria assessment

To determine the best option for WBW to meet the sewage treatment and disposal system requirements for future population increases, an MCA was performed with key project stakeholders. The MCA assessed 6 different options for upgrading the Hervey Bay Sewerage scheme.

6.1 MCA PROCESS

The MCA is a decision making process for complex problems where many different criteria are involved. The process involves assessment of a number of options against set criteria. Each of these criteria has been weighted against each other prior to the scoring of the options.

Each option is scored against each criteria and is assigned a score of 1 to 5 for that criteria. All options are scored independently, and the scoring for one option is completed entirely before moving on to the next option. This is to ensure that all options are considered against the criteria rather than against each other.

When scoring all options, the entirety of the option was considered. This includes treatment plant upgrades, effluent disposal, and catchment boundary adjustments.

6.1.1 Cost Considerations

Cost, measured as the net present value (NPV) of each option was not considered in the criteria on which each option was scored. Instead, as per the Queensland Treasury's Project Assessment Framework after each option was scored, this score was divided by the NPV of the option in millions of dollars. This results in what is known as the value for money score, which is the score that is used to determine the chosen option.

6.2 MCA CRITERIA

Table 6.1 outlines the high level criteria that were used to score each of the options as well as the weightings they were given. Each of these high level criteria was broken down into sub-criteria. The sub-criteria were directly assigned scores, and the scores of the high level criteria were determined by the scores assigned to the relevant sub-criteria. Tables 6.2 to 6.6 outline the sub-criteria and weightings that were assigned for each high level criteria.

Table 6.1 High Level Criteria

Criteria	Weighting
Technical Risk	14%
Asset Resilience and Longevity	24%
Environment	29%
Community / Social	22%
Safety	11%

Table 6.2 Technical Risk Sub-Criteria

Technical Risk Sub-Criteria	Weighting
Technical risk in construction	16%
Technical risk in service	35%
Maintainability	49%

Table 6.3 Asset Resilience and Longevity Sub-Criteria

Asset Resilience and Longevity Sub-Criteria	Weighting
Reliability / Robustness / Flexibility	70%
Expandability	30%

Table 6.4 Environment Sub-Criteria

Environment Sub-Criteria	Weighting
Approvals Risk	28%
Operational Compliance Risk	27%
Construction Impact	16%
Operating Impact	29%

Table 6.5 Community / Social Sub-Criteria

Community / Social Sub-Criteria	Weighting
Traffic (Operation)	8%
Noise and Odour	23%
Standard of Service	22%
Organisation Reputation	20%
Community Acceptance	21%
Community Impact Construction	6%

Table 6.6 Safety Sub-Criteria

Safety Sub-Criteria	Weighting
Operations and Maintenance personnel	42%
Public	31%
In Construction	27%

Refer to Appendix C for the explanation of the scores of 1 – 5 for each criteria.

6.2.1 MCA Criteria Selection Process

An initial draft for the MCA criteria and weightings was proposed by KBR. The criteria were selected by a multi-disciplinary group with the aim of assessing all possible aspects of each option without bias. The

weightings for these criteria were determined based on internal stakeholder criteria, with final weightings determined as an average of this. .

This initial draft was reviewed by stakeholders from WBW. The criteria were adjusted based on inputs of the stakeholders. Each of the stakeholders was asked to adjust KBR's weightings to each of the finalised criteria. The weightings used in the assessment were calculated using an average of all of the stakeholders' values.

6.3 MCA RESULTS

Table 6.7 outlines the criteria scores as well as the value for money scores for each of the options assessed. Note that this table represents the table that was used for the MCA process. Post MCA costs have been updated, however none of these changes affect the selected preferred option.

Table 6.7 MCA Results

Criteria	Key Theme Weighting	Attribute Value	Weighting %	Option 1		Option 2		Option 3		Option 4		Option 5		Option 6	
				Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score
Technical risk	**14**														
In construction		16	2.2	5	2.2	4	1.8	3	1.3	3	1.3	3	1.3	4	1.8
In service - operational complexity		35	4.9	5	4.9	4	3.9	4	3.9	4	3.9	4	3.9	4	3.9
Maintainability		49	6.9	4	5.5	3	4.1	3	4.1	3	4.1	4	5.5	4	5.5
Total		100			12.6		9.8		9.4		9.4		10.8		11.2
Asset resilience and longevity	**24**														
Reliability/robustness/flexibility		70	16.8	3	10.1	3	10.1	5	16.8	4	13.4	5	16.8	4	13.4
Expandability		30	7.2	3	4.3	3	4.3	4	5.8	3	4.3	5	7.2	4	5.8
Total		100			14.4		14.4		22.6		17.8		24.0		19.2
Environment	**29**														
Approvals risk (EPBC Act (NES) / Zoning / EP Act)		28	8.1	4	6.5	4	6.5	2	3.2	1	1.6	2	3.2	1	1.6
Operational Compliance Risk (Short and Long term)		27	7.8	3	4.7	3	4.7	4	6.3	3	4.7	4	6.3	4	6.3
Construction Impact - Land and Marine		16	4.6	4	3.7	4	3.7	2	1.9	2	1.9	2	1.9	4	3.7
Operating Impact - Land and Marine		29	8.4	3	5.0	4	6.7	3	5.0	3	5.0	3	5.0	3	5.0
Total		100			20.0		21.6		16.4		13.2		16.4		16.6
Community/social	**22**														
Traffic - operation		8	1.8	4	1.4	4	1.4	4	1.4	4	1.4	4	1.4	4	1.4
Noise/ Odour Issues		23	5.1	4	4.0	5	5.1	4	4.0	4	4.0	4	4.0	4	4.0
Standard of service		22	4.8	3	2.9	5	4.8	3	2.9	3	2.9	3	2.9	3	2.9
Organisation reputation / Policy Alignment		20	4.4	5	4.4	5	4.4	3	2.6	2	1.8	3	2.6	2	1.8
Community Acceptance		21	4.6	5	4.6	5	4.6	2	1.8	2	1.8	2	1.8	2	1.8
Community impact during construction		6	1.3	4	1.1	4	1.1	4	1.1	4	1.1	4	1.1	4	1.1
Total		100			18.4		21.4		13.9		13.0		13.9		13.0
Safety	**11**														
to OM personnel		42	4.6	4	3.7	4	3.7	4	3.7	4	3.7	4	3.7	4	3.7
to general public		31	3.4	5	3.4	5	3.4	5	3.4	5	3.4	5	3.4	5	3.4
Safety in Construction		27	3.0	4	2.4	4	2.4	4	2.4	4	2.4	4	2.4	4	2.4
Total		100			9.5		9.5		9.5		9.5		9.5		9.5
Total Score	***100***		***100***		**75**		**77**		**72**		**63**		**75**		**70**
NPV ($'000000)					**99.0**		**105.0**		**57.8**		**54.4**		**51.4**		**47.9**
Value for Money - Life Cycle					**0.8**		**0.7**		**1.2**		**1.2**		**1.45**		**1.45**

7 Recommended site

Table 7.1 outlines the MCA scores as well as the Value for Money score, which is calculated by dividing the MCA score by the NPV in millions.

Table 7.1 Options selection scores

Option	MCA Score	NPV ($M)*	Value for Money Score
Option 1: Nikenbah Trickling Filter with Expanded Irrigation	75	99.0	0.8
Option 2: Nikenbah Duplication with Expanded Irrigation	77	105.0	0.7
Option 3: Pulgul External Nitrification with Expanded Irrigation and Outfall	72	57.8	1.2
Option 4: Pulgul External Nitrification with Outfall	63	54.4	1.2
Option 5: Pulgul MBR with Expanded Irrigation and Outfall	75	51.4	1.45
Option 6: Pulgul MBR with Outfall	70	47.9	1.45

* NPV numbers based on the numbers used during the MCA process. Post the MCA process, some of the NPV values increased, however this strengthened the choice of option 5 as the increases were for other options that were not selected.

Based on the above scores, WBW chose to proceed with option 5 because it had the better MCA score prior to the NPV value being assessed. This option selected was the second best MCA score, the second best NPV score and the equal best value for money score.

8 Odour considerations

8.1 PRELIMINARY ODOUR ANALYSIS

8.1.1 Methodology

A matrix-based methodology for estimating the odour risk of the process areas at Pulgul WWTP — both at the existing and recommended site— has been developed for the purpose of calculating the odour potential risk. The methodology has been adapted from GHD's Report for Biosolids Reuse Strategy.

The assessment is semi-quantitative which takes into account the odour potential of the process area and the likelihood that sensitive receptors will be exposed to the odour emitted from the process area. The overall risk has been numbered from 1 to 4 for negligible risk to high risk, respectively (e.g. low risk = 2). The overall risk can be calculated from the following formula – odour potential x likelihood that sensitive receptors will be exposed to the odour emitted from the process area. Table 8.1 shows the odour assessment matrix.

Table 8.1 Odour Assessment Matrix

		Likelihood that sensitive receptors will be exposed to the odour emitted from the process area		
Odour Potential		Low	Medium	High
	Low	1 Negligible risk	2 Low risk	3 Medium risk
	Moderate	2 Low risk	3 Medium risk	4 High risk
	High	3 Medium risk	4 High risk	4 High risk

The odour potential ratings for each process area of odour concern at Pulgul WWTP are summarised in Table 8.2. All process areas include their respective sump/pump chambers. The table also includes the area type and also indicates whether the odorous area is currently within the existing configuration or in the recommended configuration/site of Pulgul WWTP.

Table 8.2 Odour Potential of Odorous Process Areas at Pulgul WWTP

Process area	Process area type	Source/Cause	Odour potential
Inlet works[1]	Existing	• Putrescible matter removed via screening • Rag blockages	High
Bathurst box	Existing	• Anaerobic zone	High
IDEA lagoon	Existing	• Moderate level of nitrogen gas within first compartment	Low
Oxidation ditch	Existing	• Insufficient aeration	Low

Process area	Process area type	Source/Cause	Odour potential
Anaerobic digester[2]	Recommended site	• Leaking hydrogen sulphide (H_2S) • High sulphate content in solids	Moderate
Secondary clarifier no. 1 & 2	Existing	• Floating solids • Excessive solids retention	Low
Upgraded dewatering facility	Recommended site	• Stockpiled dewatered sludge is removed off site after 6 month drying period • Release of odorous gases (i.e. ammonia, H_2S and trimethylamine) from solids	Moderate
Effluent lagoon	Existing	• Unsettled sludge from clarifier going into effluent lagoon	Moderate
Bioreactor	Recommended site	• Anaerobic zone of bioreactor • Return flows from upgraded dewatering facility	Moderate

1 Operation of the existing odour scrubbing unit for the inlet works needs to be investigated for efficacy

2 The existing aerobic digester will be replaced by an anaerobic digester. Single section is retained for oxidation of anaerobically digested solids

The following key assumptions have been made in the assessment:

- For the purpose of assessing the odour risk, only normal operating conditions have been evaluated. The impact of process upsets has not been considered in the assessment.
- The overall risk rating is considered the highest risk rating for each of the matrices.

Table 8.3 gives the range of potential definitions for each likelihood of exposure of sensitive receptors to the odour emitted from the process area. It also includes likelihood of exposure of potential odour recipients to the odour emitted from the WWTP in reference to wind velocities and wind direction obtained from the Maryborough wind rose (refer to Appendix A for Maryborough wind rose). Note that Maryborough is the nearest location to Pulgul for which Bureau of Meteorology Wind Rose data was available.

Table 8.3 Definitions for likelihood of exposure

Likelihood of Exposure	Definitions
Low	• Process is located in a remote location • Process has a low volumetric rate of discharge or a small area exposed to the wind • Process is equipped and operated with an adequately sized and reliably functioning unit for either reducing the odour of the air that might come into contact with the process or for suppressing the transfer of odorous materials to air that might come into contact with the process. • Odour recipients are located E, W, S, SE, or SW of the Pulgul WWTP
Medium	• Process is located away from residential development, with only minor industry at a sufficient buffer distance • Process is located adjacent to a recreational / residential / commercial area. Air having contacted the process or the materials being processed is untreated or not well dispersed, but only at times of the day when people are not active in the area • Process is located adjacent to a recreational / residential / commercial area, but there is little opportunity for fresh air to come into contact with the process or the materials being processed • Process is located adjacent to a recreational / residential / commercial area but is set up so that all air having contacted the process or the materials being processed is

Likelihood of Exposure	Definitions
	well dispersed (e.g. through a tall stack and discharged at a velocity exceeding the minimum for stack-tip downwash). • Odour recipients are located NE of the Pulgul WWTP and are not adjacent to the plant
High	• Process is located adjacent or relatively close to a recreational / residential / commercial area, and air having contacted the process or the materials being processed is neither treated nor well dispersed at times of the day when people are active in those areas. • Odour recipients fit the criteria of being located N or NW of the Pulgul WWTP or are located NE of the Pulgul WWTP and , at the same time, adjacent to the plant

8.1.2 Results of preliminary odour analysis

Table 8.4 summarises the odour assessment which includes the odour potential and likelihood of exposure for each process area. For overall ranking, the highest odour potential risk is depicted by 1 and the lowest odour potential risk is depicted by 4. These rankings were determined from the overall risks obtained from the odour assessment matrix in Table 8.1.

Table 8.4 Preliminary odour analysis results

Process area	Process area type	Odour potential	Likelihood of exposure	Risk
Inlet works	Existing	High	Low	3
Bathurst box	Existing	High	Medium	4
IDEA lagoon	Existing	Low	Medium	2
Oxidation ditch	Existing	Low	Medium	2
Anaerobic digester	Recommended site	Moderate	Low	2
Secondary clarifier no. 1 & 2	Existing	Low	Medium	2
Upgraded dewatering facility	Recommended site	Moderate	Medium	3
Effluent lagoon	Existing	Moderate	Medium	3
Bioreactor	Recommended site	Moderate	Medium	3

The results from Table 8.4 indicate that the Bathurst box has the highest odour risk whilst the inlet works, the upgraded dewatering facility and the bioreactor have medium odour risks that still need to be considered. The ranking of the inlet works is not as high as the Bathurst box due to it being treated by an activated carbon odour scrubber.

If the associated risks are considered unacceptable, any high risk structures could be covered and odorous gases to be treated. In addition, the sludge stockpile could be regularly turned to prevent becoming anaerobic.

8.2 ODOUR RECIPIENTS

Figure 8.1 shows the odour recipients within a buffer distance of 362 m from the outer boundary of the Pulgul WWTP. This distance of 362 m is the minimum buffer distance for odour containment in accordance with “Recommended buffer distances are met (as per the Victorian Environmental Protection Authority (EPA), ‘Recommended separation distances for industrial residual air emissions’, Publication No. AQ 1518)”. This distance was calculated using the design ED of 19,720.

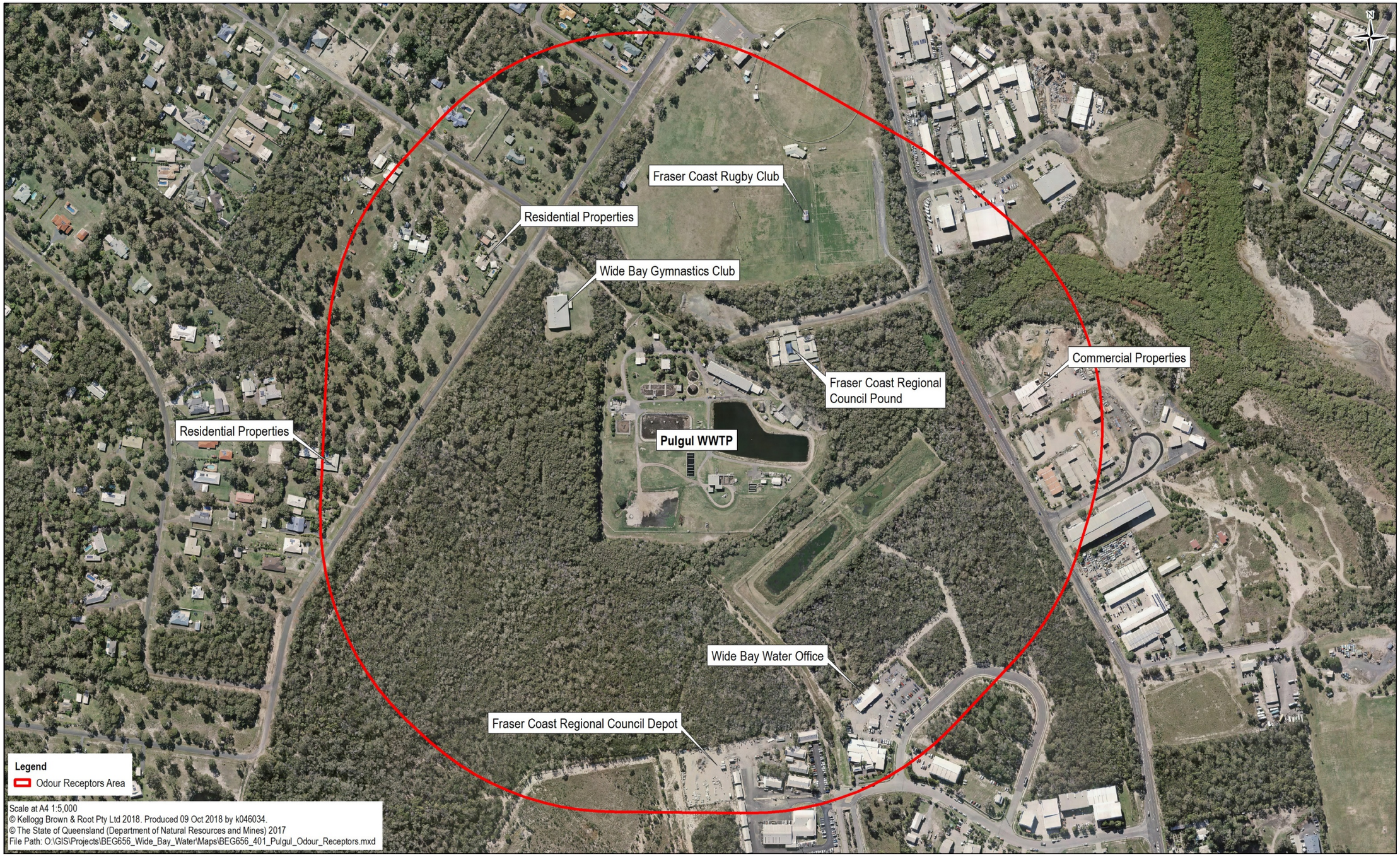


Figure 8.1 Odour Recipients

As shown in Table 8.5, the areas that are high or medium potential odour receptors are: all of the residential properties located NW of the Pulgul WWTP, the Fraser Coast Regional Council (FCRC) Pound, Fraser Coast Mariners Rugby Club (most of field), Europcar Hervey Bay City and the Wide Bay Gymnastics Club (refer to Table 8.3 for likelihood of exposure definitions).

Table 8.5 Details of Odour Receptors

Odour receptors	Building type	Direction from WWTP	Likelihood of exposure
FCRC pound	Animal shelter	NE	High
Fraser Coast Mariners Rugby Club (half of field)	Other	N	High
Wide Bay Water reception and visitors carpark	Parking structures and storage	S	Low
Wide Bay Water office	Government	SE	Low
FCRC Depot	Government	S	Low
Wide Bay Gymnastics Club	Other	NW	High
Europcar Hervey Bay City	Transport	NE	Medium
17 - 25 Walkers Rd, Urangan	Residential	NW	High
35 Walkers Rd, Urangan	Residential	W	Low
1 Sunline Ct, Urangan	Residential	NW	High
1 - 7 Senorita Pde, Urangan	Residential	NW	High
1530 Booral Rd, Urangan	Commercial	E	Low
Hervey Bay Roof Trusses	Commercial	E	Low
Active Industries – Saws	Commercial	E	Low

9 Bio solids management options

KBR has reviewed the Bio solids Environmental Management Plan and provided comments in a version of the plan included in Appendix B. The comments reflect the changes that would be required to the anaerobic digested biosolids for the recommended option at the Pulgul WWTP. It is important that the document is not updated until the project is near completion as it would be incorrect if issued prior.

KBR has reviewed the quantities and likely product stabilisation grading. We have assumed at this stage of development that the total solids volume for the projected growth is similar to the existing estimates. This is conservative, as anaerobically digested solids are easier to dewater, and typically result in a higher solids content in the dewatered solids. The anaerobic digester volume has been sized to maintain the class B stabilisation requirement as per the NSW Bio solids guidelines.

10 Selected site process design

10.1 OVERVIEW OF EXISTING PULGUL WWTP

Pulgul WWTP consists of two discrete process trains being an oxidation ditch and an Intermittently Decanted Extended Aeration Lagoon (IDEAL) plant.

The oxidation ditch process train is a modified activated sludge biological treatment process that utilises long solids retention times to remove biodegradable organics and is combined with two secondary clarifiers to separate solids. Disinfection is achieved by the addition of chlorine to the effluent in a chlorine contact tank prior to being transferred to the plantation storage lagoons or discharged to Pulgul Creek.

The IDEAL process train treats sewage through a series of phases including aeration, settling and decanting. The effluent from this process is also disinfected through the addition of chlorine in a chlorine contact tank. Following disinfection it is transferred to the onsite Pulgul lagoon. From this lagoon the effluent is either transferred to the plantation storage lagoons or discharged to Pulgul Creek.

The Pulgul WWTP will need to process an additional load from the population growth in the combined catchment.

10.2 BASIS OF DESIGN

The Pulgul WWTP needs to expand the processing capacity to accommodate growth in population as described in Table 10.1.

Table 10.1 Pulgul WWTP hydraulic capacity

WWTP	Hydraulic capacity		Biological capacity		Current loading (2016)	Conversion
	ED	ML/d	ED	ML/d	ML/d	L/ED/day
Current Pulgul WWTP	9,720	4.4	9720	4.4	4.4	n/a
Expansion needed	10,000	4.8	10,000	4.8	0	480
Design ADWF	*19,720*	*9.2*	*19,720*	*9.2*	*4.4*	n/a

n/a - not applicable

The design is based on the peaking factors as illustrated in Table 10.2.

Table 10.2 Peaking factors applied.

WWTP	Hydraulic capacity (ML/d)	Peaking factor
ADWF	9.20	Not applicable
PDWF	14.72	1.6
PWWF	27.60	3.0

PDWF - Peak Dry Weather Flow

Flow entering the WWTP will be distributed according to the ratio described in Table 10.3.

Table 10.3 Flow distribution at Pulgul WWTP.

WWTP	Hydraulic capacity (ML/d)
Oxidation Ditch	Up to 1.6
New MBR unit	Up to 3 x ADWF
Screened and Chlorinated Bypass to Lagoon	Excess above 3 x ADWF

Effluent from the Lagoon is then sent to reuse and additionally to the outfall when necessary.

10.3 PROCESS DESCRIPTION

An alternative processing scheme is proposed that will increase the capacity of the Pulgul WWTP to accommodate the increase in load.

The proposed system utilises the existing infrastructure and IDEAL lagoon and converts it into a new WWTP layout. The proposed system is based on the Westbank process system including an MBR as a solids separation step.

10.3.1 Anaerobic Reactor

Waste water enters the plant through the existing headworks and is split between the Oxidation Ditch and the new configuration. The flow into the facility will be split according to the ratio described in Table 10.3.

