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WALLCLIFFE HOUSE

Margaret River

**Application for development
approval**

Engineering Aspects

3rd November 2023

Project Ref N°: 8038-DAS

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1. Context, Proposals, and Infrastructure

This report, with its comments about the utilities and related infrastructure and their capacity, supports a proposed application for Development Approval (DA) that is being prepared by the Town Planner, Taylor Burrell Barnett.

The DA is to apply to Lot 101 (№ 752) Wallcliffe Road, Margaret River on DP No 49026 (**the Land**) and will include a hotel with guestrooms, cottages, food and beverage offerings, and ancillary buildings.

The development of the Wallcliffe House land will necessitate upgrades to the capacity of existing utilities and the provision of new services. Such utilities and services will include the wastewater collection and disposal, water supply, firefighting water supply, electricity, and communications services.

A concept plan of the proposed development of the Land is presented in Appendix A.

2. Geology, Topography, and Groundwater

The Land generally slopes south-east to north-west with an average grade of about 10 to 15%. Whilst this average slope is quite steep in parts, the existing development has stepped down the grade of the Land to near the edge of the Margaret River in an overall landform of an elongated amphitheatre. The topography is shown in Appendix B.

According to the geotechnical engineers Douglas Partners and CMW Geosciences¹, the Cowaramup-Mentelle 1:50,000 Regolith Landform sheet 1930-III and part of 1830-II indicates that the site is underlain by bedrock of the Leeuwin Complex of the Cowaramup System comprising fresh to weathered granulite and granite. The Quindalup System (calcareous sand) and the Spearwood System (quartz sand overlying calcarenite, i.e., limestone) are shown immediately adjacent to the southern site boundary and approximately 250 m to the northwest and southeast of the site, respectively.

Other available information indicates that the site is underlain by the Spearwood System (i.e., quartz sand and limestone), inferred to in turn overlay soils and rock of the Leeuwin Complex bedrock.

¹ “*Proposed Building Development Wallcliffe House Geotechnical Investigation Report*” by CMW Geosciences dated 10th October 2018.

“*Geophysical Survey*” by Douglas Partners dated 29th September 2020

“*On-site Sewage Disposal Assessment*” by Douglas Partners dated 22nd October 2021

“*Geotechnical Investigation*” by Douglas Partners dated 2nd March 2022

Given the proximity of the site to the Margaret River, it is anticipated that groundwater level is either near river level (i.e., $\leq$ RL 1 m) in limestone or at a shallower depth if perched on shallower Leeuwin Complex bedrock.

The possibility of Karst formations was considered. Some further investigations were undertaken in September 2020 and the testing revealed no Karst formations under the Land.

Groundwater was not encountered on the Land, when test pits were undertaken but it is likely to be at or near the water level of the River, as evident by a dam near the boathouse that reveals the groundwater surface after winter rains. The groundwater is likely to be confined by the underlying granite and flow through the overlying sand and limestone layers.

3. Demolition, Earthworks, and Shaping of Land

The damaged buildings that remain on the Land will be carefully and selectively deconstructed and the rubble cleared, most of which will be sorted, saved, and reused where possible. When these buildings are taken down, the plan is to salvage and reuse most of the limestone from the Dairy and Wallcliffe House.

Any metal will be removed and recycled, timber in the buildings or on the land will be salvaged from the rubble, stored, and reused. All bricks and concrete are planned to be crushed, where possible, to create road base material that can be used for the new road pavements.

A critically important consideration of the proposed development is to fit the buildings into the Land in a manner that creates the least disturbance both physically and aesthetically.

Whilst challenging, the contours and levels of the Land will be sculpted in such a manner that structures appear in harmony with the landscape. Significant and established trees have been navigated schematically and tree protection zones will be established throughout construction.

4. Water - Potable and Firefighting

The Water Corporation has been consulted to ascertain the current potable water infrastructure near and serving the Land and to determine what upgrades may be required.

A 150 mm distribution pipeline is located along the eastern side of the Wallcliffe Road reserve. A 20 mm water service serves the Land. This service will need to be upgraded to a larger diameter to suit the proposed development and a 150mm diameter fire service will also be provided.

The distribution pipeline and hence the water service to the Land, is subject, however, to *control-of-supply* and is part of a boosted (i.e., pumped) scheme. Control-of-supply in this context means that the same capacity of supply cannot be assured if the electricity system in the district is off – this would similarly affect the Prevelly and Gnarabup townsites.

