Creativity/PRECISION

JFP URBAN CONSULTANTS

PLANNERS
URBAN DESIGNERS
SURVEYORS
ENGINEERS
LANDSCAPE ARCHITECTS

PLANS AND DOCUMENTS referred to in the ULDA APPROVAL dated 10/8/12

PRELIMINARY SEWERAGE ASSESSMENT

PROPOSED DEVELOPMENT AT
Tannum Sands UDA
FOR
ULDA

M2410E – Revision E
February 2012

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DRAWINGS

1.0 INTRODUCTION

JFP Urban Consultants Pty Ltd (JFP) has been commissioned by ULDA to undertake an investigation into the provision of sewerage for the proposed Tannum Sands UDA.

It is proposed to provide a "regional solution" with the implementation of a major pump station that services the ultimate catchment from ULDA controlled and external developments.

The sewerage assessment has been undertaken to determine sewerage infrastructure required to service the interim and ultimate catchments.

JFP Drawing M2410 PS03 (attached to this assessment) provides indicative interim and ultimate catchments.

2.0 CONSTRUCTION

2.1 CONSTRUCTION ACTIVITIES

The main components of the construction program include:

- Construction of trunk gravity sewer mains (225mm & 300mm dia) upstream of the proposed sewerage pump station
- Construction of a major sewerage pump station and associated access works
- Construction of a sewerage rising main (225mm dia – interim) from the proposed sewerage pump station to the existing Gladstone Regional Council (GRC) Tannum Sands Sewerage Treatment Plant (approximate length 2,695m). The alignment of the proposed sewerage rising main will generally run parallel to the existing GRC 300mm dia sewerage rising main

JFP Drawings M2410 PS01 & M2410 PS02 (attached to this assessment) provide indicative locations of the main components to be constructed.

Indicative timing for these construction activities is provided in Table 1. The actual commencement date for construction is dependent upon the timing of approvals, and as such these dates are subject to change.

Table 1

Construction Activity	Timeframe	Indicative Dates
Construction of trunk gravity sewer mains	1 month	Commence in mid 2012
Construction of major sewerage pump station	1 month	Commence in mid 2012
Construction of sewerage rising main	2 months	Commence in mid 2012

2.2 SITE PREPARATION AND CLEARANCE

At the start of the site preparation phase surveyors will mark the location of the following construction components:

- Trunk gravity sewer main centrelines
- Sewerage pump station location
- Sewerage pump station access centreline
- Sewerage rising main centreline

The width of the construction corridor will be pegged to identify areas of particular significance that need to be avoided or protected during construction.

A qualified ecologist will inspect the site to ensure that the ecological constraints and mitigation measures are correctly implemented.

Vegetation to be retained, areas that have been identified as environmentally sensitive or other areas that require protection from potential damage will be fenced for the duration of the construction period.

A geotechnical engineering consultant with expertise in acid sulfate soils will be commissioned to undertake field testing and reporting to establish the presence and best practice management strategy for works below RL 5m AHD. Works to be undertaken below RL 5m AHD will include sewer trench excavation, sewer pump station well excavation and sewer rising main trench excavation works. The geotechnical engineer commissioned to undertake these works will prepare an Acid Sulfate Management Plan which will incorporate best practice for the identification and management of acid sulfate soils.

Erosion and transportation of sediments off-site will be controlled by the use of temporary sediment basins / barriers. Stockpiles will be located within existing cleared areas and contained within individual sediment barriers / bunds.

All sedimentation and erosion control measures will be carried out in accordance with the Institution of Engineers Australia (Queensland Division) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites.

Impacts on the surrounding environment will be minimised during the construction phase with measures outlined in the approved Erosion and Sediment Control Plans and Construction Management Plan to be provided at the operational works design stage.

2.3 LAYDOWN AREAS

Although the majority of construction activities will occur along the route of the sewerage rising main alignment, the establishment of temporary construction compounds and facilities will be required during the construction period. These compounds will be used for temporary storage of construction equipment and materials.

Where practical these laydown areas will be located in previously cleared or disturbed areas.

2.4 CIVIL WORKS

Trenching will be used to construct the sewer trunk gravity and sewerage rising mains. It is expected that an excavator will be used to dig the trench for the majority of the route. In some areas (deeper excavation associated with the sewer trunk gravity main) hard rock may be encountered a hydraulic rock breaking equipment may be required.

Typical trench dimensions for the sewerage rising main will be approximately 0.9m wide and generally 1.3m deep, allowing for a cove depth to top of pipe of approximately 1m. The actual depth profile will be determined during the detailed operational works design phase.

An indicative construction layout is detailed on JFP Drawings M2410 PS01 & M2410 PS02 (attached to this assessment) and provides indicative locations of the main components to be constructed. To manage the integrity of the sewer trunk gravity and sewerage rising mains no trees will be planted on the pipe alignments.

