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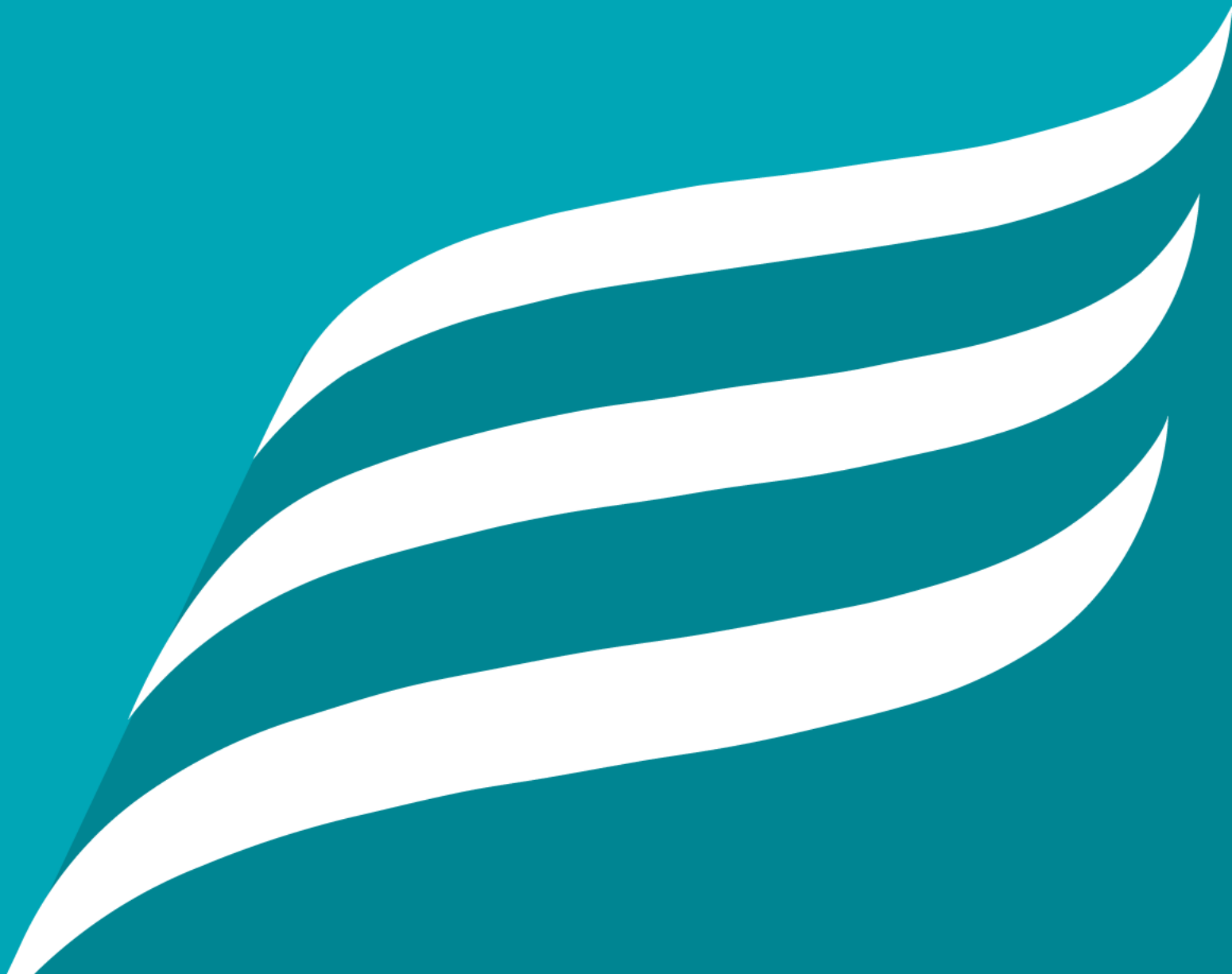


HORIZON POWER

Kimberley Desktop Geotechnical and Hydrology Study

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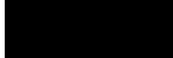
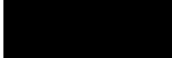
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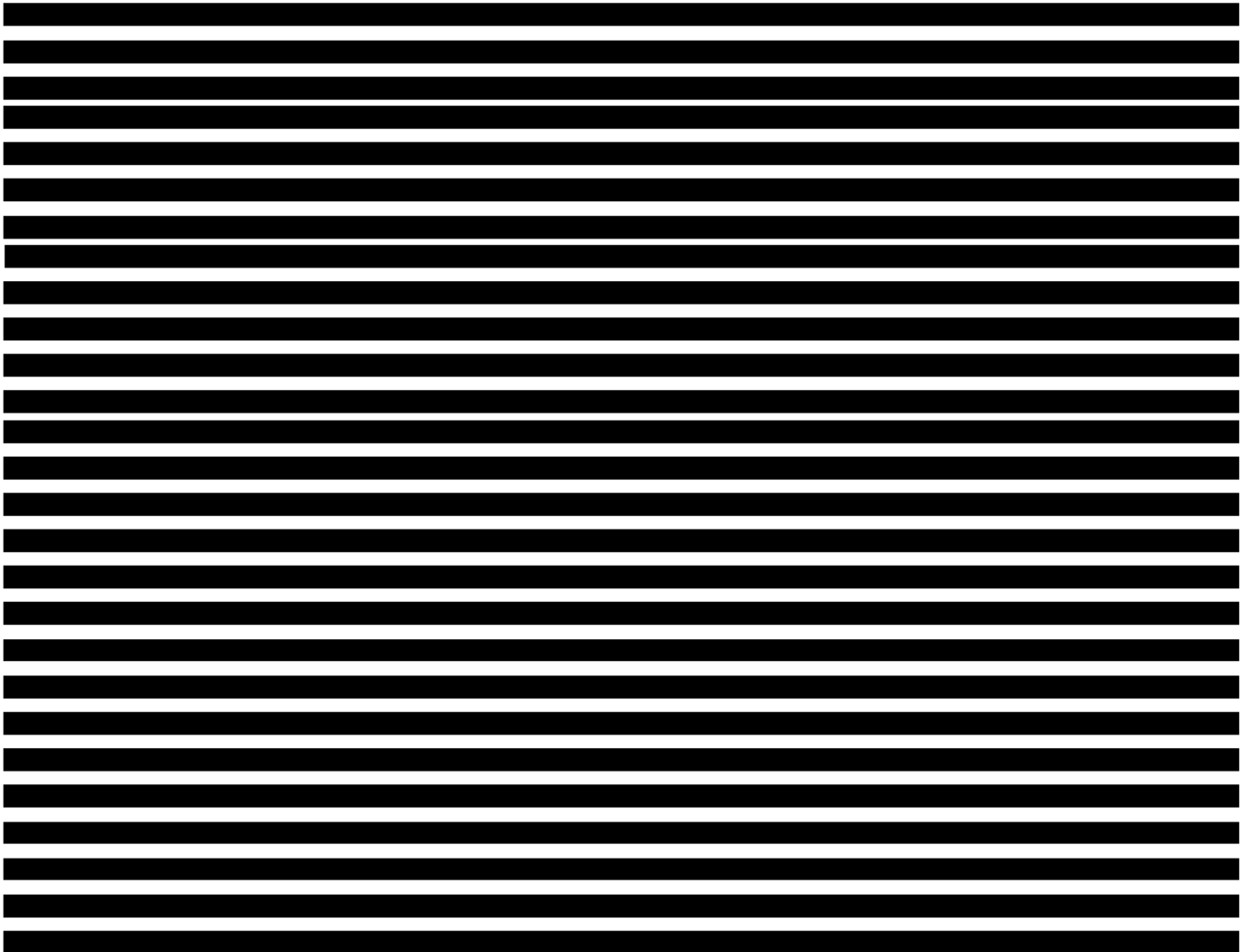


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1. EXECUTIVE SUMMARY

Horizon Power is undertaking a procurement process to engage an Independent Power Producer (IPP) to design, build, own, and operate new energy systems in five (5) remote towns in the Kimberley region of Western Australia: Broome, Derby, Fitzroy Crossing, Halls Creek, and Looma-Camballin (refer to Figure 2.1). To support this process, Horizon Power has engaged Engeny Australia Pty Ltd (Engeny) to prepare a Desktop Study to accompany the IPP Request for Tender.

This desktop study provides targeted assessments that inform early project planning and identify potential constraints including geotechnical, baseline contamination, hydrological and hydrogeological (renewable sites only) evaluations to assess conditions that may affect the design and construction of proposed energy systems. A total of ten (10) sites across the Kimberley region of Western Australia have been assessed as part of the Desktop Study and are summarised below in Table 1.1.

TABLE 1.1: SITE AND SCOPE OVERVIEW

Location	Site ID	Facility	Proposed Works
Broome	Site 1	[REDACTED]	New Thermals
	Site 2	[REDACTED]	Solar, BESS
	Site 3	[REDACTED]	Solar, BESS
Derby	Site 4	[REDACTED]	New Thermals
	Site 5	[REDACTED]	Solar, BESS
	Site 6	[REDACTED]	Solar, BESS
Fitzroy Crossing	Site 7	[REDACTED]	New Thermals
Looma-Camballin	Site 8	[REDACTED]	New Thermals, Solar, BESS
Halls Creek	Site 9	Halls Creek Existing Power Station	New Thermals
	Site 10	Halls Creek Renewables	Solar, BESS

The methodology involves a comprehensive desktop review of data using available geological, environmental, and land use data, topographic maps, satellite imagery, regional hydrology and hydrogeology reports, and government databases. Criteria for the assessment of each site is summarised in Section 3.1.

An overview of the risk assessment for all ten (10) sites are summarised in Table 1.2 and conclusions and key recommendations are provided in Table 1.3.