The Baudin Drive high-level tank (i.e., with a top water level of 110.6 mAHD and a 1,500m³ capacity) located about 1.85 kilometres south-east of the Land would continue supply to the district but with a lower rate of supply during a power outage. This control-of-supply means that development of the Land will require a suitably sized header tank designed to maintain supply for a stipulated period during a power-outage.

The Water Corporation system cannot be entirely relied upon for firefighting and hence a specific fire water system with suitably sized tanks and stand-by power supply will be designed and incorporated into the development for the Land.

Refer to Appendix C for details of the water supply scheme network.

5. Water – Non-Potable - Irrigation

The irrigation system on the Land is currently supplied from two low-yielding bores drawing from the shallow surficial aquifer. One bore is near the dam/soak in the northern part of the Land and the other is located near the Land's southwestern corner. Water is pumped to two tanks west of Wallcliffe Road near the access driveway into the Land. These two tanks then irrigate the Land by gravity. During the summer months only, the system runs three to four days per week and the tanks rarely run dry from each day's cycle time.

Future irrigation water demand is likely to be more than the historical use. The existing system is proposed to be retained upon development of the site, upgraded with a new production bore to suit the larger irrigated area anticipated. The use of groundwater for irrigation as part of the tourism land uses has been licenced pursuant to the *Rights in Water and Irrigation Act 1914*. This was determined in consultation with the Department of Water and Environmental Regulation (DWER) and a licence was issued in 2022.

6. Wastewater

In the past, the buildings on the Land were served by on-site septic tanks and leach drains. These systems will be decommissioned during demolition. The proposal to develop the Land will generate more wastewater and consequently create a need for a more sophisticated wastewater collection, treatment, and disposal systems.

To deal with this, we identified and examined three alternative options to treat and dispose of wastewater generated by the proposed development. The options are as follows:

1. **Unconventional** - A private wastewater pumping station (WWPS) and pressure main to the Water Corporation's Gnarabup sewer system, or
2. **Unconventional** - A private WWPS with an approx. 7km long pressure main connected to the Water Corporation's reticulation system near the western edge of the Margaret River townsite., or
3. **Conventional** - A private package wastewater treatment plant (WWTP), effluent polishing plant, and sludge dewatering plant located and contained on the Land, producing recycled water of sufficient quality to be wholly disposed of on the Land.

On completion of our assessments, only one option has proven to be viable.

It is noted that the Wallcliffe House property is outside of the Water Corporation's licence area and so Options 1 and 2 would need the licence area to be extended. Albeit that that is the case, in the text that follows, each of these two unconventional options has been examined in detail to show why Option 3 is preferred.

Option 3 complies with and exceeds contemporary water quality treatment and setback requirements. It is, however, a more complex system and as such will require operational management and maintenance, compared with the Option 1 and 2 connections to the Water Corporation's sewer systems.

Appropriate management of health considerations and nutrients have all been considered in the design and placement of the system. This is documented in a Water Management Plan by Emerge Associates², who have consulted widely with DWER, the Shire of Augusta Margaret River, and the Department of Health.

The wastewater generated by each new building will be collected by means of property sewers to several small WWPSs that each in turn will pump the wastewater to a single location near the Operations Barn. From that location wastewater will be either pumped to the package WWTP or via a private WWPS and pressure main offsite to the Water Corp system, depending on the option.

In each case the disposal options are as follows:

² - "Water Management Plan, Lot 101 Wallcliffe Road, Margaret River", by Emerge Associates, November 2023

Option 1 – Discharge into Water Corporation’s Gnarabup Treatment Plant

Whilst we have ruled this out, it is worth noting that the nearest potential outfall, which might accept wastewater from the Land, is an existing WWPS near Chuditch Place

A new private pressure main from the Land would have to be located along the road reserves of Wallcliffe Road then Chuditch Place and discharge into an existing sewer near the Chuditch Place WWPS. The Water Corporation, has said that this option would depend on several complex factors being resolved, including dealing with the down-hill pressure main that falls into the Gnarabup system, capacity in their system being available to accept the pumped flows, the probable need to upgrade the capacity of the Gnarabup WWTP, or to replace the WWTP with a new pressure main to Margaret River.

Dealing with the downhill pressure main gradient alone – an option not permitted by the Water Corporation – is enough to render this option unviable.

Option 2 – Discharge into Water Corporation’s Margaret River Treatment Plant

Option 2 is to pump the wastewater via a pressure main along Wallcliffe Road, to an outfall to either near Farrelly Street or possibly along a slightly shorter pressure main to near the intersections with Wallcliffe Road and either Tyrone Loop or Mansfield Avenue. The length of the pressure main will be about 6.5 to 7km.

