

Appendix 11. Land Soils and Geology

11.3. Technical Note - Ground Conditions and Preliminary Foundation Design Commentary (AtkinsRealis, 2026)

Cashla Peaker Plant: Ground Conditions and Preliminary Foundation Design Commentary: Technical Note

SUBJECT

Ground Conditions and Preliminary Foundation Design Commentary

PROJECT NO.**DATE**

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AUTHOR

CW

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TECHNICAL NOTE

1. Introduction

AtkinsRéalis have been appointed by Bórd Gáis Energy (BGE) Limited (hereafter referred to as 'BGE') to prepare the planning application design and accompanying EIA/R for the Peaker Open Cycle Gas Turbine (OCGT) power plant in Pollnagroagh/Rathmorrissy, Athenry, Co. Galway.

The proposed development will consist of the following main components:

- An open cycle gas turbine (OCGT) plant primarily fuelled by natural gas
- One emissions stack and balance of plant.
- 220kV electrical transformer
- Secondary fuel storage and transfer facilities
- New workshop, stores, car park and administration building
- Above ground gas installation (AGI)
- Ancillary grid connection infrastructure,
- Ancillary infrastructure including internal roads, external lighting, security fencing, utilities and drainage,
- Soft landscaping to enhance site integration and visual screening, and
- High voltage connection to the existing Cashla Substation.

1.1 Purpose & Objective

AtkinsRéalis have been tasked with reviewing the ground investigation and geophysical survey data undertaken by Priority Geotechnical Limited, identifying any ground-related risks and making preliminary foundation recommendations and earthworks commentary in terms of geotechnical design.

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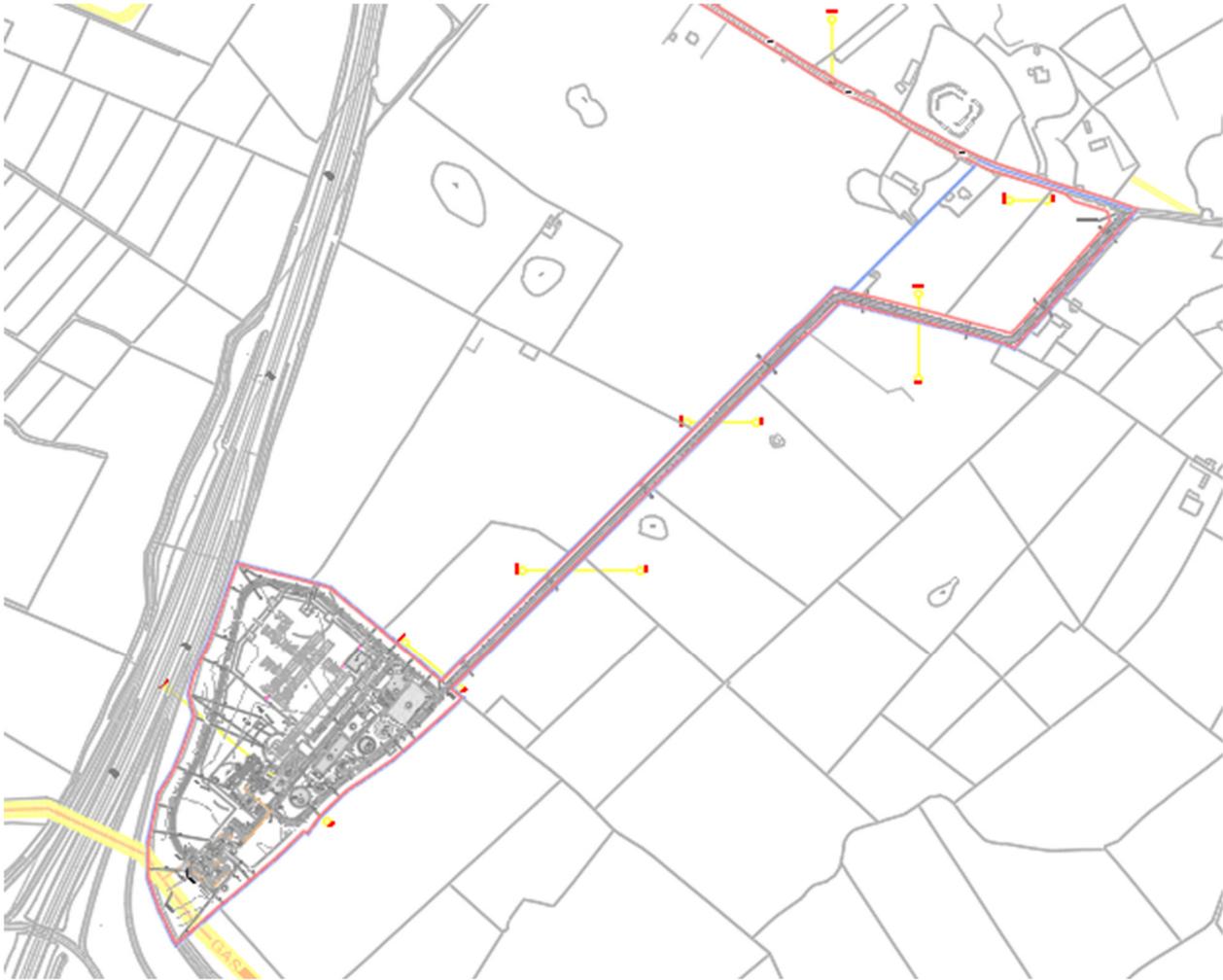


Figure 1.1 – Image of the site layout and access route

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2. Desktop Study

This section outlines the sources that were used to obtain geotechnical, historical and environmental information relating to the site. Along with the Priority Geotechnical Limited ground investigation reports, online references from Geological Survey Ireland (GSI) were utilised to determine these findings.

According to the GSI online mapping information the bedrock is part of the western lowland karst region described as pale limestone and the Quaternary sediment consists of glacial till and gravels derived from Limestones and Eskers comprised of gravels basic reaction and Karstified bedrock outcrop or subcrop. There are bedrock outcrops and subcrop located at the Peaker Plant area and the access route (Figure 2.1 and Figure 2.2).

Several karst features identified by GSI online mapping within the vicinity of the site. Karst features are described as enclosed depressions (Figure 2.3).

Groundwater Vulnerability & Resources Maps indicate that the majority of the proposed site is Extreme to High vulnerability with isolated areas of moderate and the bedrock aquifer is Regionally important Aquifer- Karstified (conduit) as shown in Figure 2.4.

Based on the findings of the desk-based study, there is no evidence of any reported active quarries, mineral localities, historic mines, landslide or geological heritage sites within the study area or vicinity according to GSI (2023). No potential sources of contamination were identified during the desk study and site investigation phase.