TABLE 1.2: RISK ASSESSMENT SUMMARY OF ALL SITES

Discipline	Characteristics	Site 1 - Existing Broome Power Station	Site 2 - NBY Site	Site 3 - Water Corporation Site	Site 4 - Existing Derby Power Station	Site 5 - BAI Site	Site 6 - Oro Nominees Site	Site 7 - Existing Fitzroy Crossing	Site 8 - Existing Looma-Camballin	Site 9 - Existing Halls Creek Power Station	Site 10 - Subsite C3
Geotechnical	Soil Reactivity	Moderate	High	High	Moderate	High	High	Moderate	Moderate	Moderate	Unknown
Geotechnical	Collapsibility	Moderate	High	High	Moderate	High	High	Unknown	Unknown	Unknown	Unknown
Geotechnical	Dispersion Potential	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Geotechnical	Excavatability	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	High
Geotechnical	Seismic Risk	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Geotechnical	Constructability	Moderate	High	High	Moderate	High	High	Unknown	Unknown	Unknown	Unknown
Flooding and Erosion	Erosion Potential	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Flooding and Erosion	IECA Erosion Hazard	High	High	High	High	High	High	High	High	High	High
Baseline Contamination	Register Search	  	Very Low	Very Low	High	Very Low	  	Low	Low	Low	Very Low
Baseline Contamination	Local Planning Site	  	Very Low	Very Low	Low	Very Low	  	Moderate	Moderate	High	Very Low
Baseline Contamination	Historical Records	  	Very Low	Very Low	Low	Very Low	  	Low	Low	Low	Very Low
Baseline Contamination	Aerial Imagery Review	  	Very Low	Very Low	Moderate	Very Low	  	High	Moderate	Low	Very Low
Baseline Contamination	Former Fuel Storage	  	Very Low	Very Low	High	Very Low	  	High	Moderate	High	Very Low
Baseline Contamination	Former Waste Disposal	  	Very Low	Very Low	Moderate	Very Low	  	High	Low	Low	Very Low
Baseline Contamination	Former Industrial Land Use	  	Very Low	Very Low	High	Very Low	  	High	Very Low	High	Very Low
Baseline Contamination	Previous Contamination Investigations	  	Very Low	Very Low	High	Very Low	  	Low	Very Low	Low	Very Low
Baseline Contamination	Previous Remediation Works	  	Very Low	Very Low	High	Very Low	  	Low	Very Low	Low	Very Low
Baseline Contamination	Nearby Service Stations	  	Very Low	Very Low	Moderate	Very Low	  	Moderate	Very Low	Moderate	Very Low
Baseline Contamination	Nearby Fire Stations	  	Very Low	Very Low	Moderate	Very Low	  	Low	Very Low	Moderate	Low
Baseline Contamination	Nearby Waste Disposal / Treatment	  	Moderate	Very Low	High	Very Low	  	Low	Very Low	Low	Low
Flooding and Erosion	Coastal Flood Risk	N/A - Not Assessed	Moderate	Very Low	N/A - Not Assessed	Low	Very Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low
Flooding and Erosion	Waterways Within Site Footprint	N/A - Not Assessed	Very Low	Very Low	N/A - Not Assessed	Very Low	Very Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Low
Flooding and Erosion	Unmapped Watercourses Within Site Footprint	N/A - Not Assessed	Moderate	Low	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low
Flooding and Erosion	Regional Flooding or Floodplain Interaction With Site Footprint	N/A - Not Assessed	Low	Very Low	N/A - Not Assessed	Very Low	Very Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low
Groundwater & Acid Sulfate Soil	Groundwater Level	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Low	N/A - Not Assessed	Low
Groundwater & Acid Sulfate Soil	Groundwater Quality	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Low	N/A - Not Assessed	Low
Groundwater & Acid Sulfate Soil	Groundwater Dependent Ecosystems	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Very Low	Very Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low
Groundwater & Acid Sulfate Soil	Acid Sulfate Soil	N/A - Not Assessed	Low	Very Low	N/A - Not Assessed	Very Low	Very Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low
Subterranean Fauna	Subterranean Environment	N/A - Not Assessed	Low	Very Low	N/A - Not Assessed	Low	Low	N/A - Not Assessed	Very Low	N/A - Not Assessed	Very Low

TABLE 1.3: KEY RISKS AND RECOMMENDATIONS

Site	Risk Item	Detail	Pre-Control Risk	Suggested Control	Post-Control Risk
All Sites	Groundwater and acid sulphate soils	Intercept groundwater water table.	Incidental take into excavations and reduced water available at other users or the environment.	If excavations planned, determine depth to groundwater with geotechnical drilling program. Design any excavations to not intercept water table.	Unlikely.
		Change in groundwater quality.	Lowering of water quality above ADWG at surrounding water bores reducing access and/or increasing costs and maintenance.	Implement a site water management system.	Unlikely.
	Geotechnical	No site-specific geotechnical data.	Unknown level of risk, due to unknown site subsurface conditions resulting in increased construction and design costs.	Develop geotechnical brief and undertake geotechnical investigation tailored to the proposed design.	Unknown level of risk, dependent on outcome of geotechnical investigation. Further investigation(s) and laboratory testing may be required dependent on the subsurface conditions encountered.
	Erosion	High risk on IECA Erosion Hazard.	High risk of erosion impacting site stability and surrounding environment.	Revise assessment with data from site specific geotechnical investigation. If required implement comprehensive erosion control measures, such as sediment barriers, vegetation stabilisation, and regular monitoring.	Reduced to manageable levels with effective controls.
Site 1 and Site 4	Contaminated land and groundwater	Listed on Contaminated Sites Register with a Site Management Plan. There is known soil and groundwater contamination that is suitable for the current land use that requires management if disturbed.	Previous investigations provide an indication of likely soil contaminant concentrations. Potential to disturb contaminated soils and cause the spread of contamination. Groundwater abstraction is prohibited for any purpose other than monitoring.	Soils proposed to be disturbed are to be assessed by a suitably qualified contaminated land consultant to determine contamination status and management requirements. Should works intercept groundwater, then a groundwater management plan or dewatering plan must be developed.	Assessment and development of necessary spoil and sediment management plans for the planned works.
Site 7 and Site 9	Potential contamination	Current and historical fuel storage associated with existing power station. Potential for uncontrolled waste disposal within the site boundaries.	Potential hydrocarbon contamination from fuel storage and dispensing. Potential for waste to be buried sub-surface.	Engage a suitable qualified contaminated land consultant to undertake investigation works prior to any site disturbance to identify potentially contaminated soils. Any works proposed to intercept groundwater will require a groundwater assessment and development of a groundwater management plan in accordance with site requirements.	Assessment and development of necessary spoil and sediment management plans for the planned works.
Site 10	Geotechnical	High risk of difficulty in excavatability due to lack of site-specific data available.	Difficulty in excavation leading to potential delays and increased construction costs.	Perform a thorough geotechnical survey/investigation to determine soil and rock characteristics; plan for appropriate excavation techniques and equipment.	Minimised excavation challenges with proper planning and equipment.
All Sites	Topography	No current detailed site specific topographical survey.	Incorrect levels due to inaccurate or out of date survey data.	Confirm the intended development scope and design for the proposed site, prepare a topographical survey brief and undertake a topographical survey. Sites 1, 2, 3, 9 and 10 should be prioritised.	Unlikely.

2. INTRODUCTION

Horizon Power is undertaking a procurement process to engage an Independent Power Producer (IPP) to design, build, own, and operate new energy systems in five remote towns in the Kimberley region of Western Australia: Broome, Derby, Fitzroy Crossing, Halls Creek, and Looma-Camballin (refer to Figure 2.1).

To support this process, Horizon Power has engaged Engeny Australia Pty Ltd (Engeny) to prepare a Desktop Study to accompany the IPP Request for Tender (RFT).

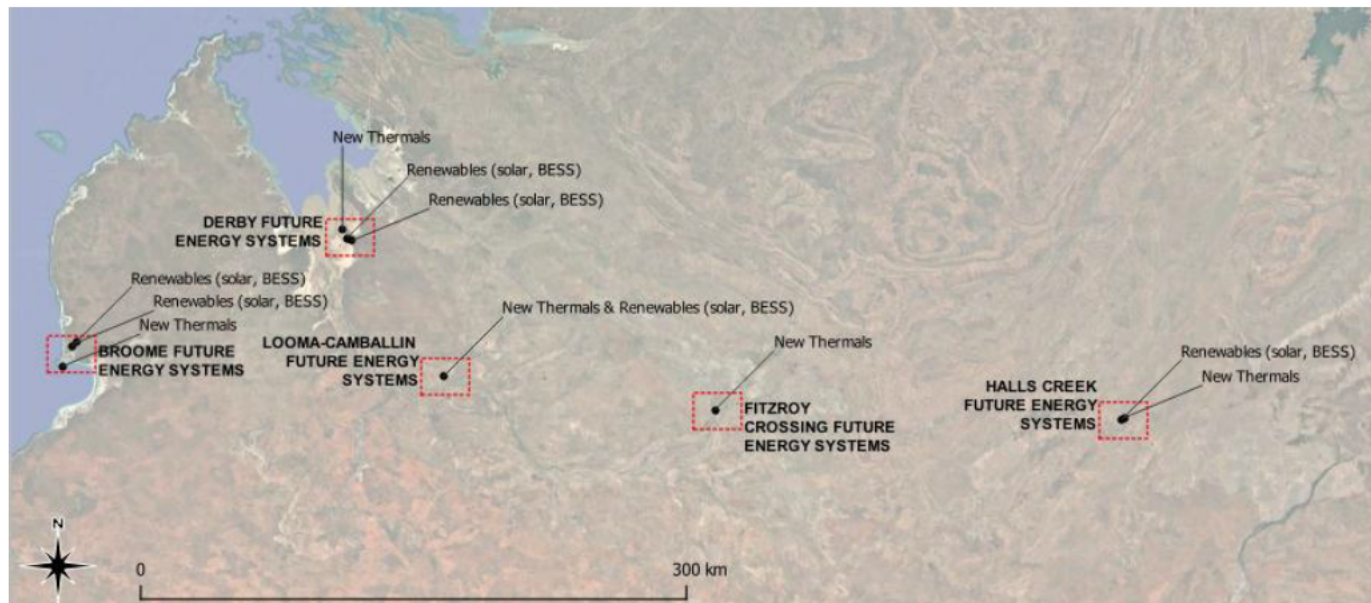


FIGURE 2.1: FUTURE ENERGY SYSTEM PROJECTS LOCATIONS

2.1 Scope of Work

The Desktop Study comprises a series of targeted desktop assessments designed to inform early project planning and identify potential constraints. The packages includes:

- Desktop Geotechnical and Baseline Contamination Study;
 - Desktop Geotechnical Assessment.
 - Desktop Baseline Contamination Risk Assessment.
- Desktop Hydrology and Hydrogeology Study (Renewable Sites Only);
 - Desktop Flooding and Erosion Risk Assessment.
 - Desktop Groundwater and Acid Sulfate Soil Risk Assessment.
 - Desktop Subterranean Fauna Risk Assessment.

A total of ten (10) sites across the Kimberley region of Western Australia have been assessed as part of the Desktop Study, and are summarised below in Table 2.1.

TABLE 2.1: SITE AND SCOPE OVERVIEW

Location	Site ID	Facility	Proposed Works
Broome	Site 1	[REDACTED]	New Thermals
	Site 2	[REDACTED]	Solar, Battery Energy Storage System (BESS)
	Site 3	[REDACTED]	Solar, BESS
Derby	Site 4	[REDACTED]	New Thermals
	Site 5	[REDACTED]	Solar, BESS
	Site 6	[REDACTED]	Solar, BESS
Fitzroy Crossing	Site 7	[REDACTED]	New Thermals
Looma-Camballin	Site 8	[REDACTED]	New Thermals, Solar, BESS
Halls Creek	Site 9	Halls Creek Existing Power Station	New Thermals
	Site 10	Halls Creek Renewables	Solar, BESS

2.2 Objective

The objectives of this Desktop Study are to:

- Assess geotechnical, hydrological, and hydrogeological conditions that may influence the design and construction of proposed energy systems.
- Identify potential environmental sensitivities, including groundwater contamination risks and the presence of groundwater-dependent ecosystems.
- Reduce risk and uncertainty for prospective vendors, enabling more consistent, high-quality, and comparable tender submissions.
- Enhance Horizon Power's internal due diligence and planning in advance of awarding the contract.