A fundamental Water Corporation design prerequisite with a private pressure main is that the main conveys wastewater to minimise the chance of the sewage going septic, and as such should turn over at least once per day. With the relatively low flows from the development, this requirement is difficult to achieve within such a long pipe section. In this case, detention times in the pressure main are likely to be longer which may create a risk of odour issues at the discharge point.

Option 2 is therefore unlikely to be viable.

Option 3 – On-site wastewater treatment and disposal

Option 3 entails a proven and locally endorsed proprietary package WWTP³ to provide the core treatment of the raw wastewater. As well as a biological treatment process for the treatment of organic matter, the WWTP also includes nitrification and

³ - <http://www.fujiclean.com.au/> and <https://www.fujicleanglobal.com/about/index.html>

denitrification processes for nitrogen removal. The wastewater will be treated to a tertiary standard.

Package WWTPs are extremely common for premises outside of the Water Corporation's licence area as well as remote camps and the plants treat domestic strength wastewater to a treated effluent suitable for basic liquid effluent disposal methods (such as *low exposure risk* recycled water reuse applications). Solids accumulated in these package WWTPs are routinely removed via vacuum truck for off-site treatment and disposal. The proposed treatment system will treat the wastewater to a much higher quality than a conventional septic tank. Conventional septic tanks and leach drains are still very common throughout the Margaret River and broader SW region.

Importantly, the package WWTP for Wallcliffe House will be accompanied by an effluent polishing plant⁴ to provide further filtration and treatment of the effluent produced from the package WWTP.

The polishing plant includes membrane filtration and chemical dosing to remove phosphorous from the WWTP effluent. The high-quality effluent (both from a chemical and biological perspective) means that the treated water is suitable for a range of disposal methods.

Based on the typical specification for this type of system, the proposed package WWTP can achieve an effluent total nitrogen of approx. 20 mg/L. Further treatment by the effluent polishing plant will reduce the total phosphorous to <1 mg/L. A final step will be applied during the infiltration of treated water, where a soil media designed for its ability to further remove phosphorous will be installed beneath effluent infiltration areas.

The effluent quality produced from the proposed package WWTP, and polishing plant will therefore be of a higher quality than that generated from utility-operated wastewater treatment plants in Western Australia, with the following points to note:

- Chemical dosing of treated effluent for *chemical phosphorous removal* is not common due to the cost and resultant sludge generated. Most utility operated WWTPs in WA rely only on biological phosphorous removal in the core treatment process, resulting in a typical total effluent phosphorous of 5 mg/L in metropolitan areas, and >10 mg/L in regional areas.
- *Membrane* filtration of all treated effluent is also rare for utility operated WWTPs. Membrane filtration involves very small filtration apertures, removing essentially all particulate solids from the effluent (a total suspended solids of <

⁴ - <https://tfggroup.com.au/>

1 mg/L is expected). For most utility operated WWTPs, filtration of final effluent is undertaken via screen filter or disc filter, which have a filtration aperture >100 times larger than membranes. With such filtration, a total suspended solids of 20 mg/L are acceptable and in accordance with recycled water guidelines. Membrane filtration is typically reserved only for niche, high-risk reuse applications (e.g., industrial process water supply, or indirect potable reuse) or for projects such as Wallcliffe House.

The effluent polishing plant proposed for the Wallcliffe House WWTP will generate sludge due to the chemical removal of phosphorous. The dosed chemical causes soluble species (of which phosphorous is one) to precipitate out of solution as a solid, which can then be filtered. The waste stream from the polishing plant will be fed to the sludge dewatering plant, which thickens and dewateres the sludge to the degree whereby it is suitable for safe offsite disposal to landfill as a solid. The dewatered liquid is recovered back to the effluent polishing plant for further treatment.

The overall system will incorporate operation and maintenance agreements with equipment vendors to ensure that the system operates reliably to a high standard suited to the development and as required by current legislation.

