Appendix D - Engineering Servicing Report

Ningaloo Lighthouse Resort
Engineering Servicing Report
March 2021

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References

Pennington Scott; H2 Hydrogeological Report – Lighthouse Holiday Park Redevelopment. Revision 1, November 2020.

CMW Geosciences; Proposed Ningaloo Lighthouse Resort – Lighthouse Bay, Exmouth. Revision 0, February 2021

1. INTRODUCTION

The following report has been prepared by Cossill & Webley, Consulting Engineers (CW) and summarises civil engineering and future servicing considerations of the proposed tourism development of the Ningaloo Lighthouse Resort (referred to herein as the Site). The report has been prepared to support the Development Application (DA) submission.

The Site fronts the Indian Ocean to the north and is surrounded by undeveloped land parcels, approximate 14km north of the Exmouth Town Site. Access to the site is off existing Yardie Creek Road.

This report has been prepared based on civil engineering infrastructure requirements to service the proposed DA and covers siteworks, sewerage, water reticulation, power supply, stormwater drainage and utility services.

Details included in this report are largely based on preliminary advice from various service authorities, and is subject to change once formal submissions have been made to those service authorities.

The Site is identified by the red boundary presented below in Figure 1.

Figure 1 - Site Plan (MNG Access, 2019)

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2. SITE DESCRIPTION

The Site contains the existing Ningaloo Lighthouse Caravan Park, is approximately 45.54 hectares in area, located 14km north of the Exmouth. The northern boundary of the Site is adjacent to the existing Yardie Creek Road, which extends to the west and south to Yardie Creek, and to the east connects into Murat Road, and onwards to Exmouth. Yardie Creek Road separates the Site from the Indian Ocean.

The Site is covered in native coastal heath vegetation, with evidence of rock outcrops at the surface in the north and west portion of the Site, and a significant creek line running through the centre of the Site. The Vlamingh Head Lighthouse sits prominently above the Site, immediately to the west.

The Site is capable of accommodating further tourism development in accordance with an approved Local Structure Plan.

2.1 Geology

CMW Geosciences (Feb 2021) have carried out an investigation of the Site. They indicate that western side of the Site is generally characterised by Vlamingh Sandstone (Tv). There are rocky outcrops through the Site, of the Pilgramunna Formation (Tp) – which is high to very high strength calcarenite and calcilutite and grey coralgal limestone. The Tp is the predominant site classification to the west, beneath the prominent Lighthouse Location. The eastern side of the site is underlain by longitudinal and networks dunes and residual sand places, comprising red brown to yellow quartz sand.

This is presented below in Figure 2.

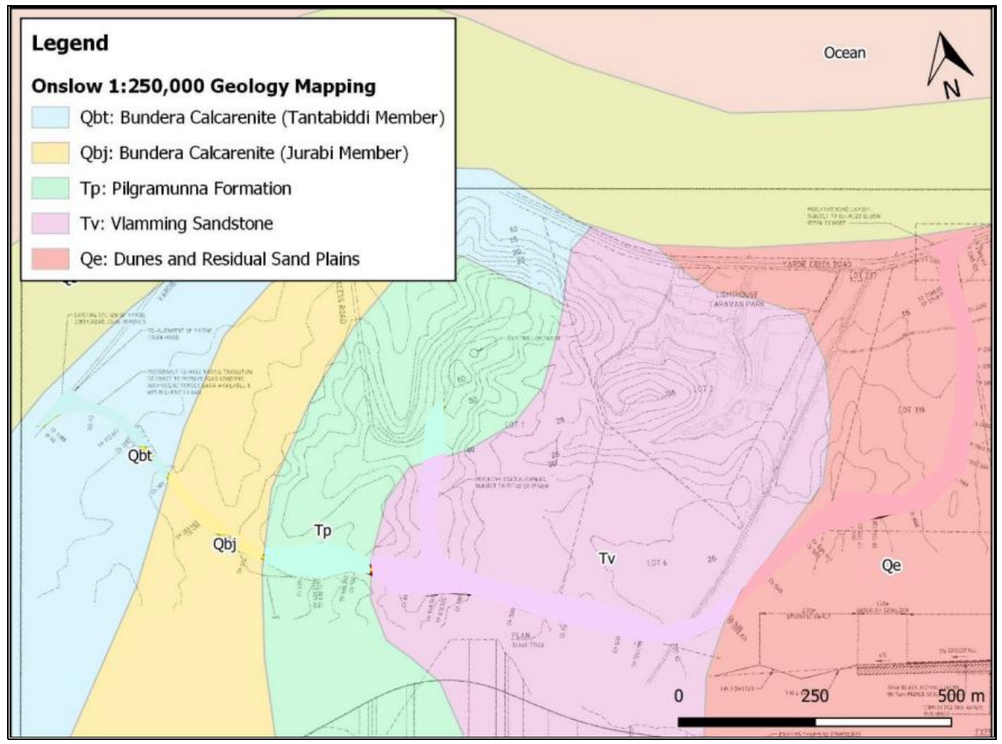

Figure 2 – Douglas Partners simplified version of the AUSGIN Geoscience Portal

2.2 Landform

Based on survey level information, the Site ranges in elevation from RL 10m AHD at the northern edge of the Site, adjacent to Yardie Creek Road, to RL 35m AHD at the south west extent of the site and at the outcrop in the centre of the Site as presented below in Appendix B. The Lighthouse is located at RL63m.

The existing topography is typical of coastal area along the Ningaloo Coast, both in terms of geomorphology and vegetation characteristics. It is proposed that future development of the Site will respond to, and incorporate the existing landform where possible. Primarily, this will be achieved through the limiting vegetation clearing and other environmental impacts wherever possible.

Remnant vegetation occurs across the vast majority of the Site, characterised by low shrub land vegetation.

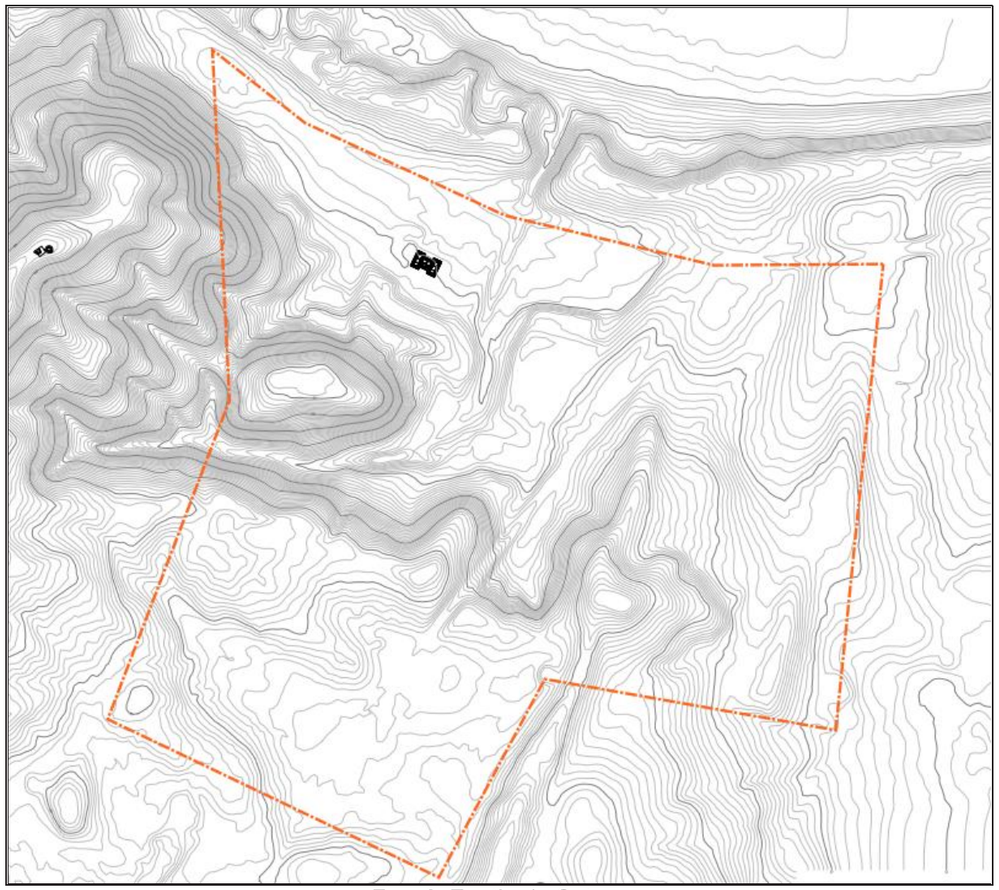

Figure 3 - Elevation 1m Contours

2.3 Groundwater

The Site is beyond the extent of the Department of Water's Perth Groundwater Atlas. However, existing groundwater bores onsite indicate that groundwater is likely to be below 1m AHD. The sands on site are free drainage, and the site is located close to the ocean. The groundwater on site has high levels of saline (from 5,000 to 10,000mg/l).

As such we do not anticipate that the presence of groundwater will constrain development.

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2.4 Acid Sulphate Soils

No data is available from the Department of Water and Environmental Regulation regarding potential for acid sulphate soils (ASS) for the proposed Site. However, we do not anticipate ASS will be present, and don't consider this issue will be a constraint to development.

3. EARTHWORKS

A site responsive earthworks approach is proposed to integrate development into the existing undulating landform. The general intent is to minimise the extent of site re-contouring and clearing, whilst ensuring drainage, roadworks and sewer reticulation requirements are met.

As a general principle it is proposed to construct just sufficient earthworks for the purpose of constructing roads with suitable gradients and cross fall, and sufficient earthworks across each of the development precincts such that the precinct can be developed for their intended use. We anticipate clearing will be kept to a minimum, and development will be integrated into the existing topography as far as practical.

4. ROADS AND FOOTPATHS

The existing Yardie Creek Road along the northern boundary of the Site has the potential to be modified to a low speed environment through design, subject to separate approval processes from the Shire of Exmouth and Main Roads WA. This will enable patrons of the Resort safe access to the beach, north of Yardie Creek Road, and create a safer and quieter frontage for the resort.

All internal roads through the Site will be sealed and built to a rural standard with table drains throughout. Kerbing may be incorporated on steeper road sections as required.

Though the Site is undulating, preliminary design indicates the majority of roads can be constructed with a longitudinal gradient of less than 4%. The undulating nature of the site does not present a material constraint to development. The steeper road sections (8%) are leading up to the Villa's on the outcrop at the western edge of the site, and the access to the Caravan Park, through the centre of the site.

5. STORMWATER DRAINAGE

The low-density nature of the development and the existing environmental characteristics of the Site (highly permeable sand and significant depth to groundwater) allow for development to occur with minimal need for constructed stormwater management infrastructure. Stormwater drainage collected from new roads and building developments will be disposed by means of swales, both roadside and natural through the site. Infiltration and groundwater recharge at source will be in the form of roadside swales or table drains and infiltration areas (generally associated with naturally occurring low points).

Appendix A contains a series of sketches which outline the crest within the site, and the valleys, and indicate where the natural water paths occur. The site is dominated by the Central Swale, which captures much of the water from the highlands to the south and west, and naturally flows north into the Indian Ocean. Roadside swales are proposed

to be directed to natural low points, into the Central Swale, avoiding key development areas of the Site.

The underlying soils are conducive to infiltration and collected water is unlikely to pond for extended periods of time. We do not propose to dispose of stormwater directly into the foreshore area apart from periods of high storm intensity, where the Central Swale will be used as point of discharge, underneath Yardie Creek Road. Please see below the Central Swale location in Figure 4.

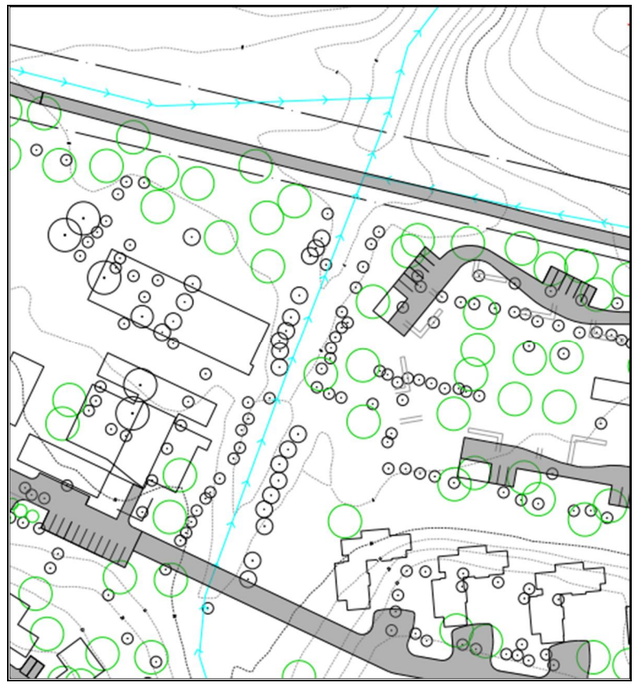

Figure 4 - Overland Stormwater Swale Paths

Subsoil drainage will not be required due to the significant clearance from proposed finished surface levels to the groundwater level.

6. WATER RETICULATION

Potable water requirements for the Resort (kitchens, showers and dishwashers) will be sourced from groundwater under abstraction licence from the Department of Water and Environment Regulation (DWER).

The existing Caravan Park is serviced with potable water via the Department of Defence bore fields, located 7km due east of the site, in addition to private bores on site. The water is treated through a reverse osmosis unit and stored in a 100,000l tank on site and a series of 13 smaller tanks (32,000l poly tanks). The Ningaloo Caravan Park has a groundwater licence allocation of 32,000KL/annum from DWER, of which the current scheme abstraction utilises 12,551KL/annum.

