David Wills and Associates
Consulting Engineers

STORMWATER MANAGEMENT PLAN

Infinite Green Energy, Northam

Stage 1: Initial Site Layout

Client's Reference Number: MEG-E01-DES-PLN-DWA-0001-RevH

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A	Draft	25/01/23	BD
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Distribution Table

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25/01/23	A	Infinite Green Energy
02/02/23	B	Infinite Green Energy
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EXECUTIVE SUMMARY

David Wills and Associates (DWA) have been commissioned by Infinite Green Energy (IGE) to provide the drainage management plan for Lot 6 Northam-York Rd Muluckine. The property is proposed to be developed with a hydrogen production facility. This drainage management plan will assess the impact of the reverse osmosis discharge water and the effects from the change in land use and provide a drainage strategy to mitigate any adverse effects.

Stormwater Management

Stormwater runoff from the plant area will be managed by a series of stormwater basins, drainage channels and pipes. These basins, pipes and channels are required to be sized for the 1 in 1 year, 1-hour storm event.

Soil permeability in the area is extremely low, water from the basins is required to flow into the nearby Mortlock River to the north of the site with a controlled outflow from the basins.

Storms greater than the 1 in 1 year, 1-hour event will overtop the basin in a controlled manner and flow into the Mortlock River, matching the predevelopment conditions.

Water Quality Management

Analysis has been undertaken to model the levels in the reverse osmosis discharge water and Mortlock River and to compare the total dissolved solids. During periods of no rainfall, the reverse osmosis disposal water will be polished in the basins and during infiltration. During storm conditions, while this polishing becomes less effective, the rainwater dilutes the disposal water. The reverse osmosis disposal water is of higher water quality than the water typically in the Mortlock River.

Managing Construction

During the construction, no debris or residue from the construction site shall be allowed to wash into the river. Adequate care must also be taken by contractors to appropriately manage dust levels to avoid negatively affecting the nearby Mortlock River, local flora and fauna.

Monitoring

If required as part of the approval process from the relevant government authority, periodic monitoring of the water quality of the reverse osmosis discharge will be undertaken to ensure acceptable water quality.

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1 INTRODUCTION

David Wills and Associates have been commissioned by Infinite Green Energy, to produce a Drainage Management Plan for the proposed development at 161 (Lot 6) Northam-York Road Muluckine.

2 PROPOSED SITE DEVELOPMENT

The Northam project site is shown in Figure 1 below and is approximately 28.3 Ha in size. It is proposed to have an area of approximately 33,000m^2 developed to allow for facility operations, including hardstand vehicle access, and office and plant areas.

Figure 1: Site Overview (Courtesy of Nearmaps, 2023)

It is proposed to develop the site with a Hydrogen Plant to allow for production of hydrogen gas that will be distributed across Western Australia. The facility will include construction of office and ablution blocks, potable and fire water tanks with associated infrastructure as well as facility specific on surface equipment. A detailed site plan of the proposed facility is provided below.