3. METHODOLOGY

3.1 General

The general methodology for the assessment includes conducting a desktop review of data using available geological, environmental, and land use data, topographic maps, satellite imagery, regional hydrology and hydrogeology reports, and government databases.

3.1.1 Data Compilation

Publicly available and site-specific datasets were collated, including geological and soil maps, environmental databases, land use records, satellite imagery, and relevant regional studies. No new field investigations were undertaken and no site specific modelling was undertaken. A list of all documents reviewed in preparation of the desktop study is included in Section 7.

3.1.2 Geotechnical Assessment

A review of geological and soil data was undertaken to assess risks related to the following characteristics:

- Soil Reactivity
- Collapsibility
- Dispersion Potential
- Excavatability
- Seismic Risk
- Constructability

3.1.3 Erosion Risk Assessment

An Erosion Hazard Categorisation form adapted from the International Erosion Control Association's (IECA) *Best Practices Erosion & Sediment Control Guideline* has been used to provide an initial assessment of erosion risk. This assessment utilised the criteria listed below (in conjunction with default parameters where detailed information is not available) to develop an erosion risk assessment based on a rating system.

- Average slope of the disturbance area
- Soil Classification Group
- Emerson Class
- Duration of soil disturbance
- Area of disturbance
- Waterway disturbance
- Rehabilitation Method
- Receiving Waters
- Subsoil Exposure
- External Catchments
- Road Construction
- pH of Soil to be Revegetated

Based on each component a total erosion hazard score for each site has been developed using the information available.

3.1.4 Baseline Contamination Risk Assessment

Historical land use, aerial imagery, and contaminated sites registers were reviewed to identify potential or known sources of contamination. Risk was assessed based on the following criteria:

- Site presence on the contaminated sites register
- Local planning land use classifications
- Historical records (including previous business listings)
- Aerial imagery review
- The presence of former fuel storage, waste disposal or industrial land use
- Previous contamination investigations or remediation works
- Nearby service stations, fire stations or waste disposal / treatment

3.1.5 Flooding

Available flood mapping and topographic data were reviewed to identify flood-prone areas, surface water features, and seasonal inundation zones. This assessment considered existing risks to each site footprint to flooding originating from coastal storm tides and regional watercourse sources. Sites have been categorised for flood risk based on the criteria below, each of these criteria could present a flooding risk to the site without proper management.

- Is the site at risk from coastal flooding?
- Is the site at risk from regional flooding?
- Is the site free draining or within a floodplain?
- Does the site have a mapped watercourse within its footprint?

This information was generally sourced from the Western Australia Department of Water and Environmental Regulation. Some additional references to coastal storm-tides were found to be suitable for use in this desktop study. The Geosciences Australia Hydrology Lines was found to be the most detailed and complete source for watercourses across Western Australia.

3.1.6 Groundwater and Acid Sulfate Soil Risk

Groundwater depth, variability, and proximity to groundwater-dependent ecosystems (GDE) were reviewed. The Atlas of Australian Acid Sulfate Soils (CSIRO, 2011) was reviewed to assess the likelihood of encountering acid sulfate soils during excavation, along with potential sensitivities for construction and environmental compliance. Key considerations in the assessment includes:

- Change in groundwater quality at nearby bores because of groundwater extraction for the project or water supply drawing in saline groundwater.
- Reduction in groundwater available at other users because of extraction for the project or water supply increasing drawdown in the surrounding aquifer

3.1.7 Subterranean Fauna

Available hydrogeological and ecological datasets were reviewed to identify potential subterranean fauna habitats (e.g., stygofauna, troglafauna). As site-specific data for subterranean fauna was limited, the desktop study identified subterranean environments known to contain communities of subterranean fauna and were compared to the local site conditions based on the following criteria:

- Surface geology
- Regional aquifer
- Groundwater levels

The likelihood of impact from construction and implications for environmental approvals were evaluated.

3.1.8 Reporting

All findings have been documented in this report, accompanied by relevant mapping. Recommendations for further site-specific investigations are provided where data gaps or material risks were identified.

3.2 Risk Framework

Based on the assessment considerations listed above, the risk framework for the Desktop Study can be summarised as shown on Table 3.1.

TABLE 3.1: RISK LEVEL AND ADOPTED RISK DESCRIPTIONS

Risk Level	Discipline				
	Geotechnical	Contamination	Flooding and Erosion	Groundwater and Acid Sulfate Soils	Subterranean Fauna
Unknown	Insufficient data available to determine risk level				
Very Low	N/A	No former or current site disturbance or use identified.	Site is not prone to flooding or erosion.	No risk of acid sulfate soils; groundwater quality is stable.	No evidence of subterranean fauna presence.
Low	Low risk of impact to design and construction	Former or current site use is vacant land / rural / residential and unlikely to cause serious contamination to soil or groundwater.	Site has minimal history of flooding or erosion; minor erosion control measures may be required.	Minor risk of acid sulfate soils; groundwater quality is generally stable but requires monitoring.	Low probability of subterranean fauna presence; minimal impact expected.
Moderate	Moderate risk of impact to design and construction	Former or current commercial / industrial site use with potential for contamination to soil or groundwater.	Site has occasional flooding or moderate erosion concerns; moderate erosion control measures required.	Potential presence of acid sulfate soils; groundwater quality may be affected.	Possible presence of subterranean fauna; requires further investigation.
High	High risk of impact to design and construction	Former or current commercial / industrial site use with known contamination to soil or groundwater.	Site is prone to frequent flooding or severe erosion; significant erosion control measures required.	Significant presence of acid sulfate soils; groundwater quality is compromised.	Confirmed presence of subterranean fauna; significant mitigation measures required.

4.9 Site 9 – Halls Creek Existing Power Station

Table 4.28 presents the property identification details for the existing Halls Creek power station on Lot 9005 on Plan 069970. Site identification details are presented in Table 4.28: Site 9, Halls Creek Existing Power Station – and shown on Figure 4.25.

TABLE 4.28: SITE 9, HALLS CREEK EXISTING POWER STATION – SITE LOT SUMMARY

Lot Details	
Plan / Lot	P069970 9005 (project footprint not on whole lot)
Title	2783/64
Address	61 Stan Tremlett Drive, HALLS CREEK 6770
Shire	Halls Creek
Proposed works	New Thermals – existing power station site

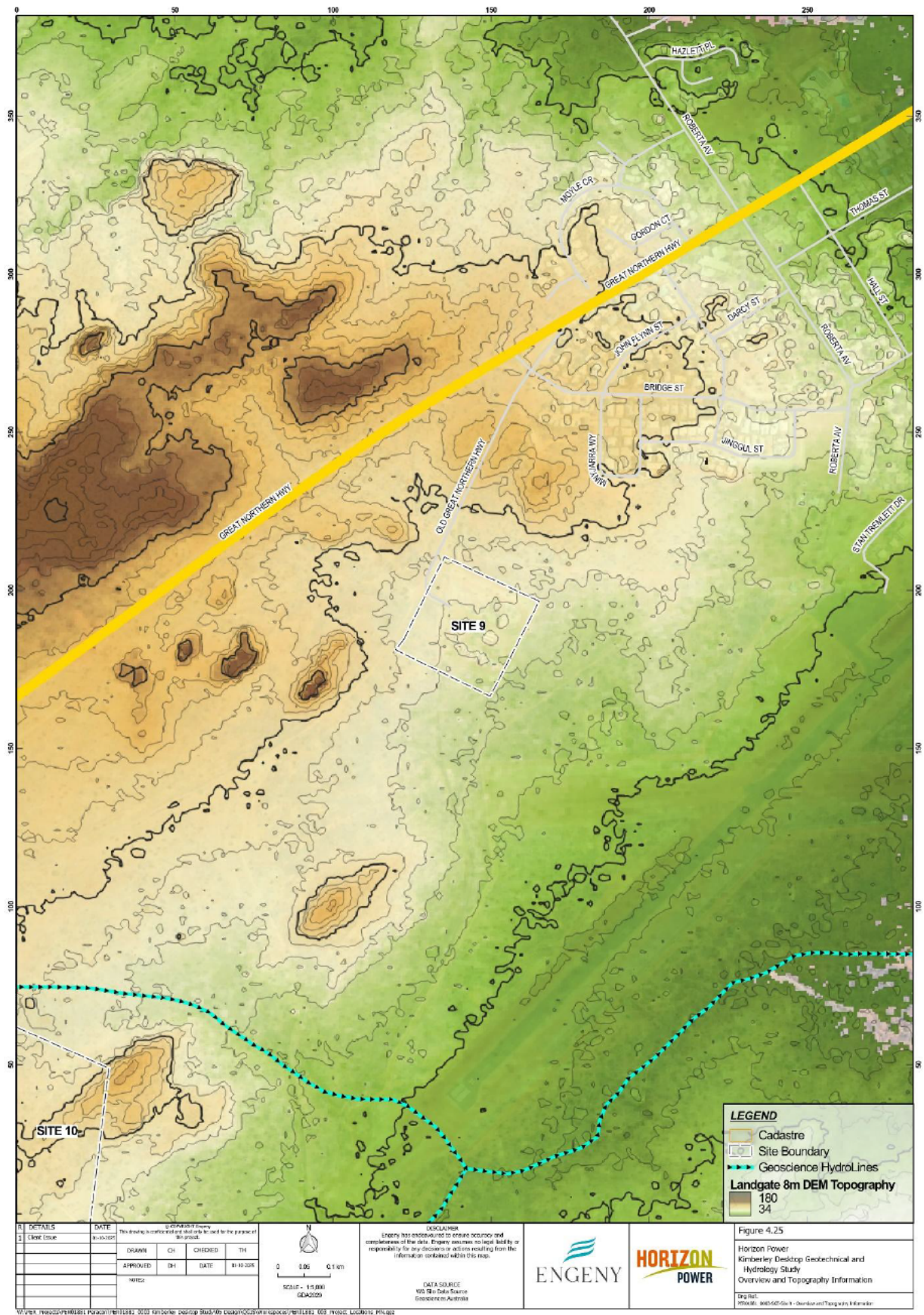


FIGURE 4.25: SITE 9, HALLS CREEK EXISTING POWER STATION – SITE OVERVIEW & TOPOGRAPHY

4.9.1 Site 9 – Geotechnical Assessment

4.9.1.1 Geotechnical Data

No site-specific information available.

Information pertaining to the section(s) below has been filtered from the client supplied data and publicly available data to provide only the most relevant information for the geotechnical risk assessment. In lieu of available geotechnical investigation data located within proximity to the site, lithology logs from the BoM (2025) Australian Ground Water Explorer have been utilised.

Client Supplied Data:

N/A not utilised for assessment on proposed site no data provided within proximity to the proposed site.