Influent water will enter the existing Bathurst Box reactor that will be converted into an anaerobic reactor. The inlet from the headworks will be in contact with recycle from an anoxic reactor that will enable biological phosphate removal to occur. Water will be pumped from the anaerobic reactor to an adjacent anoxic reactor.

Septic and grease trap waste will be diverted directly to the new solids anaerobic digester.

10.3.2 Anoxic Reactor

The current IDEA lagoon will be utilised as both an anoxic and aerobic reactor. The lagoon will be separated into two zones, by means of a polymer sheet barrier that will float on the water surface and extend down to the reactor floor. The lagoon will be divided into separated zones, with the anoxic zone occupying the first two thirds of the reactor volume. The remaining third of the reactor will be converted into an aerobic reactor zone. Water will flow through dedicated pathways through the barrier into the aerobic zone. Surface aerators present in the current lagoon operation will be retained and utilised in the aerobic zone.

10.3.3 Aerobic Reactor

Water entering the aerobic zone will be aerated with surface aerators that are present in the IDEAL lagoon. The aeration will oxidise the biomass and initiate the formation of nitrate and nitrite from the available ammonia nitrogen. Aerated water will be recycled to the anoxic zone as an internal recycle stream. The anoxic recycle will be achieved through a pathway constructed from a polymer sheet barrier that channels the water along the length of the lagoon back to the anoxic reactor inlet zone. Flow of the recycled water will be achieved through submersed axial flow pumps. The anoxic recycle will enable denitrification in the anoxic zone. Additional substrate can be introduced into the anoxic zone through a methanol dosing system. Dosing methanol will increase the denitrification potential in the anoxic zone and can be used as required.

10.3.4 Extended Aerobic Reactor

From the surface aerated reactor, water will be transferred to a new aerobic reactor. The secondary aerobic reactor is supplied with submerged aerators and agitators. The dissolved oxygen level of the water in the reactor is increased to enable nitrification and carbon removal. Water from the secondary reactor will flow with gravity into a number of membrane tanks.

10.3.5 Membrane tanks

The membrane dewatering section receives the water from the aerobic reactor through a common overflow and splits into a number of individual membrane tanks. The tanks contain individual submerged membrane cassettes. The membrane tanks are equipped with submerged aeration distribution systems that are utilised to scour and clean the membrane surfaces during operation. Water flows from the mixed liquor in the membrane tank through the membranes into the permeate line that collects water from the cassettes to the final outfall point.

Water and biological material overflow from the membrane tanks into a channel from where it is pumped through the return activated sludge recycle line to the primary aeration reactor.

10.3.6 Sludge wasting and thickening

A portion of the return activated sludge stream from the membrane tank will be diverted to a thickening section that receives sludge from both the oxidation ditch plant and the new MBR. Supernatant water from the thickening section is returned to the anaerobic reactor at the inlet to the facility. Thickened solids are transferred into a new anaerobic digester. Allowance is made for dosing equipment to dose alum and polymer as well as neutralising the sludge before entering the thickening system.

10.3.7 Anaerobic Digester

Thickened sludge is pumped to the anaerobic digester and combines with a recycle sludge stream before passing through an inlet heat exchanger. The exchanger controls the temperature in the digester to ensure proper operation conditions are maintained.

Digested sludge is pumped from the digester and enters an aerobic digester that is present in the current Pulgul scheme. The sludge will be aerated in order to be stabilised as well as to convert free ammonia to nitrate before the final dewatering stage. During the sludge digestion process, gas is produced that will be collected in the void space above the liquid surface of the digester. The digester has a floating roof construction that maintains a pressure above the liquid by expanding or contracting the space. Collected gas from the digester is transferred to a combined heat and power (CHP) plant for utilisation.

10.3.8 Sludge dewatering

The sludge from the aerobic digester is dewatered to a solid content acceptable for beneficial reuse. Dewatering of sludge will be done with existing gravity drainage deck and filter press prior to on-site storage. Supernatant water from the dewatering section is returned to the inlet of the anaerobic reactor. Dewatered sludge is transferred into trucks for transport after 6 months for land application..

10.3.9 Combined Heat and Power plant

Gas from the anaerobic digester is processed to remove moisture and components that can be harmful to the power generation equipment in the CHP. The first step is the removal of sulphides from the gas stream followed by a dehumidification/cooling step where the excess moisture is removed. Gas will be sent to an internal combustion biogas power generator. Electrical power will be produced as well as waste energy. The waste energy is recovered through heat exchangers on the engine jacket cooling water circuit as well as a waste heat exchanger on the engine exhaust stream. A closed loop water collection system will connect the waste heat exchangers in the CHP with the digester sludge stream in a separate digester feed heat exchanger.

10.4 PROCESS FLOW DIAGRAMS

The Pulgul MBR system is illustrated in the PFD attached in Appendix D.

10.5 REFINED ESTIMATE SCOPE

The following items are included in the scope for the recommended option

- Inlet works
  - concrete - elevated concrete structure
  - inlet screens
  - grit removal
  - allowance for pipework and fittings
  - allowance for electrical, instrumentation and control
  - allowance for structural steel, ladders, walkways, handrails.
- Membrane tanks
  - concrete
  - epoxy coating
  - membrane blowers
  - membrane cassettes
  - diffusers
  - permeate / backwash pumps
  - permeate tank
  - RAS screens
  - allowance for pipework and fittings
  - allowance for electrical, instrumentation and control
  - allowance for structural steel, ladders, walkways, handrails.

- Bioreactor tanks (aerobic)
  - concrete
  - epoxy coating
  - blowers
  - diffusers
  - mixers
  - allowance for pipework and fittings
  - allowance for electrical, instrumentation and control
  - allowance for structural steel, ladders, walkways, handrails.
- Solids thickener
  - feed pumps
  - drum thickener.
- Odour control
  - slab for equipment (10 * 10 * 0.4)
  - odour control system
  - allowance for pipework and fittings
  - allowance for electrical, instrumentation and control.
- Chemical dosing
  - concrete slab - truck delivery (10 m * 10 m * 0.4 m)
  - chemicals building (13 m x 5 m)
  - caustic dosing pump duty / standby
  - caustic dosing tank (25 m^3 GRP)
  - sodium hypochlorite dosing pump duty / standby
  - sodium hypochlorite dosing tank (3 m^3 GRP)
  - alum dosing pumps 2 duty / standby
  - alum dosing tank (1 m^3 GRP)
  - methanol dosing system.
- Solids processing
  - concrete (second digester tank)
  - Epoxy Coating
  - agitation pump
  - allowance for pipework and fittings
  - allowance for electrical, instrumentation and control
  - allowance for structural steel, ladders, walkways, handrails
  - final sludge dewatering to be done with existing gravity drainage deck and belt filter press.

- CHP
  - concrete (CHP BUILDING)/ (electrical switch gear)
  - gas desulphurisation (22 m^3/h)
  - gas dehumidification (22 m^3/h)
  - gas flare (22 m^3/h)
  - gas blower
  - gas engine
  - Jenbacher/heat distribution system (80 KW)
  - start-up heat system
  - heat exchanger for sludge heating
  - allowance for pipework and fittings.
- Effluent disposal
  - outfall pipe (DN 900 pipe)
  - outfall pumps
  - reuse pipeline DN125
  - reuse pumps
  - MBR permeate pipe (DN 600 pipe)
  - allowance for fittings
  - allowance for instrumentation and control.
- Pumps
  - MBR sludge waste WAS
  - anaerobic sludge recycle (r)
  - anoxic sludge recycle (a)
  - influent to anaerobic zone
  - anaerobic transfer pump
  - WAS pump
  - dewatering supernatant/pre digester
  - digester outlet pump
  - dewatering supernatant/post digester
  - dewatering sludge/pre digester
  - dewatering sludge/post digester
  - anoxic transfer pump
  - septic waste to digester
  - heating water circuit
  - allowance for fittings
  - allowance for instrumentation and control.

- Pipelines
  - combined flow to aerobic reactor (DN 800 pipe)
  - influent to WWTP anaerobic zone (DN 650 pipe)
  - combined feed to anaerobic reactor (DN 650 pipe)
  - MBR underflow recycle (s) RAS (DN 650 pipe)
  - MBR underflow recycle (s) RAS (DN 650 pipe)
  - influent to anaerobic zone (DN 500 pipe)
  - air to aerobic bioreactors (DN 315 pipe)
  - anaerobic sludge recycle (DN 225 pipe)
  - influent to oxidation ditch (DN 125 pipe)
  - air to membrane tanks (DN 90 pipe)
  - return supernatant from dewatering filters (DN 64 pipe)
  - waste activated sludge (WAS) (DN 64 pipe)
  - waste activated sludge (WAS) to dewatering (DN 64 pipe)
  - supernatant from WAS dewatering (DN 64 pipe)
  - allowance for fittings
  - allowance for instrumentation and control.
- Indirect Costs
  - design / engineering
  - design and quantity growth
  - construction and management fee.

10.6 REFINED COST ESTIMATE

The cost estimate summary for the new Pulgul WWTP is shown in Table 10.4. All plant areas include 25% contingency. The cost estimate breakdown for effluent disposal is provided in Table 10.5.

10.6.1 Additional Assumptions for Refined Cost Estimate

The following assumptions are in addition to those listed in Section 7.5.

- Outfall pipe installation method is assumed to be trenched except for the creek crossing which is assumed to be directional drilled. The section of pipe in the ocean is installed using a barge and anchored on the ocean floor.
- Outfall pipe installed in a trench is assumed to be installed with pipe coverage of between 0.8 m and 1 m.
- No geotechnical investigation has been performed on the outfall pipeline route at this stage of design. Ground conditions assumed to be urban area with sandy soil.
- Sludge storage area assumed to be compacted road base as per the existing sludge storage area.
- Farm owners around Vanderwolf Road will commit to purchasing a non-pressurised supply of effluent

Table 10.4 Refined cost estimate (plant area)

Item	Cost ($M)
Reactors	1.17
Membrane system	7.20
Digester	1.24
CHP	0.71
Dosing systems	0.50
Solids handling	0.22
Pumps	1.21
Large pipes	0.34
Inlet Works	1.67
Odour control	2.58
Sludge Storage	0.3
Indirect Costs	4.58
Total	21.72

Table 10.5 Effluent disposal cost breakdown

Item	Cost ($M)
Outfall Pipe (DN900 Trenched section)	5.04
Outfall Pipe (DN900 Creek Crossing)	1.84
Outfall Pipe (DN900 Ocean Installation)	2.10
Concrete Ballasts	0.40
Road Reinstatement	2.16
Sandy Bank Reinstatement	0.11
Traffic Control	0.18
Mobilisation and Hire of Barge incl. 10T winch and lift crane, diver boat and crew.	0.62
Outfall Pumps	0.61
Reuse Pipeline (DN 125)	2.07
Reuse Pumps	0.13
MBR Permeate Pipe (DN 600)	0.05
Fittings	0.76
Instrumentation and Control	0.76
Total	16.83

Equipment sizing is shown in the equipment lists attached in Appendix E.

11 Stakeholder engagement

A Stakeholder Engagement Strategy for the project has been prepared (KBR, 2018). This strategy will:

- Ensure engagement and communication activities are aligned and consistent, to build awareness and understanding of the project before the primary environmental approvals phase.
- Identify key stakeholders, issues and risks, with accompanying management and mitigation strategies to ensure the project is in safe hands, and the reputation of FCRC is protected.
- Recommend a variety of ways to engage stakeholders throughout the project's development.

Several stakeholders (both internal and external) were identified for the project, and include broadly:

Internal Stakeholders

- Wide Bay Water
- Fraser Coast Regional Council.

External Stakeholders

- Government agencies (regulatory functions)
- Environmental groups
- Businesses and associations
- Community and associations
- Indigenous groups
- Elected representatives
- Media.

These stakeholders were then analysed to determine the most appropriate level of engagement required to meet the strategic objectives of the project.

Also included in the Strategy is an analysis of potential stakeholder and community issues and possible mitigation measures to manage these. Key messages were also developed, with the intent being that these be used in communication and engagement tools to describe the project, and to provide a level of awareness and understanding about the project to all stakeholders.

The Strategy identified that for each project phase, a tailored Stakeholder Engagement Plan is required to be developed and implemented.

12 External funding and subsidies

12.1 INTRODUCTION

There are funding opportunities available to FCRC/WBW from Commonwealth and State governments. In the main these require a development ready project for which detailed design is available and costing is known.

In some cases the funding is being made available over a period of time in a series of funding tranches. In these cases, the funding agency will have a specific period for submissions each year over the life of the funding. If the funding submission is not lodged in the current year submission period, then a new submission would need to be made in the next funding tranche submission period.

In other cases it is a one off program. Again there is a specific period for submissions. Once the cut-off date is reached, no further submissions are received.

All funding projects have specific criteria that have to be met in order to be able to make a submission for funding. In some cases the funding is for a fixed percentage of the project cost. In others it is a contribution to the project cost within the limit of the funding available to be distributed across accepted projects.

The following sections list the current and recently closed funding opportunities for which the project may be eligible.

12.2 COMMONWEALTH GOVERNMENT FUNDING OPPORTUNITIES

12.2.1 Building Better Regions Fund (BBRF) - Infrastructure Projects Stream

Provides organisations with grants of between $20,000 to $10 million to support projects which involve the construction of new infrastructure, or the upgrade or extension of existing infrastructure that provide economic and social benefits to regional and remote areas.

https://www.business.gov.au/Assistance/Building-Better-Regions-Fund/Building-Better-Regions-Fund-Infrastructure-Projects#key-documents

“The Infrastructure Projects Stream supports projects which involve the construction of new infrastructure, or the upgrade or extension of existing infrastructure that provide economic and social benefits to regional and remote areas.

The minimum grant amount is $20,000.

The maximum grant amount is $10 million.

For most projects grant funding will be up to 50 per cent or up to 75 per cent of your eligible project costs. Your location will determine the percentage of grant funding you can receive.

You may apply for a partial or full exemption to the co-funding requirement if you can demonstrate that you are experiencing exceptional circumstances.”

Eligibility criteria

To be eligible you must be a legal entity, have an Australian Business Number (ABN) and be one of the following entities:

- a local governing body as defined by the *Local Government (Financial Assistance) Act 1995*
- a not for profit organisation.

You are not eligible to apply if you are:

- a for profit organisation
- an individual, partnership or trust (however, an incorporated trustee may apply on behalf of a not for profit trust organisation)
- a Commonwealth, state or territory government agency or body (including government business enterprises) with the exception of those organisations referred to in 6.2 of the Program Guidelines
- a university, technical college, school or hospital
- a Regional Development Australia Committee.

Your project must:

- be located in Australia and in an eligible area. You may still apply if your project is in an excluded area, however, you must clearly demonstrate the significant and demonstrable benefits and employment outcomes which flow directly into an eligible area
- provide evidence confirming all co-funding contributions
- have a project that has not started at the time of application
- be ready to commence within 12 weeks of executing the grant agreement
- be completed by 31 December 2020.

STATUS – CLOSED

Contact information: 132846

https://www.business.gov.au/Contact-us

Projects for waste treatment approved in Round One

Replacement of Gundagai WWTP - Grant $3.5m Total cost $7.0m (Cootamundra-Gundagai Regional Council NSW)

Construct gravity water pipeline to improve Curlewis water supply and water quality - Grant $2.6m Total cost $5.2m (Gunnedah Shire Council NSW)

Upgrade and Augment Bombala WWTP - Grant $3.5m Total cost $7.0m (Snowy Monaro Regional Council NSW)

Construction of new community wastewater management scheme at Orroroo - Grant $387,337 Total cost $1,137,337 (District Council Of Orroroo Carrieton SA)

Construction of a new Waste Management Facility in Onslow to accept regional Class I to IV domestic, mining and industrial waste - Grant $9,082,620 Total cost $12,975,171 (Shire of Ashburton WA).

12.2.2 Regional Jobs and Investment Packages (RJIP) - Wide Bay Burnett region, QLD

Provides local government agencies, not for profit organisations and companies in the Wide Bay Burnett region in Queensland with matched funding to the limit of available funds ($20 million) for

projects that help to diversify the regional economy, stimulate economic growth and deliver sustainable employment in the region.

This was a pilot project that is now closed. It has similar eligibility criteria to the BBRF

https://www.business.gov.au/Assistance/Regional-Jobs-and-Investment-Packages/Wide-Bay-Burnett-Queensland

STATUS – CLOSED - 15 August 2017

12.2.3 Indigenous Cadetship Support (ICS)

The Indigenous Cadetship Support (ICS) is an Australian Government initiative that improves the professional employment prospects of Aboriginal and Torres Strait Islander peoples. It links Aboriginal and Torres Strait Islander tertiary students with employers in a cadetship arrangement involving full-time study and negotiated work placements. Cadetships enable Aboriginal and Torres Strait Islander students to gain the professional qualifications and experience needed for a range of jobs in the private, public and community sectors and assists them to move into employment on completion of their studies.

https://www.ics.employment.gov.au/

STATUS - CLOSED - 1 January 2018

Cadetship funding is now available through the Tailored Assistance Employment Grant (TAEG) process.

www.pmc.gov.au/taeg

12.2.4 Supported Wage System (SWS)

The Supported Wage System (SWS) allows employers to:

- pay a wage matching the person's assessed productivity rate
- provide employment for people with a disability
- help employees with a disability improve their work productivity and work at full award wages.

https://www.business.gov.au/assistance/supported-wage-system

The wage subsidy scheme provides payments to eligible employers to help cover the wages of an employee in the first few months of employment.

The scheme helps people with disability gain skills and experience through employment.

https://www.business.gov.au/assistance/wage-subsidy-scheme

STATUS – OPEN

12.2.5 Emissions Reduction Fund - Plantation Forestry

The method can be used by forest growers to undertake commercial plantation forestry projects. Projects could either: establish new plantation forests, convert short-rotation plantations to long rotations, or maintain existing plantations established under another Emissions Reduction Fund method.

This method could benefit:

- plantation forest growers interested in establishing new plantations
- plantation forest managers with existing short-rotation plantations

- proponents who have established a plantation forest under another Emissions Reduction Fund method.

Projects under this method capture carbon by establishing and managing plantation forests. Carbon continues to be stored in the wood products from the harvested plantations.

This method uses the Full Carbon Accounting Model (FullCAM) software to model the carbon abatement of projects.

Abatement estimates take into account the fluctuations in carbon stocks associated with harvest of a plantation and new growth following harvesting. New plantations are credited up to a limit that represents the average carbon stocks of repeated harvest rotations over the long-term. For projects that convert a short-rotation plantation to a long-rotation plantation, net abatement is calculated by subtracting a baseline representing the average carbon stocks for the short rotations from average project carbon stocks. Abatement estimates must take into account the effects of disturbances such as fires.

Projects are subject to permanence obligations. This means the project must be maintained for a nominated period of either 100 or 25 years. Projects nominating a 25-year permanence period are subject to a discount on the number of credits they receive. Section 9A of the Carbon Credits (Carbon Farming Initiative) Rule 2015(link is external) and Carbon Credits (Carbon Farming Initiative) Amendment Rule (No. 2) 2017(link is external) applies a 25 per cent discount to short-rotation plantation forestry projects that nominate a 25-year permanence period. Other projects nominating a 25-year permanence period receive a 20 per cent discount.

Eligibility Criteria

A number of requirements need to be met for a project to be eligible under this method. For example:

- Projects can only be conducted within regions defined under the Australian Government's National Plantation Inventory.
- Certain types of plantation forest projects likely to occur in the ordinary course of events (African mahogany in the Northern Territory National Plantation Inventory region and Indian sandalwood in any region) are not eligible.
- Projects must not be an excluded offsets project as defined in Sections 3.36 and 3.37 of the Carbon Credits (Carbon Farming Initiative) Regulations 2011 (link is external).
- If the Minister for Agriculture and Water Resources assesses a proposed project as having an undesirable impact on agricultural production in the region, it will be ineligible. Proponents will need to submit a plantation notification to the Minister for Agriculture and Water Resources for the purpose of this assessment. For further information see the Department of Agriculture and Water Resources website (link is external).
- Projects to establish new plantations must be on land where there has been no plantation forest for the previous seven years.

[i]Projects also need to meet the additionality requirements in Section 27 of the *Carbon Credits (Carbon Farming Initiative) Act 2011* (link is external). For example, projects must not have already begun to be implemented.

STATUS - OPEN

12.3 STATE GOVERNMENT FUNDING OPPORTUNITIES

The status of Queensland Government funding opportunities will need to be revisited once the new Government is sworn in after the election and confirms existing funding programs or publishes new funding opportunities.

12.3.1 QCoast2100

A grant based funding program to assist coastal local governments to progress the preparation of plans and strategies for addressing climate change related coastal hazard risk over the long term.

Grant - Amount: $500,000

What is the eligibility?

Open to Coastal Councils for Coastal Hazard Adaptation strategy preparation.

How can I apply or get more information?

Provided by Department of Environment and Science.

http://www.qcoast2100.com.au/

STATUS - OPEN

12.3.2 Royalties for the Regions (Round 4 Closed)

The Royalties for the Regions program provides funding support to eligible local councils for infrastructure projects that addressed identified local needs.

Grant - Amount: $20,000,000

What is the eligibility?

Funding was available for construction of community infrastructure, road and transport infrastructure, and flood mitigation infrastructure. This funding program is now closed.

Local governments in regional Queensland were eligible to apply for funding.

How can I apply or get more information?

Provided by Department of State Development, Manufacturing, Infrastructure and Planning.

http://www.statedevelopment.qld.gov.au/grants-and-funding/royalties-for-the-regions.html

STATUS – CLOSED

There may be a new round next year.

13 Approvals

13.1 INTRODUCTION

This section of the report assess the approval requirements for the proposed sewage treatment plant upgrade, the proposed outfall and the proposed irrigation pipeline works under Commonwealth and State legislation and the Fraser Coast Planning Scheme 2014 (FCPS) and FCRC local laws.

13.2 LAND TENURES

Outfall (Approx 3.5km including 730 m below high water mark)

Works are on:

- constructed urban roads - Cicada Lane, Pulgul Street, Charlton Esplanade (north of Hood Street to Marine Court and from Moolyyir Street to Boat Harbour Drive)
- unnamed and unconstructed road reserve
  - unnamed road between Pulgul Street and Lot 194 on plan MCH4537
  - unnamed road (between Pulgul Street and foreshore Esplanade
  - unnamed foreshore Esplanade (north of Marine Court to Moolyyir Street)
  - unnamed foreshore Esplanade (south of Hood Street)
- state-controlled road (Booral Street)
- watercourse (Pulgul Creek, Great Sandy Strait)
- reserve on Lot 194 on plan MCH4537
- foreshore reserve on Lot 220 on SP185042
- lands lease on Lot 253 on SP166261 and on Lot 254 on SP150280
- freehold land (Lots 21 and 26 on plan MCH835653).

Pulgul WWTP

The WWTP is in a Reserve over Lot 100 on SP226980

Irrigation Pipeline (Approx 7 km)

Works are on:

- freehold land – Lot 70 on plan MCH601 in already cleared areas
- constructed road – Vanderwolf Road, road verges are partly uncleared.