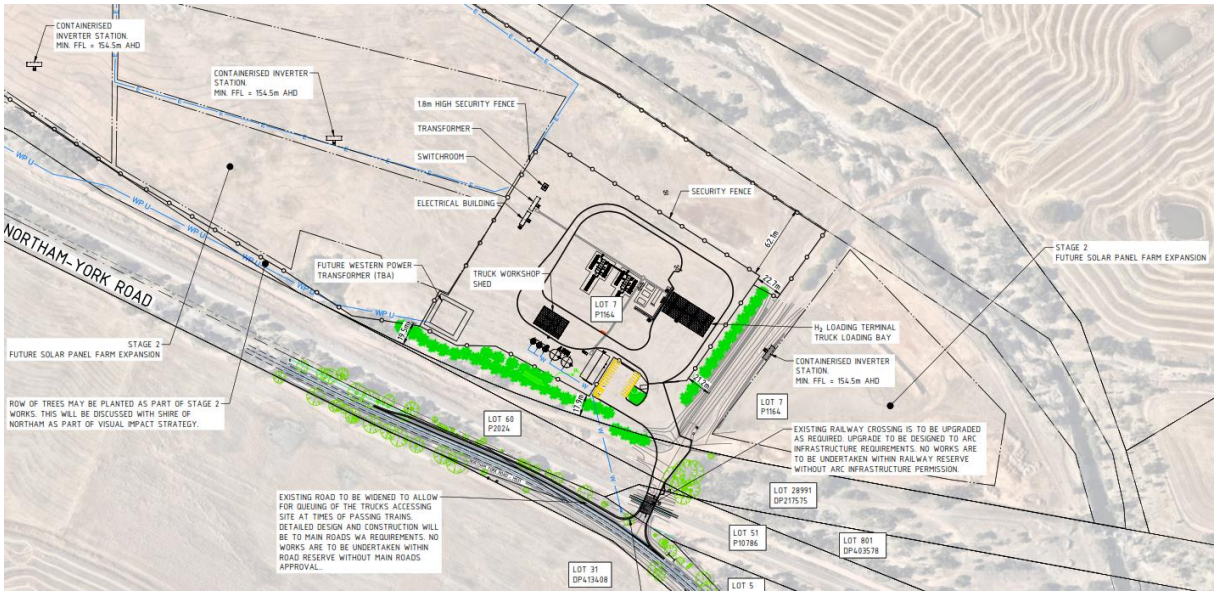

Figure 2: DWA Proposed Site Plan

3 DESIGN OBJECTIVES

Consistent with the Stormwater Management Manual for Western Australia and Draft State Planning Policy 2.9 – Planning for Water (2021), the following policy objectives and principles, form the basis for stormwater management at the proposed development site:

- Protect and improve the environmental, social, cultural and economic values of the State's water resources;
- Protect public health and the long-term supply of good quality affordable drinking water;
- Manage the risk of riverine flooding to people, property and infrastructure;
- Ensure the secure and sustainable supply, use and re-use of water resources;
- Ensure future development is resilient to the water-related impacts of climate change; and
- Minimise future costs and protect public health by ensuring that appropriate wastewater infrastructure is provided.

4 SITE CHARACTERISTICS

Location and Climate

The site is located within Shire of Northam to the east of Northam township. The site is positioned between the existing state road connecting Northam with York and the Mortlock River reserve.

The climate is Mediterranean with hot, dry summers and cool, wet winters. The mean maximum temperature is approximately 25.4°C and the mean minimum temperature is approximately 11°C.

Mean annual rainfall is approximately 427.2mm with the majority of the rainfall occurring during the months between May and August.

The below Figure 2 sourced from Bureau of Meteorology presents rainfall intensity for the site location.