Aerial photography obtained from generally available online satellite imagery sources (Google Maps and GSI Base Maps) show that road and motorways had been constructed over the years in the vicinity of the project area. However the project area is generally similar to present day use as agricultural, rural scrubland and residential. Aerial photographs throughout from 1995 to 2025 also shows the presence of the local water ponds.

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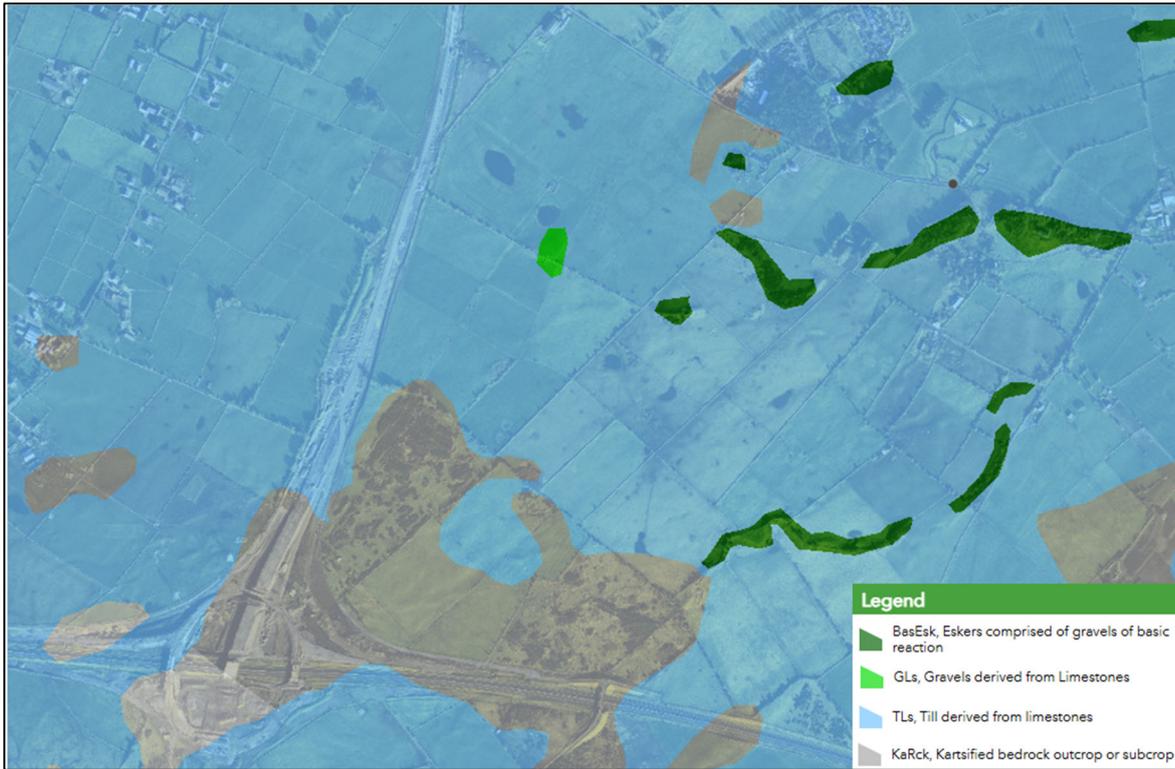


Figure 2.1 - Quaternary Sediment Map, (GSI)

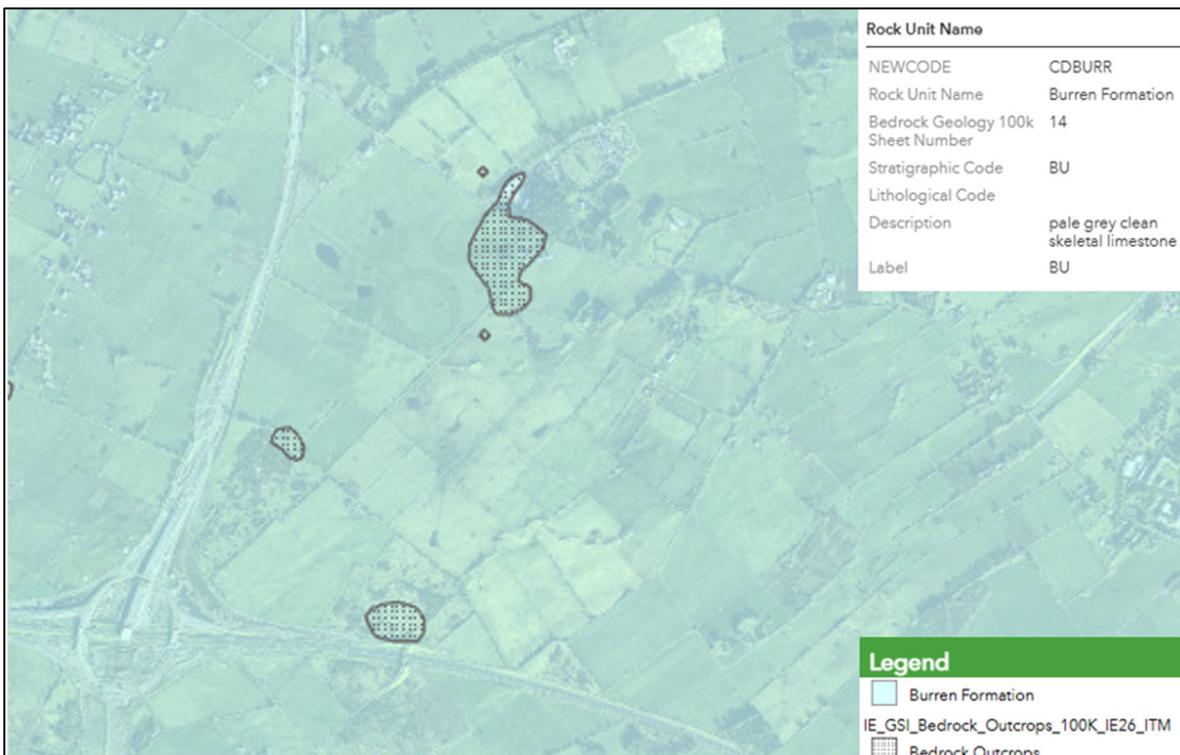


Figure 2.2 – Bedrock Geology Map, (GSI)

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Figure 2.3 - Karst Landforms at the vicinity of the site (GSI)