The existing supply agreement with the Department of Defence will not be continued, and the saline levels from the existing bores on site are too high. The proposed supply of bore water for potable water is via a new bore field, installing a number of bores, and located approximately 2km to the south, as per Figure 5 below. The bore field is expected to have a peak flow of 259kl/day. With an allowance of 30% reject stream through the RO plant, this flow will be sufficient to supply the peak potable water requirement of 181KL/day, based on 250l/person/day and peak occupancy of 726 people. The Water Balance Equation is shown in Appendix F.

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The long term water requirement of the development is based on an average water use of 250l/person/day, and an average occupancy of 448 persons per day (with a maximum of 726 person) as per the attached Occupancy Schedule (attached Appendix B). Based on the type of development proposed and estimated occupancy of the Resort, we anticipate that the development requires the existing groundwater licence to be increased to approximately 72 ML of potable water per annum, from the current 32ML. This is covered in detail in H2 Hydrogeological Report for the Lighthouse Holiday Park Redevelopment (Pennington Scott, Rev 1, Nov 2020).

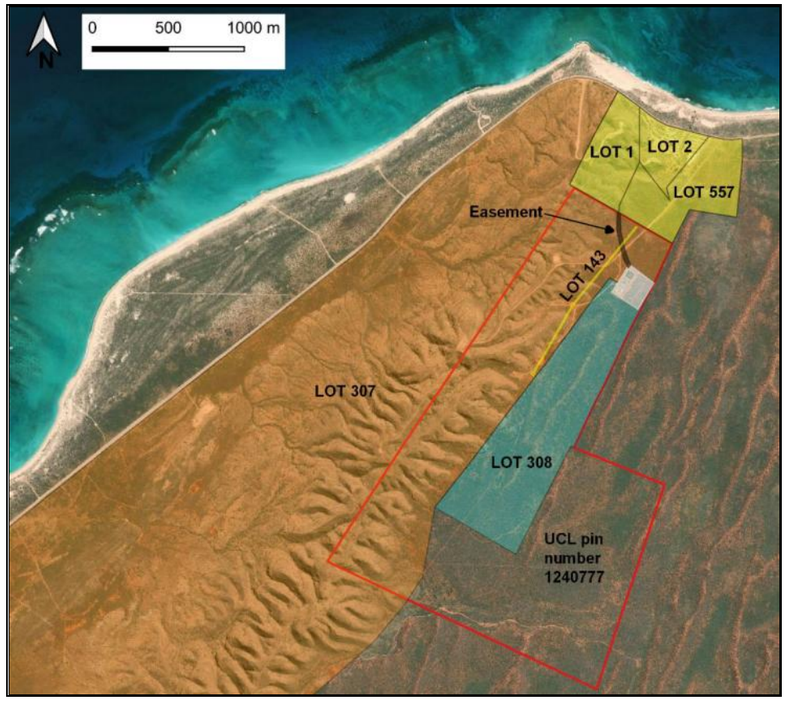

Figure 5 - Proposed Bore Field

Given the abstracted groundwater will have Total Dissolved Solids (TDS) above the minimum parameters of the Australian Drinking water Guidelines of 500 mg/L, the treatment approach will entail reverse osmosis (RO) in addition to standard disinfection.

Given that the potable water treatment plant will require separate State regulatory approvals, the proponent anticipates that approval for the plant from relevant State regulators will be a condition of the Resort Development Application.

Specifically, the potable water treatment plant will require the following approvals:

- Drinking Water Quality Management Plan (DoH)
- Drinking Water Source Protection Plan (DWER)
- Operating Strategy (DWER)
- Groundwater Abstraction Licence (DWER)
- Service Provider Licence (Economic Regulation Authority)

A Water Balance (Appendix G) has been provided with this Development Application which outlines potable water demand, on a daily basis. The full report of the Bore Field Revied, carried out by Pennington Scott, is attached in Appendix I.

Hydraulic Design Australia (Appendix C) propose a series of new tanks to store the water at the higher levels of the

site. The tanks will be located on a hill at or above RL 42mAHD, The water reticulation will be pressurised through a pump room to ensure both potable water supply, and reticulation treated water can be supplied at adequate pressures and flows to service the entire development. Infrastructure required may include a 6 new on-ground storage tank for potable water, with a total capacity of 1,800KL (8 days storage at peak demand). We also propose 2 300KL storage tanks dedicated to Fire Fighting, and will contain potable water.

Section 7 below outlines the treatment process for Waste Water – note there will be a single 300KL tank which is dedicated to irrigation purposes, and contains water treated as below. This water will be reticulated through the site, and used for irrigation of the landscape areas, and plumbed into the buildings for flushing toilets.

Reticulated potable and non-potable water will be supplied to all new development sites and lots via a network of pipes (blue and purple) that are supplied from the on-ground storage tanks.

7. WASTEWATER RETICULATION AND DISPOSAL

The Ningaloo Caravan Park has an outdated waste water treatment system, which disposes all of the treated effluent into evaporation ponds to the south of the Site. This system is not up to current environmental standards, creates odour (and associated buffer) issues and would not be suitable for the development. The proposed Resort is to be finished to a high standard, including irrigated areas which will require significant amounts of water. Water is a scarce resource in the area, and hence an alternative water supply solution is required.

There are a number of options open to the developer with respect to the disposal of wastewater from the proposed Ningaloo Lighthouse Resort development. These include:

- Aerobic treatment units (ATU's);
- A locally sited wastewater treatment plant which uses membrane bio-reactor (MBR) or Sequential Batch Reactor (SBR) plant technology;
- Settlement and evaporation ponds;
- A combination of the above.

Following a review of economic and environmental benefits, the development proposes to process all wastewater produced from the development in a fit-for-purpose on-site recycled water plant.

Wastewater servicing for Ningaloo Resort will entail the collection of blackwater and greywater (collectively, "wastewater") from within the resort for treatment and reuse. The wastewater will be gravity fed to a series pumping stations in the site, from where it will then be pumped to the wastewater treatment site in the south of the site. The area required for the wastewater treatment facility is also identified in the Site Layout drawing. The design and operational philosophy for the wastewater scheme is based on treatment to a fit-for-purpose standard which will facilitate reuse of the treated wastewater (recycled water) for open space irrigation and internal application for toilet flushing.

The treatment approach may employ membrane technology, coupled with biological and chemical processes, which will achieve a quality of water which will meet public health and environmental standards. It is relevant to note that the wastewater collection, treatment and reuse scheme will be similar to the scheme recently implemented at Monkey Mia, in the Shire of Shark Bay. That scheme has been assessed and approved by the Department of Environment and Water Regulation (DWER) and the Department of Health (DoH). The Ningaloo Resort will similarly require a number of Local/State regulatory approvals prior to implementation and operation.

Pertinently, the wastewater scheme will require separate approval from the Shire of Exmouth via the submission from the proponent of an "**Application to Construct or Install an Apparatus for the Treatment of Sewage**". This application will provide detailed plans/schematics/overview of the proposed wastewater scheme. The proponent anticipates that the approval for the Ningaloo Resort Development Applications will include a condition requiring submission and approval for the aforementioned approval.

It is also noted that in addition to the Shire's approval for and "**Application to Construct or Install an Apparatus for**

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the Treatment of Sewage", which may also require DoH approval, the scheme will require the following State regulatory approvals:

- Works Approval under Part V of the Environmental Protection Act 1986 (DWER)
- Recycled Water Quality Management Plan (DoH)
- Operating Licence (DWER)
- Water Service Provider Licence (Economic Regulation Authority)

The Water Balance (Appendix F) has been provided with this Development Application which outlines wastewater generation and treated wastewater (recycled water) reuse, on a monthly basis. All waste water generated by the treatment plant will be used for irrigation of the site. There will be an underlying irrigation demand, which can be topped up with bore water when occupancy falls below a critical level (which will be associated with less bore water demand for potable supply). For disposal of the treated waste water in peak occupancy, additional drippers will be located within roadside swales and natural swales. The vegetation in these swales will be designed to benefit from this water, however not rely on it for survival. This water will infiltrate into the sandy soils (Tv), and ultimately flow through the swales, greening the central swale, and being naturally treated, as it flows towards the central swale.

A detailed report on a possible solution for the type of Waste Water Treatment facility which may proposed at the Site has been prepared by Water West and Permeate Partners, and is enclosed in Appendix G.

8. CONSTRUCTION WATER REQUIREMENTS

It is anticipated that construction water will be required at each stage of development to facilitate the civil and building works, including dust suppression.

High level estimates assume this demand is likely to be in the order of 25,000KL, which is proposed to be supplied via groundwater. This would be a temporary water use, and would be applied for separately at the detailed design stage.

9. POWER

The Site lies in close proximity to 11kV overhead power line distribution network and is supplied with power from the main generation at the Exmouth Town Site.

The anticipated load for the development is 1500Amp, with the development able to be serviced from the 11kV overhead power lines which currently run through the site. The details of the power requirement are in the attached 3E Power Report (Appendix D).

The overhead lines will need to be removed from the site, and relocated to an underground HV network adjacent to the proposed eastern Access Road. This detail is shown attached in Appendix E.

The existing aerial Transformer will not be sufficient to meet the demands of the proposed resort development. As the development develops there will be a requirement to remove the existing transformer and replace with a ground mounted substation, located close to the relocated underground HV system. The proposed substation will have two transformers, each with a supply capacity of 630KVA.

With increased demand on the existing network it may be necessary for network reinforcement and/or network reconfiguration review to be undertaken. Horizon Power has advised the dynamic nature of their network makes it difficult to confirm exactly what reinforcement requirements will be required and when. In response to these additional power requirements the development proposes to implement renewable energy generation alternatives. These may include Photo Voltaic Cells and future power storage, subject to economic viability.

Underground power will be provided to all new sites and via a network of cables. These works will be designed at

the time of development.

10. GAS SUPPLY

It is proposed to provide reticulated gas within the development, to all units, supplied via an on-site storage tanks. These will have a capacity of 6,375litres (the same size tanks as the existing facility) and there will be a primary tank and a secondary back-up tank supply. Reticulation gas will be used for water heating throughout the proposed development.

11. TELECOMMUNICATIONS

We anticipate the Site will be serviced via an extension of the existing NBN network. Under the current NBN scheme, the developer is required to enter into an agreement to provide infrastructure which is handed over free of charge to NBN Co upon completion. The installation of the communication service to the resort would be funded through NBN, with developers responsible for funding the internal pit and pipe and a contribution to the backhaul costs (through existing network or via satellite receiver).

Capacity of the existing NBN Co and any potential backhaul costs will be finalised through the submission of a formal application with NBN.

12. IMPLEMENTATION & STAGING

It is anticipated the Site will be developed in one stage, duration of which will be determined in detailed design.

The provision of engineering infrastructure will be required as an early part of the construction process, followed be development of the built form.

13. CONCLUSION

As outlined in this report, the Site is capable of being serviced with key infrastructure including potable water supply, wastewater and power. Infrastructure upgrades to the Site will be required to facilitate the development with the scope of the infrastructure being staged to address demand growth requirements.

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APPENDIX A

LEGEND

EXISTING CONTOURS (5m)

EXISTING CONTOURS (1m)

EXISTING RIDGES

EXISTING VALLEY FLOWS

PROPOSED FLOW DIVERSION

DETAIL AREA PLAN 'C'

DETAIL AREA PLAN 'B'

DETAIL AREA PLAN 'A'

0m 50 100 150m

1:2500

REV	DATE	DRN	CHD	APP	AMENDMENT
D	12.04.21	MI	-	-	DRAWNGS REVISED TO REFLECT UPDATED LAYOUT
C	30.10.20	MI			DRAWINGS REVISED TO REFLECT UPDATED LAYOUT
B	03.09.19	ARH		M. WALLIS	DETAIL AREA PLAN 'C' MOVED
A	22.08.19	ARH		M. WALLIS	ISSUED FOR INFORMATION

Cossill & Webley CONSULTING ENGINEERS

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Subiaco WA 6904

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B12 (Level 2) 431 Roberts Road
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CLIENT: MINDEROO

APPROVED: MARK WALLIS

DESIGNED: ARH

SCALE: 1:2500

PROJECT: NINGALOO LIGHTHOUSE CARAVAN PARK

TITLE: SITE PLAN

WA/PC No.