Publicly Available Data:

No publicly available geotechnical data located within proximity to Site 9 Halls Creek Existing Power Station.

Ground water monitoring bore data was accessed through BoM (2025) Groundwater Explorer mapping program. Groundwater bores with lithology logs were within proximity to site are summarised below, monitoring bore data and lithology logs are provided in Appendix C in Table C.5 and Table C.6, respectively:

- 19 groundwater monitoring bores (publicly available data) within 1.5km of proposed site include with lithology generally comprising:
 - CLAY (with occasional GRAVEL and SAND) from surface to depths ranging from 1.5 m to 12 m bgl; overlying.
 - Mixture of sedimentary, metamorphic and volcanic rock including KAOLIN, LIMESTONE, QUATZITE, IRONSTONE, BASALT and SHALE.

It is noted that in some groundwater monitoring boreholes some rock was logged from surface and generally the profile is not consistent across the surrounding area of the proposed site.

4.9.1.2 Soil Landscape Mapping Zone

1:1,000,000 soil landscape mapping zone derived from DPIRD NRInfo (2017) interactive mapping tool, indicates the proposed site is located within the Springvale Foothills Zone comprising hills and plateaux (with some undulating plains) on granitic, volcanic and sedimentary rocks of the Halls Creek Orogen (western Lamboo Complex) with Stony soils, Red shallow loams and Deep sands.

4.9.1.3 Geology

Regional Geology (1:250,000) mapping indicates the proposed site is underlain by geological unit Czs which is defined as sand and silt, mainly aeolian and sheet-wash deposits. Regional Geology for Site 9 Halls Creek Existing Power Station and is displayed in Figure 4.26 below.

No environmental geology mapping was available for the proposed site at the time of reporting.



FIGURE 4.26: SITE 9, HALLS CREEK EXISTING POWER STATION – REGIONAL GEOLOGY

4.9.1.4 Dispersion Potential

No data available at the time of reporting, refer to the risk assessment (Table 4.29) for further details.

4.9.1.5 Excavatability

Excavatability was assessed based on available geotechnical data at the time of reporting and experience with similar materials. Refer to the risk assessment (Table 4.29) for further details.

4.9.1.6 Seismic Risk

No site-specific details at the time of reporting.

Seismic risk for the proposed site was assessed in accordance with Australian Standard AS1170.4–2007: *Structural Design Actions, Part 4 – Earthquake Actions in Australia*. The site hazard design factor (Z) was derived from Table 3.4 and Figure 3.2(c) of AS1170.4. Given no site-specific geotechnical investigation data was available at the time of reporting, the subsoil class could not be determined. Refer to the risk assessment (Table 4.29) for further details.

4.9.2 Site 9 – Erosion Risk Assessment

DPIRD has published information regarding soil potential for erosion from wind and water and can be accessed via the NRInfo interactive mapping tool. However, published information was not available at the proposed site location at the time of reporting.

Erosion potential was assessed using K factor data from CSIRO (2016) *Maps of Australian soil loss water by erosion derived using the RUSLE* for the proposed site location. The corresponding erodibility class was determined based on a study published by Rosewell & Loch (1992) *Estimation of RUSLE Soil Erodibility Factor*. An adapted summary of the classification criteria from the study is presented in Table 4.3.

CSIRO mapping indicates that the site has a k value of approximately 0.029 corresponding to a soil erodibility class of moderate.

K Factor can also be estimated from the soils encountered on site. IECA Guidelines (2008) published an estimated K factor and is summarised in Table 4.4. Based on geotechnical investigation data it is anticipated that the site will comprise CLAY corresponding to a moderate to high K Factor of 0.047 and 0.058, respectively, as per Table F3 of the IECA (2008) guidelines.

4.9.2.1 IECA Erosion Risk Rating

An Erosion Hazard Categorization form adapted from the International Erosion Control Association's (IECA) *Best Practices Erosion & Sediment Control Guideline* has been used to provide an initial assessment of erosion risk for Site 9.

Several assessment criteria did not have any suitable data or relied on assumptions within the IECA Erosion Hazard Assessment form, as such it is considered that this desktop assessment is conservative in its assessment of risk. The specifics of the risk assessment for Site 9 are presented in Appendix B. Based on the adopted IECA point system, Site 9 scored 31 and is considered high risk for erosion by this desktop assessment. It is recommended that where default values or assumptions have been used that further testing and construction methodologies are considered to provide clarity on these parameters and to manage residual risk.

4.9.3 Site 9 – Baseline Contamination Risk Assessment

The desktop contamination assessment has identified three (3) high risk items on Lot 9005 and two (2) moderate off-site risks that are potentially applicable to the Halls Creek Site (refer to Appendix G).

4.9.3.1 Local Planning Site

The local planning site shows the land is zoned as general industry with the site forming a very small part of the larger property lot that is the Halls Creek Airport.

4.9.3.2 Fuel Storage:

The aerial photograph review has revealed fuel storage within the site boundaries and industrial use since approximately 2010.

4.9.3.3 Industrial Land Use

Former and current industrial use for power generation.

4.9.4 Site 9 – Risk Assessment Summary and Recommendations

4.9.4.1 Risk Assessment

The risk assessment for the proposed site is summarised in Table 4.29. The full assessment for all sites is attached in Appendix G.

4.9.4.1 Recommendations

Based on these risks, it is recommended that:

- Confirm the intended development scope and design for the proposed site, prepare a geotechnical brief and undertake a geotechnical investigation. The brief and investigation should be tailored to address the specific requirements of the proposed design, including but not limited to the geotechnical risk(s) outlined in the risk assessment.

TABLE 4.29: SITE 9, HALLS CREEK EXISTING POWER STATION – RISK ASSESSMENT

Discipline	Topic	Risk	Commentary
Geotechnical	Soil Reactivity	Moderate	No site specific geotechnical data available. Review of groundwater monitoring bore logs located within 1.5 km of the proposed site and intersecting regional geological units underlying the area, suggests the subsurface may comprise of CLAY, underlain by a mixture of volcanic and sedimentary rock. Noted that there is variance across the logs. Proposed site is underlain by geological unit Czs, suggesting that the site is underlain by aeolian deposits comprising Sand and Silt. Portion of site has existing infrastructure. Given the limited and contradicting data, the risk of soil reactivity impact to construction is considered moderate. It is noted that if the site did not have existing infrastructure the risk would be considered unknown given the limited geotechnical data.
Geotechnical	Collapsibility	Unknown	Proposed site is underlain by geological unit Czs, suggesting that the site is underlain by aeolian deposits comprising Sand and Silt. Review of groundwater monitoring bore logs located within 1 km of the proposed site and within same regional geological units underlying the area, suggests the subsurface may comprise of CLAY underlain by a mixture of volcanic rock. Noted that there is variance across the logs. Based on the limited data available there is potential to encounter collapsible soils, however without further geotechnical investigation the risk of collapsible soils is considered unknown.
Geotechnical	Dispersion Potential	Unknown	No site specific geotechnical data is available. Dispersion characteristics of soil vary with subsurface depth and location, therefore without construction details and soil quality testing the risk level is considered unknown.
Geotechnical	Excavatability	Moderate	No site specific geotechnical data available. Regional Geology mapping indicates the site is underlain by SAND or SILT. Review of groundwater monitoring bore logs located within 1 km of the proposed site and within same regional geological units underlying the area, suggests the subsurface may comprise of CLAY underlain by a mixture of volcanic and sedimentary rock. Portion of site has existing infrastructure. Due to the potential of encountering volcanic rock (although likely deeper in the profile), lack of site specific information and that infrastructure exists on the proposed site. It is anticipated that if conventional civil earthworks equipment is utilised during construction there will be a moderate excavation risk.
Geotechnical	Seismic Risk	Low	Australia is located central to the Indo-Australian tectonic plate and the proposed site is far from active plate boundaries, generally seismic risk in Australia is considered low. Any works should be designed to meet relevant Australian Standards (AS1170.4). As per AS1170.4-2007 Halls Creek has a hazard design factor (Z) of 0.11. Further geotechnical investigations are required to determine site class. Infrastructure is already established on the proposed site, and based on aerial imagery, it appears to remain intact, indicating a low risk of earthquake or seismic-related ground disturbance. Given all design should meet relevant Australian Standards for earthquake actions seismic risk is considered low.
Geotechnical	Constructability	Unknown	Limited data available therefore risk associated with potential highly reactive soils and collapsible soils. Potential to encounter shallow rock increasing excavation risk and construction costs. Interaction with existing uncontrolled fill from civil works resulting increased construction and design costs.
Erosion	Erosion Potential	Moderate	Soil landscape mapping for water erosion and wind erosion is not available for the proposed site. CSIRO (2016) Maps of Australian soil loss water by erosion derived using the RUSLE indicates the site has a K Factor of 0.029 corresponding to a soil erodibility class of moderate. Nearby groundwater monitoring bores encountered CLAY, corresponding to a moderate to high K factor of 0.047 to 0.058, as per Table F3 of the IECA (2008) guidelines. Erosion and sediment control measures are tailored to specific design and construction requirements of the project given the lack of data the erosion risk potential is considered moderate
Erosion	IECA Erosion Hazard	High	Average Slope of Disturbance: Unknown – Average Slope of Total Footprint Applied - 3.35% Soil Classification: SM,SC,MH,CH Types Emerson Class: Untested – IECA Recommended Value Applied Duration of Soil Disturbance: Unknown – Potential 6-month timeframe applied Area of Disturbance: Unknown – Total Footprint of 4.26ha Waterway Disturbance: None mapped Rehabilitation Method: Unknown – Considered unlikely that 90% or more will be seeded without mulching Receiving Waters: Discharges flow to Tributary of Elvire River Subsoil Exposure: Unknown: Considered Unlikely External Catchments: Small Upstream Catchment – can be diverted Road Construction: Unknown - Considered Possible pH of Soil to be revegetated: Untested - IECA Recommended Value Applied
Baseline Contamination	Register Search	Low	Not listed on Contaminated Sites Register
Baseline Contamination	Local Planning Site	High	Shire of Halls Creek Scheme No. 2 Site is allocated general industry land use within the public purpose (airport area). Lot zoned as General industry (halls creek), Strategic infrastructure (halls creek), Residential (halls creek) R20 (halls creek) No Restricted or Additional Uses Special Control Area - Special Control Area - Environment - SCA2 (halls creek) No DAP Applications found within 200 metres
Baseline Contamination	Historical Records	Low	No business listings found
Baseline Contamination	Aerial Imagery Review	Low	The existing site was cleared and constructed between August 2005 and July 2010. The site appears to be relatively unchanged since construction
Baseline Contamination	Former Fuel Storage	High	Fuel storage is visible on the site in above ground tanks
Baseline Contamination	Former Waste Disposal	Low	No evidence of waste disposal from aerial review
Baseline Contamination	Former Industrial Land Use	High	Former and current industrial use for power generation

Discipline	Topic	Risk	Commentary
Baseline Contamination	Previous Contamination Investigations	Low	No records of previous investigations
Baseline Contamination	Previous Remediation Works	Low	No records of remediation works
Baseline Contamination	Nearby Service Stations	Moderate	Shell service station approximately 900 m north-east
Baseline Contamination	Nearby Fire Stations	Moderate	Fire station approximately 700 m north-east. Airport is located within same property lot and assumed to contain fuel storage and firefighting equipment
Baseline Contamination	Nearby Waste Disposal / Treatment	Low	No properties on contaminated sites register within 500m - map printed. Contaminated site listed approximately 1.5km from the site (remediated for restricted use) with hydrocarbon impacted soils noted
Flooding		N/A - Not Assessed	Not Assessed - Assessed for Renewables Sites Only
Groundwater and Acid Sulfate Soil		N/A - Not Assessed	Not Assessed - Assessed for Renewables Sites Only
Subterranean Fauna		N/A - Not Assessed	Not Assessed - Assessed for Renewables Sites Only

4.10 Site 10 – Halls Creek Renewables

Table 4.30 presents the property identification details for the Halls Creek Renewables Site on Lot 504 on Plan 400197. The site is a portion of the wider property lot, shown on Figure 4.27.