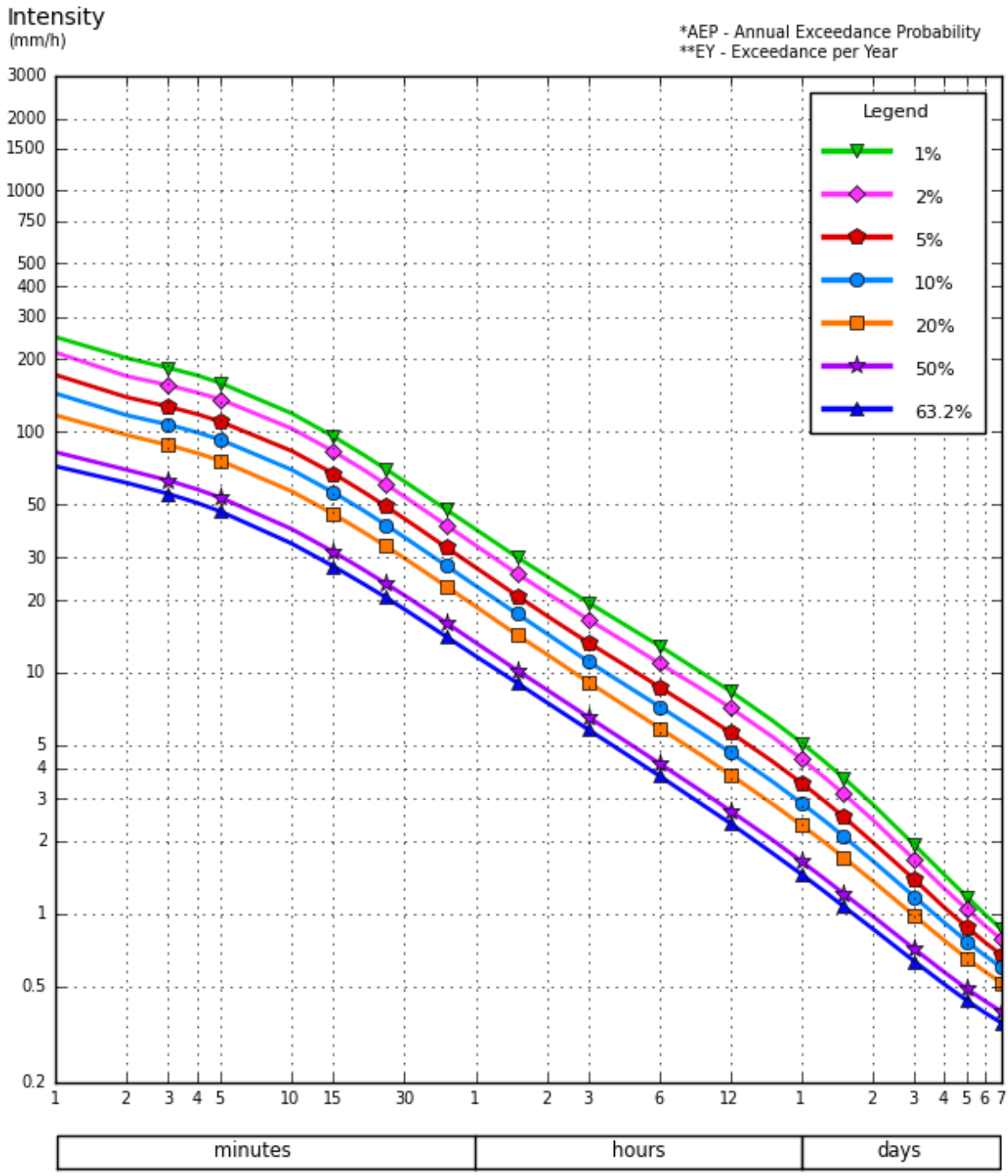

Figure 3: IFD chart for Northam (Courtesy of Bureau of Meteorology, 2023)

Site Topography

The existing site topography has been obtained from a site survey and data provided by the Water Corporation from ESINET. The existing site generally falls to the northwest, with the majority of stormwater flowing into the Mortlock River. The site also has sections of low-lying areas that currently pool in storm conditions. An extract of the ESINET contours is provided below.

