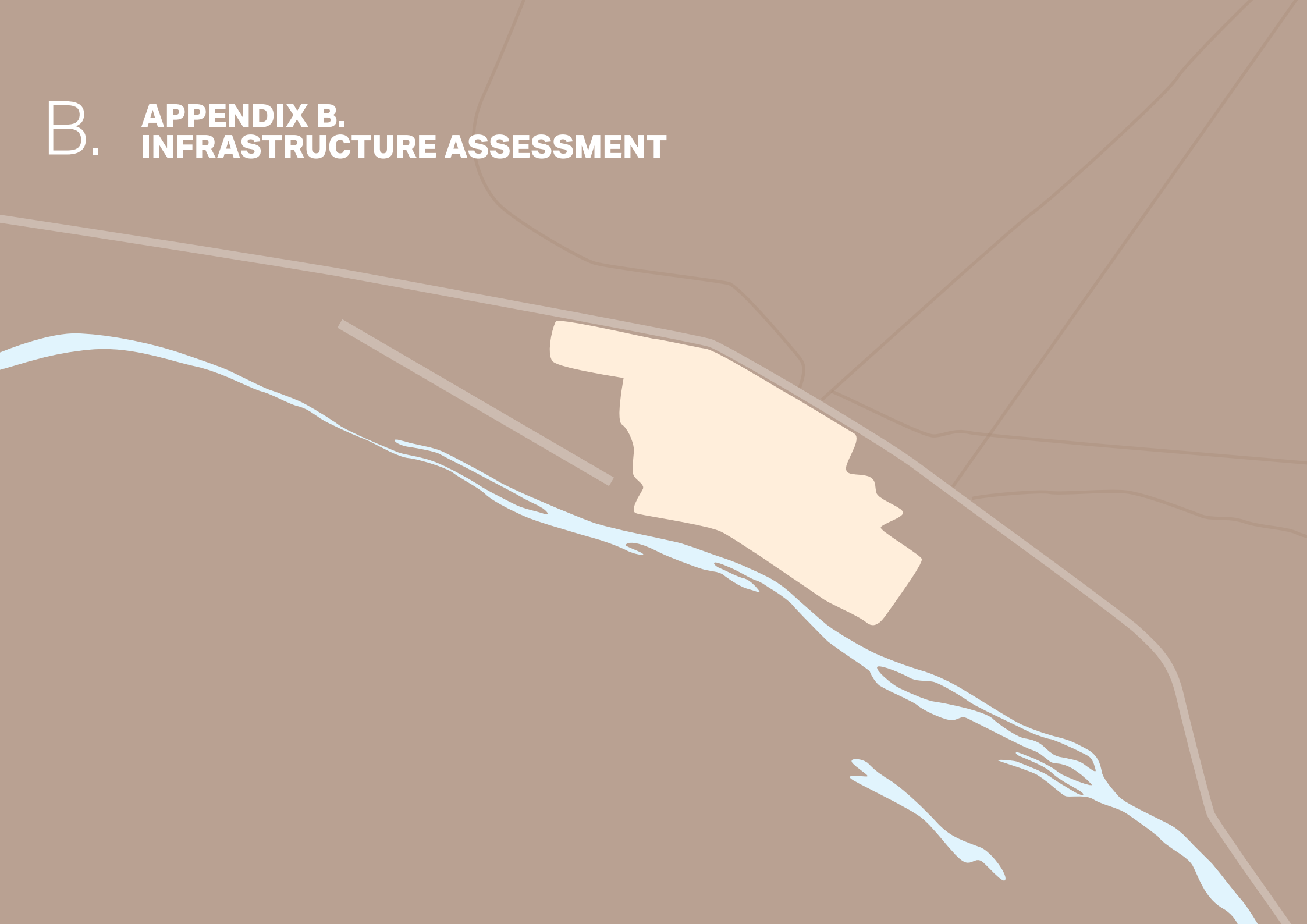


**B. APPENDIX B.  
INFRASTRUCTURE ASSESSMENT**



# INFRASTRUCTURE REVIEW

## TRANSPORT

Doomadgee contains a network of bitumen sealed internal roads. Where new developments are proposed that require new roads to access the sites, bitumen sealed roads complying with the minimum requirements of the FNQROC Regional Development Manual will be required.

## WATER SUPPLY

A review of the existing water supply infrastructure in Doomadgee is provided in the following sections.

### Existing Water Supply Infrastructure

The existing water supply infrastructure at Doomadgee includes the following elements:

- **Raw water source:** The raw water intake is located on the Nicholson River, with two separate intakes, one located adjacent to the airport and one located adjacent to Wattle Street. The raw water sources are bores equipped with two submersible multistage SP46-5 borehole pumps. The raw water pumps have a combined capacity of 35 L/s
- **Raw water rising main:** 150 mm diameter raw water rising mains
- **Water Treatment Plant (WTP) incorporating aeration, flocculation, clarification, filtration and disinfection:** The aeration tower has a capacity of 20 – 25 L/s. Clarification and filtration is provided by two package plants which are operated in a duty/standby capacity. The newer plant has a capacity of 30 L/s and the original plant has a capacity of 25 L/s
- **Potable water storage reservoir:** Ground level reservoirs with a total storage capacity of 4 ML
- **Booster pump station located at the reservoirs, containing the following pumps:**
  - / Variable speed drive (VSD) pump set: 4 No. Hydro 2000 MPC-E 2 x CRE 90-2-2 11 kW (3 duty and 1 standby pump). The design duty point is 75 L/s at 26 m, which is serviced by 3 no. pumps at 96% (48 Hz)
  - / Jacking pump: CRE 20 – 03 4 kW
- A gravity feed reticulation system consisting of DN50 mm to DN200 mm gravity feed mains