TABLE 4.30: SITE 10, HALLS CREEK RENEWABLES – SITE LOT SUMMARY

Lot Details	
Plan / Lot	P400197 504 (project footprint not on whole lot)
Title	LR3166/748
Address	Lot 504 On Deposited Plan 400197
Shire	Halls Creek
Proposed works	Renewables (solar, BESS)

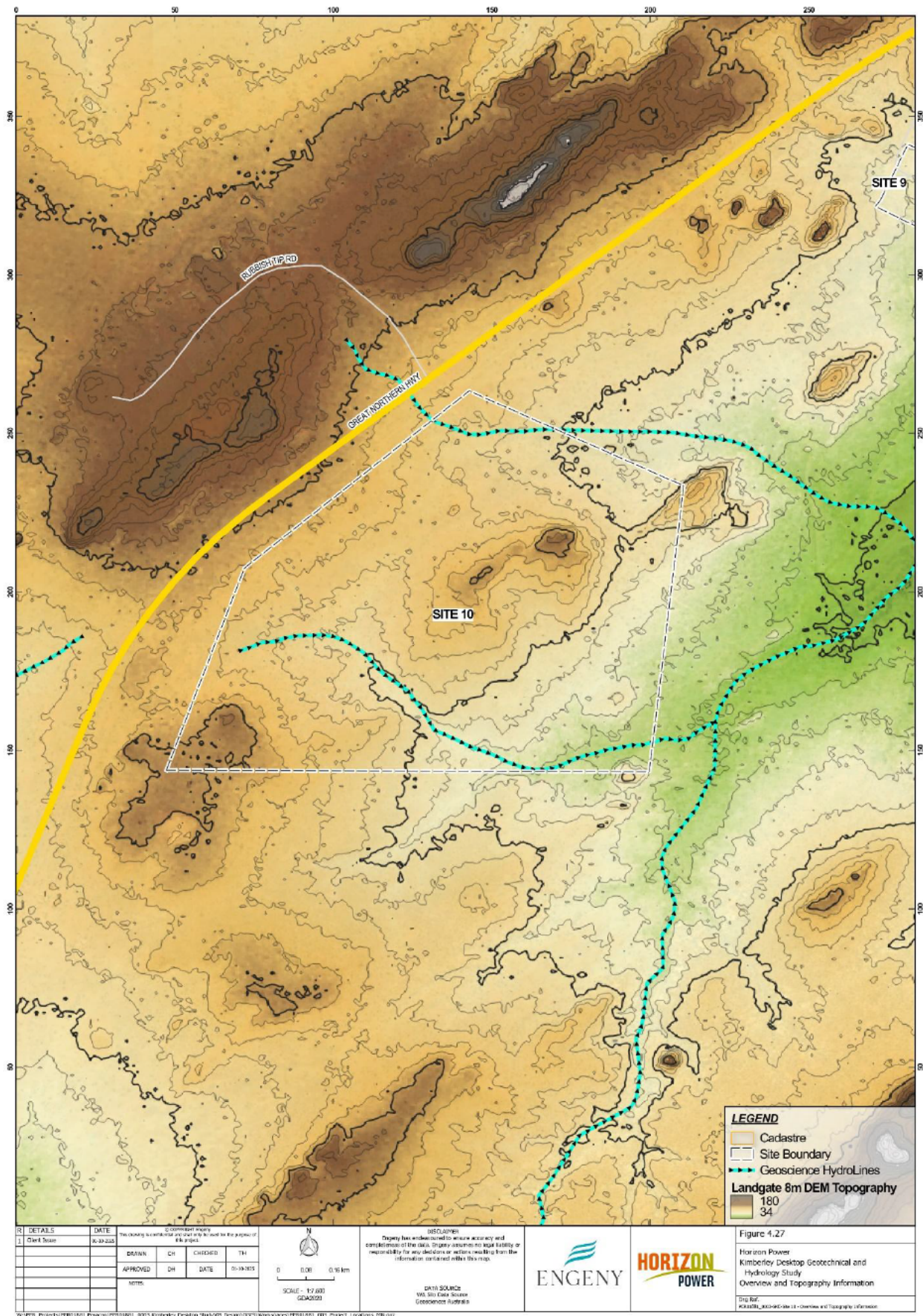


FIGURE 4.27: SITE 10, HALLS CREEK RENEWABLES – SITE OVERVIEW & TOPOGRAPHY

4.10.1 Site 10 – Geotechnical Assessment

4.10.1.1 Geotechnical Data

No site-specific information available.

Information pertaining to the section(s) below has been filtered from the client supplied data and publicly available data to provide only the most relevant information for the geotechnical risk assessment. In lieu of available geotechnical investigation data located within proximity to the site, lithology logs from the BoM (2025) Australian Ground Water Explorer have been utilised.

Client Supplied Data:

N/A not utilised for assessment on proposed site no data provided within proximity to the proposed site.

Publicly Available Data:

No publicly available geotechnical data located within proximity to Site 9 Halls Creek Existing Power Station.

Ground water monitoring bore data was accessed through BoM (2025) Groundwater Explorer mapping program. Groundwater bores with lithology logs were within proximity to site are summarised below, monitoring bore data and lithology logs are provided in Appendix B in Table C.7 and Table C.8, respectively:

- Groundwater monitoring bores (publicly available data) within 2km (from centre) of the proposed site include:
 - 80910044: comprising CLAY from surface to 33m bgl, underlain by SANDSTONE until termination depths.
 - 80910409: comprising CLAY from surface to 4m bgl, underlain by BASALT until termination depths.

It is noted that the ground water monitoring bores are located within a different Regional Geology from the proposed site, refer to the risk assessment for further details.

4.10.1.2 Soil Landscape Mapping Zone

1:1,000,000 soil landscape mapping zone derived from DPIRD NRInfo (2017) interactive mapping tool, indicates the proposed site is located within the Springvale Foothills Zone comprising hills and plateaux (with some undulating plains) on granitic, volcanic and sedimentary rocks of the Halls Creek Orogen (western Lamboo Complex) with Stony soils, Red shallow loams and Deep sands.

4.10.1.3 Geology

Regional Geology (1:250,000) mapping indicates a small portion of the site is underlain by geological unit Czs which is defined as sand and silt, mainly aeolian and sheet-wash deposits. Majority of the site is underlain by geological unit CzI which is defined as ferricrete and ferruginous pisolitic gravel (laterite) capping. Regional Geology for Site 10 Halls Creek Renewables is displayed in Figure 4.28 below.

No environmental geology mapping was available for the proposed site at the time of reporting.

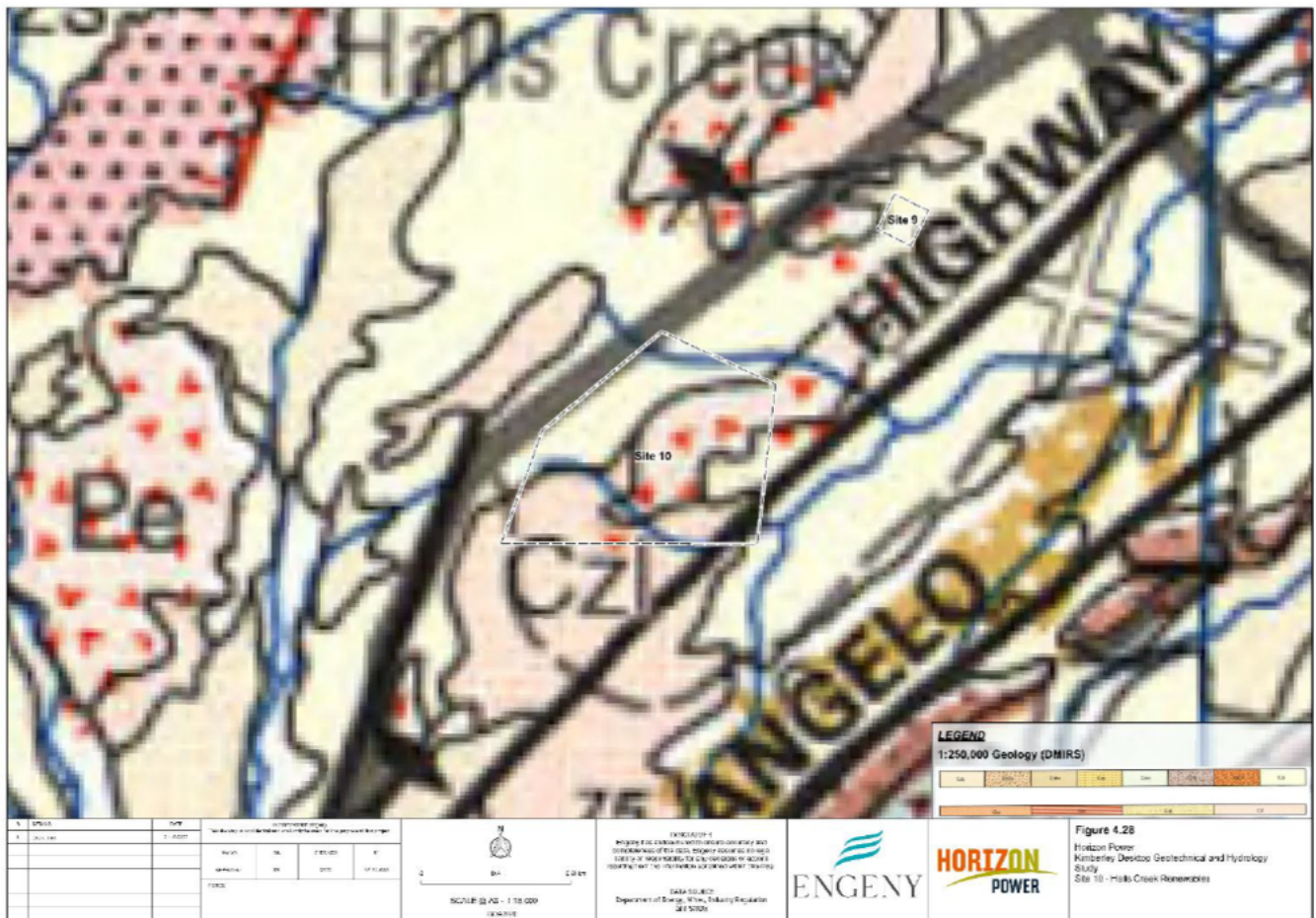


FIGURE 4.28: SITE 10, HALLS CREEK RENEWABLES – REGIONAL GEOLOGY

4.10.1.4 Dispersion Potential

No data available at the time of reporting, refer to the risk assessment (Table 4.31) for further details.