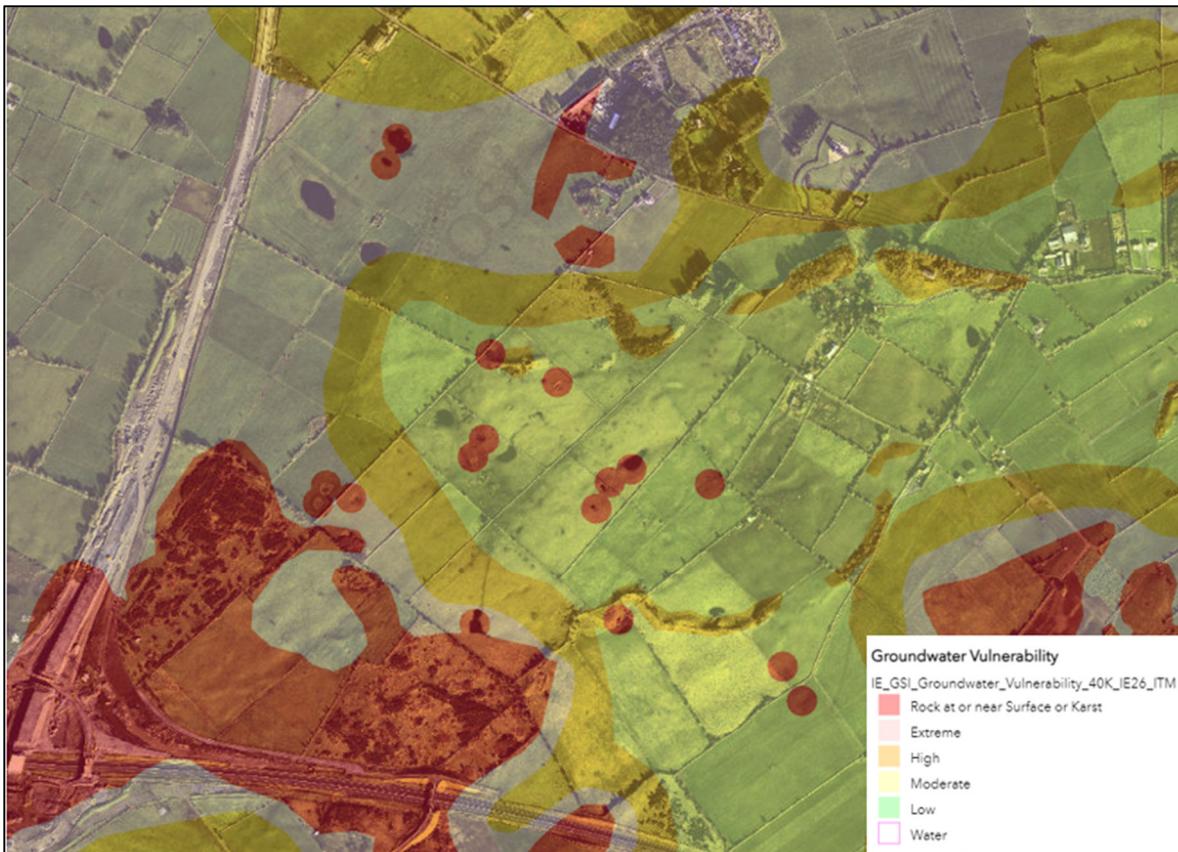
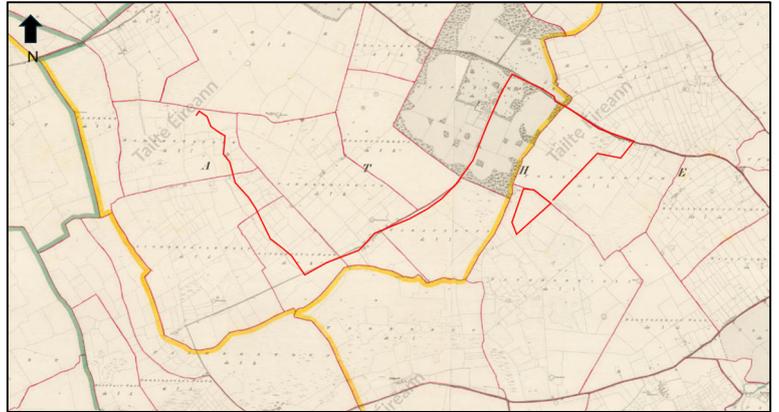


Figure 2.4 - Groundwater Vulnerability Map, (GSI)

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Description

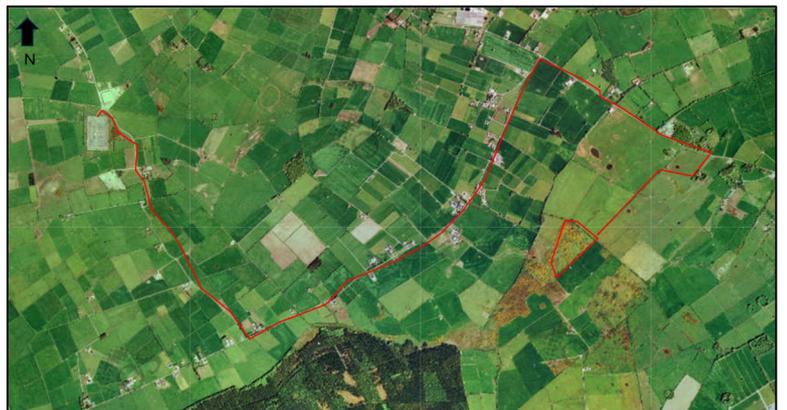
Map Genie 6 Inch First Edition 1829-1841 (OSI, 2025) - The Proposed Project, and its surrounds is dominated by agricultural use.



Map Genie 25 Inch BW 1995 (OSI, 2025) – No significant change noted.



Map Genie 1996 to 2000 (OSI, 2025) – No significant change noted.



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Map Genie 2001-2005 (OSI, 2025) - No significant change noted.



Map Genie 2011-2013 (OSI, 2025) - Aerial photography between 2011-2013 shows the development of the M6 Road to the South of the Proposed Project.



Map Genie 2013-2018 (OSI, 2025) - The aerial photography between 2013 – 2018 shows the development of national roads such as the M17, M18, M6 and the associated interchange adjacent to the Proposed Project.



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Google Maps (2025) – No significant changes noted in present day. Large industrial development noted circa (ca.) 2.5km east of the Proposed Project.