### Design Criteria

The adopted design criteria as summarised in Table B1 are generally in accordance with:

- Planning Guidelines for Water Supply and Sewerage (DEWS 2010)
- Water Supply Code of Australia (WSAA)
- Far North Queensland Regional Organisation of Councils (FNQROC) Regional Development Manual Design Guidelines.

### Design Flow Rates

ITEM	DETAIL	REFERENCE
Pressures under normal flow conditions		
Minimum Pressure	22 m	FNQROC
Maximum Pressure	60 m	FNQROC
Fire Flow Conditions		
Residential buildings	15 L/s for 2 hour duration	FNQROC
Non-residential buildings	30 L/s for 2 hour duration	FNQROC
Residual Pressure at the hydrant	12 m head	FNQROC
Residual Pressure for all other areas of the water supply zone	6 m head	FNQROC
Background Demand	2/3 Peak Hour demand	FNQROC
Reservoirs (ground level)		
Reservoir storage requirement	3 (PD – MDMM) + firefighting storage	FNQROC
Pumping Parameters		
Raw water pumps	MDMM over 20 hours	FNQROC
Pumps feeding ground level storage reservoir	MDMM over 20 hours	FNQROC
Reticulation booster pump station	PH + fire flow	FNQROC

**TABLE B1: WATER SUPPLY DESIGN CRITERIA**

### Average Day (AD) Demands

The design flow rates were based on the design guidelines and on an assessment of water supply records as presented in the Doomadgee Water Supply Upgrade - Design Report (Maunsell, 2008).

The Doomadgee Water Supply Upgrade - Design Report indicated that:

- Water demand estimates in Aboriginal communities are notoriously difficult to make as there is a lack of water metering and historical records
- Typically, estimates of 750 litres/person/day have been adopted as the basis of design in the absence of better information
- During January of 2008, records indicate that the community used 21.7 ML of water, which equates to a usage of 583 litres/person/day assuming a population of 1200 persons
- January occurs in the wet season and it is likely that dry season demands will exceed this amount.

An Average Day demand of 600 L/EP/day was adopted for residential lots within the 2008 report\*. This value has been adopted in subsequent modelling and design of water infrastructure for Doomadgee, and was adopted for this assessment.

### Peaking Factors

The following peaking factors were adopted for this assessment, consistent with the FNQROC Regional Development Manual Design Guidelines:

- Mean Day Maximum Month (MDMM): 1.50 x AD
- Peak Day (PD): 2.25 x AD
- Peak Hour (PH): 1/12 of PD
- Fire Flow: 15 L/s, applied concurrently with 2/3 PH flow.

### Existing Water Supply Demands

The existing water supply demands for Doomadgee based on the 2016 population estimate presented in Table 1 are summarised in Table B2.

*\*Recent advice has indicated that the existing population in Doomadgee is much higher than indicated by Census data, which results in a lower average day demand per person. An average day demand of 500 L/EP/day has been adopted in accordance with FNQROC Regional Development.*

DESCRIPTION	AD (L/s)	PD (L/s)	PH (L/s)
Residential Lots	13.89	31.25	62.50
Non-Residential Loads	1.89	4.26	8.51
<b>TOTAL</b>	<b>15.78</b>	<b>35.51</b>	<b>71.01</b>

TABLE B2: DESIGN FLOW RATES – EXISTING DEMANDS

## SEWERAGE

A review of the existing sewerage infrastructure in Doomadgee is provided in the following sections.

### Existing Sewerage Infrastructure

The original sewerage system for Doomadgee is a common effluent drainage scheme which was originally installed in 1991. The septic tanks are connected to the pedestals, however the kitchen wastes are generally connected directed to the effluent drainage scheme. The collection system consists of septic tanks, a network of 100 mm and 150 mm diameter effluent collection sewers and five sewerage pump stations. Details of the pump stations are provided in Table B3.

New areas in the community including the AACAP site, Marradgee Rd and Ned St expansions have been designed to operate as a traditional gravity system. The system is treated by a series of five lagoons, which include two primary ponds, three secondary ponds and a bunded evaporation area. The treatment lagoons have the capacity to treat a population of 1,650 EP.

PUMP STATION	CAPACITY	RISING MAIN DETAILS
Pump Station 1	14.3 L/s	100 mm diameter pressure main, discharges to pump station 2
Pump Station 2	20.3 L/s	150 mm diameter pressure main, discharges to pump station 4
Pump Station 3	6.7 L/s	100 mm diameter pressure main, discharges to pump station 4
Pump Station 4	27.3 L/s*	150 mm diameter pressure main, discharges to the STP. The Sewerage Upgrade design report (AECOM, 2003) recommended an upgrade to a 200 mm diameter main for 2013.
Pump Station 5	4.5 L/s single pump	68 m long HDPE DN110 PE 100 SDR 9 (84.5 mm ID)

Note: \* Design flow for pumps when pressure main upgraded to 200 mm diameter.