DRAWING No.: 6143-00-SK01

REVISION: D

ORIGINAL SIZE: A1

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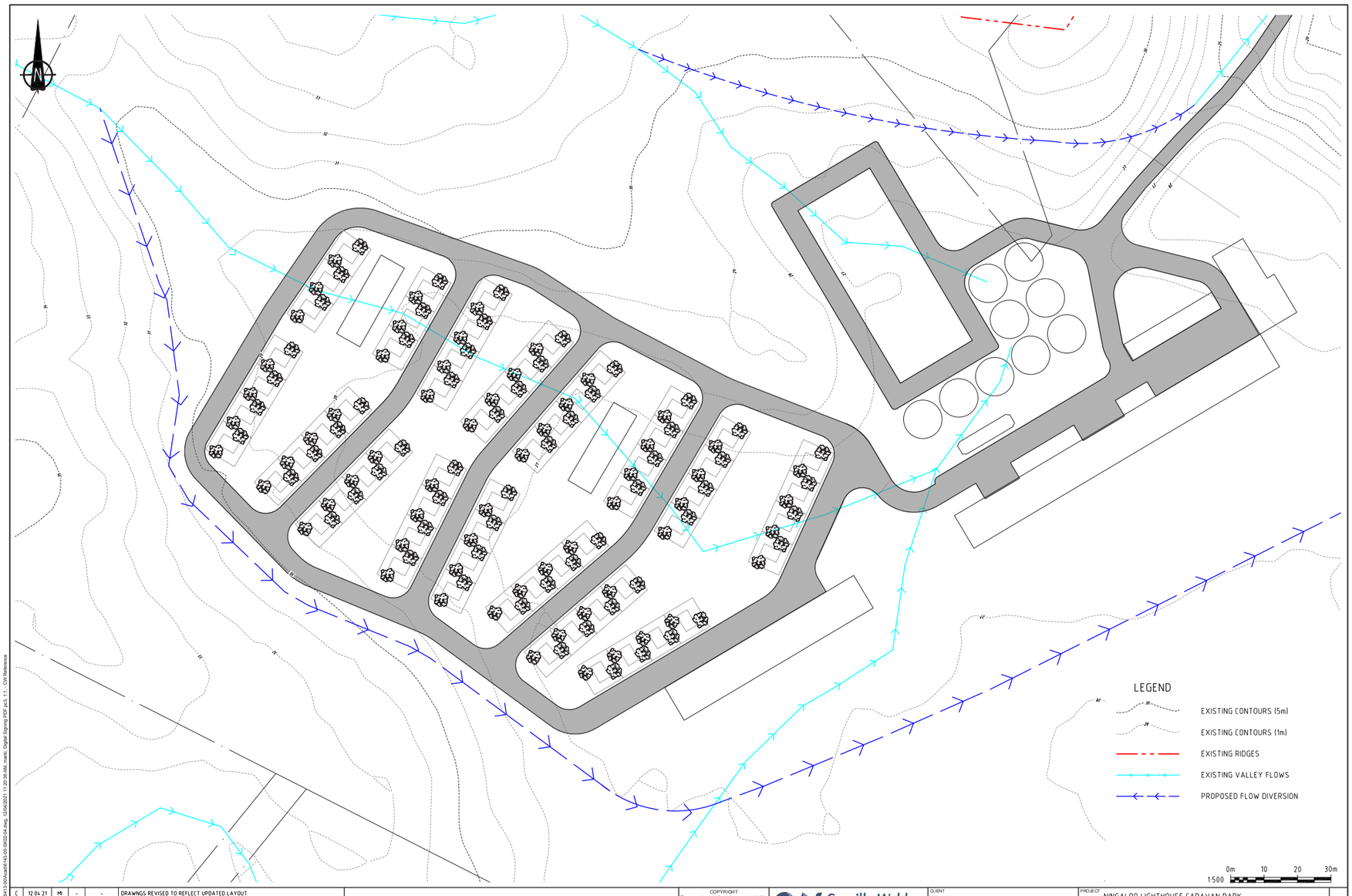

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1:500

REV	DATE	DRN	CHD	APP	AMENDMENT
C	12.04.21	MI	-	-	DRAWNGS REVISED TO REFLECT UPDATED LAYOUT
B	30.10.20	MI			DRAWINGS REVISED TO REFLECT UPDATED LAYOUT
A	22.08.19	ARH		M. WALLIS	ISSUED FOR INFORMATION

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CLIENT: MINDEROO

APPROVED: MARK WALLIS

DESIGNED: ARH

SCALE: 1:500

PROJECT: NINGALOO LIGHTHOUSE CARAVAN PARK

TITLE: DETAILED AREA PLAN 'A'

WA/PC No.

DRAWING No.: 6143-00-SK02

REVISION: C

ORIGINAL SIZE: A1

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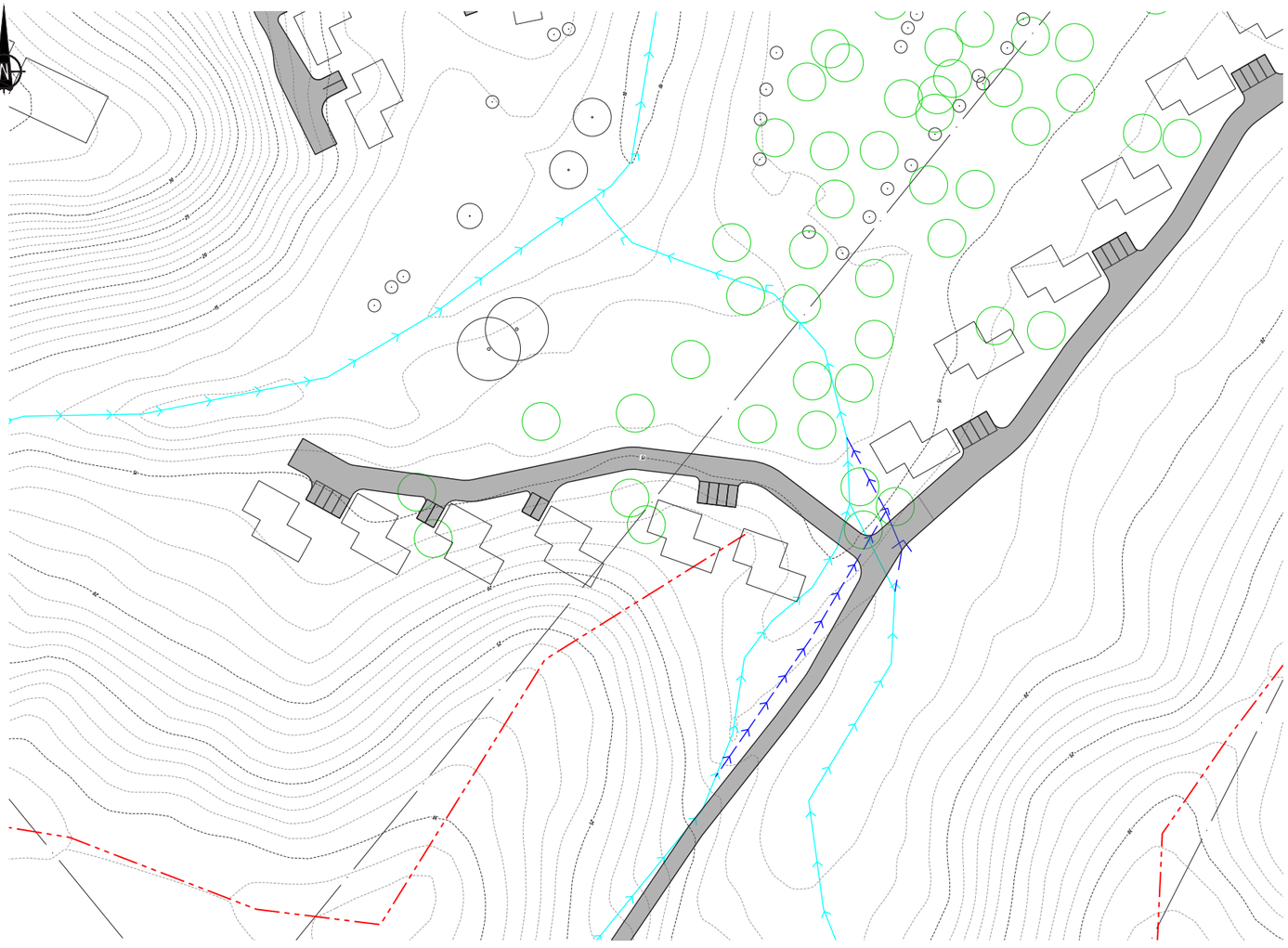

REV	DATE	DRN	CHD	APP	AMENDMENT
B	30.10.20	MI	-	-	DRAWINGS REVISED TO REFLECT UPDATED LAYOUT
A	22.08.19	ARH		M. WALLIS	ISSUED FOR INFORMATION

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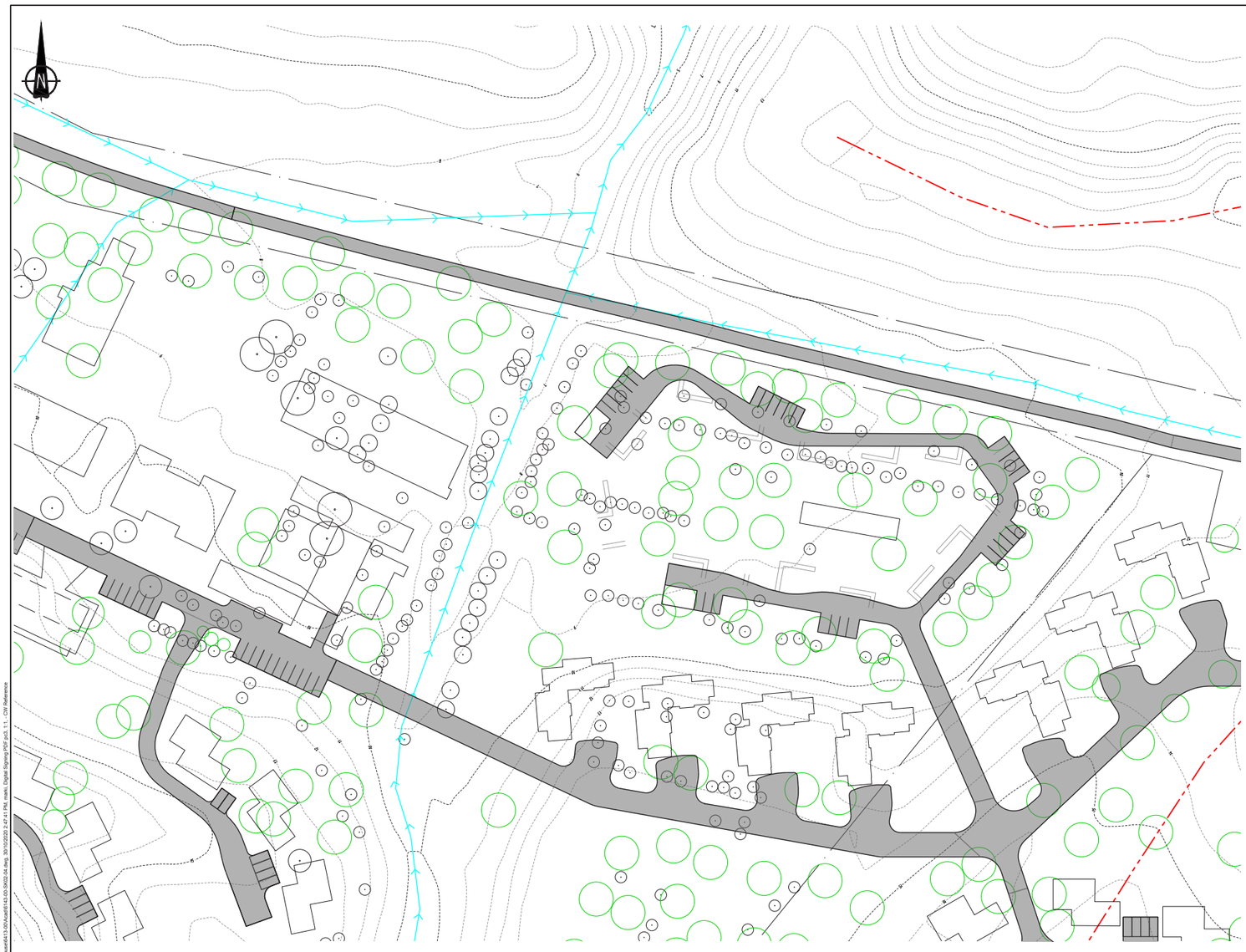
CLIENT: MINDEROO
APPROVED: MARK WALLIS
DESIGNED: ARH
SCALE: 1:500
PROJECT: NINGALOO LIGHTHOUSE CARAVAN PARK
TITLE: DETAILED AREA PLAN 'B'
WAPC No.
DRAWING No.: 6143-00-SK03
REVISION: B
ORIGINAL SIZE: A1



REV	DATE	DRN	CHD	APP	AMENDMENT
C	30.10.20	MI	-	-	DRAWINGS REVISED TO REFLECT UPDATED LAYOUT
B	03.09.19	ARH		M. WALLIS	DETAIL LOCATION UPDATED
A	22.08.19	ARH		M. WALLIS	ISSUED FOR INFORMATION

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CLIENT: MINDEROO
APPROVED: MARK WALLIS
DESIGNED: ARH
SCALE: 1:500
PROJECT: NINGALOO LIGHTHOUSE CARAVAN PARK
TITLE: DETAILED AREA PLAN 'C'
WAPC No.
DRAWING No.: 6143-00-SK04
REVISION: C
ORIGINAL SIZE: A1

APPENDIX B

NINGALOO LIGHTHOUSE RESORT - ESTIMATED OCCUPANCY SCHEDULE

Oct-20

Occupancy	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Average
Chalets & Bungalows	18%	49%	88%	81%	87%	98%	91%	74%	56%	35%	55%	42%	65%
Caravan Park Sites	19%	18%	52%	39%	59%	89%	77%	49%	38%	21%	31%	21%	43%
Average	19%	34%	70%	60%	73%	94%	84%	62%	47%	28%	43%	32%	54%
Guests	123	223	466	400	486	623	559	410	313	186	286	210	357
Vistors	6	10	21	18	22	28	25	18	14	8	13	9	16
Staff	75	75	75	75	75	75	75	75	75	75	75	75	75
Total	204	308	562	493	583	726	660	503	402	270	374	294	448

Room Type	# Keys	Base Guests	Max Guests
Hotel	60	120	120
Dual Key Villa (base key)	30	60	102
Dual Key Villa (add key)	30	60	60
Upgraded Villa (Base key)	4	16	16
Upgraded Villa (add key)	4	8	8
Small Eco Tent	14	28	28
Large Eco Tent	14	28	28
Lodge	28	56	56
Caravan	62	186	248
Total	246	562	666

Max Vistors
30

Average	
54%	
448	*people per day*

APPENDIX C

Hydraulics Design Australia

1/300 Fitzgerald Street
PERTH WA 6000
Ph: (08) 9225 9300
Fax: (08) 9228 0933
email: info@hdawa.com.au
web: www.hdawa.com.au

27th November 2020

Mr. Mark Wallis
Cossill & Webley
2/431 Roberts Rd
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EXMOUTH LIGHTHOUSE PROJECT
AMENDED HYDRAULICS SITE SERVICES DESIGN REPORT

Potable Water

The Water Corporation have established a daily average water consumption of 337 litres per person for Perth for 2017-2018 which includes cistern flushing and landscape irrigation.