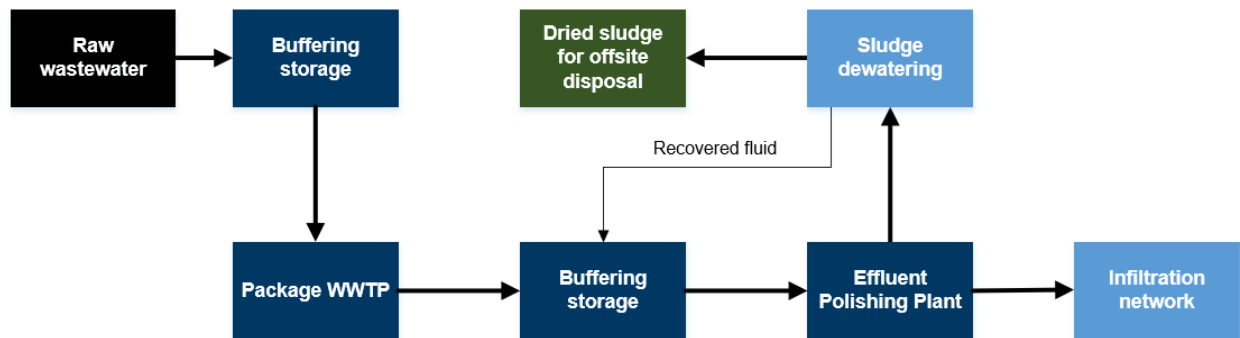
Buffering storage will also be incorporated into the system to provide contingency storage in the event of maintenance, power outage, or fault with individual system components.

The buffer storage will be incorporated before and after the package WWTP and will ensure there is time for an operator to attend the site and for brief power outages. This will safeguard the surrounding environment from potential wastewater spillage or overflow.

The system will be monitored by both hotel staff and the maintenance contractor to respond in a timely manner. A back-up generator will ensure constant electricity supply to the wastewater system in the event of prolonged power outages.

The proposed system is shown diagrammatically in Figure 1:

Figure 1 - Option 3 - On-site wastewater treatment and disposal system



The polished recycled water will be disposed of by a series of soakage structures located more than 100 metres from the River. As indicated, the recycled water will infiltrate via an engineered soil media with a high capacity for removing further phosphorous.

Failsafe systems common to each option

As noted previously, backup electricity and suitable buffer-storage tanks will be incorporated into the design of the wastewater system (i.e., all options) to avoid any risk of overflow spillage entering the environment in case of breakdown of part of the system. Management plans and maintenance contracts will be established early so that response times are understood and guaranteed and so that the system can be designed to suit that scenario.

Conclusion

Options 1 and 2 are unconventional and unlikely to be feasible. Each option faces issues that are improbable to solve, for example, hydraulic design criteria can't be met or detention times that exceed 24 hours.

Option 3 uses a conventional on-site system to treat the wastewater and then enhances the quality of the effluent to meet tertiary treatment standards. The system has been used world-wide and is a proven solution for environmentally sensitive areas. While the alternative options are unlikely to be practically achievable in any case, the preferred option is considered to represent the optimum solution for the proposed development.

As noted above, the polished recycled water from the Option 3 system will be disposed of by a series of soakage structures located more than 100 metres from the River. As indicated, the recycled water will infiltrate via an engineered soil media with a high capacity for removing further phosphorous.

An onsite package WWTP – Option 3 - is preferred because it uses a conventional and common process and provides a future-proof source of water for soakage into the Land, helping to make the non-potable water system for the development resistant to climate-change.

7. Gas Supply

Reticulated gas is not available in the district. For the development proposed, gas will not be supplied.

8. Electricity and Lighting

Electricity to the Land is supplied via high voltage (HV) powerlines to the east of the Land as shown on the plan which is an extract from Western Power's Network capacity mapping tool – refer Appendix E.

An HV underground supply is located along the entrance road into the Land to a transformer and main switchboard that serves the Land. The existing 315 kVA transformer will be replaced and upgraded with a 630 kVA transformer to serve the proposed development. A new Western Power sole use sub-station will be installed near the near crossover to Wallcliffe Road. A section of the overhead HV lines that cross the entry area will be placed undergrounded to minimise their visual impact.

The external lighting scheme to the development will be one where ecological and functional needs co-exist. Lighting solutions will be designed to preserve and protect the environment by:

- minimising upward waste light and excessive sky glow, in accordance with International Dark Sky principles and AS/NZS 4282 "*Obtrusive Effects of Outdoor Lighting*".
- considering the natural rhythms of fauna, both nocturnal and diurnal.
- nominating luminaires of an appropriate scale to minimize the visual impact on the natural landscape.

Rather than designing to prescriptive target lux values, the scheme will apply 'just enough' illumination to ensure a safe and enjoyable guest experience, sustain a connection to the natural environment and support the functional requirements of staff, without unnecessary over-illumination.

Luminaire specification will adhere to strict control of light output parameters, including excellent beam control and use of glare shields, to mitigate upward light spill (wasted light) and concentrate illumination to focus areas as required.

The colour temperature of light is an important factor in the preservation of the night sky and the natural rhythms of fauna. Light primarily at the blue end of the colour spectrum brightens the night sky more than any other colour of light. Using colour temperatures of less than 2600K is proposed.