TABLE B3: EXISTING SEWERAGE PUMP STATIONS AND ASSOCIATED PRESSURE MAINS

### Design Criteria

The adopted design criteria are generally in accordance with:

- Planning Guidelines for Water Supply and Sewerage (DEWS 2010)
- Water Supply Code of Australia (WSAA)
- Far North Queensland Regional Organisation of Councils (FNQROC) Regional Development Manual Design Guidelines.

### Design Flow Rates

#### Design Flows

The following design flow rates and peaking factors were adopted for this assessment, consistent with the FNQROC Regional Development Manual Design Guidelines:

- Average Dry Weather Flow (ADWF): 270 L/EP/day
- Peak Wet Weather Flow (PWWF): 5 x ADWF

#### Existing Sewerage Flows

The existing sewerage flows for Doomadgee are summarised in Table B4.

DESCRIPTION	ADWF (L/s)	PWWF (L/s)
Residential Lots	6.25	31.25
Non-Residential Loads	0.79	3.95
<b>TOTAL</b>	<b>7.04</b>	<b>35.20</b>

TABLE B4: DESIGN FLOW RATES – EXISTING DEMANDS

## STORMWATER

The township of Doomadgee grades away from the Nicholson River. The existing stormwater system within Doomadgee consists of an overland flow system (concrete kerb & channelling and general overland flow) which grades away from the river and discharges flows to the north of the town, and a piped drainage network which discharges flows to the Nicholson River. The proposed development sites will require an extension of the existing stormwater infrastructure.

## ELECTRICITY SUPPLY AND COMMUNICATIONS

The existing electrical supply in Doomadgee is an overhead supply to the property boundary. Extension of existing supply to new properties will be required.

Communications is provided by underground conduiting. Extension of conduiting to the frontage of new properties will be required.

# INFRASTRUCTURE REQUIREMENTS

## ASSUMPTIONS

The assumptions used to assess the infrastructure requirements for each site are summarised in the following sections.

### Design Populations for Residential Lots

The infrastructure requirements for the proposed residential lots are based on the lot layouts presented in Section 07. An occupancy rate of 5.3 EP/house was adopted for the proposed residential lots. The design populations adopted for the proposed residential lots are summarised in Table B5.

LOCATION	No. of Lots	EP/lot	Population
Marradgee Road	66	5.3	349.8
Ned Street	20	5.3	106
Cattle Street Region (infill lots)	19	5.3	100.7
TOTAL	105		556.5

TABLE B5: DESIGN POPULATIONS - RESIDENTIAL LOTS

### Design Populations for Proposed Non-Residential Land Uses

The following assumptions were adopted in determining the infrastructure requirements for the proposed non-residential lots.

#### Industrial Area

- The industrial area will be used for light industrial applications such as sheds/workshops and lay-down areas.
- Water and sewerage flows were assumed based on the low end of the typical usage for light industry provided in the DEWS guidelines as follows:
  - A typical water usage for light industrial applications of 10,000 L/day/ha was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A, Light Industry)
  - A typical sewage flow for light industrial applications of 10,000 L/day/ha was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A, Light Industry).

#### Commercial Precinct

- A typical equivalent population for shops and offices of 1.0 EP per 90 m<sup>2</sup> of Gross Floor Area (GFA) was adopted to calculate water demands and sewage flows (reference: FNQROC Regional Development Manual – Design Guidelines)
- The GFA was assumed to cover 30% of total lot area. The remaining area of the lot was assumed to be utilised for building setbacks, awnings, off-street car parking and landscaping.

#### Caravan Park

- The Caravan Park was assumed to include a caretaker's residence, amenities block, powered caravan sites and grassed camping sites
- The caretaker's residence water demand and sewage flow was sized in line with residential demands
- In order to estimate water demands and sewage loads from the caravan sites and camping sites, typical loads from FNQROC Design Guidelines and DEWS Guidelines were reviewed and the most conservative demands adopted. 1.2 EP/site was adopted for powered caravan sites and grassed camping sites (reference: FNQROC Regional Development Manual – Design Guidelines).

#### BMX Facility

- The BMX Facility was assumed to include a 350 m track, starters platform and ramp and a 90m<sup>2</sup> clubhouse/amenities building
- A clubhouse/amenities building with a GFA of 90 m<sup>2</sup> was adopted as the asset generating water demand and sewage flows for this site. Water and sewage flows were assumed based on the high end of the typical usage for a Public Building provided in the DEWS guidelines, as follows:
  - A water usage of 600 L/day per 90 m<sup>2</sup> of Gross Floor Area (GFA) was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A)
  - A sewage usage of 450 L/day per 90 m<sup>2</sup> of Gross Floor Area (GFA) was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A).