Based on recycled water used for cistern flushing throughout and a separate water consumption allowance for landscape irrigation, we recommend 250 litres of daily water consumption allowance per person for Exmouth Lighthouse project.

We estimate a total potable water consumption of 223kL during peak occupation periods based on;

- 250L x 726 guests/staff/visitors = 181kL potable water consumption per day.
- 25kL per day for landscape irrigation
- 15kL pool water make up for peak occupation periods (to be confirmed by Pool Consultant)

Potable water storage will be required to buffer the daily water consumption requirements against the available bore/treatment tank replenishment flow rate during peak occupation periods. Potable water storage will also be required to provide a potable water reserve to accommodate periods of bore and/or water treatment plant maintenance.

The Pennington Scott Technical Memorandum dated 10th November 2020 recommends an upgrade of the water bores to supply up to 259kL /day based on 726 guests at 250L of potable water per guest each day. The Peritas Ningaloo Lighthouse Caravan Park Services and Infrastructure Due Diligence Report dated 26th April 2017 indicates a bore water allocation of 32,000kL per annum for the Lighthouse Caravan Park and an annual water consumption of 12,551kL.

The Ningaloo Lighthouse Caravan Park has approximately 350kL of potable water storage contained within various water storage tanks located throughout the site.

Picture of 2,000kL total water storage comprising 4 x 500kL tanks measuring 18.4m diameter x 2.31m wall height.

We recommend a potable water storage capacity of 1,800kL litres contained within 6 x 300kL potable water storage tanks to accommodate an 8 day supply during peak occupation periods. The potable water storage capacity will be adjusted to reflect final bore yield and treated water infill flow rate.

Two electric driven potable water pressure pump sets will be installed within a Pump to supply potable water throughout the site via a ring main. Pressure vessels will be installed at the highest point of the piping system to

minimize water pressure surges. Each building will be fitted with an adjustable pressure reduction valves (installed in duplicate) to balance the supply pressures throughout and minimize water consumption. We recommend that the water pressure pumps are supplied back up electrical supply from a site generator.

We recommend that the potable water service is reticulated throughout the site utilizing uPVC pipes. We recommend the reticulation of potable water throughout the buildings utilizing PEX pipes.

PE pipes and fittings are not recommended for installation within the north west by the manufacturers. Metal pipes and fittings may be susceptible to corrosion and calcium build up.

Copper or stainless steel pipes are required to be installed in exposed locations above ground level and immediately downstream of water heaters. Stainless steel pipes are not recommended where elevated levels of chlorine may be present within the water.

We recommend the use of electronic gas instantaneous water heaters to supply hot water throughout the proposed resort buildings with an anti-scaling maintenance regime adopted to maximize the water heater life (subject to final treated water quality).

Landscape Irrigation

Water used to irrigate landscaped areas within the central facilities area could be drawn from the potable water tanks to ensure odour free clean potable water is distributed via above ground sprinkler systems.

An additional dedicated 300kL landscape irrigation tank could be installed to receive treated grey water with treated bore water top up to supplement the landscape irrigation in areas suitable for sub-surface irrigation (dripper irrigation system installed 150mm below ground level).

Fire Service

The Exmouth Lighthouse project will require the installation of a fire pressure pump set and fire water storage tanks to supply fire hydrants, fire hose reels and for bush firefighting requirements. Class 2, 3, 5 & 9 buildings (1 or 2 storeys contained) with fire compartment floor areas >1,000m^2 and ≤5,000m^2 require a minimum of 2 hydrants to operate simultaneously at a flow rate of 5 litres/second per hydrant (10 litres/second total) whilst maintaining a residual pressure of 700kPa within the fire piping system. The fire water storage tanks require hard suction connections (Storz connections) capable of supplying 20 litres/second suction flow rate for boosting the fire service system pressure via the DFES appliance. The fire water storage tanks are required to maintain a minimum of 4 hours of fire water at the minimum flow rate of 20 litres/second in addition to the static fire water storage requirements for bush firefighting. Two 300kL capacity fire water storage tanks will be required to be installed adjacent to the potable water tanks. An additional 50kL fire water storage tank with hard suction connection is required to be installed within the vicinity of the central facilities refuge area in accordance with the Bush Firefighting recommendations. A 7m x 5m Fire Pump Room is required adjacent to the fire water storage tanks to house a dual diesel driven fire pump set.

Fire hydrants will be located throughout the site to provide coverage of the internal areas of all buildings from a 60m long hose emanating from the hydrant and a 10m long water spray. The hydrants are required to be located a minimum of 10m clear of buildings or on a 3m high x 4m wide 90/90/90 fire rated wall to provide protected access to DFES personnel. A fire booster assembly will be installed within site of the main access point to the resort administration building or at an alternative location to be agreed (to minimize tank suction pipe length).

We recommend that fire hose reels and/or fire extinguishers are installed throughout the site for staff and occupant use in the event of a small fire, prior to DFES attendance. Fire hose reels shall be located throughout the site to provide coverage of the internal areas of all buildings from a 36m long hose and a 4m long water spray.

The bore water will require treatment for fire water use prior to storage. The treated bore water supply is required to replenish the fire hydrant water storage component within the storage tanks within 24 hours. Refer to attached DFES GL-06 for water quality requirements.

Hydraulics Design Australia

DFES will require a hydrological report for assessment where bore water is utilized for fire fighting water. Refer to attached DFES GL-06 for bore water use requirements.

Refer to attached GL-11 for DFES site planning requirements.

We recommend that the fire service is reticulated throughout the site utilizing uPVC (blue-brute) pipes with rislan coated ductile iron fittings and concrete thrust and anchor blocks.

PE pipes and fittings are not recommended for installation within the north west by the manufacturers.

Galvanized steel pipes are required to be installed in exposed locations above ground level.

Gas Service

The Exmouth Caravan Park incorporates a 6,375 litre bulk liquid petroleum gas storage tank located adjacent to the refuelling area. The bulk LPG tank is utilized to refill smaller LPG bottles located on buildings throughout the site.

We recommend that the existing LPG tank be relocated to the proposed new refuelling area and an additional 6,375 litre LPG tank be installed adjacent to the relocated LPG tank to accommodate the proposed resort increased gas requirements.

We recommend that LPG will be reticulated around the site to supply gas for water heating and cooking via a PVC inground piping system at 70kPa. Second stage regulators will be installed on each building to reduce the gas pressure suitable for appliance use. PVC pipes are not permitted for use where gas pressures exceed 70kPa.

PE pipes and fittings are not recommended for installation within the north west by the manufacturers.

Copper LPG pipes are required to be installed above ground level and within and under buildings. Copper LPG pipes are required to be installed between the LPG tanks and first stage regulators.

Sewerage

We estimate that 90% of guest/staff water consumption will be discharged to sewer.

We estimate the following waste water discharges per person per day;

- Grey water 240 litres
- Black water 60 litres
- Consumption 40 litres (not discharged to drain)

We estimate 174kL of grey water and 44kL of black water will be discharged daily during times of peak occupancy based on 726 guests/staff/visitors. Or a combined sewerage discharge of 218kL discharged daily during times of peak occupancy.

A property sewer drainage system will be installed throughout the resort to gravity drain to sewer pump stations utilizing the site topography. Access points will be installed where required to provide for ease of maintenance.

The sewer pump stations will discharge to the sewerage treatment systems via PVC rising mains.

Yours sincerely,

Quentin Oma

Director

Encl.

APPENDIX D

PROJECT:

NINGALOO LIGHTHOUSE RESORT, EXMOUTH

SERVICING REPORT FOR:

SITE ELECTRICAL SERVICES

DOCUMENT NO: **3E19074-R-01**

Document History and Status

Revision	Date issued	Author	Reviewed by	Approved by	Revision Description
A	28/08/2019	TJS	VH	DLJ	For Information
B	28/08/2019	TJS	VH	DLJ	For Information
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D	27/09/2019	TJS	VH	DLJ	For Information
E	29/10/2020	TJS	VH	DL	For information

SECTION 1 EXISTING POWER NETWORK DISTRIBUTION

1.1 GENERAL

The greater Exmouth area is currently supplied by various High Voltage (HV) spur lines, of 11kV and 33kV network, with the main generation located close to the Exmouth Town Site. This generation site provides a current load of 5.9MW to the surrounding area, and is comprised of 7 x 1MW Dual Fuel CNG/LPG generators and 3 x 20kW Wind Turbines. This system was built in 2003.

Based on information obtained from an existing site assessment report prepared in 2017, the site is fed by a 200kVA pole top transformer, which is connected off an 11kV overhead aerial line.

The meter data from the report also indicates that the park operates at about 50% the capacity of the transformer, based on low occupancy of the park. Extrapolating from this data, if the park were at full occupancy the transformer would be at full capacity. The current pole top transformer is thus sized to cater for the current site maximum demand only.

There is additional generation on site in the form of two backup generators, a 110kVA and 200kVA Generating Units.

See Appendix 3.1 for Horizon Power DBYD Aerial Plan

SECTION 2 POWER SUPPLY SCENARIO

2.1 LIKELY LOAD

Based on the likely development accommodation yield (Appendix 3.2) and approximate mechanical electrical loads for key buildings and accommodation types (Table 1), we have completed a general AS3000 load calculation for the overall site. Additional likely loads have been included within the assessment.

Building	Phases	Amps
Admin/Recep/Surf Shop	3	80
Rec Centre	1	15
Fuel Station	3	25
Services/BOH	1	40
Powell House	3	50
Spa	1	25
F&B Pavilion	3	50
Restaurant BOH Facilities	3	50
Hotel	3	100
Standard Villa	1	18
Std Villa + Bunk	1	22
Lodge	1	30
Luxe Villas	1	35
Staff Accommodation	3	60

Table 1. General Mechanical Electrical Loads

The load calculation for the accommodation and services portion of the site is approximately 1250A 3-phase, and makes allowance for load diversity. Additional loads at the Waste Water treatment plant (150A 3-Phase) and Water Pump Station (100A 3-Phase) increase the load demand on site to above 1500A.

Based on a load requirement of 1500A we would expect the installation of a 2 x 630kVA transformers. In addition to the transformers, a switchgear unit will also need to be installed, which provides the protection for the equipment.

The load estimate does not take into account any on site generation either in the form of renewable or non-renewable systems.

2.2 LIKELY POWER SUPPLY SCENARIO

The calculated site load will require the upgrade of the existing point of connection, which will result in the existing 200kVA aerial transformer being removed, and replaced by a ground mount substation.

In addition to the above works, as the existing aerial line is located within the proposed development area, it will need to be relocated. The access road to the south of the site is being realigned as part of these works, thus the new aerial line can be located adjacent to this access way. All works associated with the existing Horizon Power infrastructure will need to be costed, and constructed by Horizon Power.

The new substation should be located as close to the re-aligned aerial network as possible, to minimise the cost of new cabling to interconnect the substation to the aerial line. New on site generation (non-renewable) is to be installed as a requirement to feed the onsite firefighting system. This unit should also be located as close to the substation as possible. This would allow a better interface between the grid and the onsite generation. The Site Main Switchboard could be constructed as to compartmentalise the supplies, so that the generator is able to provide power to essential services in the event of mains power failure.

Any installed renewable energy systems on site, if incorporated with energy storage could be utilised to off-set the overall site energy demand. By reducing the energy demand, it may be possible to reduce the size of the installed network connected equipment.

The existing generators could be left in key locations for localised emergency power.

Appendix 3.3 for the HV Concept

Appendix 3.4 for Substation Land requirement

2.3 RENEWABLE ENERGY AND ON-SITE GENERATION

The integration of renewable generation into this electrical network should be considered, and optimised to offset as much of the localised energy needs as possible. This will benefit the development in the potential savings through reduced infrastructure, and reduced load on ongoing external energy supply.

The additional Solar PV/Wind Turbines (plus energy storage) could be used to reduce the size of the substation, from multiple transformers to a single 1MVA unit. The land requirement for the double transformer layout is larger than the single layout.

The determining factor in the connection size is peak demand of the site, which is general the evening, after sun set. As during the day Solar PV will off-set some of the daytime energy needs, and late in the evenings the network connection can cover the baseload.

During peak times is when the network connection limit will more than likely be breached. To offset this, some form of energy storage should be considered. With the energy storage in the form of Lithium Ion Batteries or Vanadium Flow Systems.

Horizon Power has unofficially confirmed that a load of up to 630kVA can be connected without having to complete a line upgrade, but may require some localised network changes. The capacity of the line is unreserved, and will require a connection application to be submitted to lock it away for the development.

The land requirement for the additional back-up generator would be approximately 4m x 9m. This compound could also contain the Site Main Switchboard, which would be the interface point between the private network, substation and generator.