Figure 2.5 – Historical view of the study area (2018 - 1995)

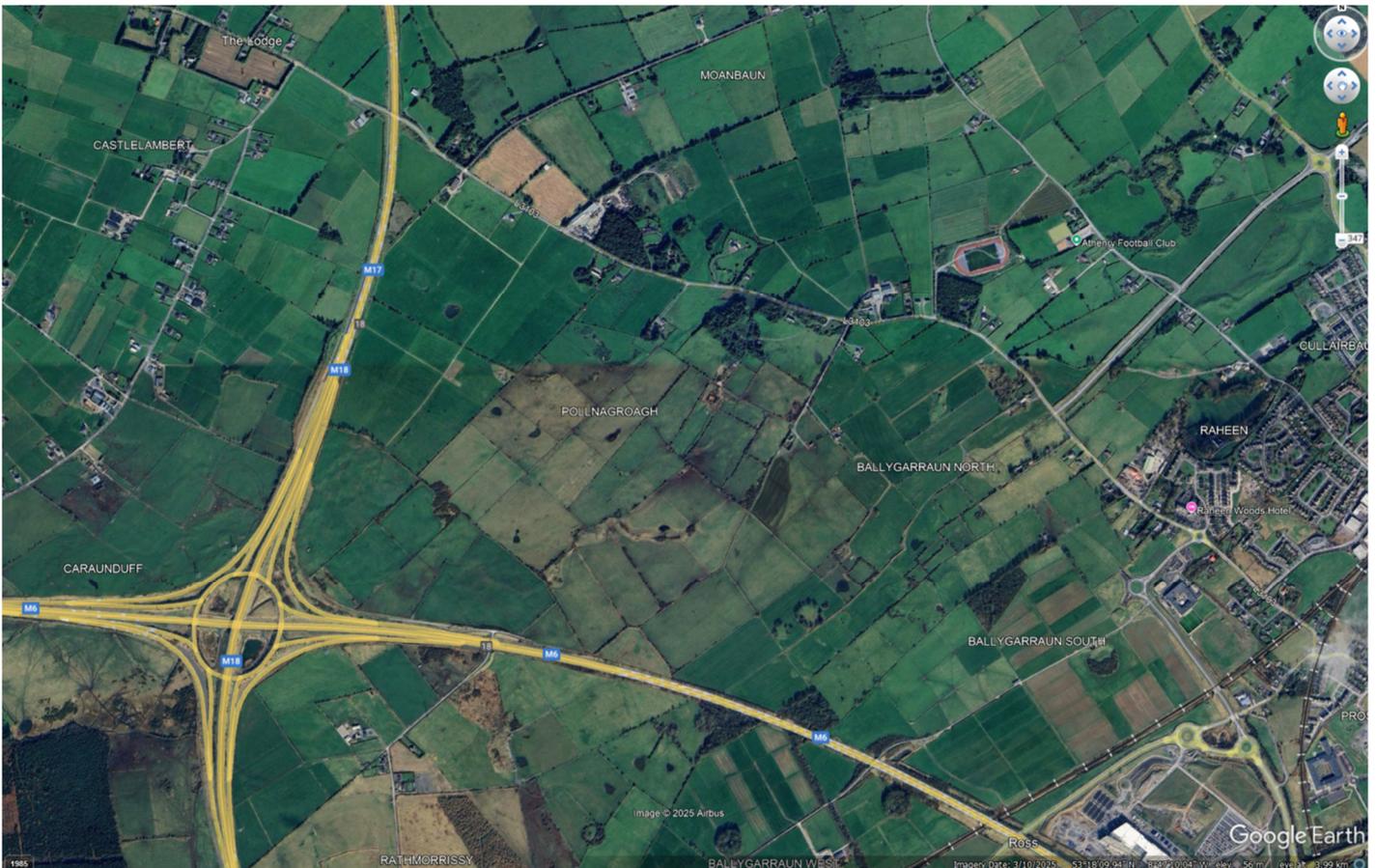


Figure 2.6 - Satellite view of the study area (2025)

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3. Ground Investigation

An intrusive site investigation was undertaken by Priority Geotechnical Limited between the 17th February and 19th March, 2025 which included a geophysical survey undertaken by Terra Company.

3.1 Geotechnical Investigation

The site investigation intrusive works comprised 4 no. cable percussion borehole with rotary follow on and 7 no. Trial Pits (T01 to TP07) on the peaker plant site itself. During the site works some of the cable percussion boreholes are re-located due to the presence of a high boulder and cobble content.

Trial pits from T08 to TP13 (7 in total) and from TP14 to TP17 (4 in total) were carried out to determine ground conditions along the western and eastern access route options, respectively.

Based on the findings obtained from the borehole data, rotary core samples, and trial pit logs, a stratigraphy of the site has been outlined and is summarised in 4.



Figure 3.1 – Site Investigation Locations

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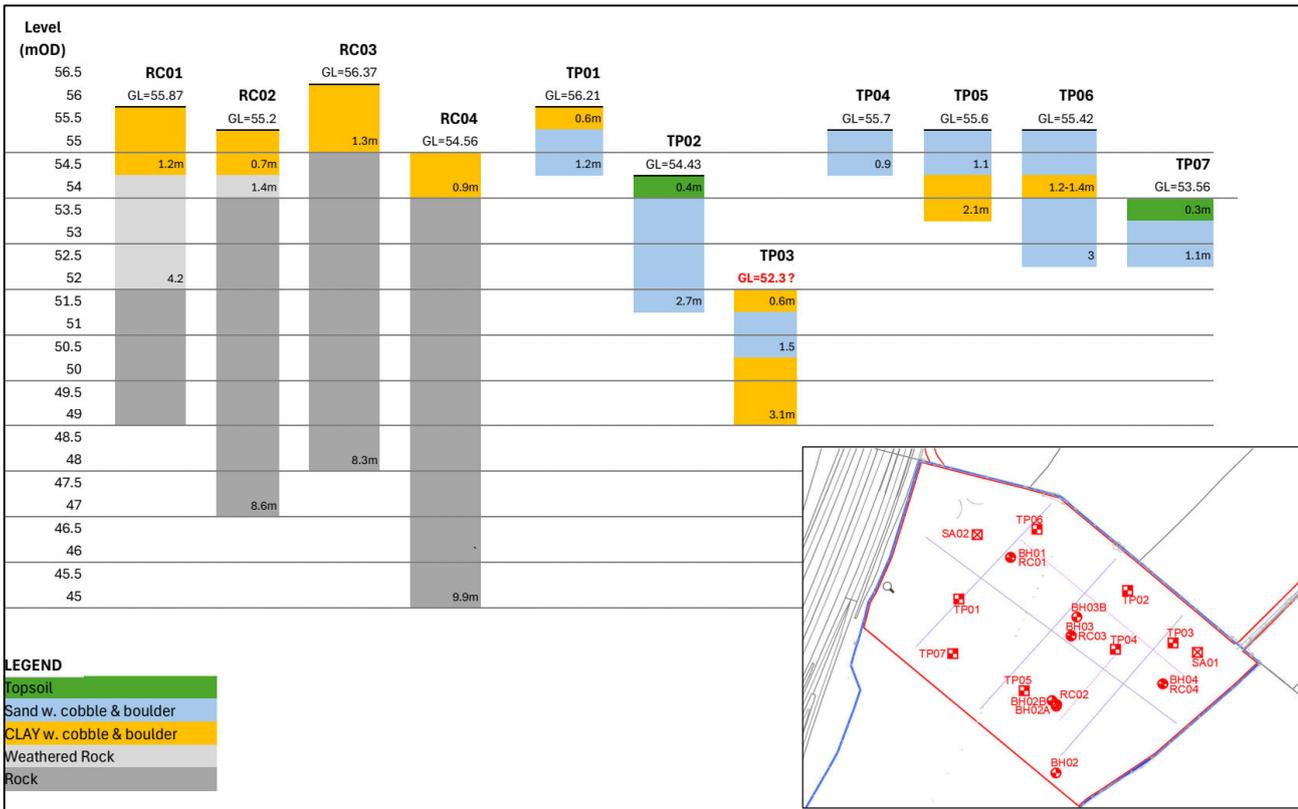