Control of lighting will contribute to the development's sustainable approach, through adaptive controls such as sensors, dimmers, and timers, providing energy savings and targeted illumination, rather than an 'always on' approach.

9. Communications

Two internet services via fibre optic cable will be provided to the development: one for the guests and the other for hotel operations. The current NBN Co satellite service will not be suitable. Fibre optic links will be provided to all buildings.

10. Stormwater

As noted in the geotechnical investigation and based on a detailed inspection of the Land, stormwater runoff from the Land is already being managed in accordance with best practice to ensure that direct discharge of runoff to the River does not take place. The access road to the Land for example is unkerbed and runoff is sheeted away from the pavement into the adjoining landscaped or natural bush areas.

While the proposed development will lead to some more impermeable surfaces – mainly roofs on buildings, this is unlikely to change the peak-event stormwater runoff significantly. Roof runoff will be disposed of by soakwells or low-profile sheet-flow when erosion or concentration of flows can be managed or may be harvested for onsite use where feasible. Water Sensitive Urban Design practices will be adhered to.

All pavement areas will be graded, shaped, and managed to dispose of runoff by sheet flow. Low-profile sheet flow over natural or artificial landscaped surfaces will largely obviate the need for either bio-retention or detention basins.

The exception to this may be some minor vegetated swales immediately adjacent to higher use pavement areas. These would be designed to capture and treat the minor amounts of hydrocarbons and sediments that may be present on these areas. Where required, some localised pavement areas may be collected via gully grates and directed to soakwell/subsurface infiltration, as currently occurs on site.

No direct discharge of any runoff to the River currently occurs, and this is not planned or contemplated for this development. Refer to the Water Management Strategy (Emerge Associates, 2019) for more details on stormwater management.

11. Pavements

In the same way that buildings are to be fitted into the Land, so will all pavements.

All pavements within the site will be designed and controlled to ensure that pedestrians and electric carts are primary users, with all other vehicles having secondary and limited access.

Kerbing of pavements will be avoided as much as practical, so as not to concentrate stormwater runoff. Flush kerbs on roads will allow runoff to flow away by low-profile sheet-flow and then overland where most will soak away. Pavements will be designed to ensure traffic speeds are less than 10 to 15 km per hour and always giving pedestrians priority. Vehicle movements near the buildings will be restricted to arriving and departing guests and deliveries, with all other cars parked in the carparks and then using electric carts for guest and staff transportation.

Where kerbs are needed, runoff will be collected in conventional collection pits, piped to disposal areas but then discharged into parts of the Land to reproduce low-profile sheet-flow – thus reversing the concentration of flows. The collection of runoff from such areas will be designed in a manner to keep contributing catchments as small as possible, meaning that less runoff has to be managed in each sub-system and so avoiding higher flows when concentrated.

12. Summary

A summary of this “Engineering Aspects Report” about key servicing and development infrastructure follows. The summary comments on what is serving the Land now as well as what upgrades are needed.

Shaping the Land

A critically important aspect of the proposed development is to fit any buildings into the land in a manner that creates the least disturbance both physically and aesthetically. This approach will especially consider the trees on the Land and look to take advantage of them to help breakup the starkness of structures otherwise placed unsympathetically.

Wastewater

The development is planned to be served by means of a small network of gravity collection property sewers with collected wastewater pumped to an on-site package wastewater treatment plant. The onsite disposal system will demonstrate appropriate consideration of nutrients and human health.

Water Supply – potable and non-potable

The land is served from the Water Corporation's reticulation system and that service will continue albeit with a larger diameter water service meter.

Irrigation water is by means of two shallow bores to tanks and thence a gravity reticulation system. This system is proposed to be retained an upgrade with a new bore and pump.

Electricity and Communications

Electricity to the Land will be by means of an upgrading of the existing high voltage system already in place and connected to the Western Power network. This system is planned to be enhanced by backup generation systems in case of outages.

Two internet services via fibre optic cable will be provided to the development: one for the guests and the other for hotel operations. The current NBN Co satellite service will not be suitable. Fibre optic links will be provided to all buildings.

Stormwater management

The existing stormwater management practices of infiltration/management via low-profile sheet flow will be maintained. While the development will lead to some more impermeable surfaces – mainly rooves on new buildings, this is unlikely to change the peak-event stormwater runoff significantly. Water Sensitive Urban Design practices will be adhered to.

Roof runoff will be disposed of by soakwells or low-profile sheet-flow when erosion or concentration of flows can be managed or may be harvested for onsite use. All pavement areas will be graded, shaped, and managed to dispose of runoff by sheet flow.