Appendix 3.5 Generator Compound Requirement

2.4 HORIZON POWER AND CONNECTION REQUIREMENTS

Horizon Power has provided general information regarding the capacity of the network, and the potential to connect additional load. A full network study upon connection request will need to be conducted to confirm that the additional load can be connected and confirm upgrade availability. Without a network connection application the spare capacity in that feeder is available to any other developer that may want to connect to the network prior to this development.

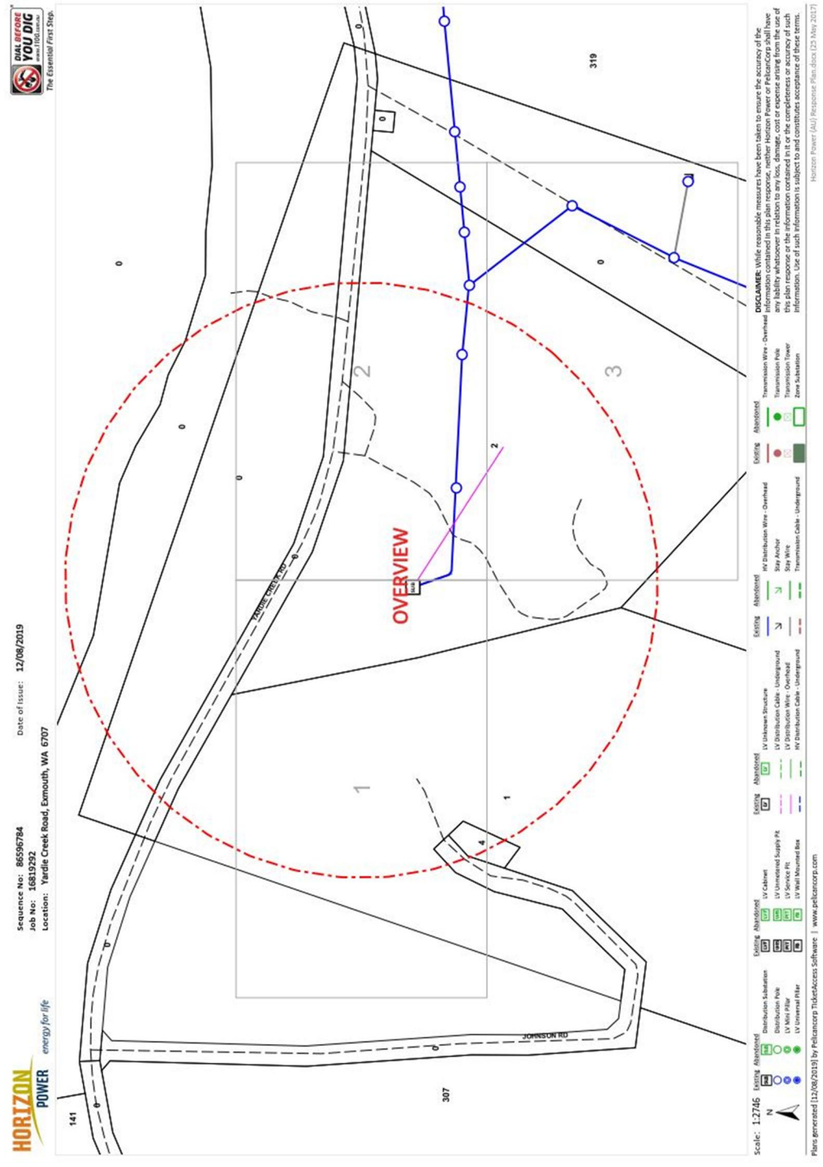
The full network study and assessment by Horizon Power on that network connection will cost $6,100 + GST to Horizon Power.

Based on the current network upgrade strategies that Horizon Power are implementing at edge of grid sites, they may provide a solution within which they own and operate any of the additional generation on site, and enter into a Power Purchase Agreement with the developer for the provision of energy.

Other than Horizon Power, there are a number of private renewable energy companies that are willing to offer PPA's for the installation of renewable assets. This could be investigated further, and reduce the capital cost of this upgrade.

SECTION 3 Appendix

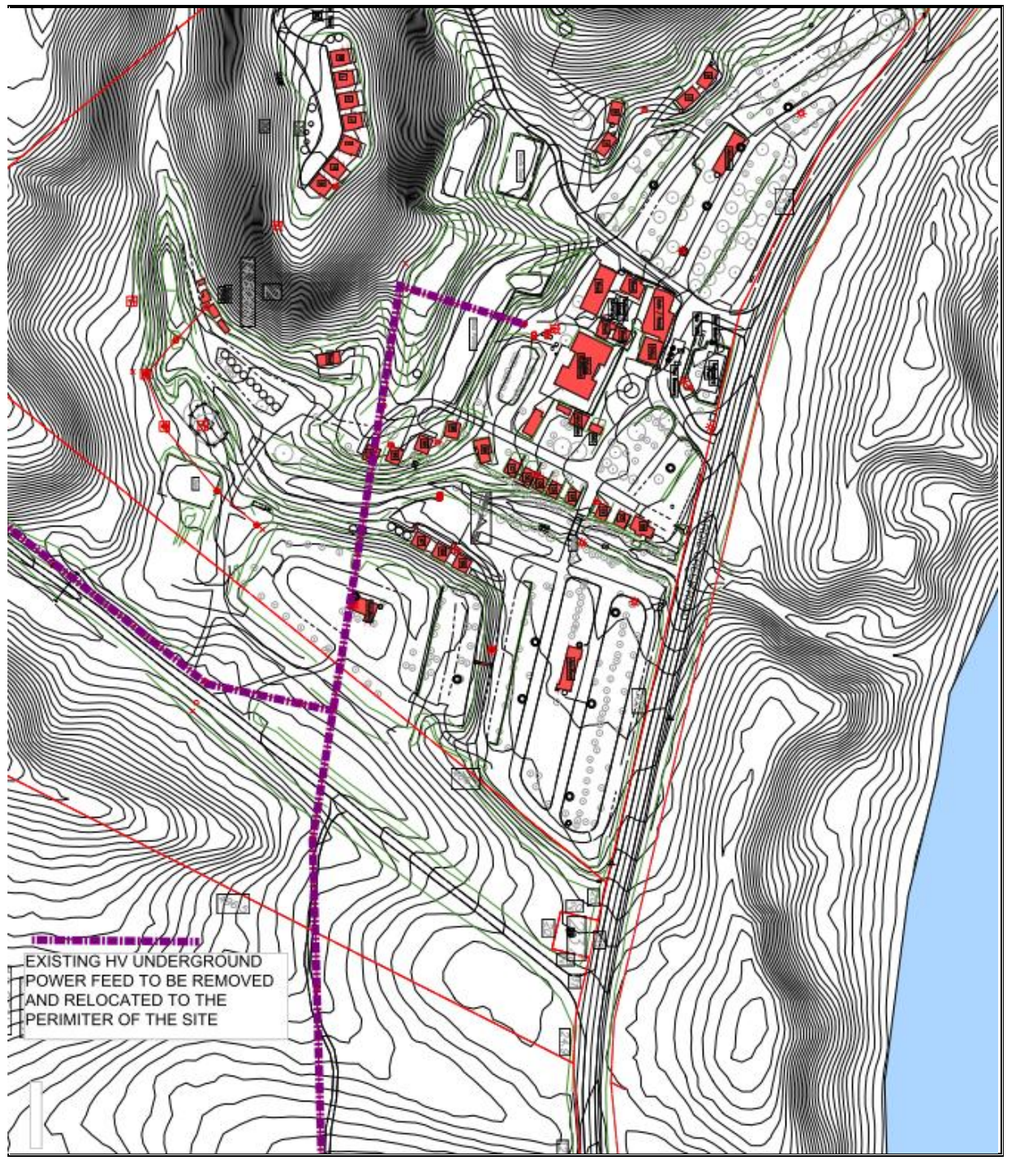
3.1 Horizon Power DBYD



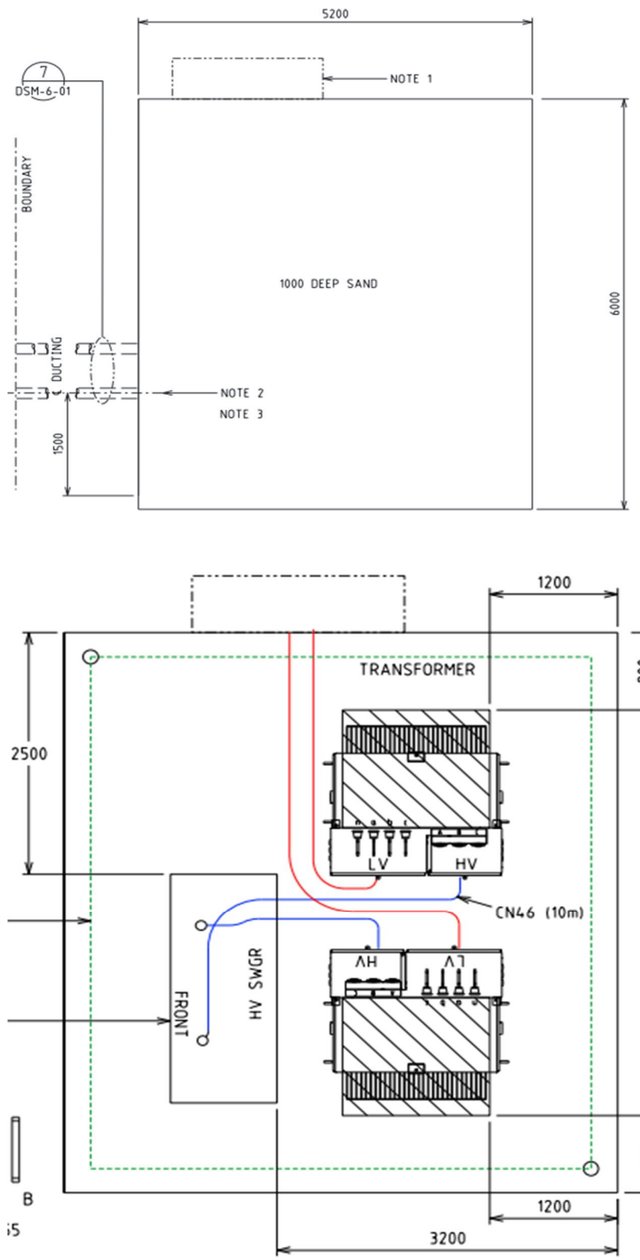
3.2 **Development Yield**

	LEGEND	YIELD	KEYS
TC	TENNIS COURTS	2	-
H	HOTEL	60	60
V	VILLAS	30	60
SV	SUNSET VILLAS	4	8
SPA	SPA - 2 TREATMENT ROOMS/ GYM	1	-
SP	SWIMMING POOLS	4	-
PH	POWELL HOUSE/ RECEPTION AND FUNCTION FACILITIES	1	-
FB	FOOD & BEVERAGE/ REC CENTRE & FUNCTION	1	-
PG	PLAYGROUND	2	-
L	LODGES	7	28
T	ON-SITE TENTS	28	28
A	ABLUTION BLOCKS	3	-
R	RETAIL/ SURF SHOP/ BAR	1	-
GM	GENERAL MANAGERS ACCOMMODATION	1	1
C	CARAVAN SITE	62	62
SF	SERVICES FACILITIES	1	-
PS	PETROL STATION	1	-
BS	BOAT STORAGE	1	-
W	WATER TANKS	9	-
WT	WATER & SEWERAGE TREATMENT FACILITIES	1	-
SA	STAFF ACCOMMODATION	6	6