Figure 3.2 - Draft Exploratory Hole Cross Sections at Plant location

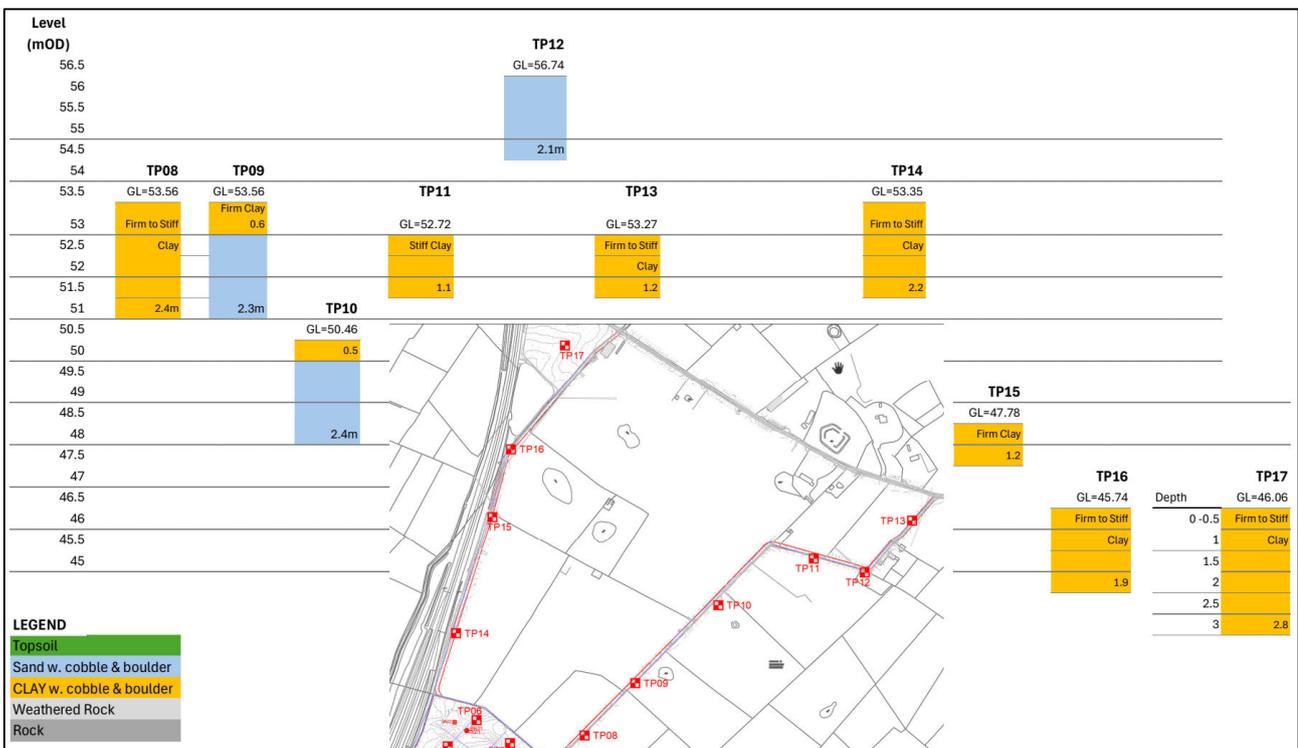


Figure 3.3 - Draft Exploratory Hole Cross Sections at Access Routes

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Figure 3.4 - Photos of trial pits TP01 and TP02 respectively



Figure 3.5 - Photos of TP03 location and pit respectively



Figure 3.6 - Photos of trial pits TP04 and TP05 respectively

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Figure 3.7 - Photos of trial pits TP08 and TP09 respectively



Figure 3.8 - Photos of trial pits TP13 and TP14 respectively

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3.2 Geophysical Investigation

A Geophysical Survey Report has been prepared by Terra Survey company and can be summarised as follows:

- Geophysical Interpretation: Across the survey area reveals a stratigraphic sequence consisting of Sandy gravelly Clay Overburden, underlain by a highly weathered Limestone with fresh bedrock located underneath. Numerous areas within the bedrock were flagged as suspect for karstification. Sharp lateral resistivity change have been identified and these anomalies were interpreted to represent potential karstified features. The anomalous zones were categorized in the below table according to priority levels.
- Anomalies A9 through to anomaly A18 are all pockets of high resistivity close to the surface within 15m, these areas of high resistivity were flagged as possible air or clay filled voids.