Low profile sheet flow over natural or artificial landscaped surfaces will largely obviate the need for either bio-retention or detention basins. The exception to this may be some minor vegetated swales immediately adjacent to higher use pavement areas. These would be designed to capture and treat the minor amounts of hydrocarbons and sediments that may be present on these areas.

No direct discharge of any runoff to the River currently occurs, and this is not planned or contemplated for the development.

Pavements

In the same way that buildings are to be fitted into the Land, so will all pavements. All pavements within the site will be designed and controlled to ensure that pedestrians and electric carts are the primary users with all other vehicles having a very secondary and limited access.

Kerbing of pavements will be avoided as much as practical so as not to concentrate stormwater runoff.

Vehicle movements near the buildings will be restricted to arriving and departing guests and deliveries, with all other cars parked in the carparks and then using electric carts for transport of guests and staff.

APPENDIX A

Concept Plan

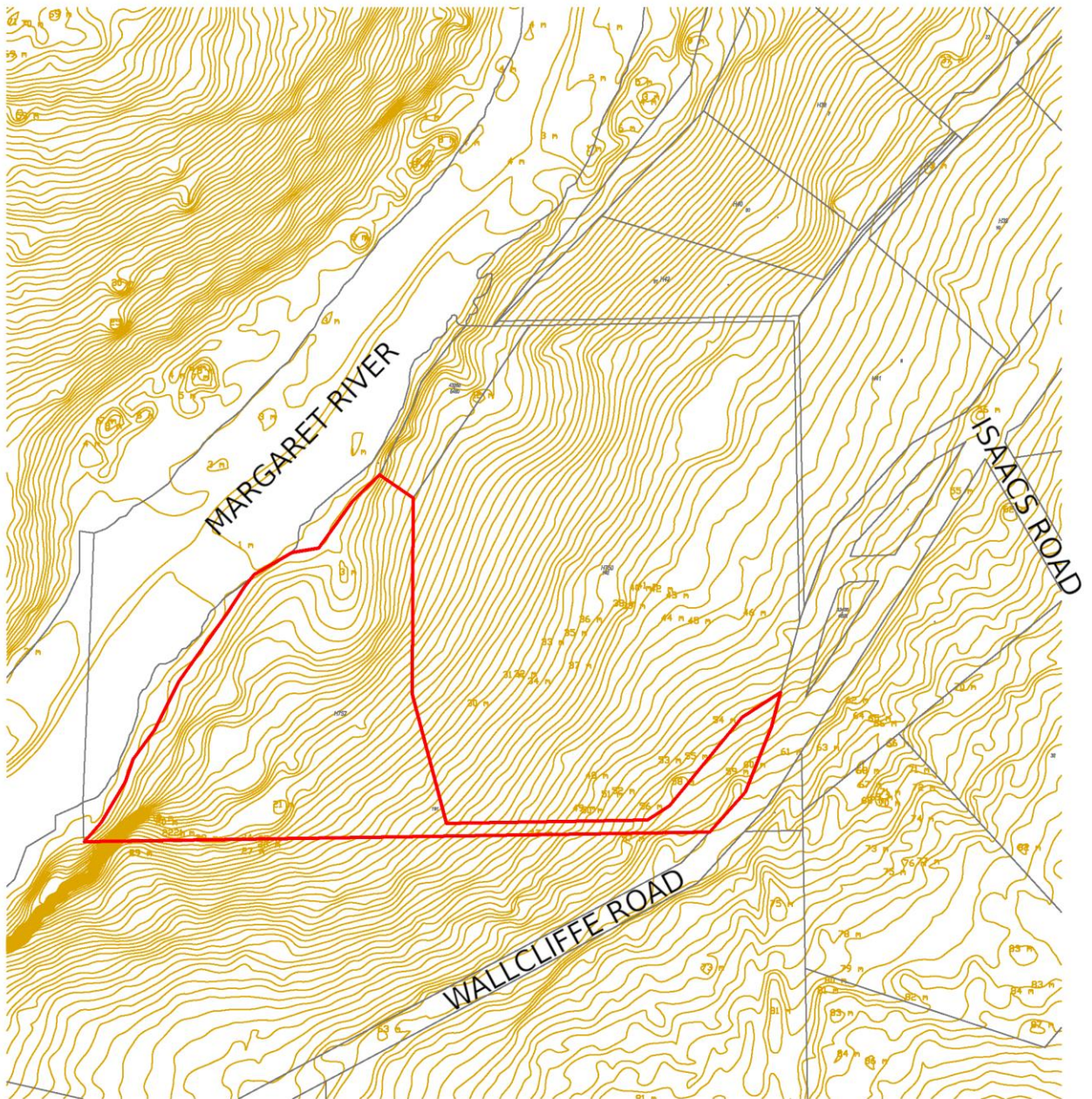
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APPENDIX B