The distance covered daily by trenching will be dependent on terrain, equipment and weather conditions.

Breaks in the trench can be left to facilitate wildlife crossing. In addition methods to prevent fauna entrapment such as trench breakers, ramped ends of trench and fauna ladders may also be implemented.

3.0 DESIGN CRITERIA

3.1 GRAVITY SEWER

Per Capita Flow:

- Average Dry Weather Flow (ADWF) = 225 L/EP/d

Peaking Factor:

- Peak Wet Weather Flow (PWWF) = Greater of 5 x ADWF or C_1 x ADWF
  Where $C_1 = 15 \times (EP)^{-0.1587}$
  Minimum value of C_1 to be 5

Depth of flow at PWWF ≤ 0.75d

3.2 PUMP STATIONS

Pump Operating Storage in Wet Well (m^3) $= \dfrac{(0.9 \times \text{Single Pump Capacity L/s})\ \text{kL}}{N}$

Where N
= 12 starts per hour for motors < 15 kW
= 8 starts per hour for motors < 50 kW
= 5 starts per hour for motors > 50 kW

Single Pump Capacity (duty & standby) = PWWF

Pump Station Level Information:

Top of Pump Station	RL 6.500m AHD
Finished Ground Surface	RL 6.300m AHD
Overflow	RL 5.700m AHD
Outgoing Rising Main	RL 4.700m AHD

3.3 RISING MAINS

For planning purposes a maximum velocity of 1.5 m/s was adopted for rising mains during single pump flow (C_1 factored flows). This velocity results in an economic balance between capital and operational costs.

Maximum Velocity ≤ 1.5 m/s

The rising main will be design to achieve a cleansing velocity of 0.75 m/s. To ensure that the cleansing velocities are achieved velocities greater than 1.5 m/s may be required for ultimate flow scenarios.

Minimum Velocity ≥ 0.75 m/s

4.0 DEVELOPMENT POPULATION AND FLOW

The sewerage equivalent person (EP) populations associated with the ULDA and external catchments was determined from allotment yield projections and GRC design standards.

The following occupancy rates were adopted:

Table 2

Use	Basis	Sewerage Demand Density (EP)
Dwelling House	Per Lot	2.8
Retirement Village	Per Unit	1.8

SCENARIO A – INTERIM CATCHMENT

Interim catchment comprises ULDA development (approximately 820 Lots), the Silverton Drive development (44 Lots – 38 to be provided with reticulated sewer) located on the southern side of Dahl Road and the proposed retirement village (158 Units) located on the eastern side of Tannum Sands Road north of the ULDA site.

Table 3A

No. of Lots/Units (ET)	Demand (EP per ET)	Population (EP)	ADWF (L/s)	5 x ADWF (L/s)	C_1	C_1 x ADWF (L/s)	PWWF (L/s)
820	2.8	2,296	5.98	29.90	-	-	29.90
38	2.8	106	0.28	1.40	-	-	1.40
158	1.8	284	0.74	3.70	-	-	3.70
	Total:	2,686	7.00	35.00	4.28	29.96	35.00

Pump Well Diameter, Well Levels and Storage

A 3.2m diameter wet well has been adopted.

The preliminary pump well levels (subject to detail design) are detailed below in accordance with GRC guidelines.

Incoming Sewer IL	0.000m AHD
Alarm Level	-0.150m AHD
Standby Pump Start	-0.450m AHD
Duty Pump Start (interim)	-1.350m AHD
Duty Pump Stop	-2.150m AHD
Pump Floor	-2.550m AHD

Minimum Operational Volume of Wet Well (m^3) $= \frac{(0.9 \times \text{Single Pump Capacity L/s})\ \text{kL}}{N}$

$$= \frac{(0.9 \times 35.00\ \text{L/s})\ \text{kL}}{5}$$

$$= 6.30\ m^3$$

Storage height required $= \frac{\text{Volume}}{\pi \times 1.6^2}$

$= \frac{6.30}{\pi \times 1.6^2}$

$= 0.78\text{m}$

Storage volume available is 1.40m (ultimate) – therefore storage volume is ok.

Emergency Storage

Emergency storage has been provided as four (4) hours x ADWF above standby pump start level in wet well.

Assume Surcharge Level (overflow RL) = 5.700m AHD

Standby Pump Start Level = -0.450m AHD

Volume above Standby Pump Start Level = $(5.700 + 0.450) \times 1.6^2$

$= 15.74\text{m}^3$

Volume in upstream sewerage reticulation pipes and manholes at ultimate development has not been included in emergency storage calculations.