13.3 DATA SOURCES

Data used in this report to identify approvals triggers comes from:

- FCRC – current Fraser Coast Planning Scheme 2014 (FCPS) and FCRC local laws.
- Federal Register of Legislation managed by the Federal Office of Parliamentary Counsel. Sourced from the Federal Register of Legislation at 22-27November 2017 © Commonwealth of Australia under a Creative Commons Attribution 4.0 International licence (CC BY). For the latest information on Australian Government law please go to https://www.legislation.gov.au.
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) Protected Matters Search Tool (PMST) database © Commonwealth of Australia under a Creative Commons Attribution 4.0 International licence (CC BY).
- Australian Heritage Database provide by the Australian Government Department of Environment and Energy (DEE) © Commonwealth of Australia under a Creative Commons Attribution International licence (CC BY 4.0).
- Queensland Government Departmental websites including:
  - Queensland legislation database maintained by the Queensland Office of the Parliamentary Counsel under a Creative Commons Attribution International licence (CC BY 4.0) Sourced from the Queensland Legislation website on 22-27 November 2017. For the latest information on Queensland Government legislation please go to https://www.legislation.qld.gov.au.
  - Queensland Government Development Assessment Mapping System (DAMS) - a Queensland Government site managed by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) that publishes spatial mapping that identifies the triggers for approvals based on the State Planning Policy July 2017 (SPP 2017) and the *Planning Act 2016* (Planning Act) under a Creative Commons Attribution International licence (CC BY 4.0).
  - 'Queensland Globe' - a Queensland Government site managed by DNRME that publishes Queensland Government spatial information under a Creative Commons Attribution International licence (CC BY 4.0).
  - Queensland Wildlife Online database provided by the Department of Environment and Science, (DES) which contains lists of species records under a Creative Commons Public Licence (version 3.0).
  - Queensland Heritage Register provided and maintained by DES under a Creative Commons Public Licence (version 3.0).

DAMS mapping is part of the State Planning Policy Integrated Mapping System (SPPIMS) that supports the new State Planning Policy July 2017 (SPP2017) and the Planning Act which came into effect on 3 July 2017.

13.4 LEGISLATION

There are three levels of legislation that can apply to the project, Commonwealth and State Acts and their supporting regulations and Local laws and local town planning instruments.

The relevant Commonwealth legislation includes:

- *Civil Aviation Act 1998*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Native Title Act 1993*
- *Telecommunications Act 1997*.

The State Acts, Policies and Guidelines that apply to the project include:

- *Aboriginal Cultural Heritage Act 2003* and Duty of Care Guidelines (Gazettal date 16 April 2004)

- *Biosecurity Act 2014*
- *Electricity Act 1994*
- *Environmental Offsets Act 2014*
- *Environmental Protection Act 1994*
- *Land Act 1994*
- *Land Title Act 1994*
- *Local Government Act 2009*
- *Nature Conservation Act 1992*
- *Planning Act 2016* and the State Planning Policy July 2017
- *Transport Infrastructure Act 1994*
- *Transport Operations (Road Use Management) Act 1995*
- *Vegetation Management Act 1999*
- *Water Supply (Safety and Reliability) Act 2008*

At the Local Government Level, there are:

- Fraser Coast Planning Scheme 2014 as at 22 November 2017
- FCRC Local Law No. 1 (Administration) 2011
- FCRC Subordinate Local Law No. 1 (Administration) 2011 Commonwealth legislation

13.4.1 Civil Aviation Act 1988

Under Section 98(g) of the *Civil Aviation Act 1988* (CA Act), the Civil Aviation Safety Regulations 1998 (CASR) have been made by the Civil Aviation Safety Authority (CASA) regarding the construction, dimensions of buildings, structures or objects and the removal of lighting of buildings, structures or objects that constitute obstructions, hazards or potential hazards to aircraft flying in the vicinity of an aerodrome.

The FCPS incorporates provisions to give effect to the CASR.

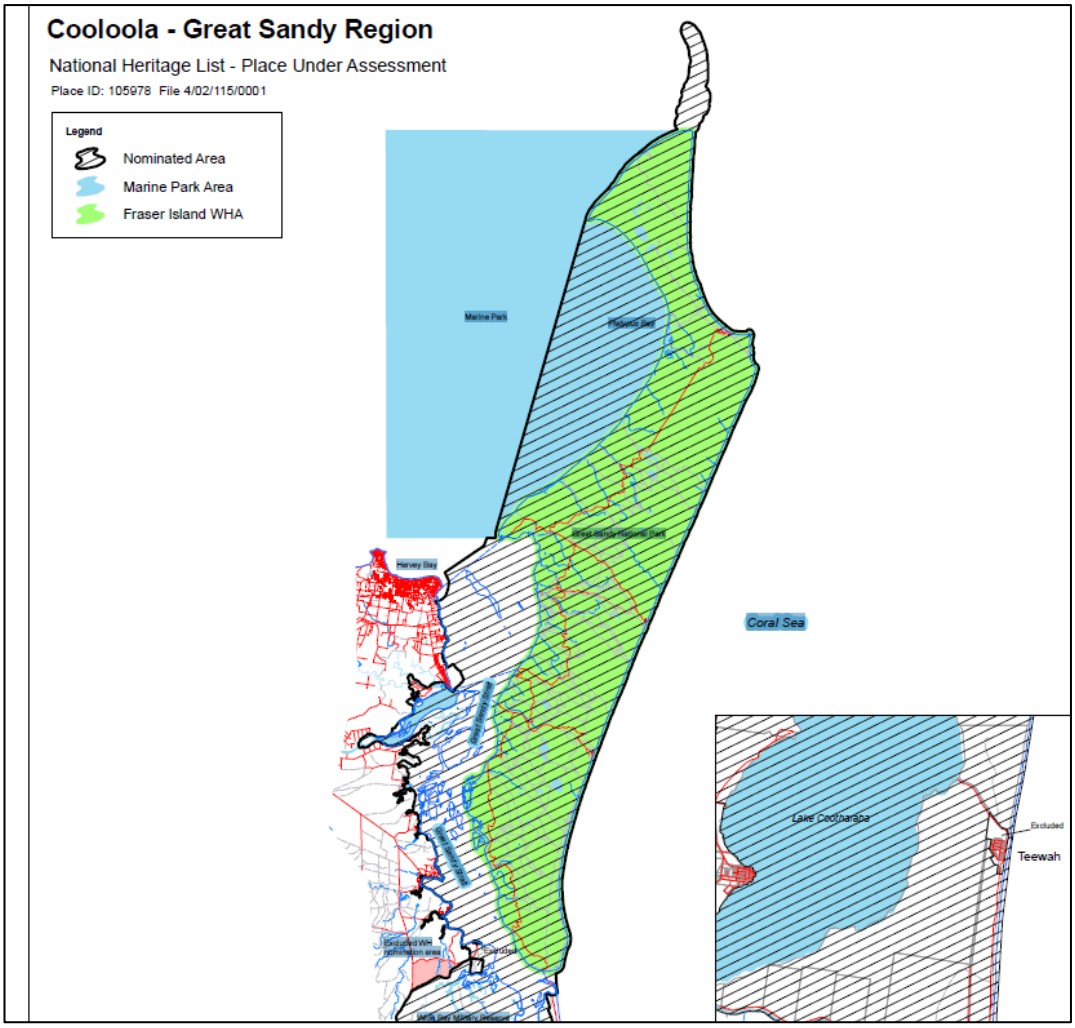
13.4.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of Matters of National Environmental Significance (MNES). Any action that may have a significant impact on MNES needs assessment and a decision on whether it can proceed by the Commonwealth Minister for the Environment. This section identifies the MNES that may exist in the vicinity of the proposed works.

Heritage

There are no heritage sites of national significance listed over the proposed works in the Australian heritage database.

There is one heritage site under consideration for listing near the site. The Cooloola-Great Sandy Region is listed as a nominated place on the National Heritage List (Place ID 105978) and is currently awaiting Minister's decision on whether to include the site on the list (due date extended to 30/6/2019).



Source DoTEE website

PMST Results

The Great Sandy Strait (including Great Sandy Strait, Tin Can Bay and Tin Can Inlet) RAMSAR site is a MNES. Its boundary comes close to the Outfall and includes the tidal waters of Susan River and Bunya Creek near the Irrigation Pipeline. It excludes private freehold lands, local government foreshore reserves on the mainland, the Urangan Boat Harbour and a 500 m zone around it, jetties and boat launching ramps, and 30 m either side of these structures.

There is a nationally important wetland – Great Sandy Strait – QLD No 32, mapped on the EPBC Act PMST interactive map. The boundary of this wetland extends over the Outfall pipeline east of Pulgul Street Urangan and over the Irrigation Pipeline at the bend in Vanderwolf Road at the south east corner of Lot 6 on RP218676, and between Lot 1 on RP225325 on the west and Lots 1 and 2 on RP42275 to the east. Most of Lots 1 and 2 on RP42275, Lot 8 on plan M37343 and Lot 63 on plan M37907 are within this wetland. Management of this wetland is undertaken by DES.

The PMST search identifies two threatened ecological communities that could occur in the area.

The Subtropical and Temperate Coastal Saltmarsh is represented in Queensland by Regional Ecosystem (RE) 12.1.2. The proposed Outfall passes through two small areas of RE12.1.2 at Pulgul Creek. There is another section of RE12.1.2 on east of Charlton Esplanade and south of Satinay Street. Small areas of

RE12.1.2 are shown around the edges of the Pulgul Creek tidal area and to the north and south of its mouth on the pre-clearing RE's map.

The Lowland Rainforest of Subtropical Australia is represented by RE 12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1 and 12.12.16. None of these REs occur in the vicinity of the Outfall, Pulgul WWTP or the Irrigation Pipeline and are not identified as pre-clearing REs in these areas.

A PMST search identified a range of flora and fauna species of national environmental significance that could be found in the area. The Queensland Wildlife Online database provided by DES contains lists of species records. Table 13.1 lists MNES species that have been recorded within a 1 km buffer around the proposed works areas.

Table 13.1 MNES Flora and fauna

Scientific Name	Common Name	Conservation Status	Location
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	Q-E, A-E	Outfall
Numenius madagascariensis	Eastern curlew	Q-E, A-CE	Outfall
Megaptera novaeangliae	Humpback whale	Q-V, A-V	Outfall

Q Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL), Least Concern (C) or Not Protected ( ).
A Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The codes are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

While detail design is proceeding, an ecological study should be undertaken to determine if the final design is likely to involve clearing vegetation (including benthic habitat) protected under Commonwealth legislation and to determine if any fauna or flora species protected under Commonwealth legislation are present in the areas to be cleared for the Outfall, at the Pulgul WWTP and along the Irrigation Pipeline.

The benthic habitat survey will consider the tidal and sub-tidal sections of the Outfall.

Given the nature of the environment at the northern end of the outfall, once the ecological survey and the benthic habitat survey are completed, a Significant Impact Analysis is essential to determine if a controlled action referral is needed. If a referral results in the action being declared a controlled action an environmental investigation and report will undergo an assessment leading to a decision by the Minister. The assessment may be undertaken by the Queensland Government under a bilateral agreement.

The approvals for the Outfall, WWTP upgrade and Irrigation elements can proceed independently of each other. However, if the Outfall was considered a controlled action under the EPBC Act, the Commonwealth Government could request that the referral consider both the Outfall and the WWTP and possibly the Irrigation Pipeline be included as being elements of the project.

The Schedule in Section 13 provides for the process up to a decision on the referral. If the Minister decides the matter is a controlled action, a formal submission and assessment will be required and construction of the outfall cannot commence until a decision is made on the controlled action.

13.4.3 Native Title Act 1993

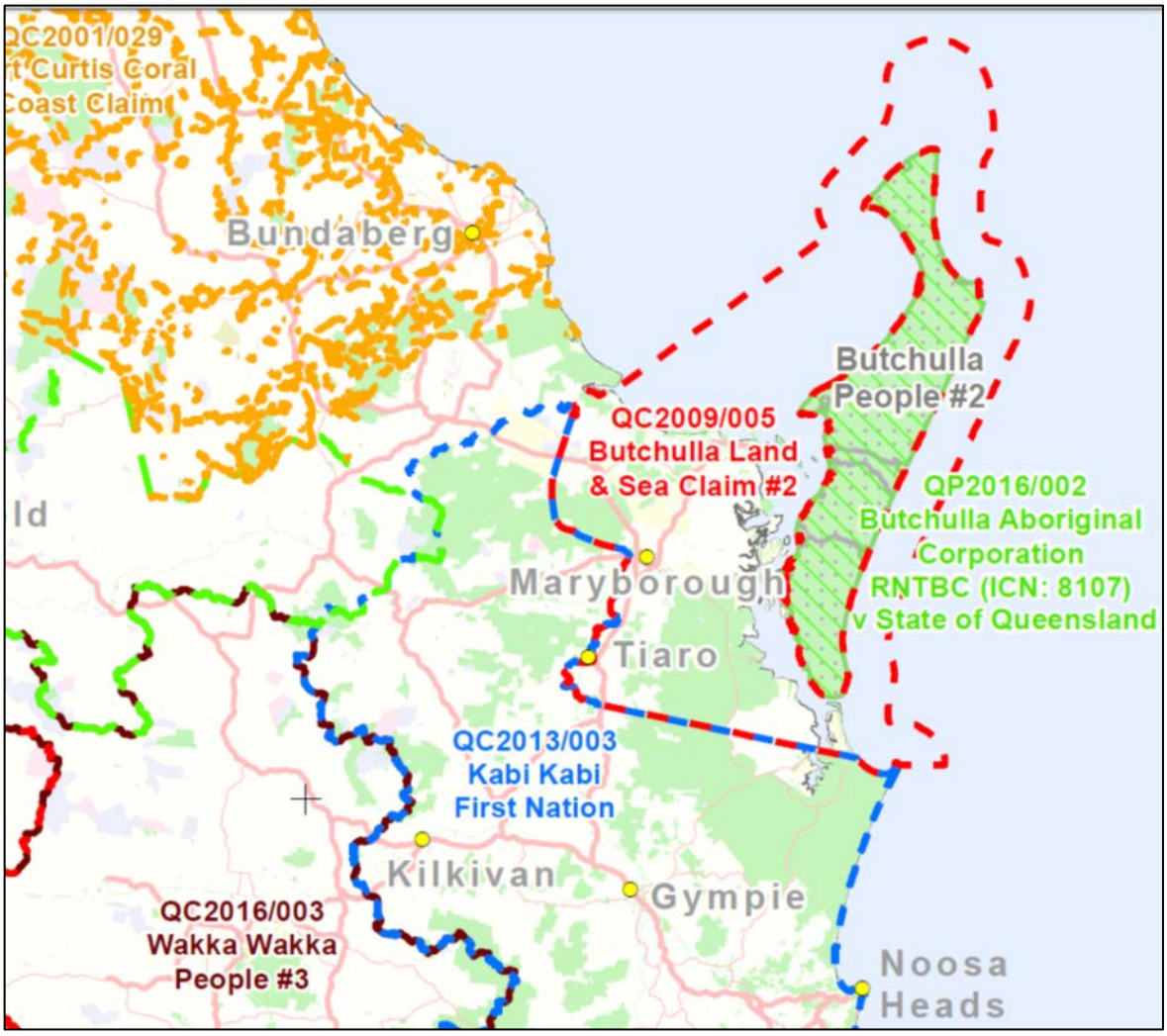
The *Native Title Act 1993* (Cth) (NT Act) would generally operate to extinguish native title over freehold land and roads where the works are proposed. The balance of the works area will require Native Title Notification.

There is one Native Title claim affecting the works areas. The NNTT map "Southern and Western Queensland Native Title Determinations and Application Areas (as per the Federal Court - 30 September 2017)" extract below shows all the works are within the boundary of the claim - QC2009/005 Butchulla Land & Sea Claim #2 (Fed Crt No QUD288/2009). The contact details for this claim are:

Queensland South Native Title Services
PO Box 10832 Adelaide Street
BRISBANE QLD 4000
Phone: (07) 3224 1200
Free call: 1800 663 693
Fax: (07) 3229 9880

Email: reception@qsnts.com.au

The Claim was filed on 27 November 2009 and entered on the Register on 30 June 2010.



Source NNTT 30 Sept 2017

13.4.4 Telecommunications Act 1997

The *Telecommunications Act 1997* (Telecommunications Act) enables telecommunications service providers to locate carrier services in roads and attach them to existing infrastructure. If the Dial Before You Dig (DBYD) search undertaken as part of the design process identifies any carrier services in the vicinity of

the proposed works, Wide Bay Water will need to consult with and obtain agreement to the location of the pipeline from any relevant service provider.

13.5 STATE LEGISLATION

The following lists in alphabetical order legislation which has a direct impact on the project and may require approvals, consents, notifications or surveys to be undertaken. Great Sandy Region Marine Park is located to the east of the outfall site but does not apply to the outfall, however its objectives will need to be considered when assessing environmental impacts of the outfall.

A search of the Queensland Heritage register did not identify any registration for the sites or in relation to land abutting the sites.

13.5.1 Aboriginal Cultural Heritage Act 2003

A search of the Aboriginal cultural heritage register held by the Department of Aboriginal and Torres Strait Islander Partnerships provided the following information and the detail set out below for the Outfall, Pulgul WWTP and the Irrigation pipeline.

The cultural heritage party for the area is the Butchulla Land & Sea Claim #2, QC2009/005 (Federal Court Ref: QUD288/2009). The contact details for the party are:

Queensland South Native Title Services
PO Box 10832 Adelaide Street
BRISBANE QLD 4000
Phone: (07) 3224 1200
Free call: 1800 663 693
Fax: (07) 3229 9880

Email: reception@qsnts.com.au

The Regional Coordinator for the area is:

Greg Heath
Cultural Heritage Coordinator
Phone: (07) 4938 4100
Mobile: 0427 406 004

Email: Gregory.Heath@datsip.qld.gov.au

All works must be undertaken in accordance with cultural heritage duty of care Section 23 of the *Aboriginal Cultural Heritage Act 2003* (ACH Act) and in accordance with the Aboriginal Cultural Heritage Duty of Care Guidelines under Section 28 of the ACH Act (refer to https://www.datsip.qld.gov.au/people-communities/aboriginal-and-torres-strait-islander-cultural-heritage/the-cultural-heritage-duty-of-care).

Outfall

There is low potential for Aboriginal cultural heritage to remain in the work sites where on constructed urban roads and where it crosses Booral Road (a State-controlled road). Elsewhere the works will be undertaken on largely undeveloped areas where there is potential for aboriginal cultural heritage to be found. None of the works are in locations where there are existing records of cultural heritage.

A cultural heritage search was undertaken, the records show there are no Aboriginal cultural heritage site points or polygons, no cultural heritage body, no cultural heritage management plans (CHMP), no Designated Landscape Areas (DLA) and no Registered Study Cultural Heritage Areas (RSCHA) recorded in the project area.

Pulgul WWTP

There is low potential for Aboriginal cultural heritage to remain in the WWTP site due to past works. None of the works are in locations where there are existing records of cultural heritage.

A cultural heritage search was undertaken, the records show there are no Aboriginal cultural heritage site points or polygons, no cultural heritage body, CHMP, no DLA and no RSCHA recorded in the project area.

Irrigation Pipeline

There is moderate potential for Aboriginal cultural heritage to remain along the proposed Irrigation Pipeline route due to limited past works. None of the works are in locations where there are existing records of cultural heritage.

A cultural heritage search was undertaken, the records show there are no Aboriginal cultural heritage site points or polygons, no cultural heritage body, no CHMP, no DLA and no RSCHA recorded in the project area.

13.5.2 Biosecurity Act 2014

Everyone is obligated to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation under Section 23 of the *Biosecurity Act 2014* (Biosecurity Act).

Restricted invasive plants are established in Queensland and seriously threaten Queensland's primary industries, natural environment, livestock, human health and people's livelihoods. The following Restricted invasive plants have been recorded in Wildlife Online in the Irrigation Pipeline area:

- Fireweed (Senecio madagascariensis) Category 3
- Olive Hymenachne (Hymenachme amplexicaulis) Category 3.

No Prohibited or Other invasive plants have been recorded in Wildlife Online in the Outfall, Pulgul WWTP or Irrigation Pipeline areas.

The Construction Environmental Management Plan and the Operational Environmental Management Plan will need to contain a Weed Management Plan that addresses management of these and any other weed species that are found at the sites.

13.5.3 Coastal Protection and Management Act 1995

Outfall

The outfall will require a development approval for Prescribed Tidal Works and comply with the requirements of the Coastal Protection and Management Regulation 2017 (CPM Regulation), Part 4 and Schedule 3. FCRC is the assessment manager for prescribed tidal works applications and assessment is against the 'Code for assessable development that is prescribed tidal works' in Schedule 3 of the CPM Regulation.

13.5.4 Electricity Act 1994

All Sites

As the works will pass under electricity lines at various locations, a safety notice will need to be submitted to Energy Queensland (Ergon Energy) by the construction contractor at least two weeks prior to works being undertaken.

13.5.5 Environmental Offsets Act 2014

This Act provide for environmental offsets to counterbalance significant residual impacts of particular activities on particular matters of national, State or local environmental significance and to establish a framework in relation to environmental offsets.

The Outfall and Irrigation Pipeline corridors contain native vegetation. Some of these trees will need to be cleared for the construction of the proposed works. The clearing may generate a requirement for environmental offsets under this Act.

13.5.6 Environmental Protection Act 1994

Outfall

There are no triggers under the EP Act for approvals for the outfall. DES would be a referral agency for the prescribed tidal works application.

Pulgul WWTP

The existing Pulgul WWTP has an environmental authority (EA) for an environmentally relevant activity – 63 Sewage treatment ERA 63(1)(a) Threshold 1(e) as it comprises operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 10,000 equivalent person (EP) but not more than 50,000 EP. The upgrade of the Pulgul WWTP will increase the design capacity from 24,000 EP to 48,000 EP. This is within the current ERA Threshold limits. Therefore no material change of use for an ERA is required.

However, if there is a need to amend the conditions or discharge limits under the EA to cater for the changed nature of the discharge to the outfall or to irrigation, an application to amend the EA under Chapter 5 Part 7 of the EP Act will be needed to seek approval to the new discharge limits.

Also, under Chapter 7 Part 3 of the EP Act, a transitional environmental program may be required to cover potential licence exceedances during the construction and commissioning of the upgrade and transitioning from operating under the existing plant to operating under the upgraded plant.

These approvals require supporting reports to address matters relevant to the applications specified in the EP Act and Regulation.

A review of chemical storage will be required once the design of the upgrade is complete to determine if an application is needed for a Material Change of Use for ERA 8 Chemical Storage. This applies if the use will involve:

- storing a total of 50 t or more of chemicals of dangerous goods class 1 or class 2, division 2.3
- storing 50 t or more of chemicals of dangerous goods class 6, division 6.1
- storing more than 500 m^3 of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3
- storing the following quantities of other chemicals in containers of at least 10 m^3:
  - 200 t or more, if they are solids or gases
  - 200 m^3 or more, if they are liquids.

Irrigation Pipeline

The works do not trigger any requirement for approvals or authorities under the EP Act. However, the works must be undertaken in compliance with the general environmental duty of care under Section 319 of the EP Act.

13.5.7 Land Act 1994

WBW will need to obtain a public utility easement over its proposed works in each lot that is a reserve. This will require an agreement between WBW and the trustees of the reserve to the easement. WBW will then need to seek DNRME approval to the location of the works and the dimensions of the easement.

WBW will need to obtain a lease from DNRME over any area occupied by the outfall below high water mark.

No easements are granted over the crossing of a road or a watercourse. This applies to the works in roads and the parts of Charlton Esplanade that are not included in a lot and to the Pulgul Creek crossing.