4.10.1.5 Excavatability

Excavatability was assessed based on available geotechnical data at the time of reporting and experience with similar materials. Refer to the risk assessment (Table 4.31) for further details.

4.10.1.6 Seismic Risk

Seismic risk for the proposed site was assessed in accordance with Australian Standard AS1170.4–2007: *Structural Design Actions, Part 4 – Earthquake Actions in Australia*. The site hazard design factor (Z) was derived from Table 3.4 and Figure 3.2(c) of AS1170.4. Given no site-specific geotechnical investigation data was available at the time of reporting, the subsoil class could not be determined. Refer to the risk assessment (Table 4.31) for further details.

4.10.2 Site 10 – Erosion Risk Assessment

DPIRD has published information regarding soil potential for erosion from wind and water and can be accessed via the NRInfo interactive mapping tool. However, published information was not available at the proposed site location at the time of reporting.

Erosion potential was assessed using K factor data from CSIRO (2016) *Maps of Australian soil loss water by erosion derived using the RUSLE* for the proposed site location. The corresponding erodibility class was determined based on a study published by Rosewell & Loch (1992) *Estimation of RUSLE Soil Erodibility Factor*. An adapted summary of the classification criteria from the study is presented in Table 4.3.

CSIRO mapping indicates that the site has a k value of approximately 0.029 corresponding to a soil erodibility class of moderate.

Given the distance from nearest ground water monitoring bores and differing regional geologies across the proposed site the K factor could not be estimates based on the IECA (2008) guidelines, refer to the risk assessment table for further details.

4.10.2.1 IECA Erosion Risk Rating

An Erosion Hazard Categorization form adapted from the International Erosion Control Association's (IECA) *Best Practices Erosion & Sediment Control Guideline* has been used to provide an initial assessment of erosion risk for Site 10.

Several assessment criteria did not have any suitable data or relied on assumptions within the IECA Erosion Hazard Assessment form, as such it is considered that this desktop assessment is conservative in its assessment of risk. The specifics of the risk assessment for Site 10 are presented in Appendix B. Based on the adopted IECA point system, Site 10 scored 33 and is considered high risk for erosion by this desktop assessment. It is recommended that where default values or assumptions have been used that further testing and construction methodologies are considered to provide clarity on these parameters and to manage residual risk.

4.10.3 Site 10 – Baseline Contamination Risk Assessment

The desktop contamination assessment has identified no potential risk items that are applicable to the Halls Creek Renewables Site and the site is classified as very low risk of contamination (Table 4.12).

4.10.4 Site 10 – Flooding

4.10.4.1 Regional Flooding or Floodplain Interactions with the Site Footprint

Site 10 is located on the eastern side of the Great Northern Highway and upstream of the Halls Creek further to the East. There were no sources of public information available which indicate regional flooding near the Halls Creek Renewables Site area. Although there is little information available regarding regional flooding in the area the site topography data has been used to infer that there is low risk to the site location from regional flooding. This is due to the site's closest major watercourses of Halls Creek being a more minor watercourse which is also located relatively far away from the site and the characteristics of the site topography such that it is not part of any flood plains.

4.10.4.2 Mapped or Overland Flow within the Site Footprint

Two mapped watercourses were found within the site footprint and delineated by Geosciences Australia and convey overland flow west to east. These watercourses are ephemeral and classed as minor by Geosciences Australia. Due to these watercourses being directed through the site it is recommended that these overland flow paths are considered as part of further site investigations for proper management. This desktop assessment has considered the overland flow risk to as medium risk.

4.10.5 Site 10 – Groundwater and Acid Sulfate Soil Risk

4.10.5.1 Surface Geology

The surface geology consists of the Orosirian (Palaeoproterozoic) aged igneous felsic volcanic and metasedimentary rocks of the Koongie Park Formation in the southern half of the site. The north is regolith (colluvium and residual sedimentary deposits).

4.10.5.2 Groundwater level

There are thirty-seven groundwater bores within 5 km of the site with recorded groundwater levels (BoM, 2025). The measured SWLs range from 4.18 mbgl to 74.4 mbgl, with the most recent measurement taken in 2006. The latest SWL measurement are presented on Figure 4.29.

No groundwater drawdown is anticipated with the project and the desktop assessment has considered the groundwater level risk as low, any excavations should consider the potential to intersect the current groundwater level.

4.10.5.3 Groundwater quality

There are level groundwater bores within 5km of the site with recorded salinity values (BoM, 2025). The measured salinity range from 221 µS/cm to 2,270 µS/cm, with the latest sample taken in 1998. The latest salinity values are presented on Figure 4.29.

The current groundwater quality should be determined with sampling. Risks to a change in groundwater quality resulting from construction is considered low.

4.10.5.4 Groundwater Dependent Ecosystems

The Groundwater Dependent Ecosystem Atlas (BoM, 2025) shows no GDE classification in the vicinity of Site 10.

4.10.5.5 Acid Sulfate Soils

The ASS classification at the site is Cq(p4), where:

- C – Extremely low probability (1-5%)
- q – generally within upper 1 m in wet / riparian areas with kandosols, ferrosols, tenosols, rudosols and podosols
- p – Potential ASS (PASS) = sulfidic material
- 4 – No necessary analytical data are available and classifier has little knowledge or experience with ASS, hence classification is provisional) (CSIRO, 2011).

The ASS categorisation is presented on Figure 4.29.

4.10.6 Site 10 – Subterranean Fauna Risk Assessment

No site-specific information is available and publicly available data is limited and sparse.

Publicly Available Data:

Subterranean fauna surveys in the Kimberley region recorded stygofauna with the Broome Sandstone aquifer (Phoenix, 2017). The alluvial aquifers of the Ord River Irrigation Area are known to contain stygofauna communities in the north-east of the Kimberley (Cho, Park, & Humphreys, 2005) and (Humphreys, 1999).

Suitable habitat for subterranean fauna may exist in the project area, therefore any activities that may impact on subterranean assemblages require investigation.

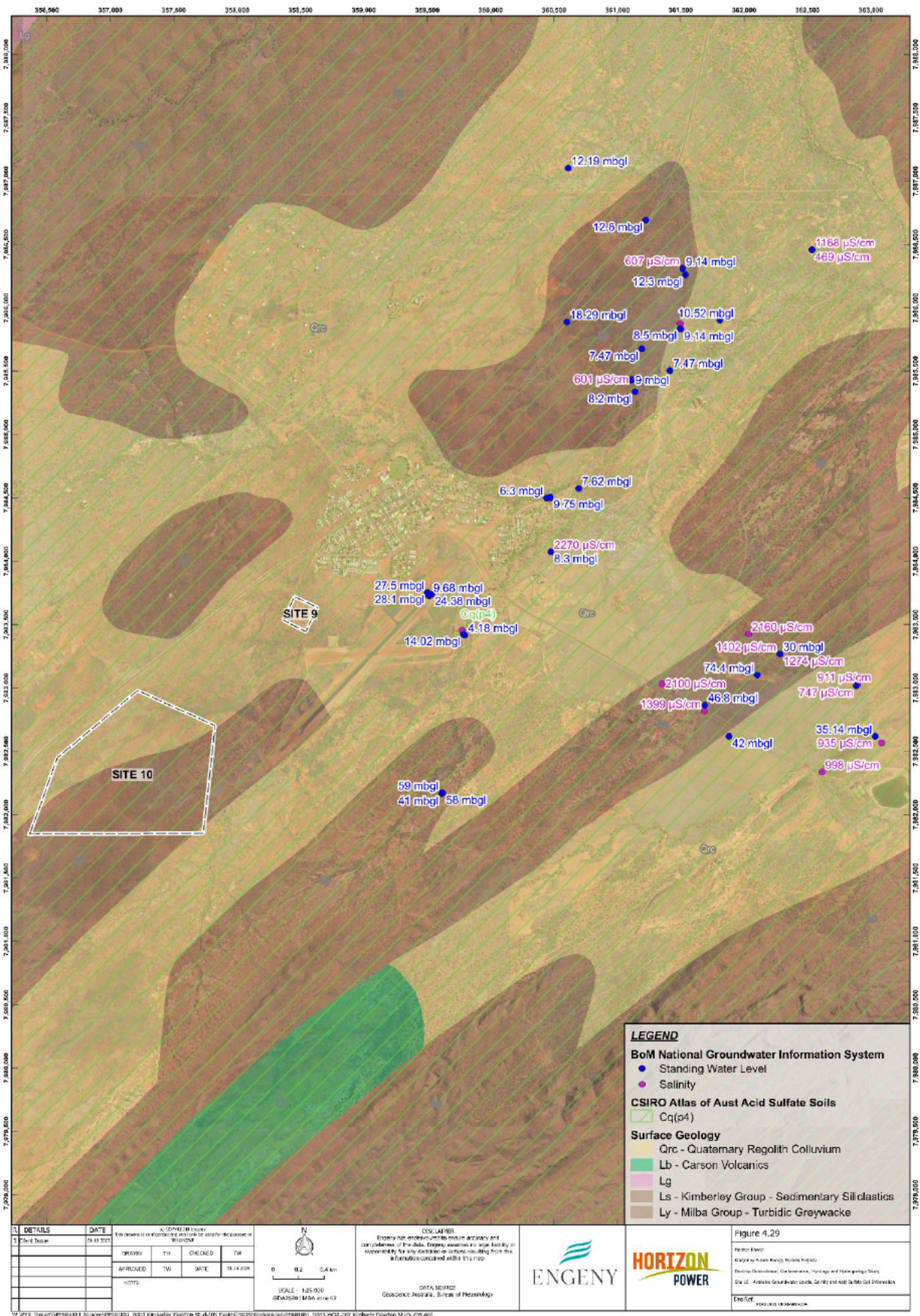


FIGURE 4.29: SITE 10, HALLS CREEK RENEWABLES – AVAILABLE GROUNDWATER LEVELS, SALINITY AND ACID SULFATE SOIL INFORMATION

4.10.7 Site 10 – Risk Assessment Summary and Recommendations

4.10.7.1 Risk Assessment

The risk assessment for the proposed site is summarised in Table 4.31. The full assessment for all sites is attached in Appendix G.