#### Water Play Park

- The proposed facilities were assumed to include:
  - Water Playground on 200 m<sup>2</sup> pad
  - 800 m<sup>2</sup> ground level fountain
  - 50 m<sup>2</sup> change room/amenities block
- It was assumed that the water play park will be installed as a recirculating system. This will incorporate the following features:
  - Drains to collect water from the wet areas
  - Water treatment system to filter and treat water for the playground and ground level fountain
  - Holding tank to collect and store water
  - Pumps to provide the required pressure to the water play equipment
- It was assumed that the water play park will be only operated during the day. 10 hours operation per day assumed for assessment
- Water usage for the playground and fountain is based on water top-up requirements, assumed to be up to 20% of daily water requirement, topped up over a 10 hour period
- The total water requirement for the water play park depends on the particular items installed at the site. Typical usages for each element were based on the following:
  - Ground level fountain: Flow range of 15 L/h to 40 L/h for a 10 m<sup>2</sup> area typical for water saving style fountains found in similar facilities. A water usage of 40 L/h/10 m<sup>2</sup> area was adopted for this project. For a 10 hour day, a total of 32 kL/day required
  - Playground: A flow range of 800 to 1700 L/h was identified for a playground incorporating a tipping bucket, slide and various water play sprayers, depending on the specific features included. For a 10 hour day, a total of 17 kL/day is required
- It was assumed that the water play park will be installed as a recirculating system. Therefore, the water from the playground will be collected, filtered, treated and reused. The flow to the sewerage system will be limited to the backwash flow from the

filters. It was assumed that the backwash flow is 10% of the total daily water supply requirement for the water park, to be discharged to the sewerage network over a 10 hour period

- The 50 m<sup>2</sup> amenities block was assumed to contain male and female facilities, with 2 x toilets, 2 x showers and hand basins in each. The water demands and sewage flows for the amenities block based on a peak flow generated during the concurrent use of 4 showers. Shower flow rates of 9 L/min were adopted, based on typical rates for 3 stars WELS rating showers
- Two potential sites for a water play park were identified within the preferred option. It was assumed that only one of these sites will be developed. Both of the potential sites were assessed to identify the infrastructure requirements for each site.

#### Community Facility Site

- It was assumed that the Community Facility Site will be used for a social club. A similar size to the PCYC building has been allowed for (approximately 1000 m<sup>2</sup> GFA)
- 600L/day per 100 m<sup>2</sup> of Gross Floor Area (GFA) was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A, Public Building)
- A social club building with a GFA of 1000 m<sup>2</sup> was adopted. Water and sewage flows were assumed based on the high end of the typical usage for a Public Building provided in the DEWS guidelines, as follows:
  - A water usage of 600 L/day per 100 m<sup>2</sup> of Gross Floor Area (GFA) was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A, Public Building)
  - A sewage usage of 450 L/day per 100 m<sup>2</sup> of Gross Floor Area (GFA) was adopted (reference: Planning Guidelines for Water Supply and Sewerage (DEWS 2010), Table A, Public Building)

## TRANSPORT

A review of the proposed developments identified that the majority of the proposed development sites within Doomadgee are located adjacent to existing sealed roads. New bitumen sealed roads will be required for the proposed development sites listed in Table B6.

DESCRIPTION	INFRASTRUCTURE REQUIREMENT
Marradgee Road Residential Lots	New Access Street (6.5 m wide sealed carriageway, 15.5 m wide road reserve), approximately 1575 m length
Ned Street Residential Lots	New Access Street (6.5 m wide sealed carriageway, 15.5 m wide road reserve), approximately 715 m length
Cattle Street Region Residential Lots	New Access Street (6.5 m wide sealed carriageway, 15.5 m wide road reserve), approximately 480 m length
Industrial Precinct	New Industrial Access street (12.0 m wide sealed carriageway, 21.0 m wide road reserve), approximately 640 m length

**TABLE B6: TRANSPORT INFRASTRUCTURE REQUIREMENTS**

## WATER

An assessment of the water supply infrastructure requirements to service the preferred future development options for Doomadgee was undertaken using a water network model for the town. The assessment and the infrastructure requirements are summarised in the following sections.

### Design Flow Rates

#### Design Flow Rates for Proposed Residential Lots

An occupancy rate of 5.3 EP/lot was adopted for the proposed residential lots based on the 2016 Census data population of 1,405 persons with 267 occupied dwellings. The design flow rates adopted for the proposed residential lots are summarised in Table B7.

LOCATION	NO. OF LOTS	AD (L/s)	PD (L/s)	PH (L/s)
Marradgee Road	66	2.43	5.47	10.93
Ned Street	20	0.74	1.66	3.31
Cattle Street Region	19	0.70	1.57	3.15
<b>TOTAL</b>	<b>105</b>	<b>3.86</b>	<b>8.70</b>	<b>17.39</b>

**TABLE B7: DESIGN POPULATIONS - RESIDENTIAL LOTS**

#### Design Flow Rates for Proposed Non-Residential Land Uses

The design flow rates adopted for the proposed non-residential lots are summarised in Table B8. These demands are based on the assumptions presented in section 4.1.