An “about plan” will need to be provided as a basis for the agreement over the easement and to identify the area of the proposed lease.

13.5.8 Land Title Act 1994

WBW will need to obtain a public utility easement over its proposed works in each lot that is freehold land. This will require an agreement between WBW and the landowner to the location of the works and the dimensions of the easement. An “about plan” will need to be provided as a basis for the agreement.

13.5.9 Local Government Act 2009

Under Section 29 of the *Local Government Act 2009* (LG Act) a local government may make local laws that are necessary or convenient for the good rule and local government of its local government area. Under Section 60 of the LG Act, a local government has control of all roads in its local government area and may make a local law to regulate the use of roads.

In accordance with those provisions, FCRC has made:

- Local Law No. 1 (Administration) 2011 (LL1)
- Subordinate Local Law No. 1 (Administration) 2011 (SLL1)
- Local Law No. 4 (Local Government Controlled Areas, Facilities and Roads) 2011 (LL4).

These local laws require applications for approval to undertake works on Council controlled lands and roads. These requirements are discussed in more detail in Section 11.7.2 of this report.

13.5.10 Nature Conservation Act 1992

DES publishes a protected plants flora survey trigger map that identifies high risk areas due to the likely presence of endangered, vulnerable, or near threatened species (EVNT species). The Outfall south of Hood Street and the Pulgul WWTP are in the High Risk area on the Protected Plants Flora Survey Trigger Map. In these areas a flora survey will be required to be undertaken in accordance with a DES flora survey guideline under the NC Act framework.

Wildlife Online Search

A search was undertaken of the Queensland Wildlife Online database provided by DSITI (now DES). The following table indicates where species that are listed above common or least concern status have been recorded within a 1 km buffer around each of the sites.

Table 13.2 Flora and fauna of State significance

Scientific Name	Common Name	Conservation Status	Location
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	Q-E, A-E	Outfall
Hydroprogne caspia	Caspian tern	Q-SL	Outfall
Numenius madagascariensis	Eastern curlew	Q-E, A-CE	Outfall
Numenius phaeopus	Whimbrel	Q-SL	Outfall
Pandion cristatus	Eastern osprey	Q-SL	Outfall, WWTP
Sula Leucogaster	Brown booby	Q-SL	Outfall, WWTP
Thalasseus bergii	Crested tern	Q-SL	Outfall, WWTP
Megaptera novaeangliae	Humpback whale	Q-V, A-V	Outfall

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

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

The flora and fauna survey should be undertaken during the detailed design phase to identify any species protected under the EPBC Act or the NC Act or habitat for those species.

13.5.11 Planning Act 2016

The *Planning Act 2016* sets the ongoing legislative framework for land use planning and development assessment. Generally, it does not make significant changes to the existing array of approvals required under the former *Sustainable Planning Act 2009* that WBW has to obtain, but there are more specific assessment benchmarks (the matters an assessment manager must assess development against).

Under this Act:

- SPP 2017 identifies matters of State interest which are then reflected in planning schemes prepared by local governments, the SPP 2017 includes new State interests and State Development Assessment Provisions (SDAP) that apply to development where a planning scheme has not yet reflected the State interests
- regional plans set out integrated planning and development assessment policies about matters of State interest for particular regions of the State
- planning schemes set out integrated State, regional and local planning and development assessment policies for all of a local government area
- planning scheme policies set out policies, for all or part of a local government area, that support planning and development assessment policies and local government planning actions,

- a development assessment system, including the State Assessment Referral Agency (SARA) and DAMS, for implementing planning instruments and other policies and requirements about development by—

  (i) categorising development; and

  (ii) categorising types of assessment for particular development; and

  (iii) stating the processes for making, receiving, assessing and deciding development applications

- the Planning Regulation 2017 (Planning Regulation) identifies triggers for approvals not covered by the SDAP that are required to protect State interests and identifies prohibited development.

Under the Planning Regulation, Schedule 6. Part 3, Section 8 operational work carried out by a public sector entity (such as WBW or FCRC) is made development that a local categorising instrument (including a planning scheme) cannot make assessable development.

Under the Planning Regulation, Schedule 7, Part 1, Section 2, building work by a public sector entity is made accepted development, provided the works comply with the relevant provisions - refer to Building Act Section 21(5) for the relevant provisions. Otherwise the building work is subject to the assessment provisions of the FCPS.

The DAMS includes SARA DA Mapping, Non-SARA DA Mapping, SPP 2017 related SPP Assessment Benchmark Mapping (SPP Mapping) and mapping of Other State Planning Matters (OSPM mapping).

Coastal Protection

This is managed through the FCPS provisions that will be taken into account where appropriate. A prescribed tidal works application will be required for the outfall where it crosses Pulgul Creek and for the outfall section east of high water mark off Charlton Esplanade.

Outfall

The majority of the Outfall is in the Coastal management district and the Coastal area - high storm tide inundation area and - erosion prone area.

Pulgul WWTP

The majority of the site is not within the mapped Coastal Protection area. There are small areas of Coastal area - high and medium storm tide inundation area.

Irrigation Pipeline

Much of the land to the east of the pipeline is within the Coastal Management District.

The irrigation pipeline will be within the Coastal area – high and - medium storm tide inundation area and - erosion prone area at the bend in Vanderwolf Road at the south east corner of Lot 6 on RP218676, and between Lot 1 on RP225325 on the west and Lots 1 and 2 on RP42275 to the east. Most of the lots south and east of the pipeline are partly or mainly within these areas.

Fish Habitat Areas and Tidal waterways

Outfall

Parts of the Outfall are in Tidal waterways. The works in tidal areas are tidal works in a coastal management district that require assessment under the Planning Regulation Schedule 10 Part 17. Trimming, pruning, burning, removing or damaging of marine plants for any purpose and on any tenure and marine plants

including mangroves, seagrass, saltmarsh and marine algae will require a development approval for marine plant disturbance under the Planning Regulation Schedule 10 Part 6 Division 3. The application for these works would be submitted in association with the prescribed tidal works application.

Irrigation Pipeline

Susan River to the south and Bunya Creek to the east are Fish Habitat – Management area A and some of the lands to the east and south of the pipeline corridor around these waterways are tidal waterways. However no approvals are needed.

Native Vegetation Clearing

There is clearing proposed as set out below, which is assessable development and will require a development approval under the Planning Regulation Schedule 10 Part 3. Clearing in tidal areas and salt flats will be considered as part of the applications for prescribed tidal works and for a permit for disturbance of marine plants.

Outfall

Clearing is required in Lot 26 on plan MCH835653 which contains a mix of least concern and of concern regional ecosystems. This clearing is assessable development. Clearing will occur across the non-tidal and tidal extents of Pulgul Creek that is shown as a waterway on the Digital Cadastral Data Base (DCDB). Clearing in the tidal area will be prescribed tidal works and disturbance of marine plants, and outside that area the clearing is assessable development. Clearing will occur adjacent to Boat Harbour Drive in a reserve, along the unconstructed section of Charlton Esplanade, within roads between the Pulgul WWTP and Pulgul Street. This clearing is assessable development.

Pulgul WWTP

No clearing is required.

Irrigation Pipeline

Clearing is required in an area of Vanderwolf Road between Lot 70 on Plan MCH601 and Lots 1 and 2 on RP807790 as there is a regional ecosystem shown extending from Lot 70 across the road. This clearing is assessable development, unless a survey can show the works will take place in an already cleared area.

The DAMS SPP Mapping shows the works are in a 'Bushfire hazard area – bushfire prone area – High' and 'Medium Potential Bushfire Intensity' and in the 'Bushfire hazard area – bushfire prone area – Potential Impact Buffer'.

SPP 2017 provides the following performance outcomes as assessment benchmarks for natural hazards, risk and resilience where there is no development application assessed against SPP 2017 Assessment Benchmarks.

- Development avoids natural hazard areas, or where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.
- Development supports and does not hinder disaster management response or recovery capacity and capabilities.
- Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties.
- Risks to public safety and the environment from the location of hazardous materials and the release of these materials as a result of a natural hazard are avoided.

- The natural processes and the protective function of landforms and the vegetation that can mitigate risks associated with the natural hazard are maintained or enhanced.

The contractor undertaking the proposed works will need to take into account the bushfire risk and manage construction works accordingly as part of their construction environmental management plan.

13.5.12 Transport Infrastructure Act 1994 (TI Act)

Under Section 33 of the TI Act, approval is required to undertake works on, or interfere with, a State-controlled road. This would apply if the Outfall is trenched across Booral Road (SCR 1632).

Under Section 50 of the TI Act, approval is required to install ancillary works and encroachments in, on, above or under a State-controlled road. This would apply if the Outfall is drilled under Booral Road.

13.5.13 Transport Operations (Road Use Management) Act 1995

Under Section 96 of the *Transport Operations (Road Use Management) Act 1995* (TORUM Act), a traffic permit is required from the Queensland Police Service (QPS) for any road or lane closure during the construction of the pipeline. This permit will be required if the work is constructed by open trenching in any constructed road (including gravel tracks) or if a temporary lane closure is required (including for a parking lane). The permit is obtained by the construction contractor once the construction methodology is determined.

The application for any traffic permit will need to be accompanied by a traffic management plan prepared by the construction contractor.

13.5.14 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) provides for the chief executive to publish regulated vegetation management maps that show where approval may be needed to clear vegetation and provides supporting maps that identify the areas and classes of remnant vegetation and a protected plants flora survey trigger map that identifies where detailed flora surveys are needed due to the likely presence of EVNT species.

Native vegetation can only be cleared under the Planning Act if an applicant satisfies the chief executive that the clearing is for a relevant purpose under Section 22A of the VM Act. Otherwise, the development is prohibited and an application cannot be made for the clearing work, and would be unlawful if carried out.

Clearing of remnant vegetation for the Outfall and the Irrigation Pipeline will need this application.

13.5.15 Water Supply (Safety and Reliability) Act 2008

The *Water Supply (Safety and Reliability) Act 2008* (WSSR Act) gives WBW the power to undertake works for the collection, treatment and supply of water. WBW is already a registered service provider and have a recycled water scheme registered. The registration of the recycled water supply scheme will need to be amended under Section 196AD of the Act to provide for the extension of the Pulgul Irrigation System and the new Irrigation Pipeline.

13.6 LOCAL GOVERNMENT

13.6.1 Fraser Coast Planning Scheme

Outfall and Irrigation Pipeline

The Outfall and Irrigation Pipeline comprise operational works that cannot be made assessable under a local planning instrument under the Planning Regulation Schedule 6 Part 3 Section 8.

Pulgul WWTP

The Pulgul WWTP is within the Community Facilities 2 Zone (2 Government Purposes and Public Utilities). A material change of use is applicable as the upgrade is not a local utility for the conveyance of sewage and there is an increase in the scale and intensity of operations and the work involves an increase in footprint of buildings and works. The application is code assessable against the following codes:

- Utility code
- Applicable Local plan code (if relevant)
- Community facilities zone code
- Landscaping code
- Transport and parking code
- Works, services and infrastructure code.

The following Overlays and codes are applicable to the assessment:

- Acid sulfate soils overlay - Acid sulfate soils overlay code
- Biodiversity areas, waterways and wetlands overlay - Biodiversity areas, waterways and wetlands overlay code
- Coastal protection overlay - Coastal protection overlay code.

13.6.2 Local Laws

FCRC Local Law No. 1 (Administration) 2011 (LL1) provides a legal and procedural framework for the administration, implementation and enforcement of the local government's local laws, subordinate local laws and specified regulatory powers under legislation. This purpose is achieved by providing for the granting of approvals for prescribed activities and specifying general criteria that Council must address in granting an approval. FCRC Subordinate Local Law No. 1 (Administration) 2011 (SLL1) supplements LL1 by providing additional criteria and standard conditions of approval for specific activities. The prescribed activities include:

- alteration or improvement to local government controlled areas and roads
- undertaking regulated activities on local government controlled areas and roads

The above prescribed activities are defined in FCRC LL1 as follows:

> **alteration or improvement to local government controlled areas and roads** means—
> 1 *Alteration or improvement to local government controlled areas and roads* means—
>
> (a) installing, changing, damaging or removing a structure in a local government controlled area or on a road; or
>
> (b) planting, clearing or damaging of vegetation in a local government controlled area or on a road.

2 *Alteration or improvement to local government controlled areas and roads* does not include an alteration or improvement—

(a) that constitutes development under the Planning Act; or

(b) for which a tree clearing permit is required under the VM Act; or

(c) that involves a network connection; or

(d) for which written approval of the local government is required under Section 75 of the LG Act.

Undertaking regulated activities on local government controlled areas and roads means undertaking one of the following activities on a local government controlled area or road—

(a) driving or leading of animals to cross a road; or

(b) depositing of goods or materials; or

(c) undertaking a public place activity prescribed under a subordinate local law for this paragraph, excluding the operation of a temporary entertainment event.

Example for paragraph (c)—

A subordinate local law may prescribe that a display or information booth in a public park or on a footpath is a regulated activity.

FCRC SLL1 contains the following schedules that specify additional requirements for applications, additional criteria and additional conditions:

- Schedule 5 Alteration or improvement to local government controlled areas and roads
- Schedule 21 Undertaking regulated activities on local government controlled areas and roads—(b) depositing of goods or materials
- Schedule 22 Undertaking regulated activities on local government controlled areas and roads—(c)undertaking of a public place activity prescribed by subordinate local law
- Schedule 26 Carrying out works in a road or interfering with a road or its operation.

These local laws will apply to the parts of the works within the roads and road crossings for the Outfall and the Irrigation pipeline. It will also apply to the part of the works in reserves. Therefore, a local law approval from FCRC will be required for those works. These would normally be obtained by the construction contractor once the construction methodology is finalised. The applications for the approvals for works on roads will need to be accompanied by a traffic management plan prepared by the construction contractor.

FCRC Local Law No. 4 (Local Government Controlled Areas, Facilities and Roads) 2011 (LL4) provides for the regulation of access to local government controlled areas and restrictions on activities on roads. It particularly provides for separate approvals for bringing motor vehicles onto local government controlled areas that are not vehicle access areas (a car park or roadway for which there is no sign or traffic control device indicating that vehicles owned by members of the public are excluded).

13.7 APPROVALS SUMMARY

A summary of the approvals required for the project is shown in Table 13.3. A conservative approach is taken in determining the need for approvals. This summary will need to be reviewed and amended as necessary to reflect the detailed design and actual location of the works.

Development of the works will require a Construction Environmental Management Plan (CEMP). This CEMP will need to incorporate provisions to ensure compliance with all approvals, compliance with the duty of care under the ACH Act, the general environmental duty under the EP Act and the general biosecurity obligation under the Biosecurity Act. Where vegetation clearing is proposed a fauna spotter catcher with a damage mitigation permit is to be engaged to ensure native fauna is not harmed, An arborist should also

be retained to ensure compliance with standards for tree clearing and protection of vegetation not to be cleared. The CEMP will need subsidiary plans for weed management, erosion and sediment control and traffic management.

Operation of the works will need an amended Operations Environmental Management Plan for the Pulgul WWTP and Outfall and for the recycled water scheme including the Irrigation Pipeline.

Table 13.3 Approvals Summary

Approval	Legislation	Applicant/ Assessment Manager	Referral Agency	Process Time (Preparation/ Assessment) (Wks)
Outfall				
Significant Impact Assessment and Referral for a controlled activity (1)	EPBC Act (Cth)	Proponent/DEE	N/A	2/5
Native Title Notification	NT Act (Cth)	Proponent	N/A	2/15
Permit under s30 or s50 of the TI Act (2) (6)	TI Act	Proponent/DTMR	N/A	2/4
Acceptance by Telecommunications Carriers	Telecommunications Act (Cth)	Proponent	N/A	2/4
Prescribed Tidal Works	CPM Act (See Planning Act)	Proponent/Local Government	SARA (DES)	
Safety Notice	Electricity Act	Constructor	Energy Queensland (Ergon Energy)	1/2
Environmental Offsets if required as a condition of clearing	EO Act	Proponent/DES	N/A	4/4
Agreement to Public Utility Easement	Land Act	Proponent/DNRME/ Trustee	N/A	4/13
Agreement to Public Utility Easement	LT Act	Proponent/Landowner	N/A	4/13
Protected Plants Clearing Permit or Protected Plants Exemption Notice (3)	NC Act	Proponent/DES	N/A	4/5 (5)
Taking or interfering with Marine Plants, (4)	Planning Act	Proponent/FCRC	SARA (DES, DAF, DNRME)	10/20 (5)
Clearing Native Vegetation (3)	Planning Act	Proponent/SARA	DNRME, DES	6/20
Permit under s30 or s50 of the TI Act (2) (6)	TI Act	Proponent/DTMR	N/A	2/4
Traffic Permit (6)	TORUM Act	Contractor/QPS	N/A	2/2
Certification that clearing is for a relevant purpose	VM Act	Proponent/CE for NC Act	N/A	2/2
Works in a local road (7)	LG Act, LL1	Constructor	N/A	2/2
Works on Council controlled land	LG Act, LL1	Constructor	N/A	2/2
Depositing material on Council controlled land	LG Act, LL1	Constructor	N/A	2/2
Use of a vehicle on Council controlled land	LG Act LL4	Constructor	N/A	2/2

Pulgul WWTP				
Application to amend EA	EP Act	Proponent/DES	N/A	4/10
Transitional Environmental Program	EP Act	Proponent/DES	N/A	4/8
Development Approval for an MCU for the upgrade of the WWTP	Planning Act, FCPS	Proponent/FCRC	SARA (DES, DNRME, DTMR) Hervey Bay Airport Manager, CASA	8/26
Development Approval for an MCU for ERA 8 Chemical Storage	Planning Act	Proponent/FCRC	SARA (DES)	8/26
Safety Notice	Electricity Act	Constructor	Energy Queensland (Ergon Energy)	1/2
Irrigation Pipeline				
Native Title Notification	NT Act (Cth)	Proponent	N/A	2/15
Acceptance by Telecommunications Carriers	Telecommunications Act (Cth)	Proponent	N/A	2/4
Safety Notice	Electricity Act	Constructor	Energy Queensland (Ergon Energy)	1/2
Environmental Offsets if required as a condition of clearing	EO Act	Proponent/DES	N/A	4/8
Protected Plants Clearing Permit or Protected Plants Exemption Notice (3)	NC Act	Proponent/DES	N/A	4/5 (5)
Clearing Native Vegetation (3)	Planning Act	Proponent/SARA	DNRME, DES	6/20
Traffic Permit (6)	TORUM Act	Contractor/QPS	N/A	2/2
Certification that clearing is for a relevant purpose	VM Act	Proponent/CE for NC Act	N/A	2/2
Works in a local road (7)	LG Act, LL1	Constructor	N/A	2/2
Depositing material on Council controlled land or road	LG Act, LL1	Constructor	N/A	2/2
Amend registration of recycled water scheme	WSSR Act	Proponent/DNRME	N/A	Not stated

Notes

1 If the Significant Impact Assessment identifies a potential significant impact, a referral for a controlled action is needed. If the decision on the referral is that the action is a controlled action, an application supported by specified documentation – possibly a Public Environment Report (PER) or Environmental Impact Statement (EIS) is required under the EPBC Act. The application could be assessed by the Queensland Government under a bilateral arrangement. The final decision is issued by the Federal Minister for the Environment.

2 If the Outfall is to be trenched across Booral Road a permit is required under s33 of the TI Act. DTMR may not agree to this and require the pipe to be drilled/jacked under the road. In that case a permit under s50 for ancillary works and encroachment is required.

3 Parts of the Outfall and the Pulgul WWTP are within a high risk area on the Protected Plants Flora Survey Trigger Map. Within this area if any clearing of native vegetation in the wild is proposed, a flora survey is required to be undertaken in accordance with a DEHP flora survey guideline. If protected plants (EVNT species) are found within 100m of the area to be cleared, a Protected Plants Clearing Permit is required. If no protected plants are found, a protected Plants Exemption Notice has to be submitted. Outside the high risk area this permit is only required if EVNT species are found in relation to clearing under the VM Act.

The wetlands in the Pulgul WWTP site are identified as Essential Habitat for the Wallum froglet (*Crinia tinnula*). As a result the ecological survey needs to determine if works are likely to impact on the habitat of this species.

4 A benthic habitat survey will be needed to determine the species and extent of marine plants including saltmarsh species in intertidal areas that will be affected by the works.

5 The time to prepare these applications includes the time to undertake and report on the ecological survey and the benthic habitat survey.

6 An application for a permit under s33 of the TI Act or under s96 of the TORUM Act has to be supported by s traffic management plan approved by FCRC.

7 A local law application for works in a road has to be accompanied by a traffic management plan.

14 Preliminary program

A preliminary project program has been prepared and is included in Appendix G. This program (represented as a Gantt chart) presents the timing and duration of key items associated with the design and construction of the new Pulgul Outfall, Pulgul WWTP upgrade and the new irrigation pipeline from Vanderwolf.

The concept design for both the outfall and plant upgrade are shown to start and finish at the same time, over an approximately 12 month period. This approach will aim to ensure cohesion in design and will assist in streamlining the environmental approvals process. Detailed design of the outfall is shown to occur after the environmental approvals step. It is anticipated that the acquisition of these approvals (in particular the commonwealth approvals) may take considerable time (when compared with the approvals for the plant upgrade). As a result, there is a delay in the commencement of the detailed design for the outfall when compared to the commencement of the detailed design for the plant upgrade. Construction of the new outfall and plant is shown to finish at around the same time.

Design and construction of the new irrigation pipeline is shown to run independently of the outfall and plant upgrade items. It is acknowledged that as the new outfall will provide flexibility for the reuse scheme as such, the new irrigation pipeline may not need to be built within the time period shown in the program. But instead would be undertaken once it can be determined that this item will be of net benefit to FCRC, the community and the environment.

It is intended that the concept design package will consist of the concept designs for the outfall and treatment plant upgrade. The concept design package will also include a separable portion for the detailed design of the treatment plant upgrade. This is done in the acknowledgement that the party engaged to carry out the concept design of the treatment plant upgrade will have specific knowledge of the design, which is regarded as a benefit as this knowledge can be transferred from one phase to the next. It should be noted that:

- a variation may be required to the separable portion for the detailed design should the concept design change from what was tendered
- FCRC would reserve the right to cancel the contract for the second separable portion for any reason.

Also included in Appendix G is an approvals schedule. This schedule is an illustration of the information presented in the approvals summary table (Table 13.3). This schedule treats each of the elements (Outfall, WWTP upgrade and Irrigation) separately. The approvals for these items can proceed independently of each other, however, if the new outfall was considered a controlled action under the EPBC Act, the Commonwealth Government could request that the referral consider both the outfall and the plant upgrade and possibly the irrigation pipeline as being elements of the project.

15 Conclusion

The site selection study documented in this report provides a summary of the targeted assessments undertaken to identify a preferred site for augmentation to cater for the planned increase in network growth. The study involved analysis and development of options to treat effluent generated within the Hervey Bay catchment, and options to manage the treated effluent.

The two sites identified as being potentially suitable for treatment process upgrade were Nikenbah and Pulgul. Factors considered in identification of treatment process upgrade options included feasible and flexible technologies which could be implemented and operated for a reasonable cost. Effluent management options considered were irrigation (effluent reuse) and outfall (effluent disposal). Several detailed assessments were undertaken to assess the practicalities associated with these two approaches, including an effluent reuse and irrigation field sustainability assessment and an outfall assessment of effluent discharges. Summary results from these assessments are included in this report.