4.10.7.1 Recommendations

Based on these risks, it is recommended that:

- Confirm the intended development scope and design for the proposed site, prepare a geotechnical brief and undertake a geotechnical investigation. The brief and investigation should be tailored to address the specific requirements of the proposed design, including but not limited to the geotechnical risk(s) outlined in the risk assessment.

TABLE 4.31: SITE 10, HALLS CREEK RENEWABLES – RISK ASSESSMENT

Discipline	Topic	Risk	Commentary
Geotechnical	Soil Reactivity	Unknown	No site specific geotechnical data available. Review of groundwater monitoring bore logs located within 2.0 km of the proposed site and intersecting regional geological unit Czs, suggests the subsurface may comprise of CLAY and / or SAND underlain by volcanic and sedimentary rock. It is noted that no groundwater monitoring bores are drilled within the Czl unit which makes up majority of the site. Proposed site is underlain by geological unit Czs and Czl, suggesting that the site is underlain by aeolian deposits comprising Sand and Silt, and ferricrete and laterite (iron rich soil), respectively. Given the lack of data the risk or impact of soil reactivity to construction is considered unknown.
Geotechnical	Collapsibility	Unknown	Proposed site is underlain by geological unit Czs and Czl, suggesting that the site is underlain by aeolian deposits comprising Sand and Silt, and ferricrete and laterite (iron rich soil), respectively. Review of groundwater monitoring bore logs located within 2 km of the proposed site and within same regional geological units underlying the area, suggests the subsurface may comprise of CLAY underlain by sedimentary and volcanic rock. Based on the limited data available there is potential to encounter collapsible soils, however without further geotechnical investigation the risk of collapsible soils is considered unknown.
Geotechnical	Dispersion Potential	Unknown	No site specific geotechnical or publicly available data is available. Dispersion characteristics of soil vary with subsurface depth, therefore without construction details and soil quality testing the risk level is considered unknown.
Geotechnical	Excavatability	High	No site specific geotechnical data available. Regional geology mapping indicates the site that is underlain by SAND or SILT, and ferricrete or lateritic soils. Review of groundwater monitoring bore logs located within 2 km of the proposed site and within same regional geological units underlying the area, suggests the subsurface may comprise of CLAY underlain by sedimentary volcanic rock. Lateritic soils in dry conditions undergoes hardening due to the cementation of the iron oxides. Which can behave as rock with varying strength. Due to the lack of site specific information and potential for encountering hardened lateritic soils. It is anticipated that If conventional civil earthworks equipment is utilised during construction there will be a high excavation risk. It is noted that this could be classified as an unknown risk given the limited data.
Geotechnical	Seismic Risk	Low	Australia is located central to the Indo-Australian tectonic place and the proposed site is far from active plate boundaries, generally seismic risk in Australia is considered low. Any works should be designed to meet relevant Australian Standards (AS1170.4). As per AS1170.4-2007 Halls Creek has a hazard design factor (Z) of 0.11. Further geotechnical investigations are required to determine site class. Given all design should meet relevant Australian Standards for earthquake actions seismic risk is considered low.
Geotechnical	Constructability	Unknown	Limited data available therefore risk associated with potential highly reactive soils and collapsible soils resulting in increased construction and design costs to allow for increased settlement. Potential for encountering hardened lateritic soils dependent on moisture conditions, may require larger civil plant to undertake excavation required.
Erosion	Erosion Potential	Moderate	Soil landscape mapping for water erosion and wind erosion is not available for the proposed site. CSIRO (2016) Maps of Australian soil loss water by erosion derived using the RUSLE indicates the site has a K Factor of 0.029 corresponding to a soil erodibility class of moderate. Erosion and sediment control measures are tailored to specific design and construction requirements of the project given the lack of data the erosion risk potential is considered moderate.
Erosion	IECA Erosion Hazard	High	Average Slope of Disturbance: Unknown – Average Slope of Total Footprint Applied - 3.06% Soil Classification: SM,SC,MH,CH Types Emerson Class: Untested – IECA Recommended Value Applied Duration of Soil Disturbance: Unknown – Potential 6-month timeframe applied Area of Disturbance: Unknown – Total Footprint of 117ha Waterway Disturbance: Potential impact to a mapped watercourse Rehabilitation Method: Unknown – Considered unlikely that 90% or more will be seeded without mulching Receiving Waters: Discharges flow to Tributary of Elvire River Subsoil Exposure: Unknown: Considered Unlikely External Catchments: Small Upstream Catchment – can be diverted Road Construction: Unknown - Considered Possible pH of Soil to be revegetated: Untested - IECA Recommended Value Applied
Baseline Contamination	Register Search	Very Low	Not listed on Contaminated Sites Register
Baseline Contamination	Local Planning Site	Very Low	Zoned as pastoral and within a development investigation area. Portions of the lot to the east are allocated as either priority 2 or priority 3 public drinking water source area
Baseline Contamination	Historical Records	Very Low	No former business records
Baseline Contamination	Aerial Imagery Review	Very Low	Aerial imagery from 2004 to 2022 shows the site is vacant land that does not appear to have been cleared or disturbed
Baseline Contamination	Former Fuel Storage	Very Low	No indication of former fuel storage
Baseline Contamination	Former Waste Disposal	Very Low	No indication of former waste disposal
Baseline Contamination	Former Industrial Land Use	Very Low	No indication of industrial land use
Baseline Contamination	Previous Contamination Investigations	Very Low	No records of previous investigations
Baseline Contamination	Previous Remediation Works	Very Low	No records of remediation works
Baseline Contamination	Nearby Service Stations	Very Low	No service station <100m from site. Nearest service station approximately 3.5 km north-east
Baseline Contamination	Nearby Fire Stations	Low	Airport is located approximately 2 km east. No fire stations within 500m. Nearest fire station approximately 3.5 km north-east
Baseline Contamination	Nearby Waste Disposal / Treatment	Low	No properties on contaminated sites register within 500m - map printed. Remediated site approximately 4km north-east of the site
Flooding	Coastal Flood Risk	Very Low	No coastal influences.

Discipline	Topic	Risk	Commentary
Flooding	Waterways Within Site Footprint	Low	Upper reaches of two small tributaries of Halls Creek is located within the site footprint. The northern watercourse originates on the upstream side of the Great Northern Highway and has an approximate catchment area of 25ha. The more southern watercourse, originates from within the site footprint with an upstream catchment of 13ha. These catchment areas are small and likely manageable with considerations to site layout.
Flooding	Unmapped Watercourses Within Site Footprint	Very Low	No additional surface water considerations further to the mapped watercourses already described.
Flooding	Regional Flooding or Floodplain Interaction With Site Footprint	Very Low	None Identified from available information
Groundwater and Acid Sulfate Soil	Groundwater Level	Low	Available groundwater level data is limited and dated. Determination of current groundwater levels is required. No groundwater drawdown is anticipated and the risk to groundwater level is low, however any excavations should consider the potential to intersect the current groundwater level.
Groundwater and Acid Sulfate Soil	Groundwater Quality	Low	Available groundwater quality data is limited and dated and determination of current groundwater quality is required.
Groundwater and Acid Sulfate Soil	Groundwater Dependent Ecosystems	Very Low	No GDE classification within the vicinity.
Groundwater and Acid Sulfate Soil	Acid Sulfate Soil	Very Low	The site and surrounds are classified as having an extremely low probability of acid sulfate soil occurrence, however the confidence level for this classification is low. The risk to construction is considered very low, however any excavation work will require further investigation.
Subterranean Fauna	Subterranean Environment	Very Low	No site-specific data available. Suitable habitats for subterranean fauna may exist in the project area. Any activities that may intersect the groundwater will require further investigation to identify subterranean assemblages however due to the depth of groundwater the risk is considered very low.

5. KEY RISKS AND RECOMMENDATIONS

The key risks and recommendations for the project are summarised in Table 5.1

TABLE 5.1: KEY RISKS AND RECOMMENDATIONS

Site	Risk Item	Detail	Pre-Control Risk	Suggested Control	Post-Control Risk
All	Groundwater and acid sulphate soils	Intercept groundwater water table.	Incidental take into excavations and reduced water available at other users or the environment.	If excavations planned, determine depth to groundwater with geotechnical drilling program. Design any excavations to not intercept water table.	Unlikely.
		Change in groundwater quality.	Lowering of water quality above ADWG at surrounding water bores reducing access and/or increasing costs and maintenance.	Implement a site water management system.	Unlikely.
	Geotechnical	No site-specific geotechnical data.	Unknown level of risk, due to unknown site subsurface conditions resulting in increased construction and design costs.	Develop geotechnical brief and undertake geotechnical investigation tailored to the proposed design.	Unknown level of risk, dependent on outcome of geotechnical investigation. Further investigation(s) and laboratory testing may be required dependent on the subsurface conditions encountered.
	Erosion	High risk on IECA Erosion Hazard.	High risk of erosion impacting site stability and surrounding environment.	Revise assessment with data from site specific geotechnical investigation. If required implement comprehensive erosion control measures, such as sediment barriers, vegetation stabilisation, and regular monitoring.	Reduced to manageable levels with effective controls.
Site 1 and Site 4	Contaminated land and groundwater	Listed on Contaminated Sites Register with a Site Management Plan. There is known soil and groundwater contamination that is suitable for the current land use that requires management if disturbed.	Previous investigations provide an indication of likely soil contaminant concentrations. Potential to disturb contaminated soils and cause the spread of contamination. Groundwater abstraction is prohibited for any purpose other than monitoring.	Soils proposed to be disturbed are to be assessed by a suitably qualified contaminated land consultant to determine contamination status and management requirements. Should works intercept groundwater, then a groundwater management plan or dewatering plan must be developed.	Assessment and development of necessary spoil and sediment management plans for the planned works.
Site 7 and Site 9	Potential contamination	Current and historical fuel storage associated with existing power station. Potential for uncontrolled waste disposal within the site boundaries.	Potential hydrocarbon contamination from fuel storage and dispensing. Potential for waste to be buried sub-surface.	Engage a suitable qualified contaminated land consultant to undertake investigation works prior to any site disturbance to identify potentially contaminated soils. Any works proposed to intercept groundwater will require a groundwater assessment and development of a groundwater management plan in accordance with site requirements.	Assessment and development of necessary spoil and sediment management plans for the planned works.
Site 10	Geotechnical	High risk of difficulty in excavatability due to lack of site-specific data available.	Difficulty in excavation leading to potential delays and increased construction costs.	Perform a thorough geotechnical survey/investigation to determine soil and rock characteristics; plan for appropriate excavation techniques and equipment.	Minimised excavation challenges with proper planning and equipment.
All Sites	Topography	No current detailed site specific topographical survey.	Incorrect levels due to inaccurate or out of date survey data.	Confirm the intended development scope and design for the proposed site, prepare a topographical survey brief and undertake a topographical survey. Sites 1, 2, 3, 9 and 10 should be prioritised.	Unlikely.