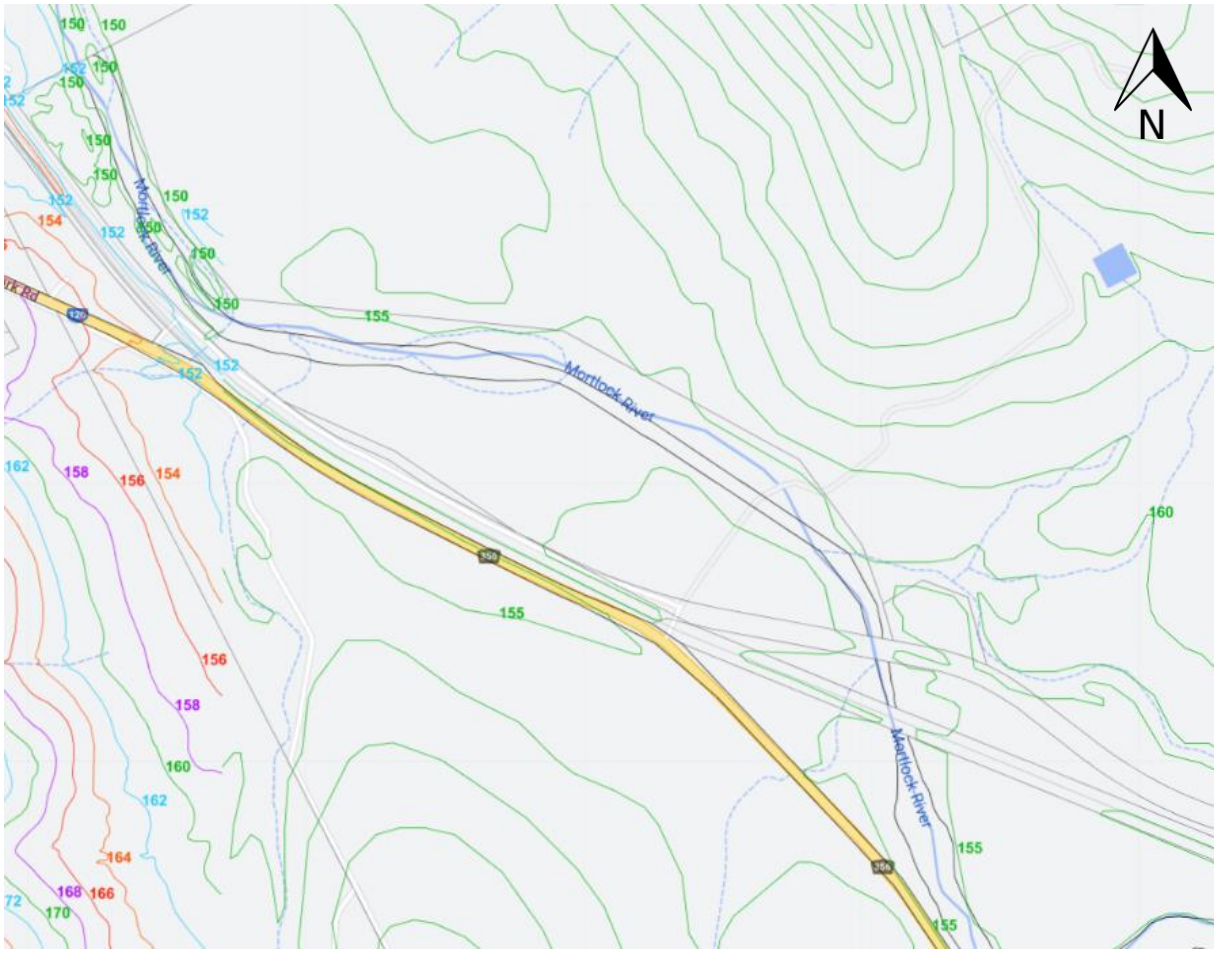

Figure 4: Site Contours (ESINET, 2023)

Geotechnical

A detailed geotechnical report was undertaken by Brown Geotechnical on September 30, 2022. A full copy of the geotechnical report is attached in Appendix A of the Services Plan. A summary of the report is provided below:

- A thin 0.1m layer of silty sand is present across the entire site, PRI (Phosphorus Retention Index) values ranged from 8 to 25. A 0.5m layer of dense silty sands was encountered at Test Holes 1 and 9;

- Stiff, fine-grained, sandy clay then extends to at least 1.5m depth. The material has a high plastic fines content, exhibiting intermediate to high plasticity and moderate expansive properties. PRI values ranged from 7 to 30. Permeability of the stiff clayey soil would be $<1x10^{-8}$ m/sec or very poor. Because of this, stormwater is required to discharge off-site rather than purely infiltrate;

- This graded into extremely weathered bedrock, recovered as clayey sand with gravel below approx. 1.6m. Refusal of the 3-tonne excavator occurred at approx. 1.6m in most test holes;

- No Groundwater levels were encountered during testing, and

- Acid Sulphate Soils were not encountered during geotechnical testing and are a low probability of occurrence based on soil mapping from Geoscience Australia. An extract is provided below in Figure 4.