ITEM	DEVELOPMENT SIZE	AD (L/s)	PD (L/s)	PH (L/s)
Industrial Precinct	25 Lots, 105,160 m <sup>2</sup> total area	1.22	2.74	5.48
Commercial Precinct	11,760 m <sup>2</sup>	0.27	0.61	1.22
Caravan Park	1 x caretaker residence 1 x amenities block 38 x powered slab sites 10 x grassed camp sites	0.44	0.99	1.97
BMX Facility	350 m track Clubhouse/amenities 90 m <sup>2</sup>	0.01	0.02	0.03
Water Play Park	Water Playground on 200 m <sup>2</sup> pad 800 m <sup>2</sup> ground level fountain 50 m <sup>2</sup> change room/amenities block	0.19	0.44	0.87
Community Facility Site	See assumptions section	0.07	0.16	0.31
<b>TOTAL</b>	<b>105</b>	<b>2.20</b>	<b>4.96</b>	<b>9.88</b>

**TABLE B8: DESIGN FLOW RATES – NON-RESIDENTIAL LOTS**

#### Summary Total Design Flow Rates for Proposed Preferred Option

The total design flow rates are summarised in Table B9.

DESCRIPTION	AD (L/s)	PD (L/s)	PH (L/s)
Existing Demands	15.78	35.51	71.01
New Residential Lots	3.86	8.70	17.39
New Non-Residential Facilities	2.20	4.96	9.88
<b>TOTAL</b>	<b>21.84</b>	<b>49.17</b>	<b>98.28</b>

**TABLE B9: SUMMARY TOTAL DESIGN FLOW RATES**

## Water Supply Network Modelling

### Introduction

An assessment of the water supply infrastructure required to service the town of Doomadgee with the preferred option was undertaken using a hydraulic model of the town developed using the hydraulic network modelling software EPANET. The model of Doomadgee was originally created for the assessment undertaken for the Doomadgee Water Supply Upgrade - Design Report (Maunsell, 2008), and was updated to incorporate water supply infrastructure upgrades constructed in Doomadgee since the original model was developed.

### Demand Allocation

Demands for the proposed preferred option were added at the nodes at the connection points identified for each of the proposed site. The water model layout and the total loads applied at each node are provided in Appendix C.

### Modelling Methodology

A static assessment was undertaken using the EPANET model for the following scenarios in order to identify the water supply infrastructure requirements for the preferred option:

- Peak Hour Demands:
  - / Existing system with demands applied based on the existing population
  - / Preferred option with water play park located at site 1 (adjacent to the BMX Facility). Demands applied based on full uptake of all elements of the preferred option
  - / Preferred option with water play park located at site 2 (on the banks of the Nicholson River). Demands applied based on full uptake of all elements of the preferred option
- Fire Flow Assessment:
  - / Existing system with demands applied based on the 2016 population
  - / Preferred option with water play park located at site 1 (adjacent to the BMX Facility). Demands applied based on full uptake of all elements of the preferred option
  - / Preferred option with water play park located at site 2 (on the banks of the Nicholson River). Demands applied based on full

uptake of all elements of the preferred option.

The fire flow assessment included a fire flow of 15 L/s with a background demand of 2/3 PH flow. Several sites for the location of the fire flow were assessed to identify the site with the greatest impact on the water network.

### Modelling Results

The model results for each assessment are provided in Appendix C.

### Review of Trunk Infrastructure

A summary of the elements of the existing Doomadgee water supply system is provided in Table B10.

ITEM	EXISTING CAPACITY	REQUIRED CAPACITY	DEFICIENCY
<b>Raw Water Source</b> The Nicholson River, two separate intakes at the following locations: <ul style="list-style-type: none"> <li>• Airport</li> <li>• Wattle Street</li> </ul>	Raw water pumps: Two pump stations, total capacity of 35 L/s	2.8 ML/day or 39.6 L/s (MDMM over 20 hours)	4.6 L/s
<b>Water Treatment Plant</b> Aeration tower and two package plants incorporating flocculation and clarification	Aeration Tower: 20-25 L/s Package Plants: Newer plant: 30 L/s Original plant: 25 L/s Currently operated in duty/standby arrangement	2.8 ML/day or 39.6 L/s (MDMM over 20 hours)	Aeration Tower: 25-30 L/s Package Plants: Nil if plants can be operated concurrently
<b>Water Storage</b> Ground level storage reservoir	4.0 ML	4.4 ML	0.4 ML
<b>Booster pump station</b> VSD pump station containing: <ul style="list-style-type: none"> <li>• 4 No. Hydro 2000 MPC-E 2 x CRE 90-2-2 11 kW (3 duty and 1 standby pump)</li> <li>• Jacking Pump: CRE 20-03 4 kW</li> </ul>	Design duty point 75 L/s at 26 m, serviced by 3 no. pumps at 96% (48 Hz)	Peak Hour: 99 L/s at 27 m head	24 L/s

**TABLE B10: DOOMADGEE EXISTING WATER SUPPLY SYSTEM ELEMENTS**

## Infrastructure Requirements

The water supply infrastructure requirements for the preferred option are summarised in Table B11.