The available emergency storage time in the system is calculated as follows:

Emergency Storage Time $= \frac{\text{Volume in System}}{\text{ADWF}}$

$= \frac{15.74 \times 1000}{7.00 \times 3600}$

$= 0.63$ hrs (Interim)

Emergency storage = 4 hrs ADWF + 50% of emergency storage of upstream pump stations (GRC Requirement). For the purposes of this preliminary assessment we have adopted a storage required for four (4) hours reaction time.

Therefore additional storage is required for ultimate scenario.

Storage required for six (6) hours reaction time $= \frac{4\text{hrs} \times 7.00\text{L/s} \times 3600}{1000}$

$= 100.80\text{m}^3$

Additional storage required $= 100.80\text{m}^3 - 15.74\text{m}^3$

$= 85\text{m}^3$

Additional storage to be a well as follows:

Top of well to be 5.700m AHD

Bottom of well to be -0.450m AHD

Diameter of Additional Storage Well (D)
Adopt four (4) additional storage wells

$D = \sqrt[2]{\dfrac{4 \times V}{\pi \times h}}$ V = $85m^3$ h = 6.150m

D = 4.20m

SCENARIO B – ULTIMATE CATCHMENT

Ultimate catchment comprises ULDA development (approximately 820 Lots), the Rio Tinto Land on the western side of Coronation Drive (approximately 750 Lots), the Silverton Drive development (44 Lots – 38 to be provided with reticulated sewer) located on the southern side of Dahl Road and the proposed retirement village (158 Units) located on the eastern side of Tannum Sands Road north of the ULDA site.

The interim rising main (225mm dia) will require augmentation and additional storage is required for the ultimate scenario.

Table 3B

No. of Lots/Units (ET)	Demand (EP per ET)	Population (EP)	ADWF (L/s)	5 x ADWF (L/s)	C_1	C_1 x ADWF (L/s)	PWWF (L/s)
820	2.8	2,296	5.98	29.90	-	-	29.90
750	2.8	2,100	5.47	27.35	-	-	27.35
38	2.8	106	0.28	1.40	-	-	1.40
158	1.8	284	0.74	3.70	-	-	3.70
	Total:	4,786	12.47	62.35	3.91	48.76	62.35

Pump Well Diameter, Well Levels and Storage

A 3.2m diameter wet well has been adopted.

The preliminary pump well levels (subject to detail design) are detailed below in accordance with GRC guidelines.

Incoming Sewer IL	0.000m AHD
Alarm Level	-0.150m AHD
Standby Pump Start	-0.450m AHD
Duty Pump Start (interim)	-1.350m AHD
Duty Pump Stop	-2.150m AHD
Pump Floor	-2.550m AHD

Minimum Operational Volume of Wet Well (m^3) $= \dfrac{(0.9 \times \text{Single Pump Capacity L/s})\ kL}{N}$

$= (0.9 \times 62.35\ L/s)\ kL$

		5
	=	$11.22\ m^3$
Storage height required	=	$\frac{\text{Volume}}{\pi \times 1.6^2}$
	=	$\frac{11.22}{\pi \times 1.6^2}$
	=	1.40m

Storage volume available is 1.40m (ultimate) – therefore storage volume is ok.

Emergency Storage

Emergency storage has been provided as six (6) hours x ADWF above standby pump start level in wet well.

Assume Surcharge Level (overflow RL)	=	5.700m AHD
Standby Pump Start Level	=	-0.450m AHD
Volume above Standby Pump Start Level	=	$(5.700 + 0.450) \times 1.6^2$
	=	$15.74m^3$

Volume in upstream sewerage reticulation pipes and manholes at ultimate development has not been included in emergency storage calculations.

The available emergency storage time in the pump station is calculated as follows:

Emergency Storage Time	=	$\frac{\text{Volume in Pump Station}}{\text{ADWF}}$
	=	$\frac{15.74 \times 1000}{12.47 \times 3600}$
	=	0.35 hrs (Ultimate)

Emergency storage = 4 hrs ADWF + 50% of emergency storage of upstream pump stations (GRC Requirement). For the purposes of this preliminary assessment we have adopted a storage required for six (6) hours reaction time.

Therefore additional storage is required for ultimate scenario.

Storage required for six (6) hours reaction time	=	$\frac{6hrs \times 12.47L/s \times 3600}{1000}$
	=	$269.35m^3$
Additional storage required	=	$269.35m^3 - 15.74m^3$
	=	$254m^3$

Additional storage to be multiple wells as follows:

Top of well to be 5.700m AHD
Bottom of well to be -0.450m AHD

Diameter of Additional Storage Wells (D)
Adopt three (3) additional storage wells

$$D = \sqrt[2]{\frac{4 \times V}{\pi \times h}}$$

V	=	$254m^3 / 3 = 85m^3$
h	=	6.150m

D = 4.20m (3 Storage Wells)