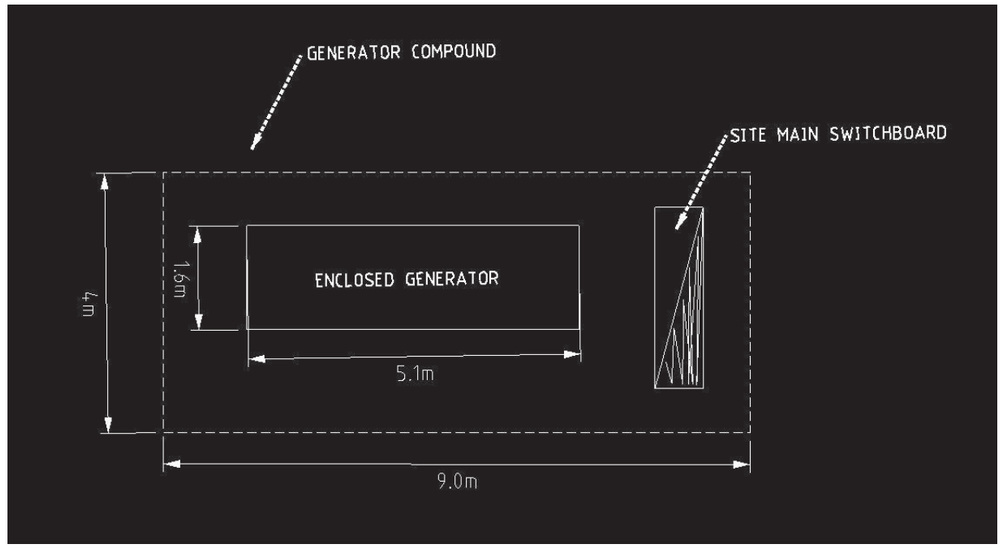
3.3 **HV Concept**



3.4 Substation Site Details

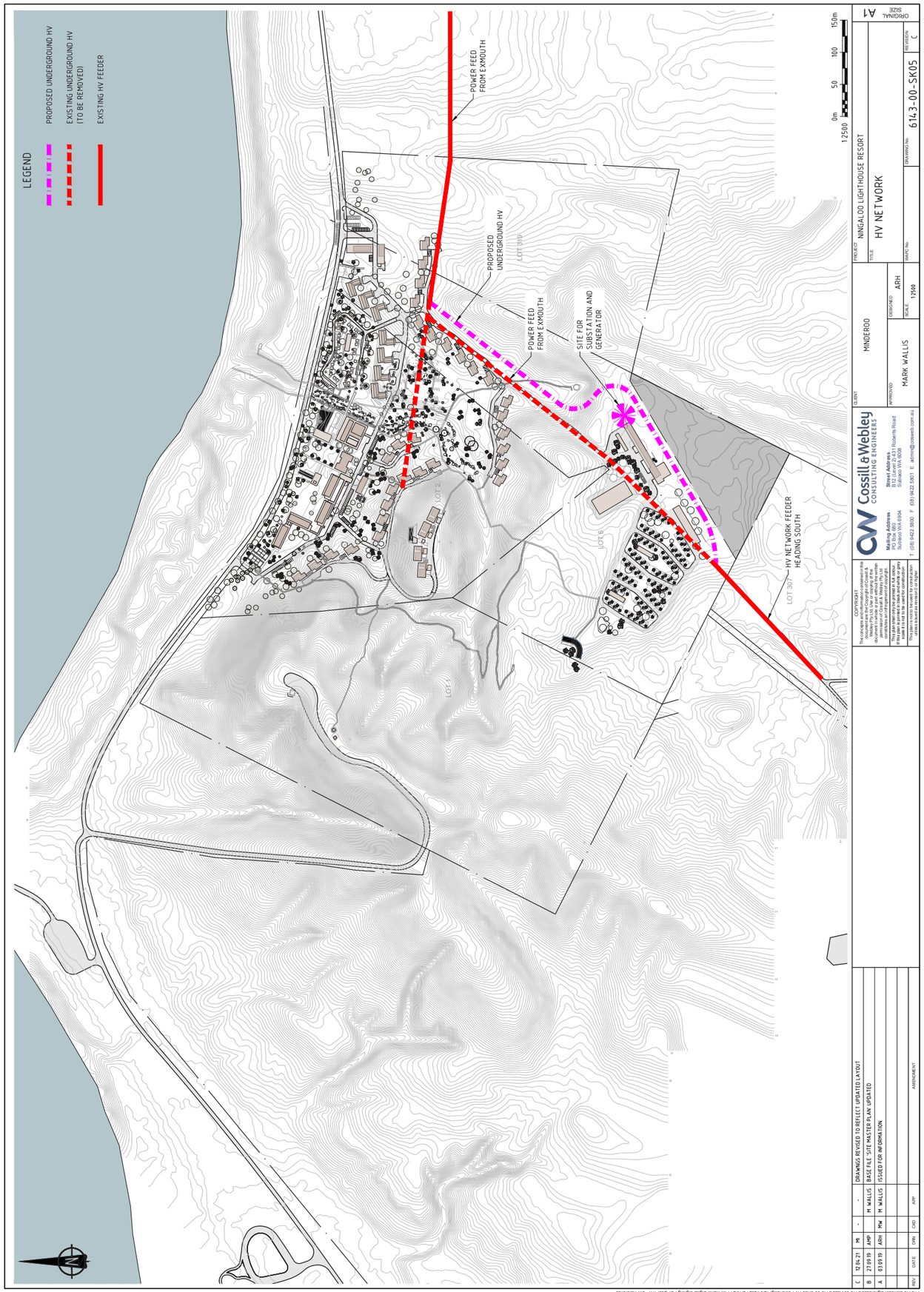


3.5 Generator Site Requirement



Ningaloo Lighthouse Resort
Engineering Servicing Report

APPENDIX E



APPENDIX F

Water Balance

		per day		
Potable Water				
Bore Water Supply (max)		259	KL	
30% reject stream		77.7	KL	
useable potable water		181.3	KL	
max annual extracition (full capacity)		**94535**	**KL**	
Bore Water Supply (average)		160	KL	
30% reject stream		48	KL	
useable potable water		112	KL	
average annual exactraction		**58400**	**KL**	
licence application		72000	KL	allowance for 25% growth
Potable Water Demand				
Peak	726	182	KL	250 L/person/day
Median	448	112	KL	
Non Potable Water				
Grey Water Produced				
Peak	726	174	KL	240 L/person/day
Median	448	108	KL	
Grey Water Requirement				
Toilet Flushing	726	44	KL	60 L/person grey water reuse
Irrigation		25	KL	25 ML/ha/year. based on 3,000m2 irrigation
TOTAL NOT POTABLE REQUIREMENT (PEAK)		69	KL	

Storage Requirements

Tanks		
Potable Supply	300KL	6 tanks
Irrigation	300KL	1 tank
Fire	300KL	2 tanks

APPENDIX G

WATER WEST

NINGALOO LIGHTHOUSE RESORT

CONCEPT STUDY REPORT

PROPRIETARY AND CONFIDENTIAL INFORMATION

The attached document contains proprietary and confidential information and is submitted under a confidential relationship for the purpose defined below.

Purpose: The purpose of this report is to demonstrate the conceptual solution for wastewater and recycled water servicing for the Ningaloo Lighthouse Resort redevelopment.

By accepting this document, the recipient agrees:

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(f) references in the above paragraphs to 'the attached document' includes any part of it and includes all drawings, designs, reports, specifications, calculations, concepts, processes and other information within the attached document or provided in conjunction with the attached document.

PROJECT REFERENCE

Permeate Partners Reference:	J2001445
Water West Reference:	TBC

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1 Background and Introduction

Z1Z Resorts Pty Ltd is proposing to redevelop the Ningaloo Lighthouse Resort to incorporate hotel rooms, cabins, lodges, caravan and tent sites. A recycled water plant is proposed to treat the sewage generated in the resort and provide recycled water for reuse in the following applications

- Internal reuse – toilet flushing, washing machines
- External use – Irrigation of open spaces, non-potable water uses.

2 Water Balance

Details of the estimated water balance of the site are included in Appendix A. The sewage flows have been assigned using the WA Department of Health (DoH) "Supplement to Regulation 29 and Schedule 9 – Wastewater system loading rates" and occupation rates sourced from the Developer. Where the occupation rates between the Developer assumptions and the DoH assumptions differ, the more conservative value has been adopted. There are significant areas of open space and revegetation that will be irrigated within the resort. Given the low annual rainfall for the region it has been assumed irrigation may be undertaken throughout the year at a conservatively low rate of 2mm per day. This equates to 7.6ML/Ha/year.

The total irrigation area on the site is approximately 7Ha, consisting of 0.6Ha turfed areas and 6.4Ha garden and revegetation areas. Based on the water balance an irrigation area of approximate 4.2Ha is required to dispose of all recycled water based on peak flows. The estimated occupancy rate for the resort is 54%. This means there is sufficient irrigation area within the resort to manage the water balance.

Typically, the recycled water storage tanks would maintain a minimum level to ensure reliable supply for the internal uses for 4-5 days. The balance of the treated water would be irrigated onto the turf and garden areas daily to manage the level in the recycled water storage tanks. Turfed areas would be prioritised for irrigation. The garden types proposed for the resort are drought resistant plants that will not be reliant on regular irrigation.

Table 1 below shows the outputs for the peak flow and average flow scenario (i.e. with the resort at full occupancy).

Table 1 – Water balance summary at full occupancy

Accommodation/population type	Sewage (kL/day)		RW Demand - Internal reuse (kL/day)	
	Peak	Average	Peak	Average
Lodges	8	4.2	1.7	0.9
Hotel Rooms	22	11.7	3.6	1.9
Caravans	35	18.7	7.4	4.0
Tent	8	4.2	1.7	0.9
Villas (Std)	26	14.1	4.9	2.6
Upgraded Villas	3	1.8	0.7	0.4
Staff	5	2.9	1.1	0.6
Visitors	1	0.6	0.2	0.1
TOTAL	**108**	**58**	**21**	**12**
Irrigation volume (kL/day)			87	36
Irrigation area required (Ha)			4.2	2.2

Table 2 below shows the annual flow totals for sewage flows and recycled water demands based on the average flow across the year. Detailed outputs of the water balance are included in Appendix A.

Table 2 – Average annual sewage flow totals

Accommodation/population type	Sewage (ML/year)	RW Demand (ML/year)	Irrigation (ML/year)
Lodges	1.55	0.33	17.04
Hotel Rooms	4.26	0.71	
Caravans	6.84	1.47	
Tent	1.55	0.33	
Villas (Std)	5.14	0.96	
Upgraded Villas	0.66	0.14	
Staff	1.05	0.22	
Visitors	0.21	0.04	
TOTAL	**21.25**	**4.21**	**17.04**

3 PROCESS DESCRIPTION

3.1 Overview

The wastewater infrastructure for the proposed recycled water treatment plant may consist of all or a combination of the processes below:

- Sewer network (not covered by this document)
- Fine screens and screenings bin
- Flow balance tank
- Biological treatment including aerobic and anoxic treatment zones
- Membrane filtration
- UV disinfection
- Chlorine disinfection
- Chemical dosing and storage
- Recycled water storage tanks
- Recycled water distribution pumps
- Chemical storage and dosing

The infrastructure listed above is described in further detail in the following sections.

A Process Flow Diagram (PFD) has been provided in Appendix B.

Figure 1 – Monkey Mia Dolphin Resort MBR wastewater treatment plant (2013)

3.2 Inlet screening

To minimise the solids entering the flow balance tank and to protect downstream equipment, all wastewater may be passed through an initial fine screen. The screened wastewater may then be directed to the flow balance tank. The inlet screens discard the solids into screenings bins which are emptied as required.

Key design features of the inlet screens include:

- Inlet screen size is 2mm punched plate.
- Sized to accept the peak instantaneous flow from the resort.
- Stainless steel construction.

3.3 Flow Balance Tank (FBT)

Wastewater flow balance tanks (FBTs) will be used to buffer flows and provide a steady feed stream to the biological reactor. The FBTs also provides an opportunity for dilution and / or neutralisation of any contaminant in the wastewater that might be harmful to the biological process. Finally, the FBT provides a mechanism to temporarily halt processing of wastewater should there be a problem with the downstream equipment.

Screened wastewater may be pumped to the biological reactor based on the level in the FBT (sewage available) and the level in the biological reactor (capacity available). A mixer may be used to keep the solids in suspension and prevent “short-circuiting” within the FBT.

Key design features of the FBT include:

- Installed in a duty / duty configuration.
- The FBT capacity will be designed to receive a nominal 24 hours feed per tank at peak flow.
- Mixer installed on each tank to mix sewage.
- Duty / Standby bioreactor feed pumps.
- The FBT will be equipped with a fan to remove foul air to atmosphere.

3.4 Biological reactor

The biological reactor (“bioreactor”) consists of a biological nutrient removal activated sludge process. The movement of the wastewater between anoxic and aerobic zones enables Nitrogen and BOD reduction. Coagulant is added to assist in the removal of Phosphorous.

Raw sewage may enter the anoxic zone (front of the process) and combine with the return mixed liquor from the membrane tank. Mixers may be used to suspend solids in the anoxic zones and provide good contact between the incoming wastewater and the mixed liquor. From the anoxic zone the mixed liquor flows to the aerobic zone. The aerobic zones may be aerated using fine bubble diffusers installed in the base of the biological reactor.

To ensure the treated wastewater quality is achieved key process indicators for the biological reactor such as flow, dissolved oxygen (DO), mixed liquor suspended solids (MLSS) and pH will be continuously monitored via the site SCADA.

Key design features of the biological reactor include:

- Membrane feed pumps.
- Anoxic zone mixers.
- Chemical addition for phosphorous removal and pH control.
- Pumps installed in duty/standby configuration
- Bioreactors sized for each bioreactor to treat the peak sewage flow.

Figure 2 – Monkey Mia Dolphin Resort equipment room

3.5 Membrane filtration

Membrane filtration may be used to separate the treated wastewater from the MLSS. The small pore size of the membrane (<0.04µm) results in the rejection of solids and pathogens at the membrane surface whilst treated water passes through. The membranes are the first disinfection barrier in the treatment process.

Membrane permeability is maintained by:

- Aeration at the base of the membranes to dislodge solids from the membrane surface.
- Periodic relaxing and back pulsing of the membranes.
- Periodic chemical cleaning of the membranes.

The permeate pump operates based on liquid level in the biological reactor and directs filtered water via the UV sterilisation unit to the chlorine contact pipe, and then through to the storage tanks. The mixed liquor from the membrane tank is returned to the anoxic zone via an overflow. To ensure membrane filtration performance is maintained, key process indicators such as flow, trans-membrane pressure (and permeability) and permeate turbidity will be continuously monitored via the site SCADA system.

Key design features of the membrane filtration system include:

- Pre-validated membranes.
- Two membrane trains, with the ability for a single membrane train to be able to process the design capacity in the event the other train is not available.
- Dedicated permeate pumps per train.
- Membrane blowers.

3.6 UV disinfection

Permeate from the membrane tanks may pass through a UV disinfection unit which provides further disinfection of the treated water. The UV units constantly monitor UV Intensity (UVI) and UV transmissivity (UVT) to ensure the performance of the UV units and the quality of the treated water.

Key design features of the UV system include:

- Pre-validated UV units.
- Continuous online monitoring of UVI and UVT.
- Installed in a duty / standby configuration with each unit sized to treat peak flows.

3.7 Chlorination

Chlorine dosing pumps dose chlorine (sodium hypochlorite) to a Chlorine Contact Tank/Pipe ("Plug Flow Contactor") to provide further additional disinfection. The residual free chlorine level can be monitored on the outlet from the contact tank and used to control the chlorine dosing to ensure the free chlorine remains within the specified control values to ensure disinfection.