DESCRIPTION	INFRASTRUCTURE REQUIREMENT
Marradgee Road Residential Lots	100 mm diameter water mains to service the new lots. Approximate 1,840 m total length of mains.
Ned Street Residential Lots	100 mm diameter water mains to service the new lots. Approximate 470 m total length of mains.
Cantle Street Region Residential Lots	100 mm diameter water mains to service new lots not located adjacent to existing water mains. Approximate 40 m total length of mains.
Industrial Precinct	150 mm diameter water mains to service the new lots. Approximate 1,360 m total length of mains.  150 mm diameter water main from nearest existing 200 mm diameter main to the proposed development site. Approximate 200 m total length of main.
Commercial Precinct	No additional water mains required
Caravan Park	150 mm diameter water main from the nearest connection point to the caravan park site. Approximately 550 m.
BMX Facility	150 mm diameter water main from the nearest connection point to the BMX Facility site. Approximately 170 m.
Water Play Park – Site 1 (adjacent to the BMX track)	The water main servicing the BMX facility site will also service the water play park site 1 location.
Water Play Park – Site 2 (on the banks of the Nicholson River)	150 mm diameter water main from the nearest connection point to the water play park site. Approximately 35 m.
Community Facility Site	150 mm diameter water main from the new mains required for the proposed caravan park to the community facility site. Approximately 80 m.  Note: Additional 380 m of water mains will be required if this site is developed prior to the caravan park
General*	A duplication of the aeration tower at the water treatment plant will be required once sufficient development of the community results in MDMM demands over 20 hours in excess of 20 L/s. The booster pump station will need to be upgraded to a capacity of 99 L/s once the Peak Hour demand exceeds 80 L/s.  <i>*Note: General upgrades are upgrades required for the overall proposed development option, but not specific to any one site.</i>  An upgrade to the raw water pumps and rising main will be required once sufficient development of the community results in MDMM demands over 20 years in excess of 39.6 L/s.  An additional 440 kL reservoir will be required once the equivalent population exceeds 2,880 EP.  These upgrades may be reduced or eliminated through the use of demand management to limit the water supply demand.

**TABLE B11: WATER SUPPLY INFRASTRUCTURE REQUIREMENTS**

## SEWERAGE

### Design Sewage Flow Rates

#### Design Sewage Flow Rates for Proposed Residential Lots

An occupancy rate of 5.5 EP/lot was adopted for the proposed residential lots in accordance with the occupancy rates presented in section 2.3.3. The design flow rates adopted for the proposed residential lots are summarised in Table B12.

LOCATION	NO. OF LOTS	ADWF (L/s)	PWWF (L/s)
Marradgee Road	66	1.09	5.47
Ned Street	20	0.33	1.66
Cantle Street Region	19	0.31	1.57
TOTAL	105	1.74	8.70

**TABLE B12: DESIGN FLOW RATES - RESIDENTIAL LOTS**

#### DESIGN FLOW RATES - RESIDENTIAL LOTS

#### Design Flow Rates for Proposed Non- Residential Land Uses

The design flow rates adopted for the proposed non-residential lots are summarised in Table B13. These flow rates are based on the following assumptions:

ITEM	DEVELOPMENT SIZE	ADWF (L/s)	PWWF (L/s)
Industrial Precinct	25 Lots, 105,160 m <sup>2</sup> total area	1.22	6.09
Commercial Precinct	11,760 m <sup>2</sup>	0.12	0.61
Caravan Park	1 x caretaker residence 1 x amenities block 38 x powered slab sites 10 x grassed camp sites	0.20	0.99
BMX Facility	350 m track Clubhouse/amenities 90 m <sup>2</sup>	0.01	0.03
Water Play Park	Water Playground on 200 m <sup>2</sup> pad 800 m <sup>2</sup> ground level fountain 50 m <sup>2</sup> change room/amenities block	0.14	0.68
Community Facility Site	See assumptions section	0.05	0.26
TOTAL		1.73	8.65

**TABLE B13: DESIGN FLOW RATES – NON-RESIDENTIAL LOTS**

#### Summary Total Design Flow Rates for Proposed Preferred Option

The total design flow rates are summarised in Table B14.

DESCRIPTION	ADWF (L/s)	PWWF (L/s)
Existing Demands	7.04	35.20
New Residential Lots	1.74	8.70
New Non-Residential Facilities	1.73	8.65
TOTAL	10.51	52.55

**TABLE B14: SUMMARY TOTAL DESIGN FLOW RATES**

#### Review of Trunk Infrastructure

A summary of the trunk infrastructure of the existing Doomadgee sewerage system is provided in Table B15.

ITEM	EXISTING CAPACITY	REQUIRED CAPACITY	DEFICIENCY
Pump Station 1	14.3 L/s	20.5 L/s	6.3 L/s
Pump Station 2	20.3 L/s	29.4 L/s	9.1 L/s
Pump Station 3	6.7 L/s	11.9 L/s	5.1 L/s
Pump Station 4	27.3 L/s	42.8 L/s	15.6 L/s
Pump Station 5	4.5 L/s	7.1 L/s	2.6 L/s
Pressure Main 1 100 mm diameter	19.6 L/s*	20.5 L/s	0.9 L/s
Pressure Main 2 150 mm diameter	44.18 L/s*	29.4 L/s	Nil
Pressure Main 3 100 mm diameter	19.6 L/s*	11.9 L/s	Nil
Pressure Main 4 150 mm diameter	44.2 L/s*	42.8 L/s	Nil
Pressure Main 5 85 mm diameter	14.2 L/s*	7.1 L/s	Nil
Sewerage Treatment Plant	1,650 EP	3,363 EP (including allowance for non-residential uses)	1,1713 EP

Note: \* Based on maximum velocity of 2.5 m/s

**TABLE B15: DOOMADGEE EXISTING SEWERAGE SYSTEM TRUNK INFRASTRUCTURE**

#### Infrastructure Requirements

The sewerage infrastructure requirements for the preferred option are summarised in Table B16.