To identify a preferred site for capacity increase (and the approach to effluent management with selection of this site), a multiple criteria assessment (MCA) process was used in a workshop setting with key Wide Bay Water personnel. The MCA process involved assessment of six combinations of wastewater treatment and effluent management options as outlined below:

1. Nikenbah WWTP Trickling Filter Upgrade with expanded irrigation
2. Nikenbah WWTP Duplication with expanded irrigation
3. Pulgul WWTP External Nitrification Upgrade with outfall and expanded irrigation
4. Pulgul WWTP External Nitrification Upgrade with outfall
5. Pulgul WWTP Membranes Upgrade with outfall and expanded irrigation
6. Pulgul WWTP Membranes Upgrade with outfall.

A scoring system embedded in the MCA process was used to rank the preferred option against five key evaluation criteria (technical risk, asset resilience and longevity, environment, community/social and safety), with weightings determined based on internal stakeholder criteria. The MCA process identified Pulgul as the preferred site for plant augmentation, with a combination of outfall and expanded irrigation as the options to manage treated effluent.

The treatment process chosen for Pulgul was an augmentation of the current IDEA lagoon into a MBR process. This uses the current lagoon as a bioreactor, while adding two new tanks. One tank as an aerobic zone, and another tank for the membrane cassettes. Additionally the solids handling process will be converted from an aerobic digester to an anaerobic digester to reduce operational costs.

The effluent management option chosen involves the construction of a new treated water discharge adjacent to the Urangan Boat Harbour. It also makes provision for expansion of the reuse scheme when appropriate opportunities arise.

16 References

Kellogg, Brown & Root (KBR) 2017a. Additional modelling of confidence levels BEG656-TD-EV-TCN-0001.

Kellogg, Brown & Root (KBR) 2018a. Wide Bay Water Site Selection Study for Major WWTP Expansion Effluent reuse and discharge assessment. BEG656-TD-EV-REP-0001 Rev. 0.

Kellogg, Brown & Root (KBR) 2018b. Wide Bay Water Site Selection Study for Major WWTP Expansion Stakeholder Engagement Strategy BEG656-TD-OT-PLN-0001 Rev. 0.

Wide Bay Water (2015). 2015 Fraser Coast Sewerage Strategy, November 2015.

Water Technology (2017). Final Report, Pulgul Sewage Treatment Plant - Discharge at Marine Option Assessment - Hydrodynamic Assimilative Capacity Assessment. Wide Bay Water and Waste Services. September 2017, version V02. Document number 5167-01_Pulgul_WWTP_Modelling_R01VO2.docx

Appendix A

Wind Rose

We Deliver

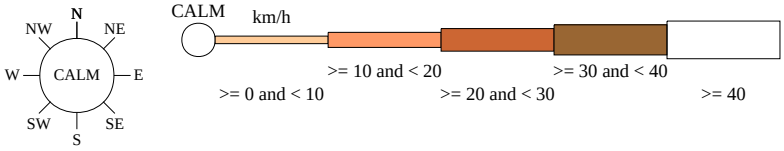
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 05 Apr 2016)

Custom times selected, refer to attached note for details

MARYBOROUGH

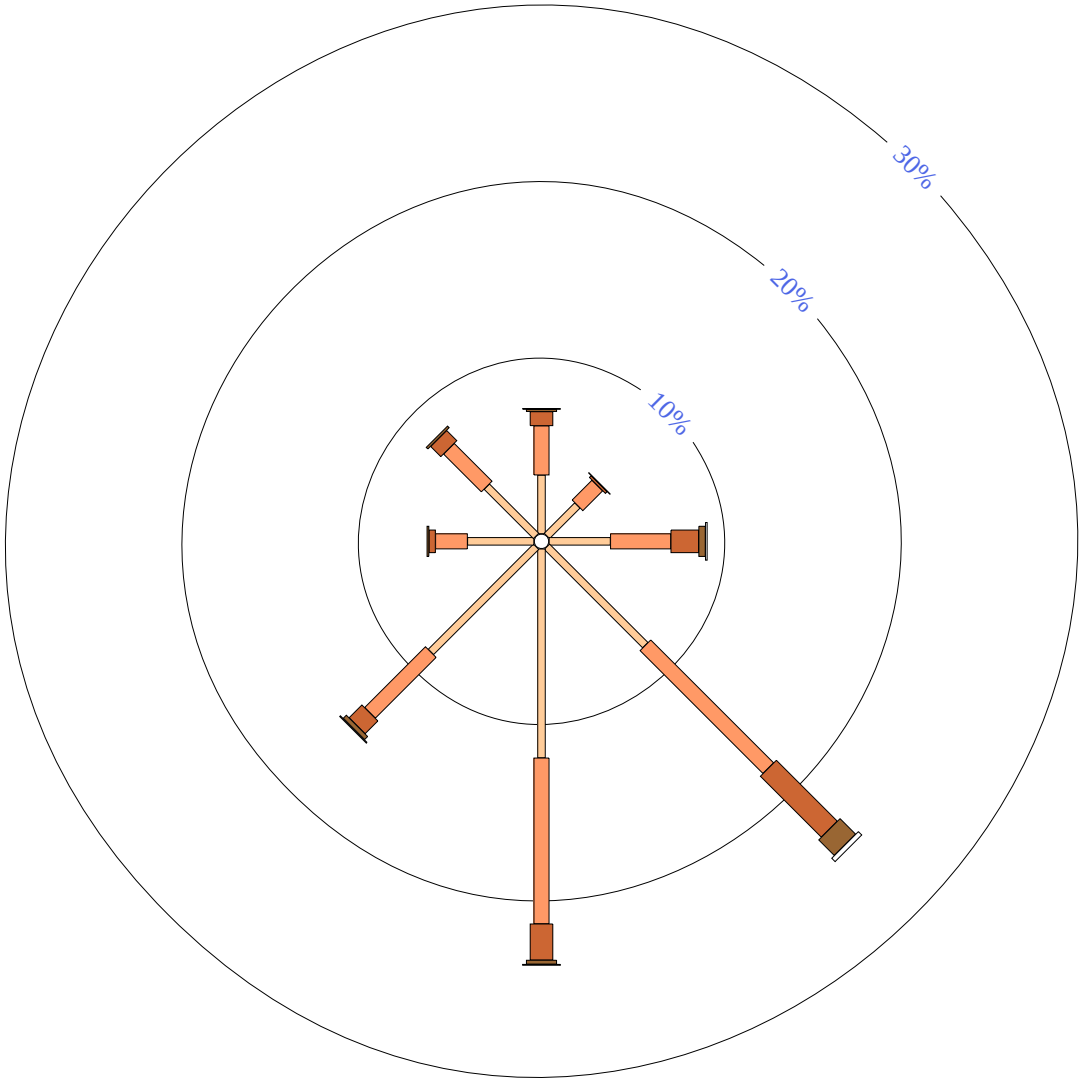
Site No: 040126 • Opened Jan 1870 • Still Open • Latitude: -25.5132° • Longitude: 152.7152° • Elevation 8.98m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
21522 Total Observations

Calm 2%



Appendix B

Biosolids Management Report

We Deliver

Environmental Management System

MANUAL

Biosolids Environmental Management Plan

Document Number	2847527	V1
Document Owner/Authoriser	Environmental Services Manager	
Date of Approval/Last Review	18/11/2014	
Date due for Review	18/11/2016	

REVISIONS TO PREVIOUS VERSIONS	
Section	**Details of Changes**
6.4.3 Environmental Monitoring and Table 4	Removal of Table 4 and addition of hyperlink to the Biosolids Analysis Procedure to avoid duplicating the monitoring matrix.

CONTENTS

Note: Words that are in bold and italics are specific terms that have formal definitions.

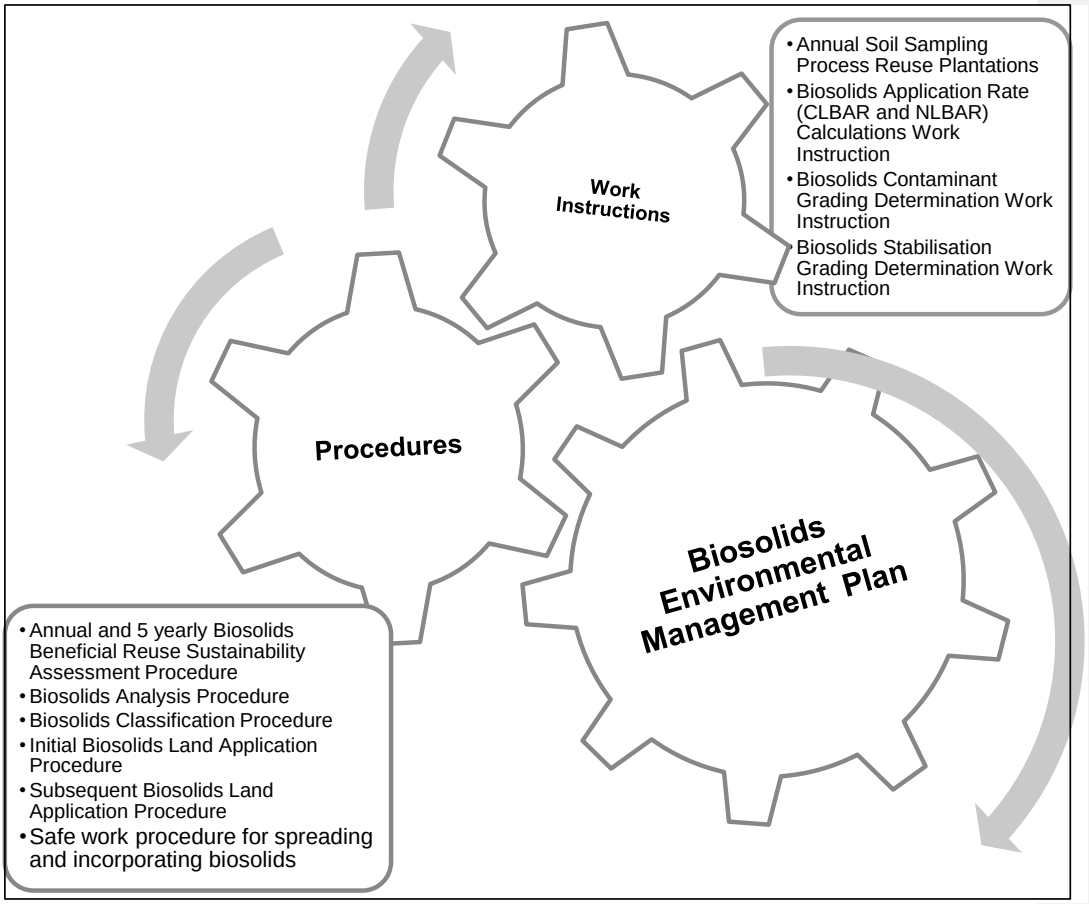
1 Introduction

Wide Bay Water Corporation (WBWC) owns and operates eight (8) wastewater treatment plants (WWTPs). The WWTP process generates significant quantities of biosolids (digested sewage sludge) which can be sustainability and beneficially reused locally, for nutrient and carbon enhancement of soils.

WBWC is committed to achieving 100% beneficial reuse of its biosolids, utilising WBWC's own resources, as authorised under the *Approval of a Resource for a Beneficial Use* (*Beneficial Reuse Approval*) issued by the Department of Environment and Heritage Protection (EHP) (permit number ENBU04970013). It is to be noted that the Approval is valid until 9 August 2018 and must be reapplied for prior to this date.

This Biosolids Environmental Management Plan describes WBWC's biosolids management practices, including reference to procedures and work instructions to achieve and maintain 100% beneficial and sustainable biosolids reuse which meet the *Beneficial Reuse Approval* requirements (**Figure 1**).

Figure 1: Biosolids Management Documents



Note: Words that are in bold and italics are specific terms that have formal definitions.

2 Purpose

The use of biosolids for nutrient and carbon enhancement of soils may create environmental hazards including land contamination, odour and contaminant runoff if not appropriately managed. WBWC is fully committed to applying best practice management protocols as defined by EHP and the New South Wales Environmental *Guidelines for Use and Disposal of Biosolids Products*, 2000 (*NSW Biosolids Guidelines*).

This Plan defines WBWC's biosolids management practices to ensure best practice environmental management protocols are met, and specifically to meet the requirements of conditions 7 and 8 of the *Beneficial Use Approval:*

Condition 7 The holder of the approval must develop and implement an Environmental Management Plan (EMP) for the storage, use and handling of the resource so as to prevent environmental harm from occurring, ensure compliance with the conditions of this approval and promote best practice environmental management.

Condition 8 a) identification of environmental hazards and assessment of the environmental risks associated with the storage, use and handling of the resource (including risks for environmental harm and nuisance);

b) set of practices and procedures to ensure that application of the resource only occurs under suitable weather conditions (e.g. not during or prior to rainfall, or during windy periods);

c) measures to be implemented to minimise identified risks (for example a cropping program to reduce potential impacts to groundwater), identify if environmental harm is occurring, corrective actions and contingency plans;

d) monitoring required by the conditions of this approval (including regimes for the monitoring of resource quality);

e) procedures to determine the agronomic loading rate prior to application of the resource to land (refer to condition 20);

f) procedure to determine the pH of the soil on which the resource will be applied (refer to condition 18);

g) procedures to assess, prior to application of the resource to land, whether the resource application rate will cause the limits in Table 2: Maximum allowable soil contaminant concentration following resource application to be exceeded (refer to condition 18);

h) procedures for documentation, record keeping, reporting and communication as required by the conditions of this approval;

i) periodic review of the EMP.

3 Scope

The environmental compliance and sustainability processes relating to treating, dewatering, storing, transporting, reusing and analysing WBWC's biosolids are defined in this Plan.

WBWC produces biosolids at the following Wastewater Treatment Plants (WWTPs):

- Aubinville WWTP,
- Eli Creek WWTP,
- Nikenbah (Eli South) WWTP,
- Pulgul Creek WWTP, and
- Toogoom WWTP.

The Eli Creek WWTP also receives sewage sludge from the Burrum Heads, Howard and Torbanlea WWTPs. This sludge once received at the WWTP is dewatered and stored onsite as biosolids ready for beneficial reuse. A schematic of these processes and responsibilities is contained in **Appendix A.**

4 Roles and Responsibilities

The following roles have defined responsibilities for this Plan and the biosolids management process.

Executive Manager Operations is responsible for:

- ensuring adequate resources to achieve beneficial and sustainable biosolids reuse.

Wastewater Treatment Superintendent is responsible for:

- implementing biosolids treatment, storage and assisting with coordinating transfer processes which provide biosolids fit for beneficial reuse in accordance with responsibilities outlined in **Appendix A**.

Water Reuse Superintendent is responsible for:

- implementing biosolids transfer and reuse processes to achieve beneficial and sustainable biosolids reuse in accordance with responsibilities outlined in **Appendix A**.

Environmental Services Manager is responsible for:

- calculating and communicating biosolids classification and management processes to achieve beneficial and sustainable biosolids reuse in accordance with responsibilities outlined in **Appendix A**.

- maintaining this Plan, and
- providing guidance and reviewing compliance with this Plan.

WBWC Laboratory is responsible for:

- conducting biosolids sampling and coordinating analysis to achieve beneficial and sustainable biosolids reuse in accordance with responsibilities outlined in **Appendix A**.

~~5 Distribution~~

~~The contents of this manual are available via:~~

- ~~WBWC intranet (electronic copy)~~

~~Notification of significant change to the document will be through the same media and be accompanied by a copy of the updated section/document. Once the new or updated document is active on the Document Portal, the document owner/authoriser will distribute to the relevant stakeholders.~~

~~6~~5 Key Information / Critical Process

~~6.1~~5.1 BACKGROUND

WBWC commenced beneficial biosolids reuse on local sugar cane farms in 2002 under an Environmental Protection Act, *Environmental Management Program Approval*. In 2008, when the regulatory approval process changed to require an *Approval of a Resource for Beneficial Use for Biosolids*, WBWC commissioned Arkwood Organic Recycling to apply for and hold this approval on behalf of WBWC. In August 2013, WBWC obtained its own *Approval of a Resource for Beneficial Use for Biosolids* to allow timely and efficient management of its biosolids utilising WBWC's own resources or a competitively chosen approved biosolids contractor.

In 2012/13, WBWC beneficially reused 63% of its biosolids for agricultural purposes to improve soil properties through nutrient and carbon enhancement which equated to approximately 10 tonnes of nitrogen being beneficially reused.

During 2013/14 WBWC committed to achieving 100% beneficial biosolids reuse by:

- Investing significant capital funds at the Aubinville WWTP to cease landfill disposal of biosolids and commission an offsite biosolids storage facility to enable beneficial reuse, and

- Consolidating reuse practices across all of its reuse schemes to enable efficient reuse of biosolids on WBWC owned hardwood tree plantations or local farms to complete the nutrient and carbon cycles for the Fraser Coast community.

By 1 July 2014, WBWC had achieved 100% beneficial reuse of biosolids and commenced implementing further continuous improvement projects to maintain this commitment in an efficient and effective manner.

During the 2015/2016 financial year, biosolids were removed from the Eli Creek, Pulgul Creek and Nikenbah WWTP's twice, in September/October 2015 and March 2016. For the period of Sept – Oct 2015 and March 2016, the total amount of biosolids removed was 2496m^3 and 1776m^3, respectively.

Comment [LG1]: As obtained from Reuse Annual Report. Will need to obtain biosolids data for 2017, if wanting to update the report in 2018.

Appendix B summarises WBWC's current and planned biosolids activities.

~~6.2~~5.2 LEGISLATION AND COMPLIANCE

The leading Queensland statutes for managing environmental aspects of WWTP biosolids activities are the *Environmental Protection Act 1994* and W*aste Reduction and Recycling Act 2011* which aim to achieve environmental sustainability for biosolids processes by:

a) Licensing WWTPs as Environmentally Relevant Activities and issuing relevant compliance conditions including biosolids management conditions, and
b) Approving beneficial biosolids reuse processes and issuing relevant compliance conditions.

To ensure compliance with and assess continual improvement opportunities against these Acts, WBWC undertakes many routine monitoring processes including:

- Annual Environmental Licence/Approval Reviews,
- Annual National Pollution Inventory Reporting,
- Continual laboratory non-compliant sample alert processes,
- Environmental Annual Return,
- Quarterly and annual Strategic Asset Management Plan (SAMP) Reporting, and
- Reuse Annual Reporting.

Any corrective or preventative actions arising from this monitoring are raised, tracked and reviewed in accordance with Corporate procedures. These corrective or preventative actions will also need to take into account the changes occurring at the Pulgul WWTP when the site expansion works are completed.

~~6.3~~5.3 BIOSOLIDS DESCRIPTION

WBWC's *Beneficial Reuse Approval* changes the classification of WBWC's biosolids from a regulated waste to a resource. The resource which this Plan relates is treated sewage sludge (biosolids) from WBWC's WWTPs. Details of each WWTP's biosolids are included in **Appendix B**.

WBWC's biosolids will meet Contamination Grade C (**Table 1**), Stabilisation Grade B (**Table 2**) and ~~are~~ classified as Restricted Use 2, suitable for application to agricultural land under the NSW Biosolids Guidelines.

Table 1: Contaminant Grade Summary

WWTP Biosolids	Contaminant Grade	Limiting Contaminant
Aubinville WWTP	C	Chromium, Copper, Selenium and Zinc
Burrum Heads WWTP	Refer to Eli Creek WWTP	-
Eli Creek WWTP	C	Copper, Mercury, Selenium and Zinc
Eli South (Nikenbah) WWTP	C	Copper, Selenium and Zinc
Howard WWTP	Refer to Eli Creek WWTP	-
Pulgul Creek WWTP (existing)	C	Copper, Selenium and Zinc
Pulgal Creek WWTP (recommended site)	C	Copper, Selenium and Zinc
Toogoom WWTP	Refer to Eli South WWTP	-
Torbanlea WWTP	Refer to Eli South WWTP	-

Table 2: Stabilisation Grade Summary

WWTP	Biosolids Process Description	Stabilisation Grade
Aubinville WWTP	Anaerobic digestion with minimum 38% reduction in mass volatile solids followed by six (6) months of storage	B

Burrum Heads WWTP	Refer to Eli Creek WWTP	-
Eli Creek WWTP	Anaerobic digestion with minimum 38% reduction in mass volatile solids followed by six (6) months of storage	B
Eli South (Nikenbah) WWTP	Aerobic digestion with minimum of 20 days intermittent extended aeration followed by six (6) months of storage	B
Howard WWTP	Refer to Eli Creek WWTP	-
Pulgul Creek WWTP	Existing: Aerobic digestion with minimum of 20 days intermittent extended aeration followed by six (6) months of storage. Recommended site: Anaerobic digestion with 25 day retention time and in sequence with secondary aerobic digestion with one (1) day steady aeration . This is followed by six (6) months of storage.	B
Toogoom WWTP	Refer to Eli South WWTP	-
Torbanlea WWTP	Refer to Eli South WWTP	-

~~6.4 ENVIRONMENTAL MANAGEMENT PLAN~~

~~Conditions 7 and 8 of WBWC's *Beneficial Use Approval* require that an Environmental Management Plan is developed and implemented by WBWC to manage biosolids. Section 6.3 details how WBWC meets these conditions.~~

~~6.4.1~~5.3.1 ENVIRONMENTAL RISK ASSESSMENT

WBWC manages biosolids reuse with a multiple barrier approach in accordance with the *NSW Biosolids Guidelines*, to reduce risk and ensure that human health and environmental quality are not compromised.

Annually each WBWC Reuse Scheme is assessed for significant environmental hazards (aspects) (refer to the *Annual and 5 yearly Biosolids Beneficial Reuse Sustainability Assessment Procedure)*. WBWC defines significant environmental risks as having a residual risk rating of High or Extreme. Where a significant environmental hazard is identified, a corrective action request is submitted aligned with WBWC's Business Management System and actions tracked in the Corrective Actions Register.

An assessment of environmental hazards, including land contamination, odour and contaminant runoff is defined as part of WBWC's Environmental Management System's Aspects Register and includes an assessment of the following hazards:

- Vegetation or soil structure damage from biosolids use
- Weed/disease release/transfer from stockpiled biosolids or vehicle movements
- Dust from biosolids reuse activities (e.g. vehicle movements, soil incorporation)
- Fumes from reuse activities - vehicle use
- Odour from biosolids storage and application
- Noise from biosolids reuse activities (e.g. vehicle & farm equipment movements)
- Vibration from biosolids reuse activities (e.g. vehicle & farm equipment movements)
- Visual appearance of reuse sites
- Onsite biosolids delivery & storage - stockpile storage and run-off from vehicle wash down facility
- Biosolids spill/leak while in transit to reuse site
- Runoff from biosolids storage and application
- Carbon dioxide release from fuel consumption

As evident from the Aspects Register, there are no significant environmental risks identified for WBWC's biosolids reuse activities, as best practice environmental management is being implemented. However, the Aspects Register needs to be updated to cater for the 'recommended configuration' at Pulgal WWTP – especially to assess the hazards of the anaerobically digested solids when the upgrade project begins construction.

Additionally, site specific land slope and buffer distance assessments are conducted prior to any biosolids application as summarised in **Table 3** below.