An additional chlorine top-up can be included on a recirculation loop in the recycled water storage tank to ensure a free chlorine residual is maintained.

Key design features of the chlorine disinfection system include:

- Buried chlorine contact pipe.
- Continuous online monitoring of free chlorine.
- Sodium hypochlorite dosing pumps installed in duty / standby configuration.

3.8 Chemical dosing and storage

Various chemicals are typically required for sewage treatment, recycled water production and membrane cleaning. These chemicals can be stored in appropriately sized tanks, taking into consideration the type and consumption. The tanks along with the chemical dosing pumps will be located within separate bunded areas. The chemicals that may be used and their purposes are described in Table 3 below.

Table 3 – Chemical type and purpose

Chemical	Purpose
Aluminium Sulphate (Alum)	Used as a coagulant to precipitate phosphorus.
Sodium Hypochlorite	Used for final disinfection of the treated recycle water and membrane cleaning.
Citric acid	Used for membrane cleaning.
Sodium Hydroxide (Caustic)	Used to control pH of the biological process.
Polymer	For sludge thickening to improve sludge dewatering.

The chemical storage tanks and dosing pumps will be designed and bunded in accordance with AS3780-2000.

Key design features of the chemical storage systems include:

- Chemical storage tank volumes sufficient for 30 days' continuous operation at resort capacity.
- Bunding in accordance with AS3780-2000.
- Chemical dosing pumps installed as duty/standby.

3.9 Recycled water storage and distribution

The Recycled Water Storage Tank will provide sufficient storage for a nominal 4-5 days supply at peak demand. The recycled water will be pumped into the recycled water network for distribution around the development for re-use and irrigation.

The recycled water storage tank will have a potable water connection to provide potable water top up in the event the recycled water demand exceeds the availability of recycled water. An air break or other suitable means of cross-contamination prevention will be provided.

The recycled water distribution pumps will pump recycled water to the distribution network. The pumps will operate to maintain pressure in the network.

Key design features of the recycled water storage and distribution system include:

- Recycled water storage tanks sized for a nominal 5 days supply at peak demand (combined volume).
- Recycled water storage tanks installed in duty / duty configuration.
- Recycled water storage distribution pumps installed in a duty / assist / standby configuration.

3.10 Sludge dewatering

The waste activated sludge (WAS) from the bioreactor needs to be periodically removed to maintain the sludge concentration in the bioreactor and the biological performance of the plant. Sludge can be dewatered with the dry solids transported off-site for disposal and residual water pumped back to the head of the WWTP for re-processing. This concept design allows for a geobag dewatering system. The geobag is lag semi-permeable geofabric bag that dewaters the wasted solids.

Key design features of the dewatering system include:

- Geobag dewatering with space for 2 drying bays.
- Polymer dosing to improve filterability of the WAS.
- Goebag bays slope to a drain which is directed to the plant sump to collect all filtrate and any rainfall.

3.11 Emergency storage basin

There are existing sewer treatment ponds located south from The Site which may be included in the concept design. In the unlikely instance of an extended treatment plant outage the sewer treatment ponds would be able to accept sewage flows to maintain the sewage service to the resort. These ponds would be cleaned out and checked for integrity of the lining, and made good as necessary. These ponds would normally be empty. Any sewage directed to the sewer treatment ponds would be returned to the treatment plant when normal operations are resumed, any rainfall captured in the ponds would also be processed through the treatment plant.

Key design features of the emergency storage dam include:

- Sized for nominally 5 days sewage flow at capacity.
- Lined storage dam.
- Sloped floor to allow for the dam to be fully emptied to the plant sump.

3.12 Control system

The plant will include a PLC / SCADA system with remote monitoring and alarm paging capability. The plant is proposed to be highly automated to minimise the requirement for regular operator intervention.

4 REGULATORY APPROVALS

The table below summarises the regulatory approvals that will be required for the implementation of the recycled water scheme. The relevant stakeholders and the associated approvals are summarised in Table 4 below:

Table 4 – Regulatory approvals

Regulatory Body	Approval description	Timing
Department of Water and Environmental Regulation	Works Approval – Category 54 prescribed premises	Prior to commencement of construction of the treatment plant
	Operating licence – Category 54 prescribed premises	Prior to commencement of operation of the treatment plant
Department of Health	”Application to construct or install an apparatus for the treatment of sewage”	Prior to commencement of construction of the treatment plant
	“In Principle” approval of Recycled Water Quality Management Plan	Prior to commencement of construction of the treatment plant (supply of recycled water to customers)
	Recycled water scheme operating licence – full approval of Recycled Water Quality Management Plan	After treatment plant validation but prior to commencement of full operation (supply of recycled water to customers)
Shire of Exmouth	Development application	Prior to commencement of construction of any infrastructure (likely to be included in overall resort development application)
	Certificate of occupation (Plant building)	Upon completion of the plant building if required
	”Application to construct or install an apparatus for the treatment of sewage”. Typically deferred to Department of Health	Prior to commencement of construction of the treatment plant

Similar infrastructure and schemes which have been successfully implemented will be considered during the detailed design phase of the Lighthouse Resort wastewater treatment system. Some examples of include Rottnest and Monkey Mia, which have both been developed in environmentally sensitive locations similar to the proposed Ningaloo Lighthouse Resort:

- Monkey Mia Dolphin Resort – MBR technology used for the treatment of wastewater from the resort. The treated effluent in this application is not reused but disposed of via restricted irrigation and infiltration.
- Rottnest Island – MBR technology with chlorine disinfection used for the treatment of wastewater from the Island. The recycled water is used for unrestricted irrigation of the golf course and sporting oval on the Island.

Figure 3 – Rottnest Island MBR recycled water plant

APPENDICES

Appendix A WATER BALANCE

Project: Ningaloo Lighthouse Resort
Client: Water West
Revision: A
Date: 17/12/2020

Average occupancy flow rates

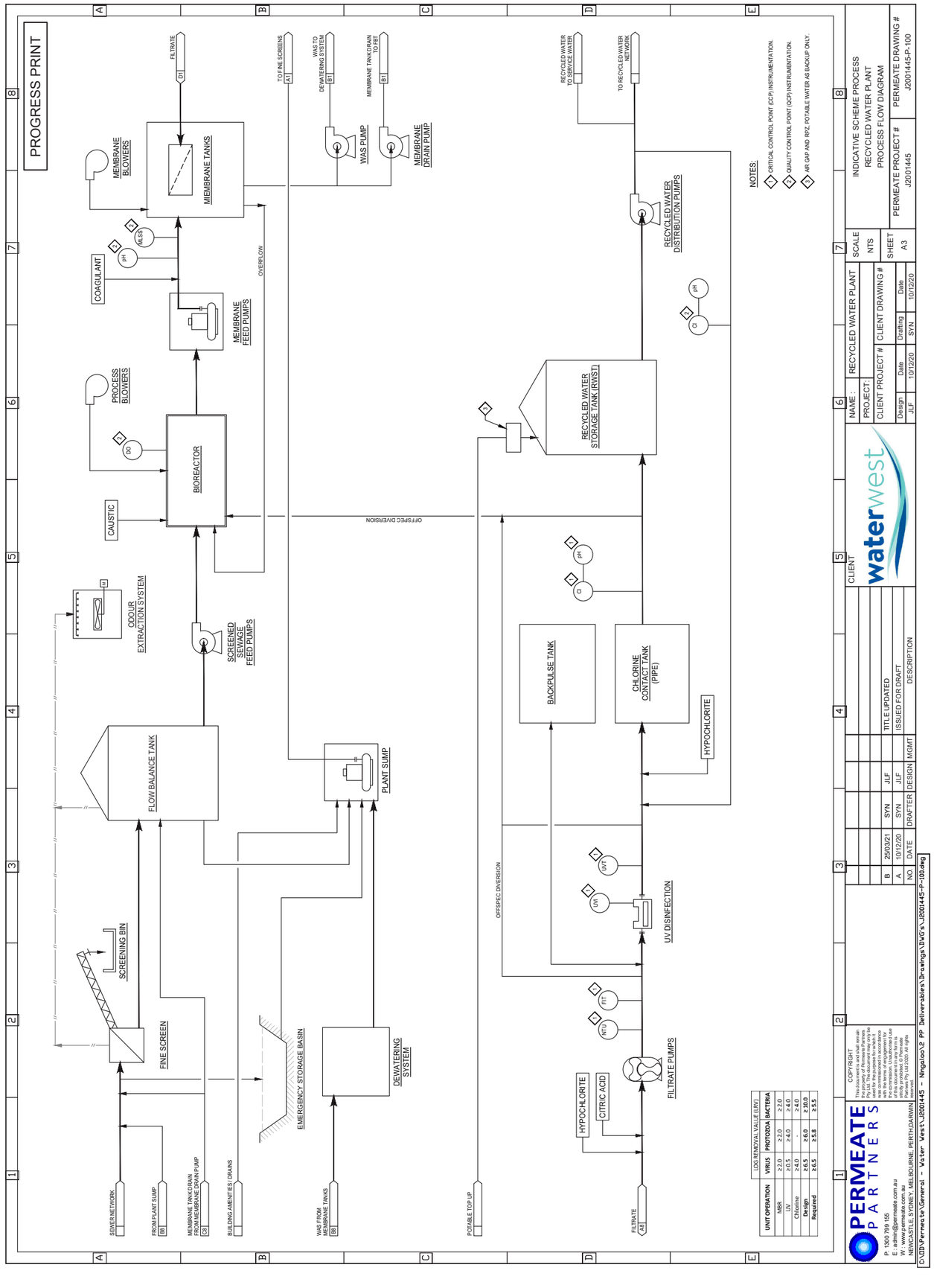
Month	Sewage Flow (ML)	RW Internal use (ML)	Irrigation demand (ML)
January	1.81	0.36	1.45
February	1.64	0.32	1.31
March	1.81	0.36	1.45
April	1.75	0.35	1.40
May	1.81	0.36	1.45
June	1.75	0.35	1.40
July	1.81	0.36	1.45
August	1.81	0.36	1.45
September	1.75	0.35	1.40
October	1.81	0.36	1.45
November	1.75	0.35	1.40
December	1.81	0.36	1.45
Total	**21.32**	**4.21**	**17.04**

Accommodation type	Units	EP/unit	EP	Sewage flow/ EP (L/EP/day)	Peak sewage flow (kL/day)	Peak recycled water demand (intrenal reuse) (kL/day)	Average sewage flow (kL/day)	Average recycled water demand (internal reuse) (kL/day)	Comments
Lodges	6	9	56	140	8	1.7	4.2	0.9	140L/EP/day in lieu of 829L/dwelling as higher value
Hotel Rooms	48	2.5	120	180	22	3.6	11.7	1.9	
Caravans	62	4	248	140	35	7.4	18.7	4.0	Higher EP than noted in Supplement to Regulation 29 and Schedule 9
Tent	28	2	56	140	8	1.7	4.2	0.9	
Villas (Std)	30	5.4	162	161	26	4.9	14.1	2.6	Based on 829L/dwelling/day
Upgraded Villas	4	6	24	140	3	0.7	1.8	0.4	140L/EP/day in lieu of 829L/dwelling as higher value
Staff	76	0.5	38	140	5	1.1	2.9	0.6	Adjusted EP/Staff rate to accommodate some showering staff
Visitors	30	0.25	8	140	1	0.2	0.6	0.1	Adjusted EP rate for visitors to give higher than "Public building (frequent use)" rates
		TOTALS	**711**		**108**	**21**	**58**	**12**	

Appendix B DRAWINGS

Drawing no.	Revision	Description
J20001445-P-100	B	Process Flow Diagram
J2001445-GA-001	B	General Arrangement – Plan view
J2001445-GA-002	B	General Arrangement – Elevations
J2001445-L-001	B	Location Plan

.