- The site is underlain by a clayey subgrade close to or at the surface. It has been determined that the appropriate site classification for footing design is Class 'M' (Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes (y_s 20-40mm)) in accordance with AS2870-2011. The land is therefore suitable for development.

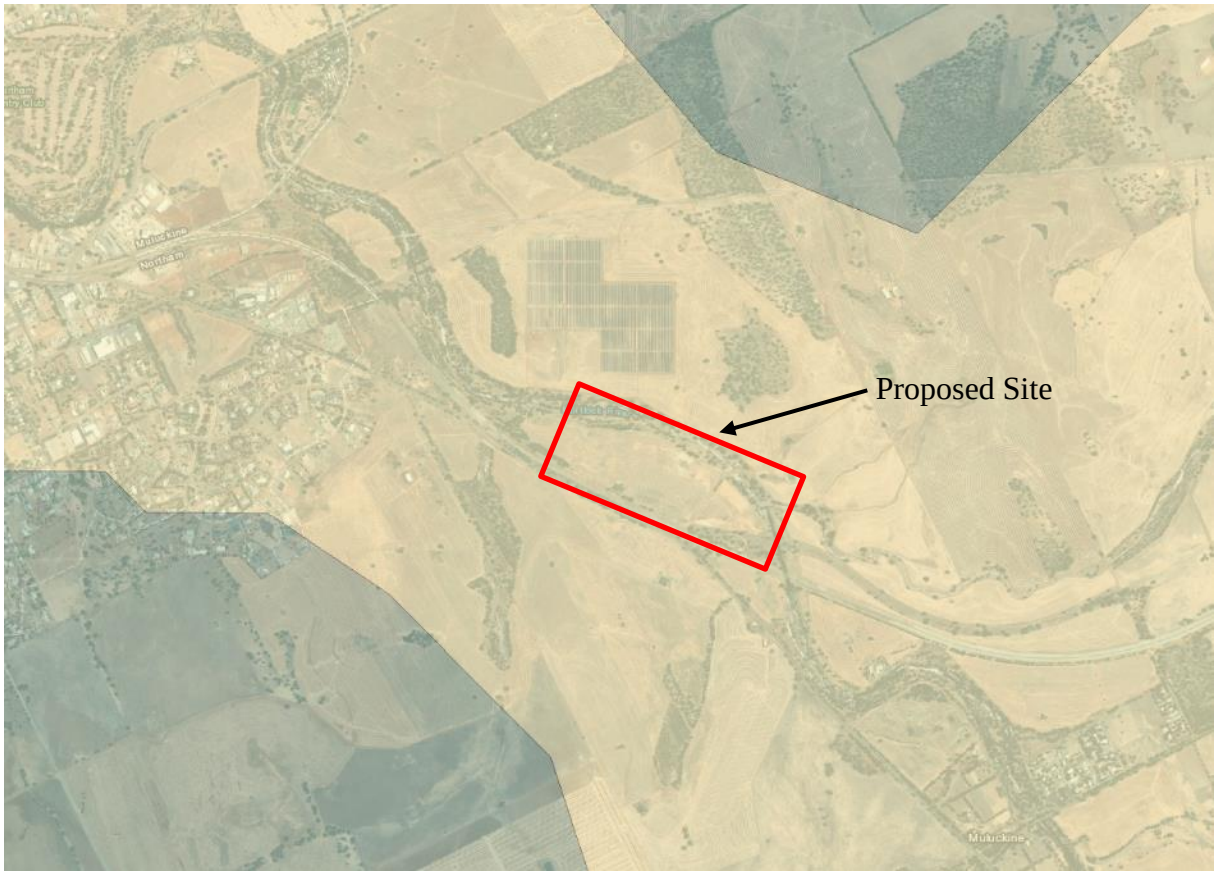

Figure 5: Acid Sulphate Soils (Courtesy of Geoscience Australia, 2023)

Legend:
Yellow - Low Probability of Occurrence
Blue - Extremely Low Probability of Occurrence

Surface Water

The existing site generally grades towards the northwest, with a large amount of the runoff flowing towards the Mortlock River that flows along the northern boundary of the site. A section of the stormwater currently flows to the southern boundary of the site where it collects in a small dam and natural depression basins.