Table 3: Land slope and buffer distance assessment

Source of Biosolids	Property Name	Property Description	Land slope	Vegetation	Buffer Distances (refer to NSW Biosolids Guidelines)								
					Surface waters (minimum 50m)	Farm Dams (minimum 20m)	Drinking Water Bores (minimum 250m)	Other bores (minimum 50m)	Farm Driveways & Fence lines (minimum 5m)	Native vegetation (minimum 10m)	Animal Enclosures (minimum 25m)	Occupied dwelling (minimum 50m)	Residential zone (minimum 250m)
Aubinville Wastewater Treatment Plant Burrum Heads Wastewater Treatment Plant Eli Creek Wastewater Treatment Plant	"4 Mile Plantation", Quarry Road, Aldershot, QLD 4650	Lot 1 RP 27217	Flat (<3%)	Sugar Cane Farm	50m biosolids exclusion buffer will be implemented	20m biosolids exclusion buffer will be implemented	Nil drinking water bores within 250m	Nil bores within 50m	5m biosolids exclusion buffer will be implemented	10m biosolids exclusion buffer will be implemented	Nil animal enclosures within 25m	50m biosolids exclusion buffer will be implemented	250m biosolids exclusion buffer will be implemented
Eli South (Nikenbah) Wastewater Treatment Plant Howard Wastewater Treatment Plant Pulgul Creek Wastewater Treatment Plant Toogoom Wastewater Treatment Plant	"Atkinson Farm" Lawson Street, Maryborough	Lot 3 on SP147568 Lot 1 on RP840835 Lot 2 on RP840835	Flat (<3%)	Sugar Cane Farm	70m	20m biosolids exclusion buffer will be implemented	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	50m	400m
	Bay Turf, Booral Road, Bunya Creek, QLD, 4655	Lot 258 M371066 Lot 5 RP884812	Flat (<3%)	Turf Farm	50m biosolids exclusion buffer will be implemented	20m biosolids exclusion buffer will be implemented	Nil drinking water bores within 250m	Nil bores within 50m	5m biosolids exclusion buffer will be implemented	10m biosolids exclusion buffer will be implemented	Nil animal enclosures within 25m	50m biosolids exclusion buffer will be implemented	250m biosolids exclusion buffer will be implemented
	"Bunya Plantation" Buckley's Road, Hervey Bay	Lot 69 on MCH596 Lot 61 on MCH11 Lot 82 on MCH953	Flat (<3%)	Hardwood Tree Plantation	70m	10m Turkey nest dam	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	600m	750m
	"Dreamtime Plantation" Fisher Road, Burrum Heads	Lot 102 on SP1841681	Flat (<3%)	Hardwood Tree Plantation	50m biosolids exclusion buffer will be implemented	10m Turkey nest dam	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	510m	510m
	"Fermoyle Farm" Booral Road, Hervey Bay	Lot 2 on RP176296 Lot 48 on M3725 tfrLot 228 on M37328 (lower slope)	Flat (<3%)	Sugar Cane Farm	160m	20m	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	40m	1.1km
	"Hebblewhite Plantation" Hebblewhite Road, Hervey Bay	Lot 42 on M37305 Lot 1201 on 37497	Flat (<3%)	Hardwood Tree Plantation	530m	10m A 20m biosolids exclusion buffer will be implemented on this	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	230m	380m

Source of Biosolids	Property Name	Property Description	Land slope	Vegetation	Buffer Distances (refer to NSW Biosolids Guidelines)								
					Surface waters (minimum 50m)	Farm Dams (minimum 20m)	Drinking Water Bores (minimum 250m)	Other bores (minimum 50m)	Farm Driveways & Fence lines (minimum 5m)	Native vegetation (minimum 10m)	Animal Enclosures (minimum 25m)	Occupied dwelling (minimum 50m)	Residential zone (minimum 250m)
						property							
	"Pulgul Plantation" Booral Road, Hervey Bay	Lot 1 on SP191570	Flat (<3%)	Hardwood Tree Plantation	30m	30m Turkey nest dam	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	50m	40m A 250m biosolids exclusion buffer will be implemented on this property
	"Toogoom Plantation" O'regan Creek Road, Toogoom	Lot 151 on MCH2188	Flat (<3%)	Hardwood Tree Plantation	70m	Nil farm dams within 20m	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	310m	310m
	"Vanderwolf Plantation" Vanderwolf Road, Hervey Bay	Lot 70 on MCH601	Flat (<3%)	Hardwood Tree Plantation	80m	300m Turkey nest dam	Nil drinking water bores within 250m	Nil bores within 50m	5m	10m	Nil animal enclosures within 25m	90m	1.6km

Note: Words that are in bold and italics are specific terms that have formal definitions.

~~6.4.2~~5.3.2 SUITABLE WEATHER PRACTICES AND PROCEDURES

WBWC has developed and implemented *Beneficial Use of Biosolids Land Agreements (Third Party)* for all WBWC and third party properties undertaking recycled water use activities and has expanded these management plans to include biosolids reuse. These management plans address stormwater and runoff during rainfall events. These management plans also address dust generation from biosolids application practices.

~~6.4.3~~5.3.3 ENVIRONMENTAL MONITORING

WBWC undertakes biosolids sampling and assessment on monthly, six (6) monthly, annually and 5 yearly schedules to continuously monitor biosolids and application site soil and groundwater quality and potential impacts. The parameters assessed are outlined in the Biosolids Analysis Procedure. The monitoring processes undertaken are defined in the associated documents listed in section 9. The procedure is to be reviewed in the light of the production of anaerobically digested biosolids at the Pulgul WWTP when the upgrade works begin construction.

Comment [LG2]: KBR has obtained a copy of this. After cross-referencing this with the NSW Biosolids Guideline, it has been found that there is a discrepancy between the two. In section 5.1 of the Biosolids Analysis Procedure it states that "FCRC is required to take a biosolids **sample at least every 120 dry tonnes** of treated biosolids at each Wastewater Treatment Plant (WWTP) producing biosolids to monitor changes in quality". Whilst in the NSW Biosolids Guideline it states that "Each composite sample must represent a **maximum of 100 dry tonnes** of biosolids product". This discrepancy needs to be verified.

In addition, Section 5.5 of the Biosolids Analysis Procedure will need to be updated for the Belt Filter cake at Pulgul WWTP. This needs to take into account that the upgraded facility will consist of an additional gravity drainage deck and screw press. Although, the sampling will be kept the same as for what it is for the existing belt filter cake.

~~6.4.4~~5.3.4 AGRONOMIC LOADING RATE

WBWC calculates the Nitrogen Limiting Biosolids Application Rate (NLBAR), and Contaminant Limiting Biosolids Application Rate (CLBAR) in accordance with the New South Wales *Environmental Protection Authority Environmental Guidelines: Use and Disposal of Biosolids Products* (2000) (*NSW Biosolids Guidelines*) to ensure compliance with condition 1 (Limitations of Approval) of Wide Bay Water Corporation's (WBWC's) *Approval of a Resource for Beneficial Use for Biosolids* (*Beneficial Use Approval*) to achieve and maintain 100% beneficial and sustainable biosolids reuse.

The *Biosolids Application Rate (CLBAR and NLBAR) Calculations Work Instruction* details this process.

~~6.4.5~~5.3.5 SOIL CHARACTERISTICS

WBWC's biosolids must be classified as Restricted Use 2 suitable for application to agricultural land under the *Beneficial Use Approval* and *NSW Biosolids Guidelines*.

Additionally, the proposed biosolids land application site must meet the site characteristics and maximum allowable soil contaminant requirements defined in the *NSW Biosolids Guidelines*. The *Initial Biosolids Land Application Procedure* and *Subsequent Biosolids Land Application Procedure* define WBWC's process of ensuring that the pH of the application site soil meets the *Beneficial Use Approval* requirements.

~~6.4.6~~5.3.6 CONTAMINANT CONCENTRATION

The *Biosolids Contaminant Grading Determination Work Instruction* summarises how WBWC consistently and compliantly determines the Contaminant Grade of biosolids in accordance with the biosolids classification processes outlined in the *NSW Biosolids Guidelines* and the *Beneficial Use Approval*. Biosolids contaminant characteristics are utilised in determining the agronomic loading rate as discussed in section 6.4.4.

~~6.4.7~~5.3.7 DOCUMENTATION

A biosolids electronic tracking system has been developed and is utilised by the biosolids transport contractor to enable tracking and GIS registration of biosolids movements. The tracking system records the following details:

- Date
- Transporter ID
- Biosolids generator
- Quantity
- Biosolids receiver
- Receiver date and time

WBWC maintains these records for at least five (5) years in accordance with the Business Management System.

~~7~~6 Exceptions

To improve efficiencies in biosolids management processes, from time to time some alterations to this above processes may occur, however, the *Approval of a Resource for a Beneficial Use* issued by the Department of Environment and Heritage Protection (EHP) on 16 August 2013 (permit number ENBU04970013), and the New South Wales *Environmental Guidelines for Use and Disposal of Biosolids Products*, 2000 must be complied with at all times.

~~8~~7 Associated Documents

- DOCSHBCC-#2847530-Annual and 5 yearly Biosolids Beneficial Reuse Sustainability Assessment Procedure
- DOCSHBCC-#2539511-ERM Annual Soil Sampling Reuse Plantations Work Instruction v1

- DOCSHBCC-#2847531-Biosolids Analysis Procedure
- DOCSHBCC-#2847550-Biosolids Application Rate (CLBAR and NLBAR) Calculations Work Instruction
- DOCSHBCC-#2847533-Biosolids Classification Procedure
- DOCSHBCC-#2847551-Biosolids Contaminant Grading Determination Work Instruction
- DOCSHBCC-#2847553-Biosolids Stabilisation Grading Determination Work Instruction
- DOCSHBCC-#2847535-Initial Biosolids Land Application procedure
- DOCSHBCC-#2540101-ERM Safe Work Procedure -Collecting Soil Samples v1.dotx
- DOCSHBCC-#2847538-Subsequent Biosolids Land Application Procedure

~~9~~8 Definitions

Beneficial Use	The use of nutrients in biosolids at or below the agronomic loading rate or use of the soil conditioning properties of the biosolids.
Biosolids	Primarily an organic solid product produced by the municipal sewage treatment process, previously referred to as sewage sludge. Solids become biosolids when they come out of a digester or other treatment process and can be beneficially used. Until such solids are suitable for beneficial use they are defined as waste-water solids. The solid content in biosolids should be equal to or greater than 0.5% weight by volume (w/v).
Biosolids Products - Restricted Use	Products which are restricted in their application as a result of the concentration of constituent contaminants or their stabilisation characteristics. Restrictions on the products include loading rates and management practices, as well as limitations on the future uses of land to which they can be applied.
Beneficial Use Approval	WBWC's *Approval of a Resource for Beneficial Use for Biosolids*
Classification	The process of assigning biosolids products to classes, based on their quality.
Document Portal	Document search tool located on the intranet
Grading	A necessary input to classification. Grading of biosolids products is based on their constituent contaminants (contaminant grade), and degree of stabilisation (stabilisation grade).

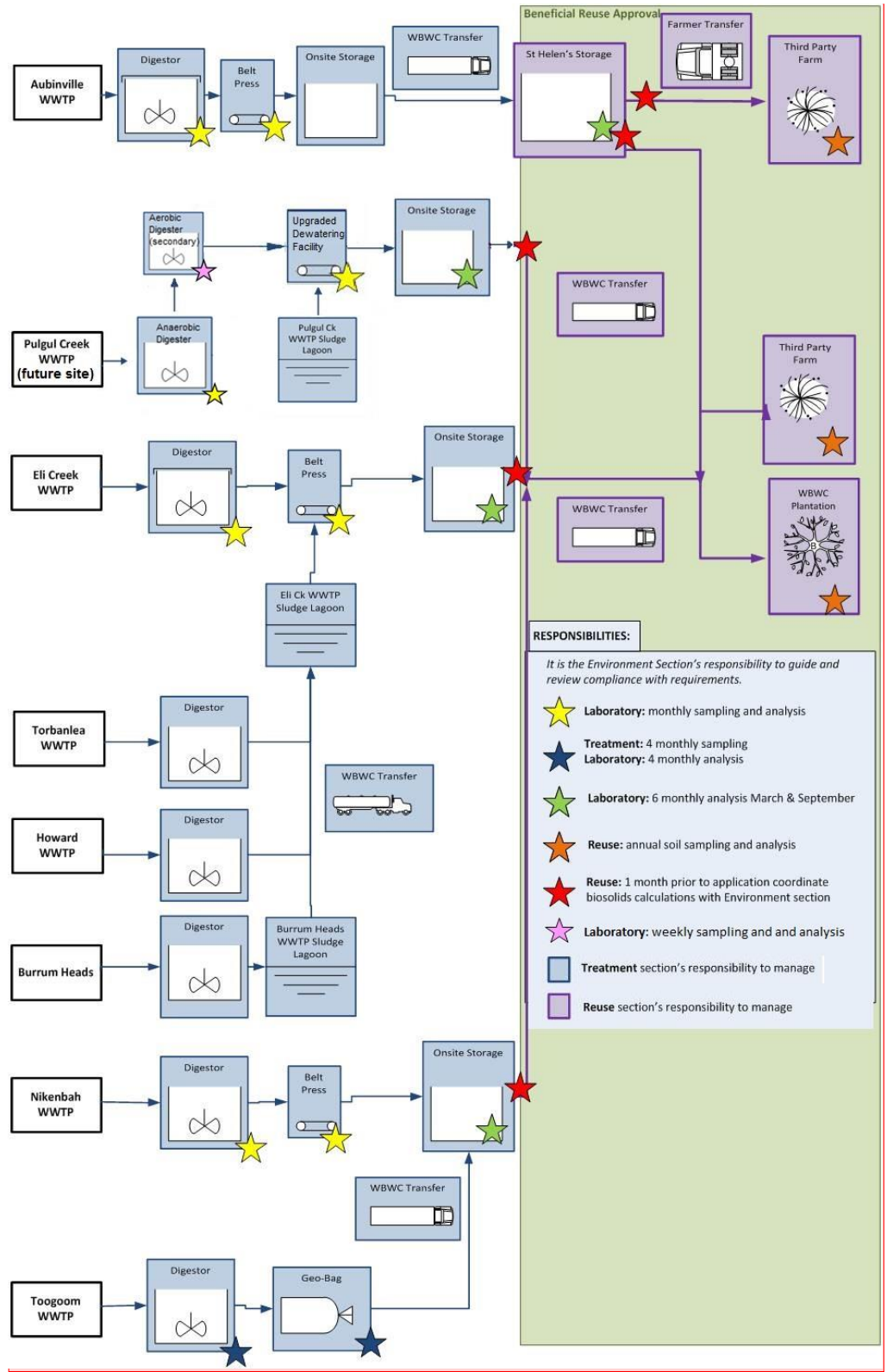
Contaminant Grade	Classification category used to describe the quality of a biosolids product based on the concentration of its constituent contaminants.
NSW Biosolids Guidelines	New South Wales Environmental Protection Authority's *Environmental Guidelines: Use and Disposal of Biosolids Products (2000)*
Stabilisation Grade	Classification category used to describe the quality of a biosolids product based on its microbiological characteristics, vector attraction and potential to generate offensive odours.

~~10~~9 Review

The document shall be reviewed within 2 years or as a result of significant legal and business changes.

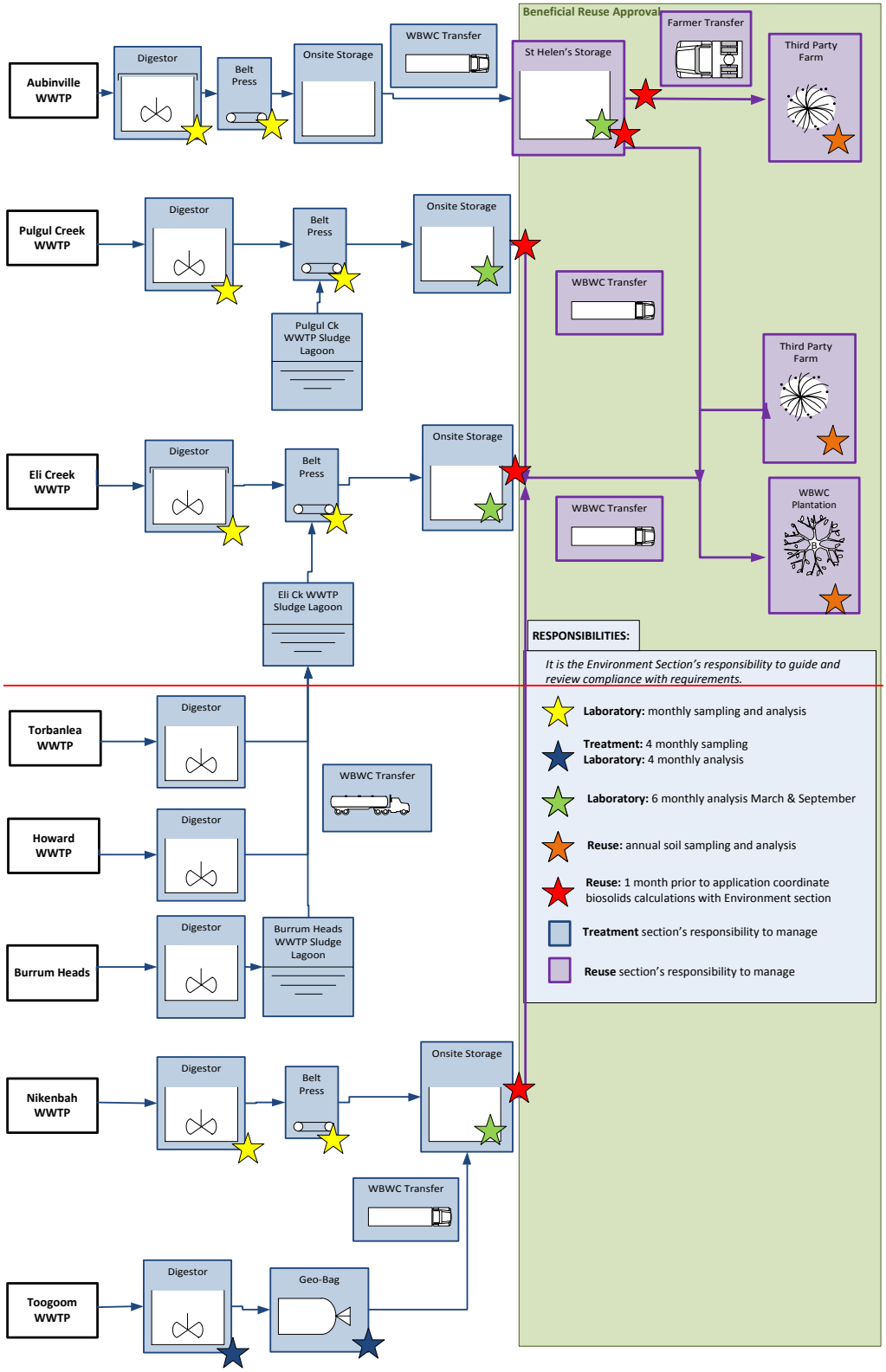
~~11~~10 Appendices

~~11.1~~10.1 APPENDIX A – BIOSOLIDS RESPONSIBILITIES



Comment [LG3]: This is the revised version of Appendix A. It includes the anaerobic digester which is to be sampled and analysed monthly whilst the secondary aerobic digester is to be sampled and analysed weekly. The revised version also includes the upgraded dewatering facility.

Note: Words that are in bold and italics are specific terms that have formal definitions.



Note: Words that are in bold and italics are specific terms that have formal definitions.

~~11.2~~10.2 APPENDIX B - SUMMARY WBWC BIOSOLIDS ACTIVITIES

Biosolid Source									Beneficial Reuse			
Environmental Authority	WWTP	Quantity biosolids produced (dry t/yr)	% Solids	Estimated Application Rate (wet t/yr)	Current WWTP Sludge Treatment Process	Planned WWTP Sludge Treatment Process	NSW Biosolids Quality	Current Management Activity	Proposed Biosolids Strategy	Owner	Scheme/Property Name	Industry
CM0113DA **Booker Street, Aubinville** **Lot 9 RP74505**	**Aubinville WWTP** 20,000 e.p. capacity	465	20	55	• Extended aeration • Anaerobic digestion • Onsite dewatering • Short term onsite storage	• N/A	• Stabilisation Grade: B • Contaminant Grade: C • Restricted Use 2	100% beneficial reuse on local farms • Three (3) monthly transfer as Regulated Waste to Eli South (Nikenbah) WWTP • Six (6) months storage • Transport & application on local sugar cane or turf farms, or WBWC plantations	100% beneficial reuse on local farms 1. Commission St Helen's off-site biosolids storage facility 2. Utilise Regulated Waste contractor to transport biosolids to off-site storage site 3. Six (6) months storage 4. Transport to reuse site 5. Incorporation within 36 hours	Jeff Atkinson WBWC	Maryborough Reuse Scheme: • "Atkinson Farm" Lawson Street, Maryborough • "4 Mile Plantation", Quarry Road, Aldershot	Sugar Cane Farm Sugar Cane Farm and cattle grazing

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Biosolid Source									Beneficial Reuse			
Environmental Authority	WWTP	Quantity biosolids produced (dry t/yr)	% Solids	Estimated Application Rate (wet t/yr)	Current WWTP Sludge Treatment Process	Planned WWTP Sludge Treatment Process	NSW Biosolids Quality	Current Management Activity	Proposed Biosolids Strategy	Owner	Scheme/Property Name	Industry
CM0274 **Hythe Street, Pialba** **Lot 1 RP122157**	**Eli Creek WWTP** 20,000 e.p. capacity	197	16	30	• Anaerobic digestion • Onsite dewatering • Six (6) months storage onsite	N/A	• Stabilisation Grade: B • Contaminant Grade: C • Restricted Use 2	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	WBWC Dennis Fermoyle Bay Turf	Burrum Heads Reuse Scheme: • "Dreamtime Plantation" Fisher Road, Burrum Heads Hervey Bay Reuse Scheme: • "Bunya Plantation" Buckley's Road, Hervey Bay • "Hebblewhite Plantation" Hebblewhite Road, Hervey Bay • "Pulgul Plantation" Booral Road, Hervey Bay • "Vanderwolf Plantation" Vanderwolf Road, Hervey Bay Toogoom Reuse Scheme • "Toogoom Plantation" O'regan Creek Road, Toogoom "Fermoyle Farm" Booral Road, Hervey Bay Bay Turf, 865 Booral Road, Bunya Creek,	**Hardwood Tree Plantations** **Sugar Cane Farm** **Turf Farm**
IPDE00220905 C11 **Bushnell Road, Burrum Heads** **Lot 129 CK3588**	**Burrum Heads WWTP** 2,500 e.p. capacity	42	6	Refer to Eli Creek WWTP	• Extended aeration • Aerobic digestion • 6 monthy tanker to Eli Creek WWTP sludge lagoon	N/A	Refer to Eli Creek WWTP					

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Biosolid Source									Beneficial Reuse			
Environmental Authority	WWTP	Quantity biosolids produced(dry t/yr)	% Solids	Estimated Application Rate (wet t/yr)	Current WWTP Sludge Treatment Process	Planned WWTP Sludge Treatment Process	NSW Biosolids Quality	Current Management Activity	Proposed Biosolids Strategy	Owner	Scheme/Property Name	Industry
IPCE00719607 **Piggford Lane,** **Walligan** **Lot 1 plan RP35386**	**Eli South (Nikenbah) WWTP** 10,000 e.p. capacity	204	15	65	• Aerobic digestion • Minimum 20 days aeration • Onsite dewatering • Six (6) months storage onsite	N/A	• Stabilisation Grade: B • Contaminant Grade: C • Restricted Use 2	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	WBWC Dennis Fermoyle Bay Turf	Burrum Heads Reuse Scheme: • "Dreamtime Plantation" Fisher Road, Burrum Heads Hervey Bay Reuse Scheme: • "Bunya Plantation" Buckley's Road, Hervey Bay • "Hebblewhite Plantation" Hebblewhite Road, Hervey Bay • "Pulgul Plantation" Booral Road, Hervey Bay • "Vanderwolf Plantation" Vanderwolf Road, Hervey Bay Toogoom Reuse Scheme • "Toogoom Plantation" O'regan Creek Road, Toogoom "Fermoyle Farm" Booral Road, Hervey Bay Bay Turf, 865 Booral Road, Bunya Creek,	**Hardwood Tree Plantations** **Sugar Cane Farm** **Turf Farm**
IPDE00091904C11 **Morris Road, Toogoom** **Lot 217 SP111516**	**Toogoom WWTP** 1,500 e.p. capacity	19	8	Refer to Eli South WWTP	• Extended aeration • Aerobic digestion • Onsite geo-bag dewatering • 4 monthly transfer to Eli South WWTP	N/A	Refer to Eli South WWTP					

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Note: Words that are in bold and italics are specific terms that have formal definitions.