6. FORWARD WORK PLAN

The following forward work plan is proposed to reduce risk for the Kimberley Future Energy System Projects:

6.1 General

- For all sites, confirm the intended development scope and design for the proposed site, prepare a topographical survey brief and undertake a topographical survey. Sites 1, 2, 3, 9 and 10 should be prioritised.

6.2 Geotechnical

- For all sites, confirm the intended development scope and design for the proposed site, prepare a geotechnical brief and undertake a geotechnical investigation. The brief and investigation should be tailored to address the specific requirements of the proposed design, including but not limited to the geotechnical risk(s) outlined in the risk assessment.
- For sites with existing infrastructure (Site 1, 4, 7, 8 & 9) request existing design plan including geotechnical investigation factual and interpretive reports to assist in further developing geotechnical risk, planning future geotechnical investigations and determining interaction(s) with existing earthworks resulting in ground disturbance (i.e. cut / fill pads).

6.3 Erosion

- Revise the IECA Erosion Hazard Assessment with data from site specific geotechnical investigation.

6.4 Contamination

- Sites 1 and 4 have been subject to contaminated land investigations and the contamination status is defined. A suitably qualified consultant is recommended to be engaged to review the existing data and determine if further assessment is required for any proposed ground disturbance within these sites. No interaction with groundwater is to occur without the development of a groundwater management plan in accordance with site requirements.
- Assessment of proposed areas of soil disturbance are recommended to be completed at Sites 7, 8 and 9 prior to any works being completed. Potential for contamination has been identified at these sites; therefore, a preliminary site investigation is recommended to provide a detailed assessment of the potential for contaminated soil and groundwater to be present.
- Proposed works at Sites 2, 3, 5, 6 and 10 are low risk, therefore, no additional assessment is necessary from a contaminated land perspective. Should additional information become available that indicates potential contamination, or visual evidence of potential contamination be identified on these sites, then a preliminary site investigation would be recommended.

7. REFERENCES

- BoM. (2025, August). *Australian Groundwater Explorer*. (Bureau of Meteorology) Retrieved from Bureau of Meteorology: <http://www.bom.gov.au/water/groundwater/explorer/map.shtml>
- Cho, J.-L., Park, J.-G., & Humphreys, W. F. (2005). A new genus and six new species of the Parabathynellidae (Bathynellacea, Syncarida) from the Kimberley region, Western Australia. *Journal of Natural History*, 39(24), 2225-2255. doi:10.1080/00222930400014148
- CSIRO. (2011). *Atlas of Australian Acid Sulfate Soils*. (R. Fitzpatrick, B. Powell, S. Marvanek, Editors, & CSIRO) Retrieved 2025, from CSIRO Data Access Portal: <https://doi.org/10.4225/08/512E79A0BC589>
- DWER. (2025). *WA Department of Water and Environmental Regulation*. Retrieved August 04, 2025, from Contaminated Land Map Viewer: <https://dow.maps.arcgis.com/apps/webappviewer/index.html?id=c2ecb74291ae4da2ac32c441819c6d47>
- GA. (2025). *Geoscience Australia Portal*. (Commonwealth of Australia) Retrieved from Geoscience Australia: <https://portal.ga.gov.au/>
- Humphreys, W. F. (1999). Relict stygofaunas living in sea salt, karst and calcrete habitats in arid northwestern Australia contain many ancient lineages. (W. Ponder, & D. Lunney, Eds.) *The Other 99%: The Conservation and Biodiversity of Invertebrates*. doi:<https://doi.org/10.7882/RZSNSW.1999.036>
- International Erosion Control Association. (2008). *Best Practice Erosion & Sediment Control Book 1-3*.
- Landgate. (2025). *Landgate (WA Land Information Authority)*. Retrieved August 04, 2025, from Map Viewer Plus: <https://www.landgate.wa.gov.au/location-data-and-services/maps/online-maps/map-viewer-plus/>
- Phoenix. (2017, August 15). Subterranean fauna desktop assessment – Shamrock Station Irrigation Project. Perth, WA, Australia: Phoenix Environmental Services.
- Plan WA. (2025). *Department of Planning, Lands and Heritage (WA)*. Retrieved 08 04, 2025, from Plan WA: <https://espatial.dplh.wa.gov.au/planwa/Index.html?viewer=planwa>
- Shire of Broome. (2025). *Shire of Broome Online Mapping*. Retrieved August 04, 2025, from <https://www.broome.wa.gov.au/Shire-Services/Planning/Online-mapping>
- Shire of Derby/West Kimberley. (2025). *Western Australian Government*. Retrieved August 04, 2025, from Shire of Derby/West Kimberley Planning Information: <https://www.wa.gov.au/government/document-collections/shire-of-derbywest-kimberley-planning-information>

1.

2. Geotechnical Assessment Data Sources

- Client supplied geotechnical investigation data:
 - Douglas Partners (2012). Report on Preliminary Geotechnical Investigation Proposed Subdivision, Project No.: 76353, Rev 1. Dated 23/07/2012.
 - TABEC Civil Engineer Consultants (2017). BROOME NORTH STRUCTURE PLAN – STAGE 2 ENGINEERING INFRASTRUCTURE REPORT, Project: 2287 – BROOME NORTH LDP2, Rev 8. Dated 24/11/2017.
 - UTS Soiltec (2025). Site Classification at Lot 9010 Site 1 Nagula Court, Cable Beach Broome. Reference: D712 S. Dated 30/02/2025.
 - WANT Geotechnics (2021). Geotechnical Investigation Report for the Proposed Energy Storage Systems Broome and Derby, Western Australia. Project No: NTG20212276. Rev A. Dated 2/10/2021.
- Publicly available geotechnical investigation data:
 - Talis Consultants (2021). Site Investigation Report – Broome Regional Resource Recovery Park – Site D2. Project.: TW19118, Rev 2A. Dated 12/02/2021
 - Verheyde, F Douglas Partners (2010). WEST KIMBERLEY REGIONAL PRISON, AUSTRALIA - A CASE STUDY OF SITE UNDERLAIN BY COLLAPSING SOILS, 3rd International Conference on Problematic Soils, 7 -9 April 2010, Adelaide, Australia.
- Other (publicly available) information:

- Bureau of Meteorology. (2025). Australian Groundwater Explorer. Retrieved from Bureau of Meteorology: <http://www.bom.gov.au/water/groundwater/explorer/map.shtml> Accessed 07 August 2025.
- State of Western Australia, Department of Primary Industries and Regional Development (2025). Soil Landscape Mapping - Best Available (DPIRD-027) <https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available> Accessed 27/08/2025
- Government of Western Australia, Department of Energy, Mines, Industry Regulation & Safety Bookshop (2025). 1:250:000 Geology. [1:250 000 geology - Department of Energy, Mines, Industry Regulation and Safety Bookshop](https://www.wa.gov.au/government/document-collections/department-of-energy-mines-industry-regulation-and-safety-bookshop) Accessed 27/08/2025
- Government of Western Australia, Department of Mines, Petroleum and Exploration (2025). GeoVIEW.WA Geological Survey of Western Australia Accessed 27/08/2025

3. Contamination Risk Assessment

- Department of Planning, Lands and Heritage (Plan WA), <https://espatial.dplh.wa.gov.au/planwa/Index.html?viewer=planwa> Accessed 04-05 August 2025
- Shire of Broome, <https://www.broome.wa.gov.au/Shire-Services/Planning/Online-mapping> Accessed 04-05 August 2025
- Landgate (WA Land Information Authority), <https://www.landgate.wa.gov.au/location-data-and-services/maps/online-maps/map-viewer-plus/>, Accessed 04-05 August 2025
- Department of Water and Environmental Regulation (WA), <https://dow.maps.arcgis.com/apps/webappviewer/> Accessed 04-05 August 2025
- Western Australian Government Shire of Derby/West Kimberley Planning information , <https://www.wa.gov.au/government/document-collections/shire-of-derbywest-kimberley-planning-information> Accessed 04-05 August 2025

4. Hydrology and Erosion (Renewable Sites Only)

- International Erosion Control Association. (2208). *Best Practices Erosion & Sediment Control Book 1-3*.
- Viscarra Rossel, Raphael; Teng, Hongfen; Zhou, Shi; Behrens, Thorsten; Chappell, Adrian; & Bui, Elisabeth (2016): Maps of Australian soil loss by water erosion derived using the RUSLE. v1. CSIRO. Data Collection. <https://doi.org/10.4225/08/582cef2dd5966>
- Geoscience Australia. (2025). Geoscience Australia Portal. (Commonwealth of Australia) Retrieved from Geoscience Australia: <https://portal.ga.gov.au/> Accessed 07 August 2025
- State of Western Australia, Department of Primary Industries and Regional Development. Soil Landscape Mapping - Best Available (DPIRD-027) <https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available> Accessed 04/08/2025
- State of Western Australia, Department of Primary Industries and Regional Development. Hydrographic Catchments - Catchments (DWER-028) <https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available> [Hydrographic Catchments - Catchments \(DWER-028\) - Datasets - data.wa.gov.au](https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments) Accessed 04/08/2025
- State of Western Australia, Department of Primary Industries and Regional Development. Hydrographic Catchments - Subcatchments (DWER-030) [Hydrographic Catchments - Subcatchments \(DWER-030\) - Datasets - data.wa.gov.au](https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments) Accessed 04/08/2025
- State of Western Australia, Department of Primary Industries and Regional Development. FPM Floodplain Area (DWER-020) [FPM Floodplain Area \(DWER-020\) - Datasets - data.wa.gov.au](https://catalogue.data.wa.gov.au/dataset/fpm-floodplain-area) Accessed 04/08/2025

5. Groundwater and Acid Sulfate Soils (Renewable Sites Only)

- Bureau of Meteorology. (2025). Australian Groundwater Explorer. Retrieved from Bureau of Meteorology: <http://www.bom.gov.au/water/groundwater/explorer/map.shtml> Accessed 07 August 2025
- CSIRO. (2011). Atlas of Australian Acid Sulfate Soils. (R. Fitzpatrick, B. Powell, S. Marvanek, Editors, & CSIRO) Retrieved 2025, from CSIRO Data Access Portal: <https://doi.org/10.4225/08/512E79A0BC589> Accessed 8 August 2025

6. Subterranean Fauna (Renewable Sites Only)

- Cho, J.-L., Park, J.-G., & Humphreys, W. F. (2005). A new genus and six new species of the Parabathynellidae (Bathynellacea, Syncarida) from the Kimberley region, Western Australia. *Journal of Natural History*, 39(24), 2225-2255. doi:10.1080/00222930400014148
- Humphreys, W. F. (1999). Relict stygofaunas living in sea salt, karst and calcrete habitats in arid northwestern Australia contain many ancient lineages. (W. Ponder, & D. Lunney, Eds.) *The Other 99%: The Conservation and Biodiversity of Invertebrates*. doi: <https://doi.org/10.7882/RZSNSW.1999.036>
- Phoenix. (2017, August 15). Subterranean fauna desktop assessment – Shamrock Station Irrigation Project. Perth, WA, Australia: Phoenix Environmental Services.

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