From data provided by the upstream DWER stream gauging station (O'Driscoll's Farms - Station Number 615020) the 1 in 100 year flood level of the Mortlock River is 153.5m RL. This 1 in 100 year event conveys a flow of $172m^3/s$ from the Department of Water flood modelling. A 0.5m minimum freeboard is required for the finished floor level of all flood sensitive buildings.

Historic Land Use

The current land use is farmland, with large numbers of sheep previously being located at the property. The land has also been used as a quarry from historical aerial images. The adjacent northern lot has been fitted with a large solar panel farm.

The change in land use will improve the quality of stormwater runoff by reducing the biological load from the livestock.

Other Relevant Information

The tributaries of the Avon River are of Aboriginal cultural significance. The Mortlock River is included in this. Data from the Department of Land Administration and the Aboriginal Affairs Department shows that there are no registered sites or communities of Aboriginal significance along Mortlock River North.

Anecdotal evidence suggests that there were once Aboriginal clans living in the area surrounding this River, with territories bordering the waterway. Past occupation of the land by Aboriginal people suggests that the land may have important spiritual and cultural meaning to the current generations of these tribes.

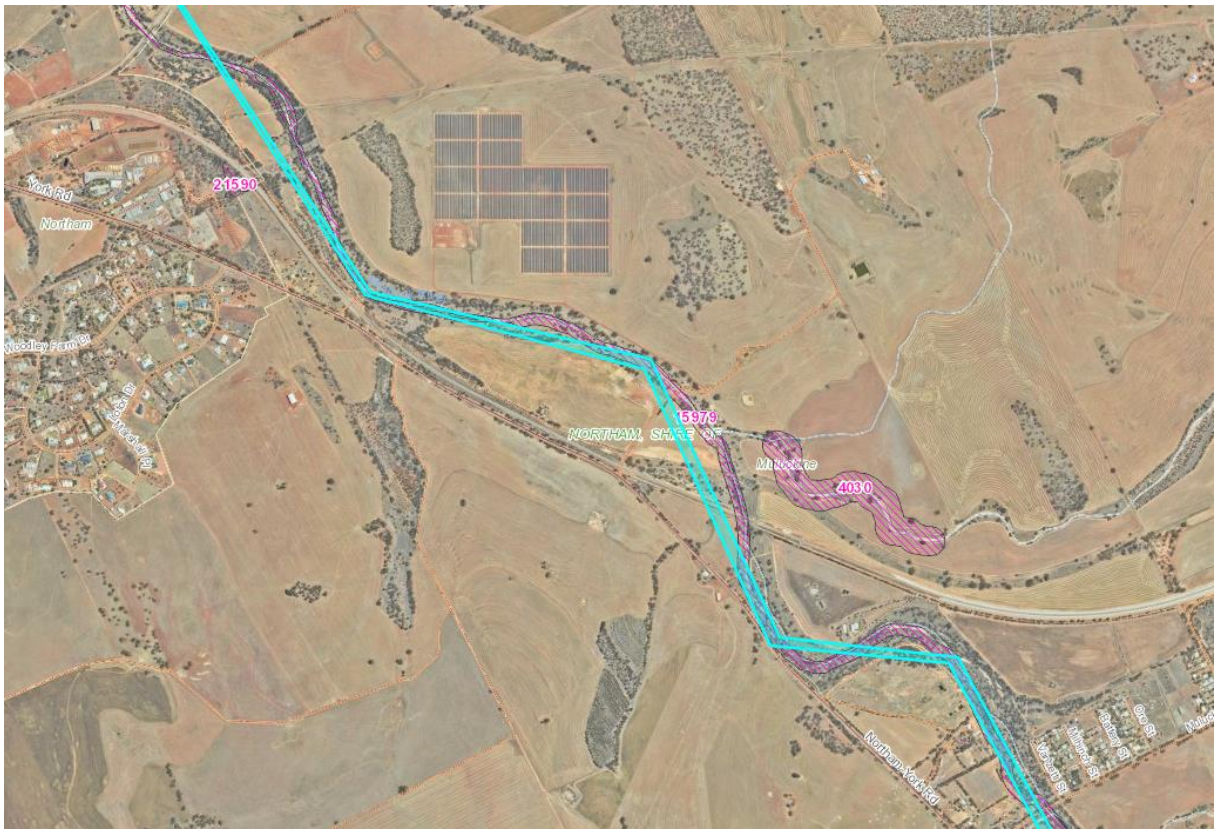

Figure 6: Area of Aboriginal Heritage Significance (Courtesy of the Western Australian Department of Planning, Lands and Heritage, 2023)

5 STORMWATER MANAGEMENT OBJECTIVES

The objectives of the stormwater management plan as listed in "Section 3. Design Objectives" taken from Stormwater Management Manual for Western Australia and Draft State Planning Policy 2.9 – Planning for Water (2021) can then be achieved by the following:

Water Quantity Management

- Manage rainfall events to minimise runoff as high in the catchment as possible. The one-year, one-hour (1 in 1) ARI event should be detained on-site;

- Infiltration should be encouraged in permeable areas through mechanisms such as soakwells, landscaping and flush kerbing;

- Manage catchment runoff up to 1 in 100-year ARI event for peak flows, to pre-development levels;

- Maximise water use efficiency, reduce potable water demand, and maximise the re-use of water harvested; and

- Stormwater egress from the site post-development must not exceed pre-development flows.

Water Quality Management