Topography

LiDAR contours

November 2018



Lot 101 (No. 752) Wallcliffe Rd Margaret River
(Contour interval = 1m)

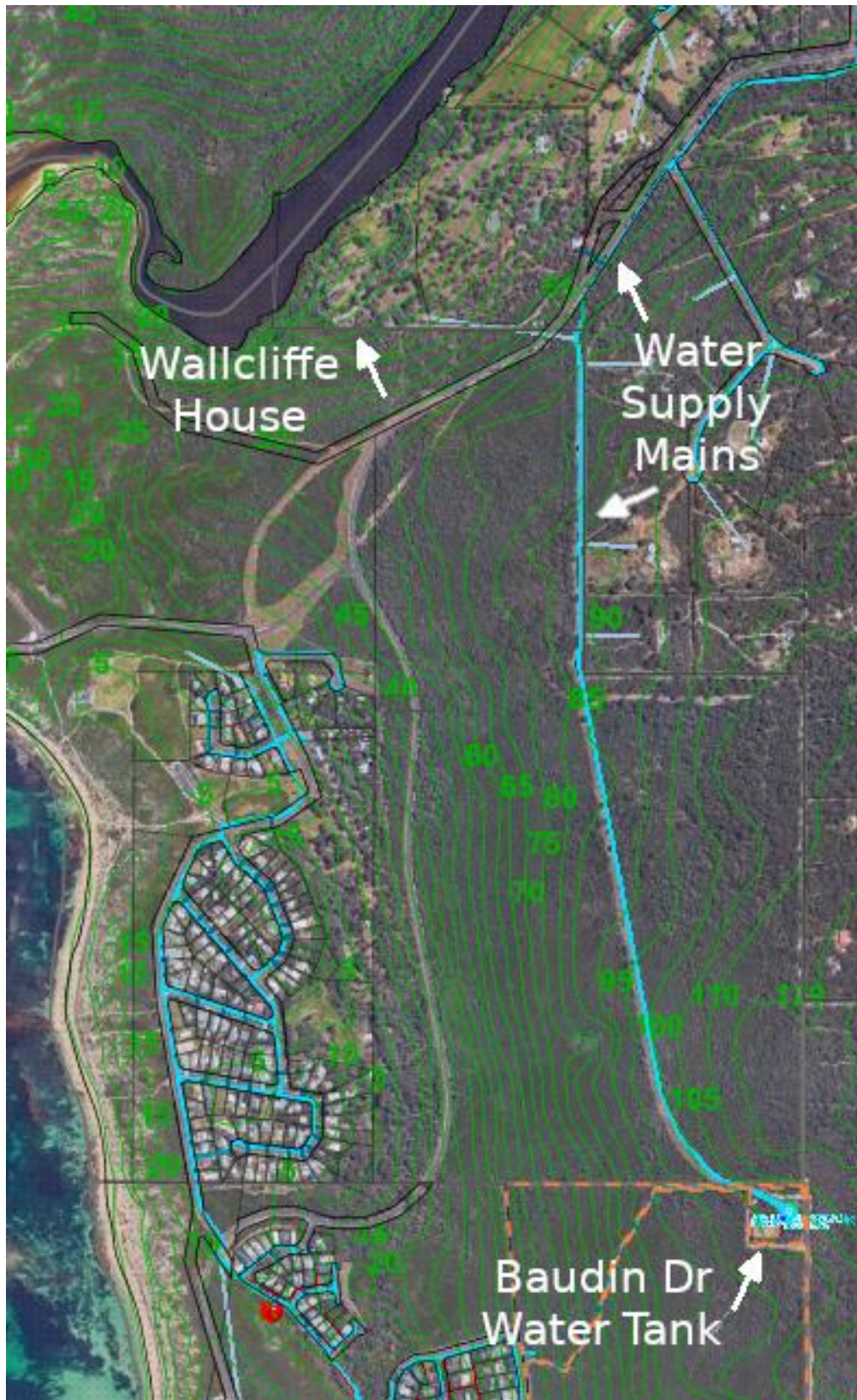
APPENDIX C

Existing Water Infrastructure

Water Corporation

Legend

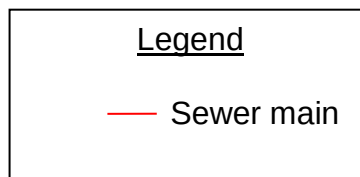
 Existing water main

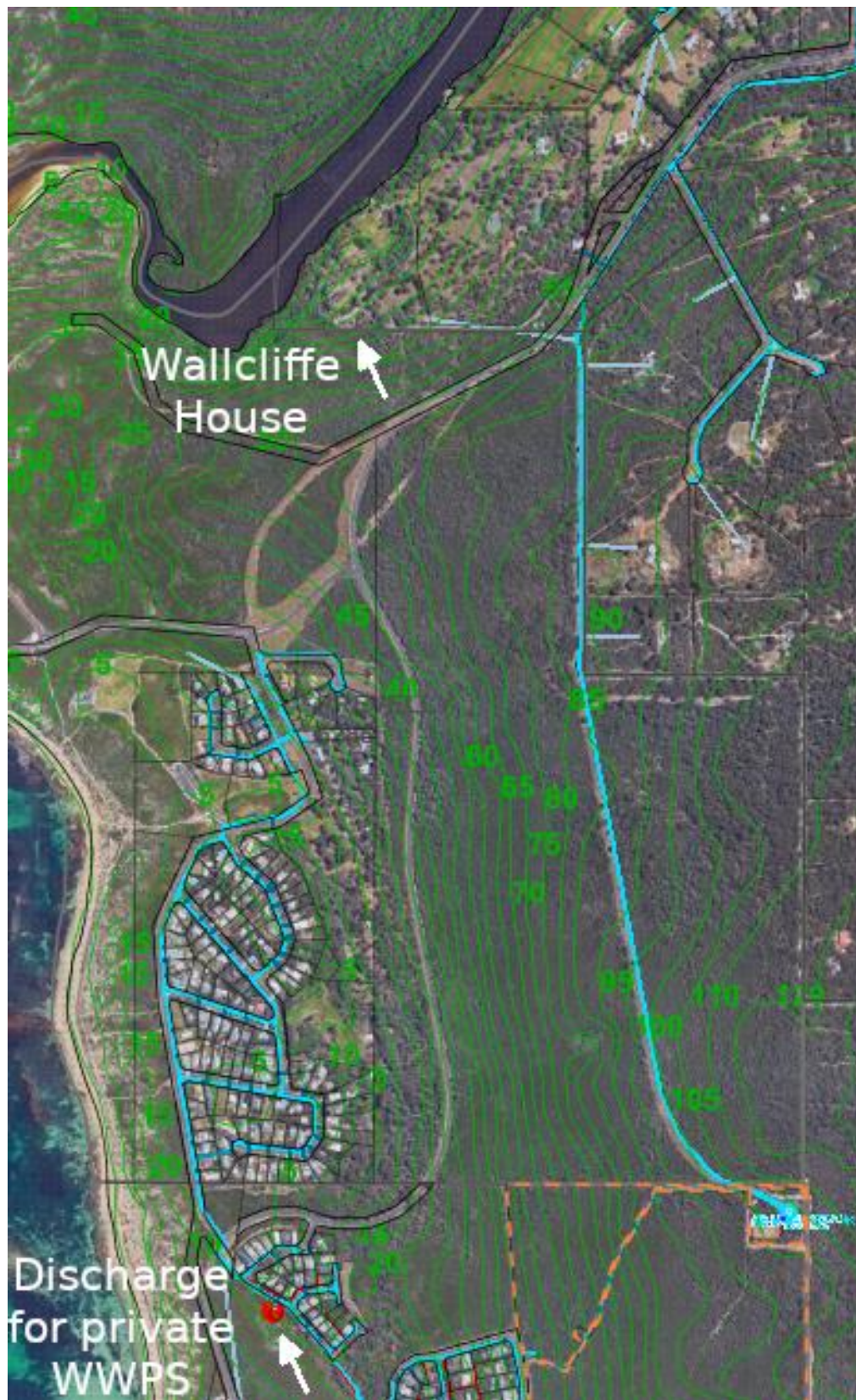


APPENDIX D

Existing Wastewater Infrastructure

Water Corporation





APPENDIX E

Western Power

High Voltage powerlines

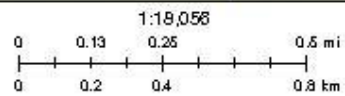
Network Capacity Mapping Tool



3/29/2019, 10:57:52 AM

High Voltage Distribution Lines : WP-003

- HVOH 1Ph
- HVOH 3Ph
- HVUG 1Ph
- HVUG 3Ph



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGIS, © OpenStreetMap contributors, and the GIS User Community

Plans printed from the Network Capacity Mapping Tool (NCMT) are indicative
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