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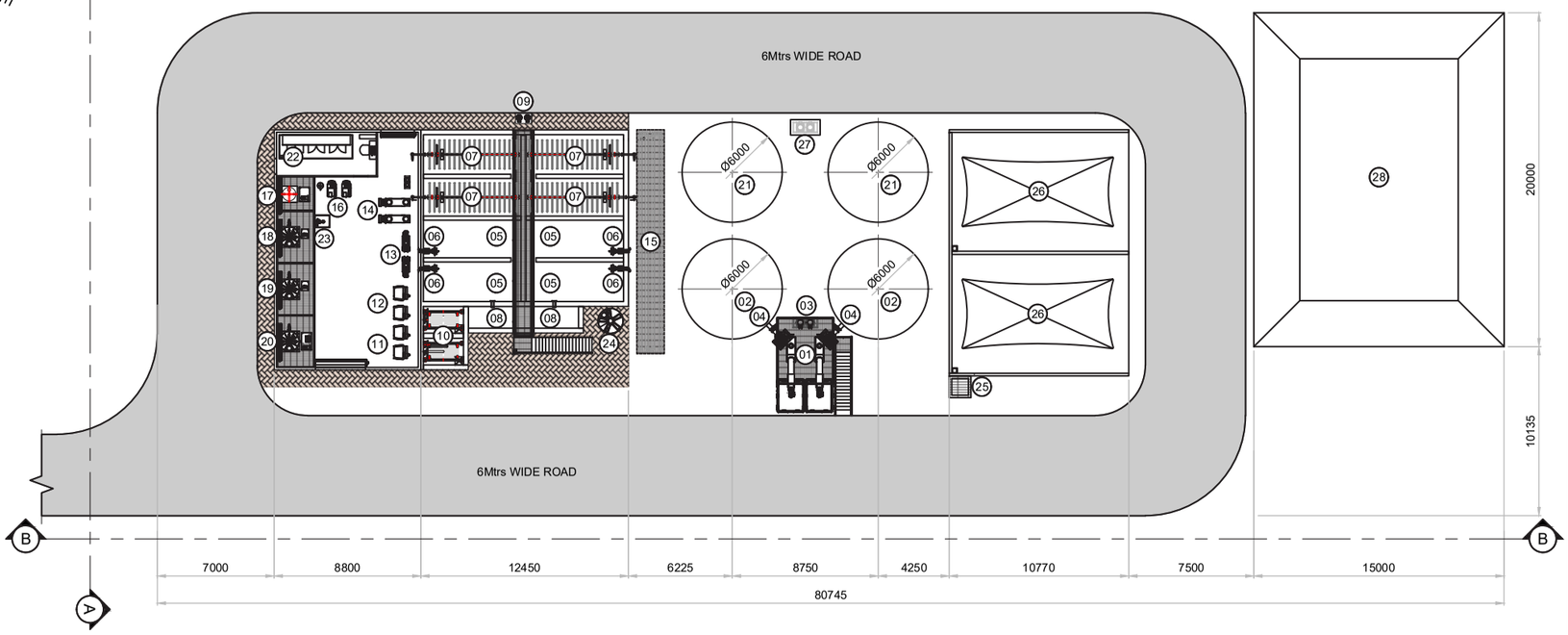

LEGEND :

PEDESTRIAN FOOTPATH

PLATFORM / GRATING

ROAD

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	FINE SCREEN	11	MEMBRANE BLOWERS	20	SODIUM HYPOCHLORITE STORAGE AND DOSING
02	FLOW BALANCE TANK	12	PROCESS BLOWERS	21	RECYCLED WATER STORAGE TANK
03	SCREENED SEWAGE FEED PUMPS	13	PERMEATE PUMPS	22	MCC / CONTROL ROOM
04	JET MIXER	14	UV DISINFECTION (LBX90 - 1.85Mx0.43Mx0.3M)	23	SAFETY SHOWER AND EYE WASH
05	ANOXIC ZONES	15	CHLORINE CONTACT TANK (PIPE)	24	BACKPULSE TANK
06	ANOXIC MIXER	16	AIR COMPRESSOR AND RECEIVER	25	PLANT SUMP
07	AEROBIC ZONES	17	CITRIC ACID STORAGE AND DOSING	26	GEOBAG
08	RAS WELL	18	ALUM STORAGE AND DOSING	27	RECYCLED WATER DISTRIBUTION PUMPS
09	MEMBRANE FEED PUMPS	19	SODIUM HYDROXIDE STORAGE AND DOSING	28	EMERGENCY STORAGE BASIN
10	MEMBRANE TANKS				

SCALE 1:250 A3

0 5000mm 10000mm

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION MAP REFER DWG NUMBER - J2001445-L-001

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NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
B	25/03/21	SYN	JLF		ORIENTATION UPDATED
A	14/12/20	SYN	JLF		FIRST DRAFT

CLIENT: waterwest

NAME :	RECYCLED WATER PLANT		
PROJECT:			
CLIENT PROJECT #		CLIENT DRAWING #	
Design	Date	Drafting	Date
JLF	11/12/20	SYN	11/12/20

SCALE 1:250 | SHEET A3

INDICATIVE LAYOUT
RECYCLED WATER PLANT
GENERAL ARRANGEMENT - PLAN VIEW

PERMEATE PROJECT # J2001445 | PERMEATE DRAWING # J2001445-GA-001

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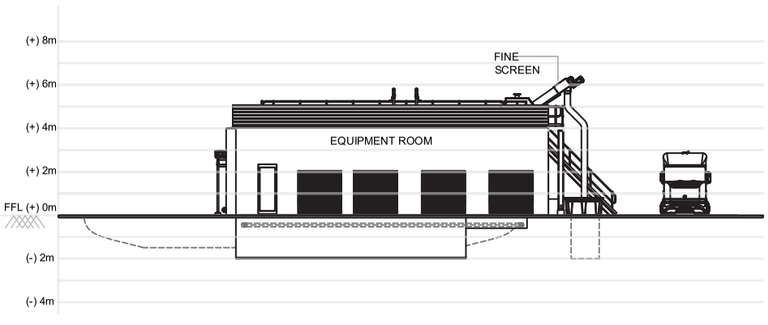
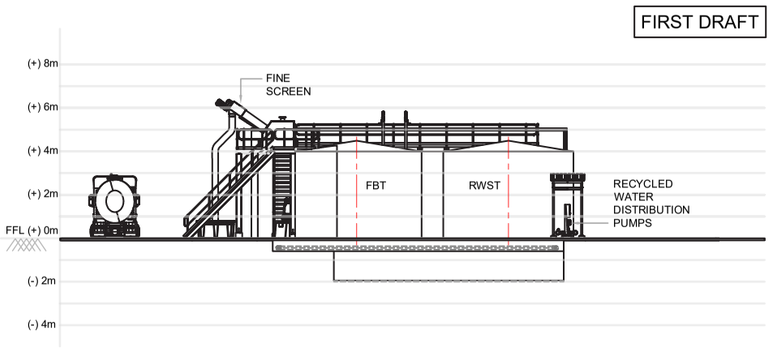
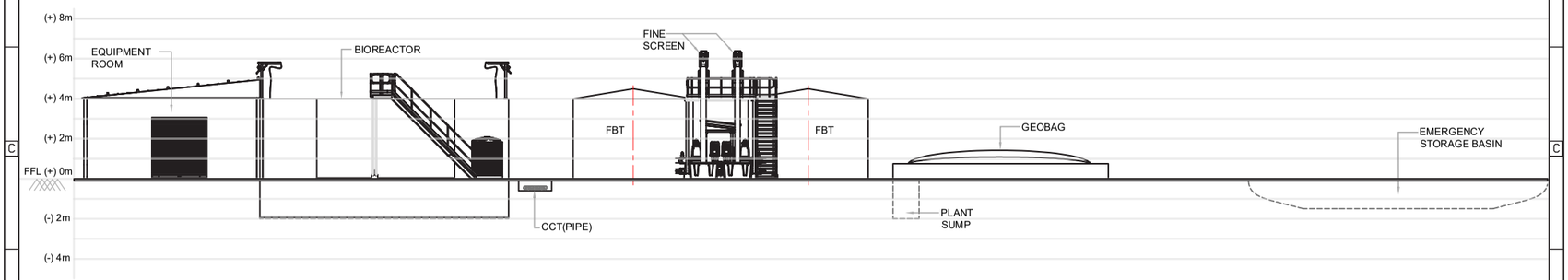


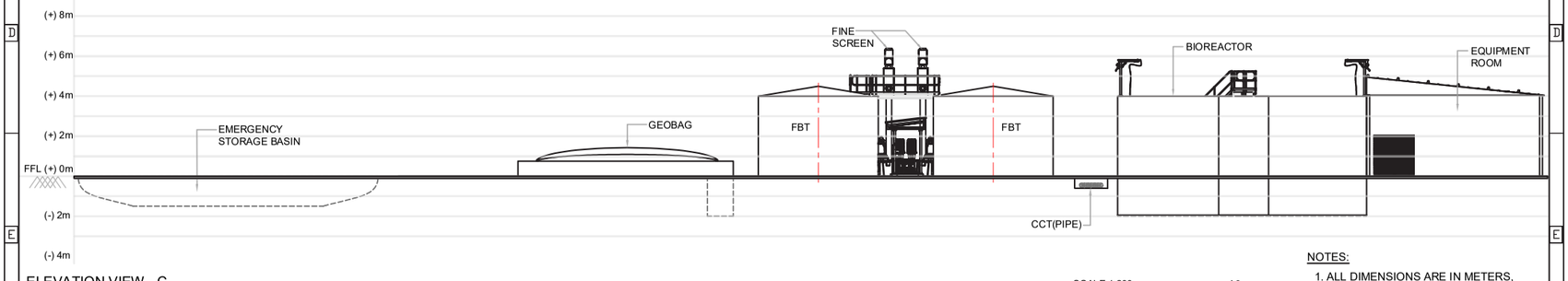
ELEVATION VIEW - A



ELEVATION VIEW - D



ELEVATION VIEW - B



ELEVATION VIEW - C

SCALE 1:200 A3

0 2m 4m 6m 8m

NOTES:

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR GENERAL ARRANGEMENT REFER DRAWING NUMBER - J2001445-GA-001

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B	25/03/21	SYN	JLF		TITLE UPDATE
A	14/12/20	SYN	JLF		FIRST DRAFT

CLIENT: waterwest

NAME :	RECYCLED WATER PLANT		
PROJECT:			
CLIENT PROJECT #		CLIENT DRAWING #	
Design	Date	Drafting	Date
JLF	16/12/20	SYN	16/12/20

SCALE 1:200 | SHEET A3

INDICATIVE ELEVATIONS
RECYCLED WATER PLANT
ELEVATION VIEWS

PERMEATE PROJECT # J2001445 | PERMEATE DRAWING # J2001445-GA-002

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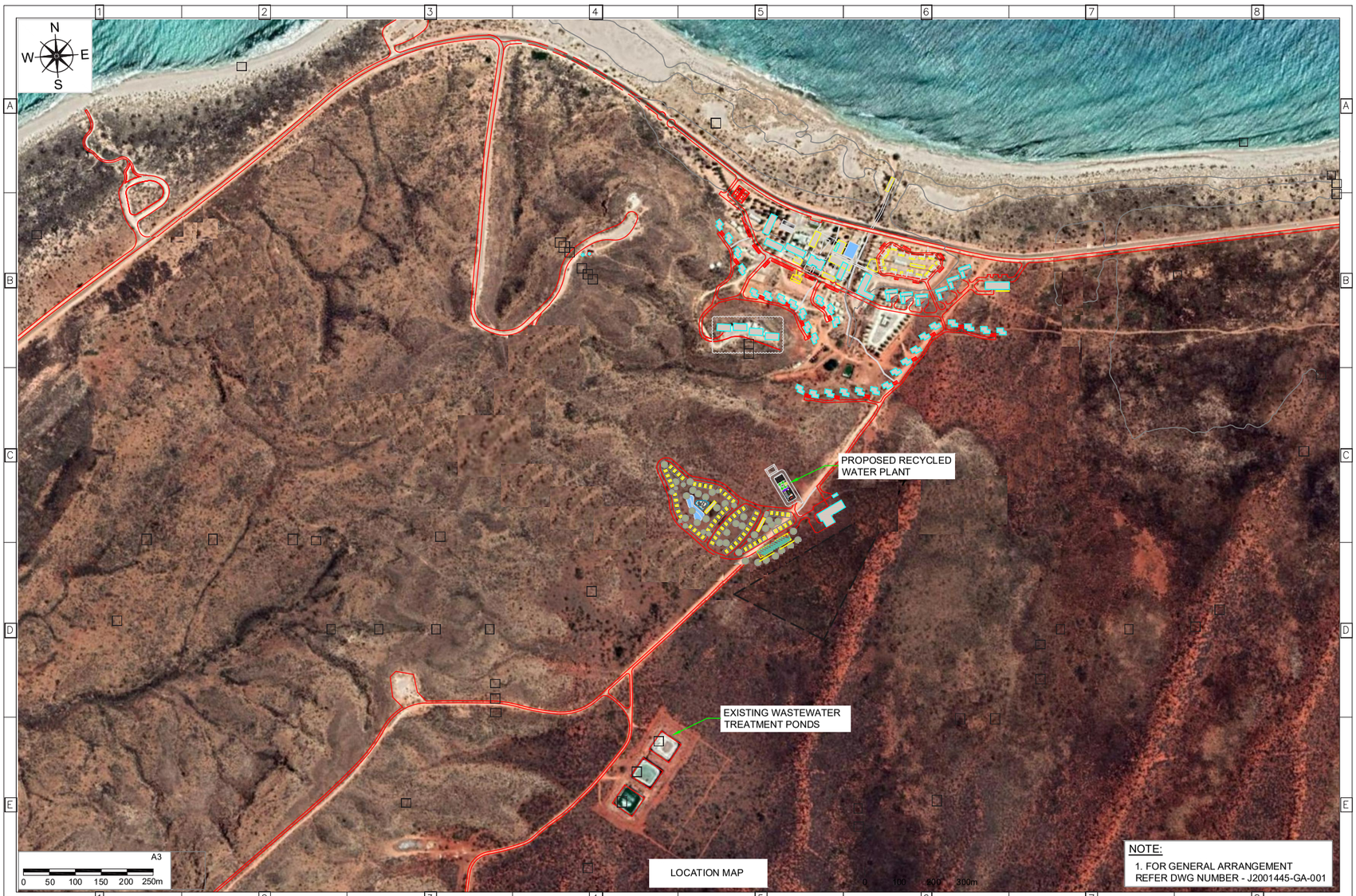

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B	25/3/21	SYN	JLF		LOCATION UPDATED
A	14/12/20	SYN	JLF		FIRST DRAFT

CLIENT: waterwest

NAME :	RECYCLED WATER PLANT		
PROJECT:			
CLIENT PROJECT #		CLIENT DRAWING #	
Design	Date	Drafting	Date
JLF	14/12/20	SYN	14/12/20

SCALE 1:500
SHEET A3

INDICATIVE LOCATION
RECYCLED WATER PLANT
LOCATION PLAN

PERMEATE PROJECT #	PERMEATE DRAWING #
J2001445	J2001445-L-001

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