- All stormwater runoff from the plant area is to be polished in planted stormwater basins before flowing into the river. The basins will be heavily vegetated to remove nutrients from the runoff and to ensure the quality of the stormwater discharge into the river body.

Protect and manage water bodies

- No development within the flood fringe area;

- 0.5m freeboard above the 1 in 100-year ARI river flood levels to all flood sensitive buildings.

6 PROPOSED STORMWATER MANAGEMENT REGIMENT

Design Approach

The design approach is to:

1. Collect and treat stormwater runoff generated by the site development for a 1 in 1 year, 1-hour storm event;
2. Also collect and treat the volume of disposal water produced during reverse osmosis over a 1 hour period. The resulting total volume is the critical design parameter for the proposed nutrient stripping basins, pipes and channels.

Water Quantity Management

Preliminary stormwater calculations have been undertaken to provide indicative basin sizing. These calculations are required to be confirmed at the detailed design stage once all relevant approvals are gained.

Table 1: Catchment Summary

Catchment	Catchment Area (m^2)	C_{10}	1 year, 1-hour volume (m^3)
Total Site Affected	180’101	0.6	1’011.45
Developed Plant Area	33’000	0.9	277.99

The location of the basins may require slight adjustment depending on the exact level of the river bank.

The proposed basins plan area, average depth and assumed volume are listed in the table below.

Table 2: Proposed Basin Summary

Basin	Plan Area (m^2)	Ave Depth Assumed (m)	Assumed Volume (m^3)
East	5'620	0.2	1'124
Central	2'870	0.2	574
West	1'790	0.2	358

The total estimated supplied volume of the basins is approximately 2'050 m^3 or approximately 200% greater than the design storm's resulting volume. These numbers will be re-assessed in the detailed design stage but there is a high degree of flexibility to meet the designed stormwater design volume.

Preliminary channel sizes and pipe sizes between basins have also been detailed in the DWA drawing set. The sizes and detailed scour protection design will be re-assessed in the detailed design stage.

Water Quality Management

During periods of no rainfall, reverse osmosis disposal is to be used to water the basins and landscaping areas. During storm conditions, while this polishing becomes less effective, the rainwater dilutes the disposal water. The reverse osmosis disposal water is of higher water quality than the water typically in the Mortlock River. More details regarding the reverse osmosis disposal can be found in DWA Report 21295—Infinite Green Energy – Infrastructure Servicing Report.