Biosolid Source									Beneficial Reuse			
Environmental Authority	WWTP	Quantity biosolids produced(dry t/yr)	% Solids	Estimated Application Rate (wet t/yr)	Current WWTP Sludge Treatment Process	Planned WWTP Sludge Treatment Process	NSW Biosolids Quality	Current Management Activity	Proposed Biosolids Strategy	Owner	Scheme/Property Name	Industry
IPDE00082504 A11 **Walkers Road, Urangan** **Lot 100 CP896209**	**Pulgul Creek WWTP** 24,300 e.p. capacity	326	14	90	• Aerobic digestion • Minimum 20 days aeration • Onsite dewatering • Six (6) months storage onsite	• Anaerobic digestion with twnty-five (25) days retention time • Secondary aerobic digestion with one (1) day steady aeration • Onsite upgraded dewatering facility • Siz (6) months storage onsite	• Stabilisation Grade: B • Contaminant Grade: C • Restricted Use 2	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	100% beneficially reused on local farms • Six (6) months onsite storage • Transport & application on local sugar cane or turf farms, or WBWC plantations • Incorporation within 36 hours	WBWC Dennis Fermoyle Bay Turf	Burrum Heads Reuse Scheme: • "Dreamtime Plantation" Fisher Road, Burrum Heads Hervey Bay Reuse Scheme: • "Bunya Plantation" Buckley's Road, Hervey Bay • "Hebblewhite Plantation" Hebblewhite Road, Hervey Bay • "Pulgul Plantation" Booral Road, Hervey Bay • "Vanderwolf Plantation" Vanderwolf Road, Hervey Bay Toogoom Reuse Scheme • "Toogoom Plantation" O'regan Creek Road, Toogoom "Fermoyle Farm" Booral Road, Hervey Bay Bay Turf, 865 Booral Road, Bunya Creek,	**Hardwood Tree Plantations** **Sugar Cane Farm** **Turf Farm**
CM0274 **Steley Street, Howard** **Lot 1 SP116610**	**Howard WWTP** 100 e.p. capacity	1.3	3	Refer to Pulgul Creek WWTP	• Anaerobic digestion • Monthly transfer to Pulgul Creek WWTP	N/A	Refer to Pulgul Creek WWTP					
CM0274 **Burgowan Road, Torbanlea** **Lot 179 CP859379**	**Torbanlea WWTP** 150 e.p. capacity	3.7	14	Refer to Pulgul Creek WWTP	• Extended aeration • Aerobic digestion • Monthly transfer to Pulgul Creek WWTP	N/A	Refer to Pulgul Creek WWTP					

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Note: Words that are in bold and italics are specific terms that have formal definitions.

Biosolid Source									Beneficial Reuse			
Environmental Authority	WWTP	Quantity biosolids produced(dry t/yr)	% Solids	Estimated Application Rate (wet t/yr)	Current WWTP Sludge Treatment Process	Planned WWTP Sludge Treatment Process	NSW Biosolids Quality	Current Management Activity	Proposed Biosolids Strategy	Owner	Scheme/Property Name	Industry
TOTAL		**1,258**					**100% beneficially reused**					

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Appendix C

MCA Criteria scoring explanation

We Deliver

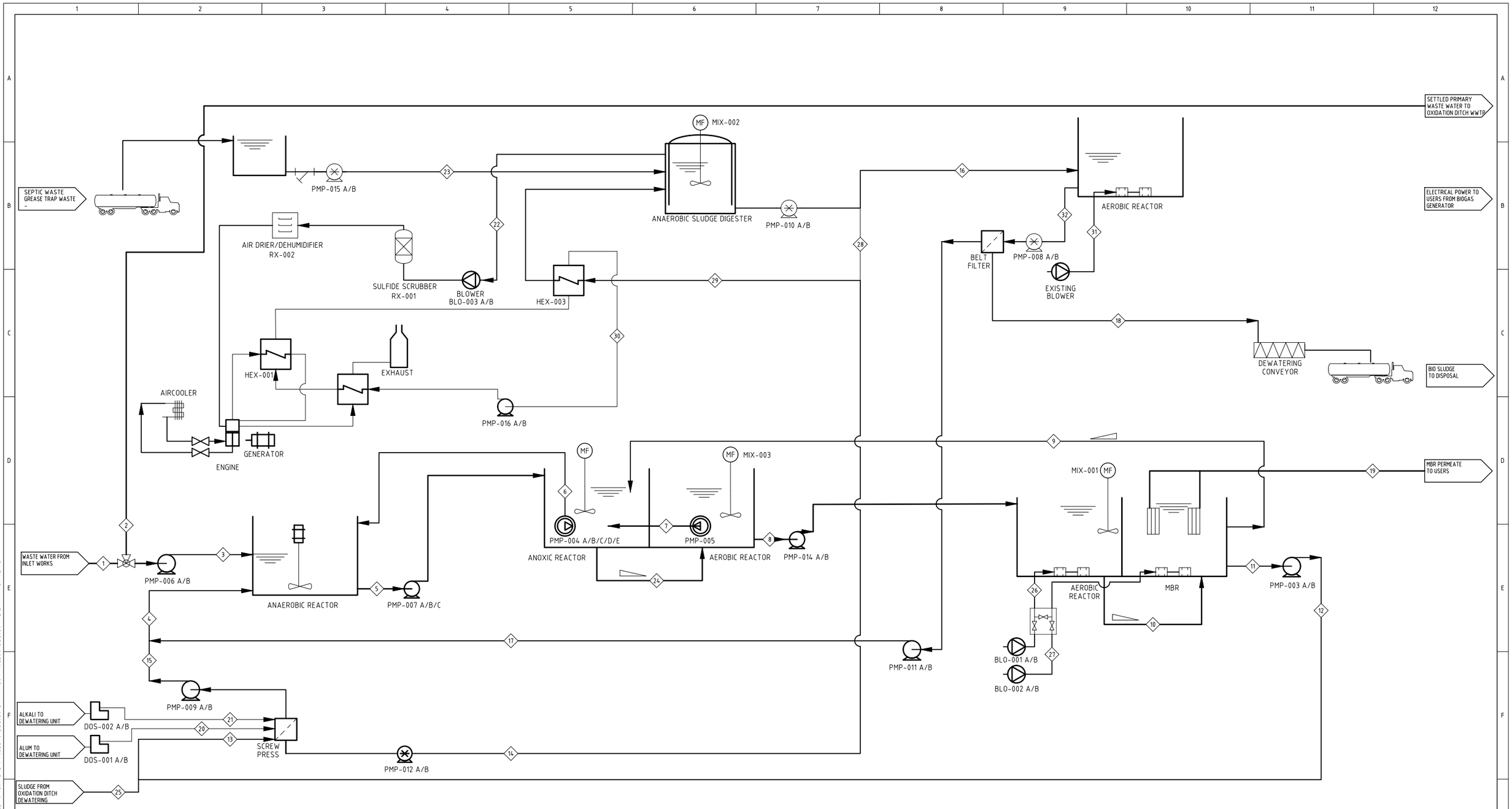
Rating Matrix for Multi Criteria Analysis

Points Range	Descriptor	Technical risk			Asset resilience and longevity		Environment				Community/Social						Safety		
		In construction	In service - operational complexity	Maintainability	Reliability/ robustness/ flexibility	Expandability	Approvals risk (EPBC Act (NES) / Zoning / EP Act)	Operational Compliance risk (Short and Long term)	Construction Impact - Land & Marine (Flora, Fauna, Groundwater, Surface Water, soil, hydrology, marine quality)	Operating Impact - Land & Marine (Flora, Fauna, Groundwater, Surface Water, soil, hydrology, marine quality)	Traffic - operation	Noise/ Odour Issues	Standard of service	Organisation reputation / Policy Alignment	Community Acceptance	Community Impact from construction	to OM personnel	to general public	Safety in Construction
1	Unacceptable deficiencies (LEAST PREFERRED)	1 - Construction requires materials and expertise that are not available. . Unacceptable construction conditions from a constructability viewpoint.	1 - Technical solution provides capacity for design condition under particular circumstances. Departure from these circumstances may result in failure of the service.	1 - System will require significant increased maintenance workload and cost with new plant. Frequent maintenance intervention will be required AND/OR difficult and unfamiliar maintenance requirements. High risk of licence non compliance without rapid response maintenance attention.	1 - There are significant concerns that the system would fail its service requirements under some extreme events either natural or manmade. Could negatively impact the resilience or longevity of other components in the system.	1 - Expansion of the system in the future will not be possible.	1 - Resistance to the proposed scheme is expected and there will be extensive effort required to achieve the required environmental approval, resulting in long delays or lack of approval altogether.	1 - No opportunities to capture or reduce compliance failure prior to discharge	1 - There are significant environmental issues that require a well considered management plan. Constant environmental management would be likely with regular reporting and potential interaction with construction required. Potential for non-compliance with DEHP licences or development approvals.	1 - Irreversible damage to land due to salt or nutrient build up / Irreversible damage to the marine environment	1 - Significant number of heavy truck movements through highly sensitive areas, including school zones.	1 - Frequent and significant noticable noise and odour impacts at a receptor resulting in complaints.	1 - System provides the same level of customer service that meets most of the required standards of service . Prolonged & significant adjustment may be required to community behaviour with the inclusion of the scheme.	1 - Long term (3 months) loss of confidence among key stakeholders. Sustained state and national adverse media coverage. Shareholder intervention.	1 - Strong , widespread and persistent community opposition	1 - Continuous disruption to community for an extended period	1 - The scheme poses a significant risk of serious injury, illness or death to personnel interacting with the scheme. Eg Fatality, amputation, long term/terminal illness or permanent disability.	1 - The scheme poses a significant risk of serious injury, illness or death to members of the public near the scheme. Eg Fatality, amputation, long term/terminal illness or permanent disability.	1 - Long periods of high risk of difficult to manage potential for permanent injury or death incidents
2	Number of important deficiencies. (NOT DESIRABLE)	2 - Construction using difficult techniques, involves high risks and long lead times for supply of materials or equipment. Contains high risk of delays. Constructability severely constrained by prevailing geotechnical conditions.	2 - Technical solution provides capacity for design condition but no capacity for over design conditions.	2 - The solution is difficult to maintain and will require special equipment or skills.	2 - Significant management or intervention would be required to ensure the system continues to operate during extreme events either natural or manmade. There is potential for deterioration of the system over its design life unless some significant maintenance or upgrades are implemented. Could result in early intervention or higher maintenance requirements for other components in the system.	2 - The system will be difficult to expand in the future and will required very significant planning, involvement of exeternal parties and agencies.	2 - Resistance to the proposed scheme is expected and there will be significant effort required to achieve the required environmental approval, resulting in delays.	2 - Limited opportunity to intercept and correct a non compliant effluent	2 - There are significant environmental issues that require a well considered management plan. Constant environmental management would be likely with regular reporting and potential interaction with construction required.	2 - Serious damage to soils with a period greater than 5 years to recover / Serious damagae the marine environment requiring greater than 5 year to recover	2 - Significant number of heavy truck movements through residential areas, but does not include school zones.	2 - Fequent but minor noise and odour impacts at a receptor resulting in complaints.	2 - System provides improved customer service that meets most of the required standards of service . Significant adjustment may be required to community behaviour with the inclusion of the scheme.	2 - Medium term (1 month) loss of confidence among key stakeholders. Short term state and/or national adverse media coverage. Board intevention.	2 - Widespread community opposition, that may be reduced through stakeholder engagement	2 - Long periods of disruption to the community	2 - The scheme poses a significant risk of a lost time injury or illness to personnel interacting with the scheme. Eg lost time injury, long term disability.	2 - The scheme poses a significant risk of a lost time injury or illness to members of the public interacting with the scheme. Eg lost time injury, long term disability.	2 - Long periods of high risk of low severity injuries and short peroids of high risk of permanangt injury or death incidents.
3	Significant deficiencies but has merit. (NEGOTIABLE)	3 - Construction using difficult techniques, involves significant risks. Little known about prevailing geotechnical conditions that could have a significant impact on constructability assumptions	3 - New or less widely used technical solution that will work with appropriate construction and management in service. Requires more operational intervention OR Technical solution provides capacity for design condition but limited capacity for conditions that exceed the design conditions.	3 - The solution is maintainable with existing skills but requires a high frequency or costly materials to maintain.	3 - There may be some extreme events where management or intervention is required to ensure the system continues to operate, but this would be considered as achievable and could be built into the system operating procedure. Deterioration of the facilty can be effectively managed with acceptable programmed maintenance. Minimum to zero impact on other components in the system .	3 - The system will be capable of being expanded in the future but will required a typical level of planning, involvement of exeternal parties and agencies.	3 - Resistance to the proposed scheme may occur and there may be significant effort required to achieve the required environmental approval, resulting in short delays.	3 - May have compliance failure, but can be intercepted and corrected when detected	3 - Environmental disturbance issues that require a well considered management plan. A high level of environmental management is required during construction.	3 - Damage to soils requiring greater than a year, but less than 5 to recover / damage to the marine environment requiring greater than a year, but less than 5 to recover	3 - Slight increase in truck movements to the business as usual. May include heavy truck movements through limited residential areas, but does not include school zones.	3 - Minor and occasional noise and odour impacts at a receptor resulting in complaints.	3 - System provides improved customer service that meets standards of service . Some adjustments to community behaviour may be required with the inclusion of the scheme.	3 - Short term (1 week) loss of confidence among some key stakeholders. Short term local adverse media coverage. CEO intevention.	3 - Some community opposition, that can be overcome through stakeholder engagement	3 - High number of short periods of disruption to the community	3 - The scheme has the potential to result in a first aid injury to personnel interacting with the scheme. Eg lost time injury or illness, short term disability.	3 - The scheme has the potential to result in a first aid injury to members of the public interacting with the scheme. Eg lost time injury or illness, short term disability.	3 - Long peroids of high risk of low severity injuries, short peroids of low risk of high severity injury.
4	Benefits outweigh deficiencies. (ACCEPTABLE/NORMAL)	4 - Construction using techniques that involve new technology. Limited geotechnical investigations suggesting some risk to constructability assumptions.	4 - Technical solution will effectively meet all the objectives. No additional benefits necessary.	4 - The solution is maintainable with existing skills and standard materials, tools and frequency of attendance.	4 - The system has a level of robustness and resilience that that will ensure it can operate under extreme events over the acceptable life of the system.	4 - The system will be capable of being expanded in the future but will required a typical level of planning and the involvement of agencies.	4 - No resistance to the proposed scheme is expected and achieving the required environmental approvals is expected.	4 - Very low probability of compliance failure	4 - Effective Environmental Management Plan can address all construction issues and results in neutral impacts to the environment during implementation.	4 - Short term degredation of either soils or the marine environment	4 - Similar number of truck movements to the business as usual. No truck movements through residential areas.	4 - Minor and occasional noise and odour impacts. No complaints received.	4 - System provides improved customer service that meets standards of service .	4 - Minimal stakeholder interest/concern. Isolated local adverse media story. ELT intervention.	4 - General support, but minor interest group opposition that can be overcome through stakeholder engagement	4 - Small number of short periods of disruption to the community	4 - The scheme is safe for all operators exercising due care and dilligence with limited opportunity for harm.	4 - The scheme is safe for all members of the public interacting with the scheme.	4 - Short peroids of high risk of low severity injuries, very low risk of high severity injuries.
5	High merit with limited deficiencies. (MOST PREFERRED)	5 - Construction using well tested and familiar construction techniques. Good understanding of prevailing geotechnical conditions.	5 - Technical solution will effectively meet all the objectives in the simplest most direct way . Additional benefits will be provided to the community from the ultimate technical solution.	5 - The solution has a lower than usual maintanence requirement that is infrequent or has a low cost per incidence.	5 - The system has a level of robustness and resilience that that will ensure it can operate under extreme events over the acceptable life. Potential for additional life from the system. Can add considerable benefit and improved longevity or resilience to other components in the system but are impacted by the outcomes.	5 - The system will be capable of being expanded in the future with limited levels of planning and the involvement of agencies.	5 - No resistance to the proposed scheme is expected and achieving the required environmental approvals is expected to be very quick and timing is not on the critical path.	5 - No possibility of compliance failure	5 - Effective Environmental Management Plan can address all construction issues and provides benefits to the environment during implementation.	5 - No impact on either the soils or the marine environment	5 - Less truck movements to the business as usual. No truck movements through residential areas.	5 - No noticable noise or odour impacts at any receptor.	5 - System provides improved customer service that meets standards of service and can provide additional community benefits.	5 - No material impact expected.	5 - Widespread community support	5 - No disruptions to the community	5 - The scheme is inherently safe with an exceptionally low probability of harm to personnel interacting with the scheme.	5 - The scheme is inherently safe with an exceptionally low probability of harm to members of the public near the scheme.	5 - Low risk of low severity injuries and very low risk of high severity injuries.

Appendix D

Option 5 PFD

We Deliver



Line Tag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Liquid Flow rate (l/s)	170.4	18.52	151.85	2.778	193.4	38.77	4514	472.3	299.9	472.3	2.4	2.431	2.894	0.4630	2.431	0.4630	0.3472	0.1157	170.0	0	0.9156	-	0.1529	4986	0.4630	-	-	6.731	7.194	6.731	-	0.7407
PWWF	319.4	18.52	300.9	2.778	342	38.8	4514	613	310	613	2	2.43	2.89	0.463	2.43	0.4630	0.3472	0.1157	300.2	0	0.916	-	257.2	5127	0.4630	-	-	6.731	7.194	6.731	-	0.7407
Gas Flow rate (Nm3/h)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.62	-	-	-	501.3	5400	-	-	-	55.14	-
PWWF	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34.59	-	-	-	601.5	5400	-	-	-	55.14	-
MLSS (mg/l)	350.0	350.0	350.0	200.0	1795	5497	5676	5676	8500	5676	8500	8500	8500	52904	200	40885	200.0	232044	0	-	-	-	1000	5499	8470	-	-	40885	40885	-	-	-
Fluid Medium	Water	Water	Water/ Solids	Water	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water/ Solids	Water	Water/ Solids	Water	Water/ Solids	Water	Water / Alkali	Water/ Alum solutio	CH4,CO2	Septic waste/ Grease	Water/ Solids	Water/ Solids	Air	Air	Water/ Solids	Water/ Solids	Water	Air	Water/ Solids

FOR CONSTRUCTION

REV	DESCRIPTION	DATE
A	ISSUED FOR REVIEW	11.12.17

POSITION	NAME	SIGNATURE
DRAFTING		
DESIGN		
DESIGN VERIFICATION		
PROJECT APPROVAL		
CLIENT		

WIDE BAY water CORPORATION

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd
ABN 91 007 660 317

DRAWING SCALE: NTS
ORIG. SIZE: A1
DRAFTER: M. PICKETT

TITLE
WIDE BAY WATER CORPORATION
PULGUL - WBW WATER TREATMENT FACILITY
PROCESS FLOW DIAGRAM

DRAWING No.: BEG656 PFD DRAFT REVA
REVISION: A

FILE: O:\G&I\CAD\PROJECTS\BEG656\DRAWINGS\PROCESS\BEG656 PFD DRAFT REVA.DWG
DATE: Monday, 11 December 2017 3:22:41 PM

Appendix E

Option 5 Equipment Sizing

We Deliver

MBR Equipment list

Pipelines

Pipe line list.

Item Tag	Description	Fluid type	Length	Flow	Material of construction	Nominal size
Pipeline items			m	l/s		mm
1	Influent to WWTP Anaerobic zone	Water	30	319.4	PE	560
2	Influent to Oxidation Ditch	Water	15	18.50	PE	125
3	Influent to Anaerobic Zone	Water/ Bio solids	50	300.9	PE	500
4	Return Supernatant from dewatering filters	Water	170	2.800	PE	63
5	Combined Feed to Anaerobic reactor	Water/ Bio solids	15	342.5	PE	560
6	Anaerobic Sludge recycle (r)	Water/ Bio solids	53	38.80	PE	200
8	Combined flow to Aerobic reactor	Water/ Bio solids	55	612.7	PE	710
9	MBR underflow recycle (s) RAS	Water/ Bio solids	15	310.1	PE	500
11	MBR underflow recycle (s) RAS	Water/ Bio solids	1	2.400	PE	50
12	Waste activated sludge (WAS)	Water/ Bio solids	70	2.400	PE	50
13	Waste activated sludge (WAS) to dewatering	Water/ Bio solids	10	2.900	PE	63
14	Sludge from WAS dewatering	Water/ Bio solids	15	0.500	PE	25
15	Supernatant from WAS dewatering	Water	10	2.400	PE	50
16	Anaerobic Digester outlet pump	Water/ Bio solids	15	0.500	PE	25
17	Supernatant from Digester dewatering	Water	10	0.300	PE	20
18	Digester Sludge from WAS dewatering	Water/ Bio solids	5	0.100	PE	16
19	MBR permeate	Water	65	300.2	PE	500
20	Alkali dosing line	Water/ Alkali	15	0.0	PE	25
21	Alum dosing line	Water/ Alum	15	0.900	PE	32
22	Anaerobic Digester off gas	CH4,CO2	15	9.600	PE	25
23	Septic waste/Grease from road truck	Septic waste/Grease trap	10	257.2	PE	450
25	Flow from Oxidation ditch dewatering	Water/ Bio solids	Existing	0.500	PE	25
26	Air to Membrane tanks	Air	15	167.1	PE	90
27	Air to Aerobic bioreactors	Air	15	1500	PE	315
29	Anaerobic Digester re-heat line	Water/ Bio solids	10	0.5000	PE	75
30	Heating water circuit to Anaerobic Digester	Water	30	0.400	PE	75

Item Tag	Description	Fluid type	Length	Flow	Material of construction	Nominal size
Pipeline items			m	l/s		mm
31	Heating water circuit to Anaerobic Digester	Water	30	15.30	PE	40
32	Heating water circuit to Anaerobic Digester	Water	30	0.700	PE	25
XX	Outfall line	Water	3600	2129	PE	900

Reactors

Sized Reactor list.