DESCRIPTION	INFRASTRUCTURE REQUIREMENT
Marradgee Road Res Lots	150 mm diameter gravity sewer to service the new lots. Approx. 880 m total length of mains.
Ned Street Res Lots	150 mm diameter gravity sewer to service the new lots. Approx. 275 m total length of mains.
Cantle Street	No additional sewers required
Industrial Prec.	150 mm diameter gravity sewer to service the new lots. Approximate 925 m total length of mains. New Pump Station capable of pumping 6.1 L/s to the STP. 100 mm diameter rising main from the new pump station to the STP. Approx. 130 m total length of main.
Comm. Prec.	No additional sewers required
Caravan Park	Low pressure pump station unit and 50 mm diameter pressure main. Approx. 325 m total length of mains. Note: approximately 155 m length of the pressure main will also service the Community Facility Site
BMX Facility	150 mm diameter gravity sewer to service the facility. Approx. 210 m total length of mains.
Water Play – Site 1 (adj BMX track)	The sewers servicing the BMX facility site will also service the water play park site 1 option.
Water Play – Site 2 (Nicholson Riv.)	150 mm diameter gravity sewer to service the facility. Approximate 87 m total length of mains.
Community Facility Site	Low pressure pump station unit and 50 mm diameter pressure main. Approximate 95 m total length of mains, to connect to pressure mains constructed for the Caravan Park site. Note: If the community facility site is developed prior to the caravan park, an additional approx. 155 m length of pressure main will need to be constructed.
General:	Pump Station 1 – upgrade to a capacity of 23.5 L/s. Pump Station 2 – upgrade to a capacity of 31.3 L/s, Pump Station 3 – upgrade to a capacity of 10.2 L/s, Pump Station 4 – upgrade to a capacity of 43.4 L/s, Pump Station 5 – Upgrade to a capacity of 6.8 L/s, Pressure main 1 – Upgrade to 150 mm diameter main.  STP – An upgrade of the sewerage treatment plant will be required once the total population exceeds 1650 EP. For the purpose of this project, it has been assumed that the existing lagoons will be replaced with a mechanical sewerage treatment plant.

1. General upgrades are upgrades required for the overall proposed development option, but not specific to any one site.

2. A full assessment of the condition of the existing sewerage treatment lagoons and the potential upgrade options will be required to confirm the upgrade required. Potential upgrade options to be investigated include:

- Construction of additional treatment lagoons to treat the additional sewerage. This option is subject to the availability of suitable land outside of the areas prone to flooding.
- Addition of aerators to increase the capacity of the existing sewerage treatment lagoons. An assessment of the capacity of the existing system and the increased capacity that could be obtained through the provision of aerators is required to confirm whether this option is suitable.
- Installation of a mechanical STP. This option will enable the treatment of the potential future volume of sewerage without the need for a large area of land.

**TABLE B16: SEWERAGE INFRASTRUCTURE REQUIREMENTS**

## EARTHWORKS

The earthworks requirements for the preferred option are summarised in Table B17.

DESC.	COMMENTS	EARTHWORKS REQ.
Marradgee Road Residential Lots	Very flat site, filling of adjacent subdivision was required to allow grading of road, sewers and stormwater	Site filling required to allow minimum grading of sewerage and stormwater infrastructure.
Ned Street Residential Lots	Very flat site	Site filling required to allow minimum grading of infrastructure.
Cantle Street Region Residential Lots	Infill development, current site levels match the adjacent developed lots levels	No cut or fill required.
Industrial Precinct	Flat area, located within the low flood hazard area. The site is to drain to the north by overland flow.	Filling is required to achieve minimum required grade for stormwater drainage.
Commercial Precinct	The site is not located within the flood hazard area. Site levels match the levels of the surrounding area	No cut or fill required.
Caravan Park	Flat area, located within the low flood hazard area	No cut or fill to be applied to the site. The caravan park to be evacuated in the event of floods.
BMX Facility	The site is not located within the flood hazard area.	No cut or fill required.
Water Play Park – Site 1 (adjacent to the BMX track)	The site is not located within the flood hazard area.	No cut or fill required.
Water Play Park – Site 2 (on the banks of the Nicholson River)	The site is not located within the flood hazard area.	No cut or fill required.
Community Facility Site	Flat area, located within the low flood hazard area	Fill is required to the location of the building only.

**TABLE B17: EARTHWORKS REQUIREMENTS**

## STORMWATER

The stormwater infrastructure requirements for the preferred option are summarised in Table B18.