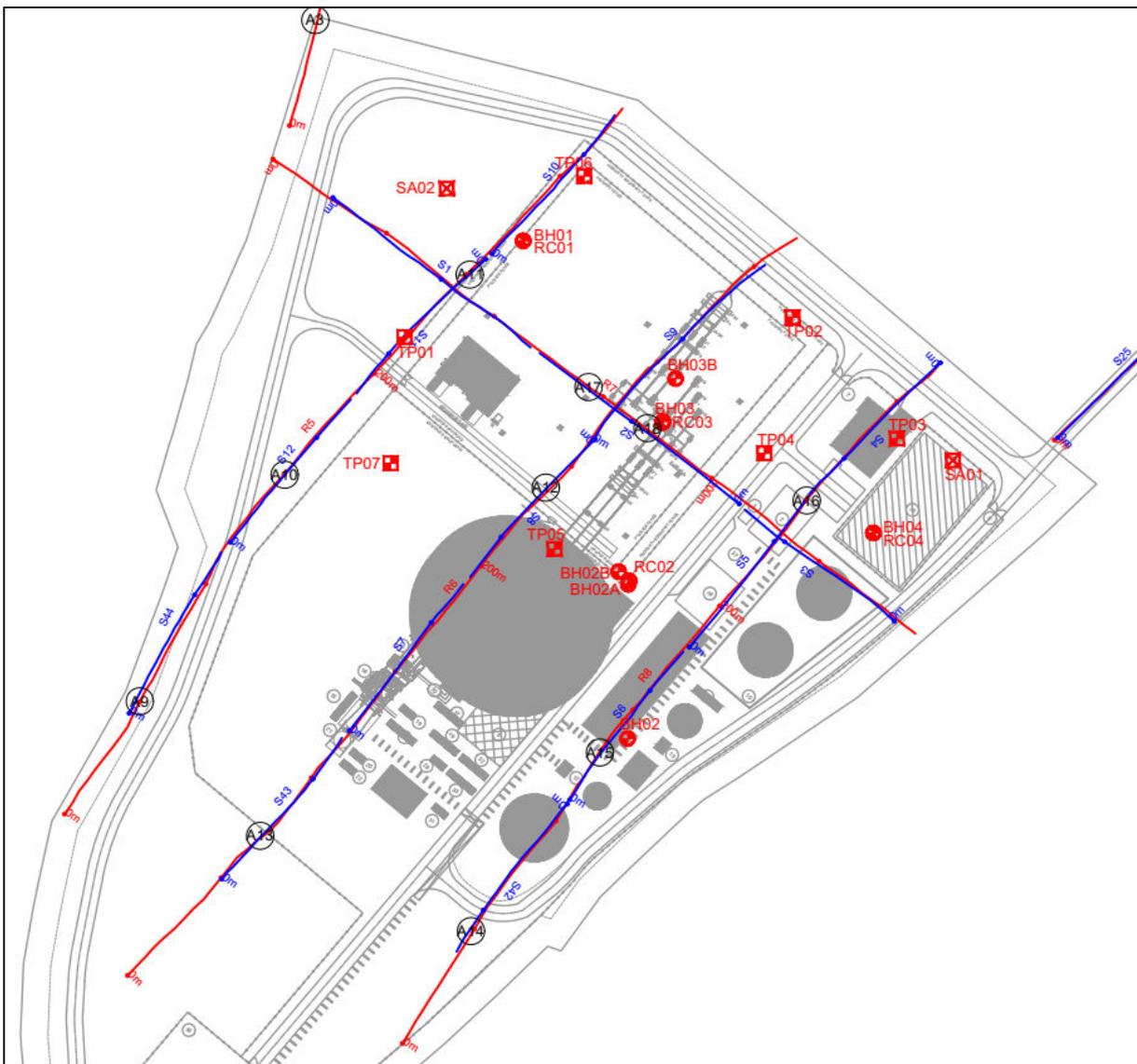


Figure 3.9 – Ground Investigation Layout Plan with the Geophysical survey section lines

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Table 3-1 - Anomalies encountered in Geophysical survey

Name	Easting	Northing	Depth of interest [m bgl]	Priority	Note
A1	547302.3	728710.6	20	High	Very notable low resistivity extending to depth, suspect a sinkhole here, at edge of ERT so depth of penetration maxed out on ERT
A2	547389.1	728688.4	15	Low	Small area of resistivity
A3	546492.4	728376.9	20	Medium	Area of low resistivity extending to depth, suspect karst
A4	546576.4	728644.6	40	High	We have 250m of anomalously low resistivity extending to a depth of 40m bgl, highly suspect karst in this area
A5	546647.3	728873.1	30	Low	Similar to A4, suspect karst
A6	546714.2	728994.0	30	High	Very strong low resistivity extending to depth
A7	547260.0	728722.1	30	Medium	Similar to A1
A8	547093.1	728551.5	30	High	Very strong low resistivity extending to depth
A9	546428.0	728124.8	15	High	Very high resistivity, possible air void
A10	546481.2	728208.6	15	Medium	Very high resistivity, possible air void
A11	546549.1	728282.7	15	Medium	Slightly high resistivity, possible air void
A12	546577.0	728203.8	20	High	Very high resistivity, possible air void
A13	546472.2	728075.0	20	Medium	Slightly high resistivity, possible air void
A14	546549.6	728039.7	20	High	Very high resistivity, possible air void
A15	546597.4	728106.1	20	High	Very high resistivity, possible air void
A16	546672.8	728199.1	15	High	Very high resistivity, possible air void
A17	546592.7	728241.1	20	High	Very high resistivity, possible air void
A18	546613.8	728225.6	20	Low	Slightly high resistivity, possible air void

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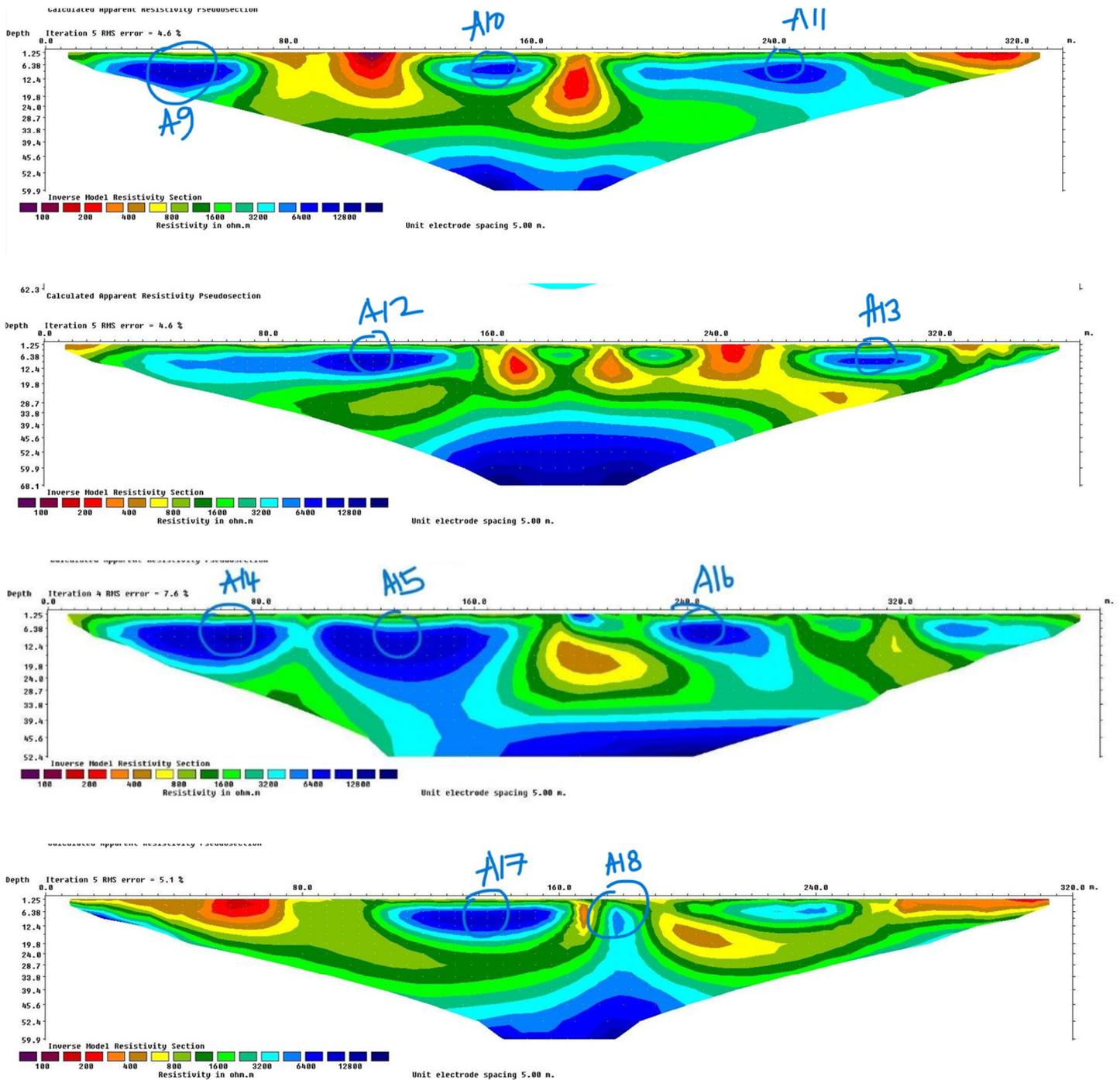