Item Tag	Description	Fluid type	Number of	Pressure	Flow	Material of construction	Equipment Type	Length	Width/ Diameter	Height	Volume
			each	KPa	l/s			m	m	m	m^3
RX-001	Aerobic reactor	Water/ Sludge	1	atm	513	Concrete/Polymer lined	Below ground tank	15.0	5.2	5.0	390
RX-002	Membrane Bioreactor tanks	Water/ Sludge	6	atm	513	Concrete/Polymer lined	Below ground tank	7.6	3.5	5.1	728
RX-003	Anaerobic Digester	Water/ Sludge	1	103	0.89	Concrete/Polymer lined	Below ground tank	-	16.74	9.00	1100

Packaged Units

Individual packaged units

Item Tag	Description	Fluid type	Number of	Power	Liquid Flow	Gas Flow	Material of construction	Driver	Equipment Type
			each	KW	l/s	Nm^3/h			
FTR-001	BMR sludge dewatering filter	Biological sludge	1	-	4.63	-	TBC/Vendor	Electric	Gravity Drainage deck
FTR-002	Digester sludge dewatering filter	Biological sludge	1	-	0.74	-	304/316 SS	Electric	Screw Press
GEN-001	Biogas Engine with generator	CH_4, CO_2	1	58.0		21.62	TBC/Vendor	-	Internal combustion CHP
RX-001	Digester gas sulphate scrubber	CH_4, CO_2,H_2S	2	-	-	21.62	TBC/Vendor	-	Per vendor specification
RX-002	Digester gas dryer	CH_4, CO_2,H_2S	3	-	-	21.62	TBC/Vendor	-	Per vendor specification

Blowers

Blower sized equipment list.

Item Tag	Spare	Description	Fluid type	Number of	Pressure	Flow	Material of construction	Driver
	each			each	KPa	Nm^3/h		
BLO-001	A/B	Aerobic reactor Air supply blowers	Air	TBC	200	601.5	Stainless Steel (TBC/Vendor)	Electric
BLO-002	A/B	Aerobic reactor Air supply blowers	Air	TBC	200	5400	Stainless Steel (TBC/Vendor)	Electric
BLO-003	A/B	Digester biogas recovery blowers	Bio gas (75% CH4, 25% CO2)	TBC	500	21.62	Stainless Steel (TBC/Vendor)	Electric

Agitators/Mixers

Mixer sized equipment list.

Item Tag	Description	Fluid type	Number of	kW rating	Material of construction	Equipment Type	Driver
			each				
MIX-001	Aerobic Reactor Tank Mixing agitator	Water/ Bio sludge	3	2.08	316 SS	Paddle type	Electric
MIX-002	Anaerobic Digester Mixing agitator	Water/ Bio sludge	2	8.66	316 SS	Submersible pump	Electric

Pumps

Pump sized equipment list.

Spare	Description	Fluid type	Number of	Pressure	Flow	Hydraulic power	Equipment Type	Driver	line number
each			each	KPa	l/s				
A/B	Alkali dosing pump	Water/ Alkali solution	2	1000	TBC	TBC	Helical Rotor Pump/Diaphragm metering/"Alldos" KM series	Variable frequency electric	20
A/B	Alum dosing pump	Water/ Alum solution	2	1000	0.9156	0.92	Helical Rotor Pump/Diaphragm metering/"Alldos" KM series	Variable frequency electric	21
A/B	MBR Sludge waste WAS	Water/ Bio solids	3	200	2.4	0.50	Non Clog/Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm	Electrical	11
A/B	Anaerobic Sludge recycle (r)	Water/ Bio solids	2	200	38.77	7.75	Submersible pump	Electrical	6
A/B	Anoxic Sludge recycle (a)	Water/ Bio solids	5	50	4514	226	Submerged Axial flow pumps	Electrical	7
A/B	Influent to Anaerobic Zone	Water/ Bio solids	2	150	300.93	45.1	Submerged Axial flow pumps	Electrical	3
A/B	Anaerobic transfer pump	Water/ Bio solids	3	100	342.5	34.2	Non Clog/Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm	Electrical	5
A/B	WAS pump	Water/ Bio solids	2	500	0.741	0.37	Non Clog/Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm	Electrical	32
A/B	Dewatering supernatant/pre Digester	Water/ Bio solids	2	500	2.431	1.22	Centrifugal	Electrical	15
A/B	Digester outlet pump	Water/ Bio solids	2	500	0.463	0.23	Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm/High pressure piston/Rotary lobe	Electrical	16
A/B	Dewatering supernatant/post Digester	Water/ Bio solids	2	200	0.3472	0.07	Centrifugal	Electrical	17

Spare	Description	Fluid type	Number of	Pressure	Flow	Hydraulic power	Equipment Type	Driver	line number
A/B	Dewatering sludge/pre Digester	Water/ Bio solids	2	200	0.4630	0.09	Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm/High pressure piston/Rotary lobe	Electrical	14
A/B	Dewatering sludge/post Digester	Water/ Bio solids	2	200	0.1157	0.02	Progressive cavity/Plunger/Diaphragm/High pressure piston/Rotary lobe	Electrical	18
A/B	Anoxic transfer pump	Water/ Bio solids	3	100	613	61.0	Progressive cavity/Plunger/Diaphragm/High pressure piston/Rotary lobe	Electrical	8
A/B	Septic waste to digester	Water/ Bio solids	1	100	257	26.0	Torque flow centrifugal/Progressive cavity/Plunger/Diaphragm/High pressure piston/Rotary lobe	Electrical	23
A/B	Heating water circuit	Water	2	200	0.382	0.08	Centrifugal	Electrical	30
A/B/C/D	Outfall water pump	Water	4	750	2130	1597.22	Centrifugal	Electrical	XX

Appendix F

Itemised estimate scope

We Deliver

Option 1 – Nikenbah Trickling Filter

The following pieces of equipment have been costed for option 1:

- Inlet works
  - Inlet Screens * 2
  - Grit Removal System
  - Elevated Concrete Platform
  - Allowance for pipes and fittings
  - Allowance for electrical, instrumentation and control
  - Allowance for structural steel, ladders, walkways and handrails
- Clarifiers
  - Concrete
  - Epoxy coating
  - Mechanical components, including bridge, scraper, launders, drive
  - Allowance for pipework and fittings
  - Allowance for electrical, instrumentation and control
  - Allowance for structural steel, ladders, walkways, handrails
- De-nitrification Tank
  - Concrete
  - Epoxy Coating
  - Mixers
  - Diffusers
  - Blower
  - Allowance for pipework and fittings
  - Allowance for electrical, instrumentation and control
  - Allowance for structural steel, ladders, walkways, handrails
- Humus Tanks
  - Concrete
  - Epoxy Coating
  - Mechanical components, including bridge, scraper, launders, drive
  - Allowance for pipework and fittings
  - Allowance for electrical, instrumentation and control
  - Allowance for structural steel, ladders, walkways, handrails
- Trickling Filters
  - Concrete
  - Epoxy Coating

  - Reinforced fibreglass underdrainage
  - Packing Media
  - Distribution Arms
  - Motor
  - Allowance for pipework and fittings
  - Tank Walls - Steel Sheeting on Steel Frame
  - Allowance for structural steel
  - Maintenance Platform and Ladder
  - Allowance for electrical, instrumentation and control
- Chlorine Contact Tank
  - Concrete
  - Epoxy Coating
  - Allowance for pipework and fittings
  - Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Chemical Dosing
  - Concrete Slab - Truck delivery (10m * 10m * 0.4m)
  - Chemicals Building (13m x 5m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3m^3 GRP)
- Solids Processing
  - Concrete
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal Costs
  - Land Acquisition
  - Plantation
  - Water Storage
  - Reuse Pipe DN450
  - Reuse Pipe DN355
  - Pumps

  - Allowance for fittings
  - Allowance for instrumentation and control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth
  - Construction and Management Fee

Option 2 – Nikenbah Duplication

The items included in the cost estimate for option 2 include:

- Inlet Works
  - Concrete
  - Inlet Screens
  - Grit Removal
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Allowance for structural steel, ladders, walkways, handrails
- Membrane Tank
  - Concrete
  - Epoxy Coating
  - Membrane Blowers
  - Membrane Cassettes
  - Permeate / Backwash Pumps
  - Permeate Tank
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Bioreactor Tank
  - Concrete
  - Epoxy Coating
  - Blowers
  - Diffusers
  - Mixers
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails

- Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Odour Control
  - Slab for equipment (10 m * 10 m * 0.4 m)
  - Odour control system
  - Electrical, control and instrumentation
- Chemical Dosing
  - Concrete Slab - Truck delivery (10 m * 10 m * 0.4 m)
  - Chemicals Building (13 m x 5 m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25 m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3 m^3 GRP)
  - Citric acid dosing pumps duty / standby
  - Citric acid dosing tank (1 m^3 GRP)
  - Methanol Dosing System
- Solids Processing
  - Concrete (Second Digester Tank)
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal
  - Land Acquisition
  - Plantation
  - Water Storage
  - Pipe DN450
  - Pipe DN355
  - Pumps
  - Allowance for fittings
  - Allowance for Instrumentation and Control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth
  - Construction and Management Fee

Option 3 – Pulgul External Nitrification and Expanded Irrigation

The items included in the cost estimate for option 3 are:

- Inlet Works
  - Concrete Platform
  - Inlet Screens
  - Grit Removal
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Membrane Tanks
  - Concrete
  - Epoxy Coating
  - Membrane Blowers
  - Membrane Cassettes
  - Permeate / Backwash Pumps
  - Permeate Tank
  - RAS Screens
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Trickling Filter
  - Concrete
  - Epoxy Coating
  - Reinforced fibreglass underdrainage
  - Packing Media
  - Distribution Arms
  - Motor
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Tank Walls - Steel Sheeting on Steel Frame
  - Maintenance Platform and Ladder
- Clarifiers
  - Concrete
  - Epoxy Coating

  - Mechanical components, including bridge, scraper, launders, drive Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Odour Control
  - Slab for equipment (10m * 10m * 0.4m)
  - Odour control system
  - Electrical, control and instrumentation
- Chemical Dosing
  - Concrete Slab - Truck delivery (10 m * 10 m * 0.4 m)
  - Chemicals Building (13 m x 5 m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25 m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3m^3 GRP)
  - Citric acid dosing pumps duty / standby
  - Citric acid dosing tank (1m^3 GRP)
  - Methanol Dosing System
- Solids Processing
  - Concrete (Second Digester Tank)
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal
  - Outfall Pipe (DN 900 pipe)
  - Outfall Pumps
  - Reuse Pipeline DN125
  - Reuse Pumps
  - Fittings
  - Instrumentation and Control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth

  - Construction and Management Fee

Option 4 – Pulgul External Nitrification and Outfall

The items included in the cost estimate for option 4 are:

- Inlet Works
  - Concrete Platform
  - Inlet Screens
  - Grit Removal
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Membrane Tanks
  - Concrete
  - Epoxy Coating
  - Membrane Blowers
  - Membrane Cassettes
  - Permeate / Backwash Pumps
  - Permeate Tank
  - RAS Screens
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Trickling Filter
  - Concrete
  - Epoxy Coating
  - Reinforced fibreglass underdrainage
  - Packing Media
  - Distribution Arms
  - Motor
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Tank Walls - Steel Sheeting on Steel Frame
  - Maintenance Platform and Ladder
- Clarifiers
  - Concrete

  - Epoxy Coating
  - Mechanical components, including bridge, scraper, launders, drive Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
  - Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Odour Control
  - Slab for equipment (10m * 10m * 0.4m)
  - Odour control system
  - Electrical, control and instrumentation
- Chemical Dosing
  - Concrete Slab - Truck delivery (10 m * 10 m * 0.4 m)
  - Chemicals Building (13 m x 5 m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25 m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3 m^3 GRP)
  - Citric acid dosing pumps duty / standby
  - Citric acid dosing tank (1 m^3 GRP)
  - Methanol Dosing System
- Solids Processing
  - Concrete (Second Digester Tank)
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal
  - Outfall Pipe (DN 900 pipe)
  - Outfall Pumps
  - Fittings
  - Instrumentation and Control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth
  - Construction and Management Fee

Option 5 – Pulgul Membrane and Expanded Irrigation

The items included in the costs for option 5 are:

- Inlet Works
  - Concrete
  - Inlet Screens
  - Grit Removal
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Membrane Tank
  - Concrete
  - Epoxy Coating
  - Membrane Blowers
  - Membrane Cassettes
  - Permeate / Backwash Pumps
  - Permeate Tank
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Bioreactor Tank
  - Concrete
  - Epoxy Coating
  - Blowers
  - Diffusers
  - Mixers
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Odour Control
  - Slab for equipment (10 m * 10 m * 0.4 m)
  - Odour control system
  - Electrical, control and instrumentation

- Chemical Dosing
  - Concrete Slab - Truck delivery (10 m * 10 m * 0.4 m)
  - Chemicals Building (13 m x 5 m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25 m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3 m^3 GRP)
  - Citric acid dosing pumps duty / standby
  - Citric acid dosing tank (1 m^3 GRP)
  - Methanol Dosing System
- Solids Processing
  - Concrete (Second Digester Tank)
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal
  - Outfall Pipe (DN 900 pipe)
  - Outfall Pumps
  - Reuse Pipeline DN125
  - Reuse Pumps
  - Allowance for fittings
  - Allowance for instrumentation and control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth
  - Construction and Management Fee

Option 6 – Pulgul Membranes and Outfall

The items included in the costs for option 5 are:

- Inlet Works
  - Concrete
  - Inlet Screens
  - Grit Removal
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation

  - Structural Steel, Ladders, Walkways, Handrails
- Membrane Tank
  - Concrete
  - Epoxy Coating
  - Membrane Blowers
  - Membrane Cassettes
  - Permeate / Backwash Pumps
  - Permeate Tank
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Bioreactor Tank
  - Concrete
  - Epoxy Coating
  - Blowers
  - Diffusers
  - Mixers
  - Allowance for pipework and fittings
  - Electrical, control and instrumentation
  - Structural Steel, Ladders, Walkways, Handrails
- Solids Thickener
  - Feed Pumps
  - Drum Thickener
- Odour Control
  - Slab for equipment (10 m * 10 m * 0.4 m)
  - Odour control system
  - Electrical, control and instrumentation
- Chemical Dosing
  - Concrete Slab - Truck delivery (10 m * 10 m * 0.4 m)
  - Chemicals Building (13 m x 5 m)
  - Caustic dosing pump duty / standby
  - Caustic dosing tank (25 m^3 GRP)
  - Sodium hypochlorite dosing pump duty / standby
  - Sodium hypochlorite dosing tank (3 m^3 GRP)
  - Citric acid dosing pumps duty / standby

  - Citric acid dosing tank (1 m^3 GRP)
  - Methanol Dosing System
- Solids Processing
  - Concrete (Second Digester Tank)
  - Epoxy Coating
  - Surface Aerators
  - Allowance for pipework and fittings
- Effluent Disposal
  - Outfall Pipe (DN 900 pipe)
  - Outfall Pumps
  - Allowance for fittings
  - Allowance for instrumentation and control
- Indirect Costs
  - Design / Engineering
  - Design and quantity growth
  - Construction and Management Fee

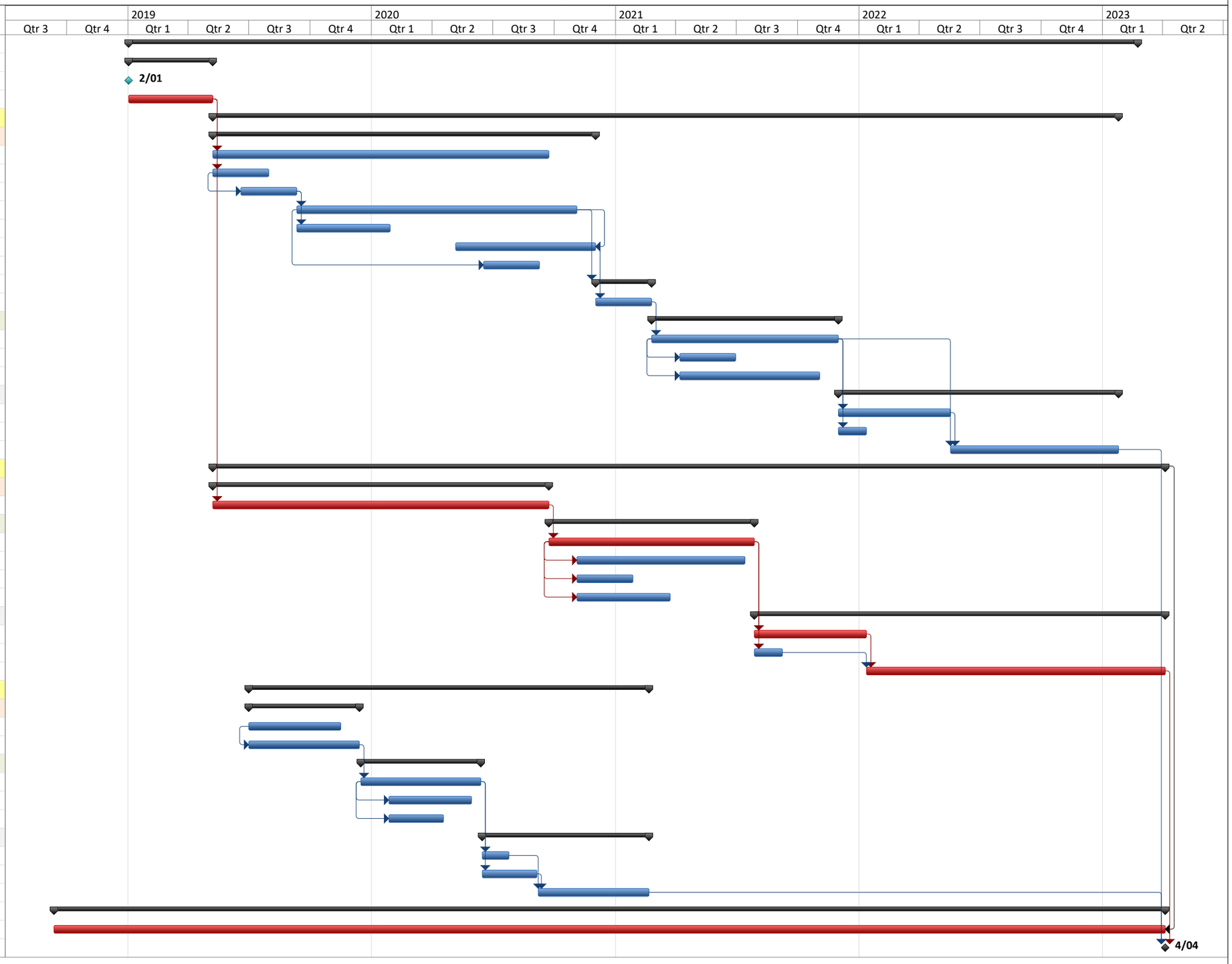
Appendix G

Preliminary program and approvals schedule

We Deliver

Wide Bay Water Site Selection Study Project - Future Works Program

ID	Delivery	Task Name
1		**Project Delivery**
2	**Internal**	**Tender**
3		Issue RFP
4		Tender and award
5		**Pulgul Outfall**
6	**Package A**	**Concept Design Phase**
7		Concept design
8		Env. data collection
9		SIA & Referral (Cth)
10		EPBC Act EIS (Cth)
11		Native Title (Cth)
12		DES pre lodgement & early approvals
13		Refine hydrodynamic model
14	**Internal**	**Tender and award**
15		Detailed Design tender & award
16	**Package B**	**Detailed Design Phase**
17		Detailed design
18		Cth approvals
19		State approvals
20	**Package C**	**Construction Phase**
21		Pre construction activities
22		Obtain construction & local law approvals
23		Outfall construction
24		**Pulgul WWTP Upgrade**
25	**Package A**	**Concept Design Phase**
26		Concept design
27	**Package A**	**Detailed Design Phase**
28		Detailed design
29		DA for MCU
30		Application to amend EA
31		Transitional Environmental Program
32	**Package D**	**Construction Phase**
33		Pre construction activities
34		Obtain construction & local law approvals
35		WWTP Construction
36		**Vanderwolf Rd Irrigation Pipeline**
37	**Package E**	**Concept design phase**
38		Cth approval (NT Act)
39		Concept design
40	**Package E**	**Detailed design phase**
41		Detailed design
42		State approvals
43		Cth approvals
44	**Package F**	**Construction Phase**
45		Pre construction activities
46		Obtain construction & local law approvals
47		Construction
48	**Package G**	**Stakeholder Engagement**
49		Outfall, WWTP & irrigation pipeline engagement
50		**Project Completion**



Project: WBW Site Selection Stud
Date: Wed 10/10/18

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Critical
Milestone	External Milestone	Manual Task	Start-only	Critical Split
Summary	Inactive Task	Duration-only	Finish-only	Progress

WBW major WWTP upgrade - approvals schedule

Field work
Prepare application
Application processing

Approvals	Legislation	Schedule Week 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Outfall		
Concept Design Phase		
Significant Impact Analysis and Referral for a controlled activity (1)	EPBC Act (Cth)	SIA; Referral
Native Title Notification	NT Act (Cth)	
Detail Design Phase		
Acceptance by Telecommunications Carriers	Telecommunications Act (Cth)	
Permit under s30 or s50 of the TI Act (2) (6)	TI Act	
Prescribed Tidal Works, Taking or interfering with marine Plants, Prescribed tidal works in tidal waters (4)	Planning Act	
Taking or interfering with marine plants	Planning Act	
Agreement to Public Utility Easement (Over reserves and leases)	Land Act	
Agreement to Public Utility Easement (Over freehold land)	LT Act	
Certification that clearing is for relevant purpose	VM Act	
Protected Plants Clearing Permit or Protected Plants Exemption Notice (3)	NC Act	
Clearing Native Vegetation (3)	Planning Act	
Environment Offsets if required as a condition of clearing	EO Act	
Traffic Permit (6)	TORUM Act	
Construction Phase		
Safety Notice	Electricity Act	
Traffic Permit (6)	TORUM Act	
Works in a local road (7)	LG Act, LL1	
Works on Council controlled land	LG Act, LL1	
Depositing material on Council controlled land or road	LG Act, LL1	
Use of vehicle on Council controlled land	LG Act, LL4	
Pulgul WWTP		
Detail Design Phase		
Application to amend EA	EP Act	
Transition Environmental Program	EP Act	
Development Approval for an MCU for the upgrade of the WWTP	Planning Act, FCPS	
Construction Phase		
Safety Notice	Electricity Act	
Irrigation pipeline		
Concept Design Phase		
Native Title Notification	NT Act (Cth)	
Detail Design Phase		
Acceptance by Telecommunications Carriers	Telecommunications Act (Cth)	
Certification that clearing is for relevant purpose	VM Act	
Protected Plants Clearing Permit or Protected Plants Exemption Notice (3)	NC Act	
Clearing Native Vegetation (3)	Planning Act	
Environment Offsets if required as a condition of clearing	EO Act	
Certification that clearing is for relevant purpose	VM Act	
Construction Phase		
Safety Notice	Electricity Act	
Traffic Permit (6)	TORUM Act	
Works in a local road (7)	LG Act, LL1	
Depositing material on Council controlled land or road	LG Act, LL1	
Amend registration of recycled water scheme	WSSR Act	