The basins will cascade downstream to the west, through a series of specifically designed drainage channels and pipes. These channels will be planted with nutrient-stripping plants and protected with rock pitching where required. This combination of planting and rock pitching will aid to reduce the velocity of collected stormwater runoff prior to final discharge into the Mortlock River.

For storm events beyond the 1 in 1 year, 1-hour storm event, the basins will overtop at the eastern most basin in a controlled manner, with the excess stormwater falling towards the nearby Mortlock River.

Protect and Manage Water Bodies

In order to protect the accessible buildings from flooding of the river, the Finished Floor Levels (FFL's) of all accessible buildings will be set at a minimum of 154.0m AHD. This is 0.5m above the predicted Mortlock River 1 in 100-year flood level of 153.5m AHD.

Fire Protection

A detailed fire hydrant system with pumps and tanks shall be installed and shall use potable water only.

A deluge system shall be installed over the truck refuelling area. The truck refuelling area shall be bunded and contain two 1050mm diameter stormwater pits to collect runoff from the deluge system and any spillage generated inside the refuelling area.

An irrigation slide gate valve shall be installed at the outlet of the first nutrient stripping basin. This can be shut during a fire event and will allow any fire water runoff to be collected and treated if required. This limits the hydrocarbons generated from the fire, flowing into the nearby Mortlock River.

Grading

The proposed plant area will be graded towards the proposed nutrient striping basins located near the northern boundary of the site. All stormwater landing on the proposed roof areas shall be directed onto the pavement and then flow north towards the proposed basins.

The western basin is proposed to be the lowest laying to mimic current site conditions and to allow for controlled discharge of stormwater runoff from major storm events A detailed grading plan will be undertaken as part of the detailed design for the site. The site grading has been indicated with arrows on DWA 21295-C-06 Stormwater discharge plan included as part of Appendix E of the Services Plan.

The overall site has been separated into the plant area with development occurring (3.3 ha) and the total affected area (18.0 Ha).

7 CONSTRUCTION SITE MANAGEMENT

During the construction, no debris or residue from the construction site shall be allowed to wash into the river. Adequate care must also be taken by contractors to appropriately manage dust levels to avoid negatively affecting the nearby Mortlock River, and local flora and fauna.

8 POST-DEVELOPMENT MONITORING

If required as part of the approval process from the relevant government authorities including the Department of Primary Industries and Regional Development, periodic monitoring of the water quality of the reverse osmosis discharge will be undertaken. All required testing will be undertaken in accordance with the requirements.

9 IMPLEMENTATION AND MAINTENANCE

Implementation

Stormwater basins are required to be constructed during the site grading process to ensure that they are established prior to the construction of the plant.

Planting of the basins is required to be undertaken at the end of the winter months to ensure the vegetation can be established before the warmer summer months while reducing the risk of being washed out.

Maintenance

Maintenance of the swales and basins shall be managed by Infinite Green Energy.

Short term maintenance shall include:

- Plants are suitably established at a density of approximately 6-10 plants per square meter (depending on species)
- Plants are to be regularly irrigated during the establishment period (18-24 months).
- Plants that fail to thrive during this period shall be replaced as required.

Long Term maintenance shall include:

- Assess plants for disease, pest infection, stunted growth or senescent plants.
- Treat or replace as necessary. Reduced plant density reduces pollutant removal and infiltration performance.
- Maintain original plant density.
- Inspect for and manually remove weed species. Application of herbicide should be limited to a wand or restrictive spot sprayer.

Long term maintenance tasks shall be undertaken at a 3-month frequency period or as desired for aesthetics.

10 CONCLUSION

From the above, the listed objectives of the drainage management plan can be achieved on the site. This will ensure that: sufficient storage is provided for the 1 in 1 year, 1 hour storm event, the property is sufficiently protected from flood damage, and runoff water quality is of an acceptable level.

The area is therefore suitable to be developed provided the proposed infrastructure is constructed.

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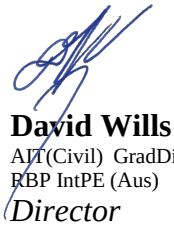

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