Figure 3.10 – Geophysical Profile of R5, R6, R7 and R8

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4. Groundwater

Based on the available data groundwater was encountered only in the rotary cored boreholes (RC01 to RC04) at depths ranging from 5.2 m to 7.3 m below ground level (m bgl), where standpipes were installed for future monitoring within the Open Cycle Gas Turbine (OCGT) power station site.

No groundwater was encountered during the excavation of trial pits or in the cable percussion boreholes. Notably, Trial Pit TP03 was excavated in close proximity to surface water ponds observed on site, yet no groundwater ingress was recorded in the log for TP03 (refer to Figure 3.5).

Groundwater strikes and groundwater monitoring data is presented in Table 4-1.

Groundwater impact on Construction

Based on the presented data in Priority Ltd Factual Report (initial strikes) and subsequent groundwater monitoring data obtained on 03/06/2025, ground water was encountered at depths varying between 5.2m and 7.3m below ground level in the rotary cores only. No groundwater was encountered in the trial pits.

Cognisant of proposed excavation depth along the access route and Peaker Plant area is up to 1.8m level and in average 1.5m, it is envisaged that groundwater is not expected to impact the excavation of either roads or plant and building foundations.

Table 4-1 - Groundwater Strikes & follow on stand pipe readings

Location	Groundwater Strike (m bgl)		Groundwater Monitoring (m bgl)	Remarks
	28/02/2025	03/03/2025	03/06/2025	
BH01	-			Dry
BH02	-			Dry
BH02A	-			Dry
BH02B	-			Dry
BH03	-			Dry
BH03B	-			Dry
BH04	-			Dry
RC01	5.2	-	Dry	-
RC02	6.5	-	7.25	-
RC03	6.0	5.0	7.13	-
RC04	5.9	-	5.94	-
SA01	-			None encountered
SA02	-			None encountered
TP01	-			None encountered

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TP02	-			None encountered
TP03	-			None encountered
TP04	-			None encountered
TP05	-			None encountered
TP06	-			None encountered
TP07	-			None encountered
TP08	-			None encountered
TP09	-			None encountered
TP10	-			None encountered
TP11	-			None encountered
TP12	-			None encountered
TP13	-			None encountered
TP14	-			None encountered
TP15	-			None encountered
TP16	-			None encountered
TP17	-			None encountered

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5. Ground Summary

Based on the findings obtained from desktop study, borehole data, rotary core samples, trial pit logs and geophysical survey, a preliminary stratigraphy of the site has been outlined and is summarized below. It is important to note that this stratigraphy represents an approximate interpretation based on the current data and further analysis may be required to refine and validate these initial observations.

- 0 – 0.3m: Topsoil
- 0.3 – 3.1 m: Overburden material consists of mostly Firm to Stiff CLAY and/or Sand and Gravel having cobbles and large boulders.
- > 1.2m: Weathered Limestone
- > 4.2m: Limestone bedrock

Topsoil:

Topsoil was encountered 0.2m to 0.4m below ground level.

Clay:

Clay layer was encountered below topsoil and described as sandy gravelly Firm to Stiff CLAY with low boulder content. Boulders were 200-450mm in diameter. In TP05 boulder sizes were 200-1200mm in diameter.

Firm to stiff Clay were extensively encountered and up to 2.8m below ground level at the trial pits TP08 to TP17 which are located at west and east access routes.

The over burden material was described as Clay in rotary core holes, however in cable percussive boreholes soil was described as gravel at the same holes in the proposed Peaker Plant area. Thus laboratory test results are needed to clearly describe the presence of Clay in Plant area.

Sand / Gravel:

Sand/Gravel was described as clayey, gravelly Sand/Gravel with medium to high boulder content with 200-850mm in diameter. In TP05 boulders sizes were encountered 200 to 1200mm.

Rock:

Bedrock was described as moderately to heavily weathered, medium strong to very strong, grey, fossiliferous, LIMESTONE in rotary core holes. Total core recovery at the boreholes were almost 100 % and the RQD Values ranges from 0 to 100 %.

The rock head was noted at 0.7m to 1.3m below ground level in rotary core holes.

In trial pits the Sand/Gravel were encountered up to a depth of 3m below ground level. When the trial pit photos are examined carefully, it can be concluded that encountered Sand/Gravel at the trail pits may be the product of weathered rock.

According the Geophysical Survey Report, numerous areas were flagged as suspect for karstification within Limestone bedrock such as possible air-filled voids or indicative of clay-filled voids

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6. Foundations

The Peaker plant facility comprises several single storey buildings, the open cycle gas turbine itself (with 30m vent stack), associated ancillary plant together with several liquid tanks storing diesel and demineralised water.

At the peaker plant location, the underlying rock is generally shallow (0.9m to 3.1m bgl), with rotary core samples showing intact rock with varying degrees of surface weathering. Along the site access road (trial pits 8 to 13) the rock head is typically located at 1.2m to 2.7m bgl. We note the geophysical survey suggests the presence of possible karst features extending to depths of up to 20m

A **robust karst protocol** will therefore be adapted during foundation construction comprising the following:

- Soil strip across each foundation footprint to expose the bedrock surface.
- Targeted closely spaced proof coring to confirm the presence of any possible Karst within 15 to 20m of the bedrock surface. The spacings between proof cores will vary depending on the plan dimension of the structure involved however it is expected that 1.5 to 2m spacing would be adapted under the heavier items of plant.
- If no significant voids or Karst features are encountered during the proof coring process then Foundation Solution 1 will be adapted.
- If a significant Karst feature is encountered during the proof coring process then Foundation Solution 2 will be adapted.