DESC.	COMMENTS	INFRASTRUCTURE REQ.
Marradgee Road Res. Lots	As the site is very flat, filling is required to assist with the stormwater drainage system for the site.	A stormwater drainage network discharging to the Nicholson River will be required.
Ned Street Res. Lots	As the site is very flat, filling is required to assist with the stormwater drainage system for the site.	The adjacent Ned Street development included an overland drainage swale which drained away from the Nicholson River. This drainage swale will need to be extended through the new development.
Cantle Street Region Residential Lots	The existing development drains away from the Nicholson River. An improvement of this network will require extensive upgrade of the drainage network within Doomadgee. It is proposed to use the existing drainage network for this infill development.	Nil. The existing overland drainage paths for the existing development will be used to service the infill lots.
Industrial Precinct	As the land grades away from the Nicholson River, an underground stormwater network from the industrial precinct cannot grade towards the river. The precinct will need to drain to the north instead. An overland system will be required by the discharge conditions, and filling of the site will be required to achieve the minimum grade of 0.6%.	Kerb and Channel to be installed on the road with a minimum grade of 0.6% to divert the stormwater from the industrial precinct to the north of the site. Filling of the site will be required to achieve the minimum required grade.
Comm. Precinct	This site is surrounded by existing stormwater infrastructure.	Nil
Caravan Park	Stormwater from this region currently drains to the north by overland flow.	Nil. Site to continue to flow to the north by overland flow.
BMX Facility	Stormwater from this region currently drains to the north by overland flow.	Nil. Site to continue to flow to the north by o'land flow.
Water Play – Site 1 (adj. to BMX track)	Stormwater from this region currently drains to the north by overland flow.	Nil. Site to continue to flow to the north by overland flow.
Water Play – Site 2 (river)	This site currently drains to the adjacent Nicholson River.	Nil. Site to continue to drain to the adjacent river.
Community Facility Site	Stormwater from this region currently drains to the north by overland flow. This site is located within the low flood hazard area.	Nil. Site to continue to flow north by overland flow. Local fill will be required to the building site to ensure the building floor level is a min. 300 mm above the highest known flood level.

**TABLE B18: STORMWATER INFRASTRUCTURE REQUIREMENTS**

## ELECTRICITY SUPPLY AND COMMUNICATIONS

Communications will require the installation of pits and conduits for any sites located on new roads. The length of conduit for the communications has assumed to be generally the same as the length of new water main required. The electrical supply will require the installation of overhead supply and new poles for any sites located on new roads. Poles will be required every 80 m and at changes in direction. The same alignment has been assumed for communications and electrical services. The electricity supply and communications services required are summarised in Table B19.

DESCRIPTION	INFRASTRUCTURE REQUIREMENT
Marradgee Road Residential Lots	Approximately 1840 m length of mains to service the new lots.
Ned Street Residential Lots	Approximately 470 m length of mains to service the new lots.
Cantle Street Region Residential Lots	Infill development - electrical mains are located on the road to service the existing lots.
Industrial Precinct	Approximately 1360m length of mains to service the new lots.
Commercial Precinct	Electrical mains are located adjacent to the site.
Caravan Park	Approximately 550 m length of mains to service the site.
BMX Facility	Electrical mains are located adjacent to the site.
Water Play Park – Site 1 (adjacent to the BMX track)	Electrical mains are located adjacent to the site.
Water Play Park – Site 2 (on the banks of the Nicholson River)	Approximately 35 m length of mains to service the site.
Community Facility Site	Approximately 100 m length of mains to service the site if constructed after the caravan park. Note, if constructed after the caravan park, an additional approximate 380 m length of mains will be required.

**TABLE B19: ELECTRICITY SUPPLY AND COMMUNICATIONS INFRASTRUCTURE REQUIREMENTS**



## COST ESTIMATES

An Opinion of Probable Construction Costs was developed based on the approximate quantities derived from the planning level assessment undertaken for this report and costs obtained from recent similar projects with an adjustment to account for cost escalation. The estimate includes costs associated with construction only. A summary of the probable construction costs is provided in Table B20.

LOCATION	CAPITAL COST ESTIMATE
Marradgee Road	\$9,132,978
Ned Street	\$1,869,552
Cantle Street Region	\$396,565
Industrial Precinct	\$15,174,939
Commercial Precinct	\$0
Caravan Park	\$951,210
BMX Facility	\$387,660
Water Play Park – Site 1 (adjacent to the BMX track)	\$0 (if installed after BMX Facility)
	\$387,660 (if installed prior to BMX Facility)
Water Play Park – Site 2 (on the banks of the Nicholson River)	\$120,011
Community Facility Site	\$343,980
General	\$11,374,410 (based on the replacement of the existing STP with a mechanical plant)
<b>TOTAL</b>	<b>\$39,751,305</b>

**TABLE B20: OPINION OF PROBABLE CONSTRUCTION COSTS**

The cost required for the development of the Marradgee Road residential site and the Industrial area are quite high, with a large component of the cost associated with the earthworks required to develop the site. Cost estimates for reducing the size of the proposed developments were prepared and are presented in Table B21 and Table B22.

Development Size	CAPITAL COST ESTIMATE
66 Lots	\$9,132,978
40 Lots	\$6,132,157
14 Lots	\$2,359,502

**TABLE B21: OPINION OF PROBABLE CONSTRUCTION COSTS – MARRADGEE ROAD RESIDENTIAL LOTS**

Development Size	CAPITAL COST ESTIMATE
Industrial Site – 25 Lots	\$15,174,939
Industrial Site – 7 Lots (on Potter Street)	\$4,817,625

**TABLE B22: OPINION OF PROBABLE CONSTRUCTION COSTS – INDUSTRIAL SITES**