Foundation Solution 1:

In the event the targeted proof coring confirms no significant Karst features are present it is envisaged that traditional reinforced concrete (RC) raft and strip foundations (founded directly on the limestone bedrock) will be adequate for the proposed plant and single storey buildings. For the single storey buildings a traditional reinforced concrete strip foundation will be founded directly on the weathered bedrock. This strip foundations for single storey buildings will be in the order of 1m wide by 300 to 400mm deep. Pad foundations for any columns that form part of the single storey buildings will be in the order of 1.5m square x 500mm deep. Where the rock head is deeper than 1.2m, C15 blinding concrete will be used to avoid fixing reinforcement at depth.

For the heavier items of plant / tanks we expect the top surface of weathered bedrock will be 'ripped' down to unweathered bedrock with the reinforced concrete foundations founded on this un-weathered rock. RC Foundations to heavier plant items will be in the order of 500 to 700mm deep and will occupy the plan footprint of the item of plant. These reinforced foundations will be designed to span over any minor surface karst fissures encountered at the bedrock formation level (exposed as part of the local overburden soil strip at the foundation locations).

Foundation Solution 2:

In the event that the abovementioned targeted proof coring exercise identifies a Karst feature under the footprint of a heavy item of plant it is envisaged that a piled foundation solution will be required locally at the karst feature. This piled foundation solution will comprise cased Odex drilled piles. We note the piles will need to be cased to mitigate the risk of grout loss and negate the risk of aquifer contamination. In terms of piling plant, we note an Odex piling rig is typically used for piling through karst. A reinforced concrete pile cap or ground beams (located just below ground level) will be built on top of the piles to support the plant or building above as applicable. In terms of reinforced concrete foundation

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footprint (on plan), Solution 1 and Solution 2 will be virtually identical with the only varying item being the introduction of local piling at any karst voids encountered. In terms of piling quantum the depth and spacing of same will depend on the size of the karst feature encountered. In the event the karst feature is not significant then 200 to 300mm diameter micro-piles at 900mm centres will provide the solution with the steel casing provided to the micro-pile designed to span through any voids. Under more heavily loaded plant items (such as the Gas Turbine itself) a larger 450mm diameter pile diameter will be adapted with a centre to centre spacing of 1.35m (equating to 3 times the pile diameter). Depending on the depth of the karst void encountered we envisage a maximum pile depth of 35m being required (for both the micro-piles and the larger 450mm diameter pile).

Site Access Road: The access road to the peaker plant site will be designed for the heavy vehicular plant that will both construct and maintain the peaker plant. The design vehicular loadings will include the abnormal loads associated with the gas turbine transport. The site access road construction will typically comprise granular 6F2 capping material (founded on competent subgrade confirmed via on-site CBR testing) with a Clause 804 granular sub-base and stone matrix asphalt wearing and surface courses as is typical for standard road construction.

We note the access road crosses several suspected karst features identified as part of the geophysical site investigation work and again a robust karst protocol shall be adapted here as follows:

The formations in the vicinity of the suspected karst features will be proof rolled and observed for signs of weakness with CBRs taken to confirm capacity. In any areas of low CBRs the top soil and overburden clay will be removed to expose the weathered rock surface. Any dips in the limestone rock surface will be infilled with granular 6F2 capping material laid and compacted in accordance with the TII specification for roadworks. The road construction above any significant karst features shall incorporate a high strength geotextile. This geotextile shall have a 100-year design life.

The above measures hence present a robust engineering solution to mitigate any risks associated with the presence of karst.

7. Earthworks

Earthworks will be conducted on the peaker plant site and access route. Excavation depth along the access route and Peaker Plant site is shown on the Civil Engineering cut and fill drawings that form part of the planning application pack.

- No made ground was recorded; topsoil (0.3–0.4m thick) and following subsequent layers up to the top of bedrock may be reused as Class 1 or 2 fill material following site-based testing.
- The excavated material is expected to be acceptable for re-use under TII Earthwork Specification standards (Table 6/1). Granular material is expected to be Class 1 Granular Fill material and due to cobble and large boulder content of the material, crushing may be required. Cohesive material is expected to be Class 2 Cohesive Fill material. Re-use of the material will be confirmed after receipt of the sieve analysis test results.
- Based on the ground investigation information, it is anticipated that weathered Limestone will be encountered in the excavations. It is expected to be easily ripped, due to the experience of the excavation during trial Pit works.
- Groundwater levels are expected to remain well below excavation depths based on the ground water monitoring results received as part of the Site Investigation.

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- In terms of control of rainwater run off during construction and until the permanent infiltration pond and hydrocarbon separators are operational, a temporary infiltration lagoon will be provided. The lagoon will be sized for the 1 in 10 year, 24 hour storm event and lined with permeable geotextile, filter aggregates, and sand to remove suspended solids before infiltration to groundwater. Surface water runoff generated during construction will be pumped to this lagoon for controlled infiltration to ensure the risk of groundwater /aquifer contamination is negated.

7.1 Assessment of Material

Based on the borehole and trial pit log descriptions and available trial pit pictures, the excavated material at the site will have the following classifications:

Table 7-1 - Classification of site material

Stratum	Expected Class of Fill	Comments
Firm to Stiff CLAY	Class 2	
Sand & Gravel – Granular	Class 1	Possibly weathered bedrock
Weathered / Intact Limestone	Class 1	

8. Conclusions

We note the boreholes and follow-on rotary coring did not encounter any Karst features or voids. Similarly, the base of trial pits did not encounter any open fissures or depressions and all terminated on solid limestone bedrock. In Karst areas it is standard investigative practice to carry out geophysical surveying to assess for the presence of Karst. Based on the results of the geophysical survey, several anomalies have been identified across the site area. Notably, these anomalies exhibit very high resistivity levels and indicate potential air voids or sediment filled voids at several resistivity points, ranging from A1 to A18. The presence of these high resistivity point suggests the possibility of karst formations or other subsurface pockets (either air voids or infilled with paleokarst sediment). From the desktop investigation this is as expected based on the regional geological setting.

We note the foundation solutions presented in Section 6.0 of this technical note present the engineering solutions that will respond to the presence of karst and at construction stage the robust karst protocols identified in Section 6.0 shall be implemented to control and respond to any karst features encountered. This hence ensures that the risk of landslide or structural collapse due to ground movement / subsidence (both during construction and operation) has been fully considered and designed out.