

Technical Note

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From: Robert Hutchison
CC: Nicole Cook
Date: 29 September 2025
Re: MAG Argosy

1.0 Introduction

This Technical Note (TN) outlines the ground conditions and summary of geotechnical issues relating to the above site, suitable for preliminary costing purposes.

2.0 Commentary on Proposed Geotechnical Solutions

There have been a number of geotechnical intervention measures presented in the documentation. These are:

- 2.1 Vibro Stone Columns – there have been mixed recommendations with regard to these. They have discounted in the site investigation report due to the soft layers and the risk of further degradation. They have been recommended by the Civil and Structural Engineer. On balance, VSC's are NOT recommended to be progressed, due to the aforementioned risks;
- 2.2 Controlled Modulus Columns (CMC's) – these can be technically utilized, however, they would be very small/short in nature, unless they were over bored into the underlying mudstone. Furthermore, there would be commercial issues with the installation of a working platform for the CMC rig to install the columns. It is recommended that CMC's are NOT progressed on commercial issues;
- 2.3 Lime/cement modification/stabilisation – while not specifically noted or tested for, it is intimated by the Civil and Structural Engineer that these methods are both allowed and required. These methods are discussed herein.

3.0 Summary of Ground Conditions

The ground conditions are, from a geological perspective, Made Ground overlying Devensian Till, overlying Bedrock (mudstone). Overlying this there are various hardstandings comprising site infrastructure and car parking.

It should be noted that the description of the ground conditions are based on highly limited data and the recommendations of further site investigation later in this technical note should be carried out.

For the purposes of engineering design, the overall sequence and thicknesses of the strata are:

- Made Ground – this ranges from 1.0m thick to 1.7m thick with an average of 1.35m thickness;
- The Till mainly comprises firm to stiff sandy, gravelly clay. There are bands and areas of soft clay and also granular materials within the Till. The Till has an average thickness of 3.55m; overlying
- Mudstone bedrock has been encountered at depths of 4.0m and 6.0m, with an average depth of 4.9m.

The Made Ground is a very heterogeneous material but it can be generally stated that the upper bounds of the Made Ground are granular in nature, with some of the deeper bands/materials being cohesive (clayey) in nature.

The till varies in strength both with depth and spatially. The low strengths measured by the SPT's may be localised softer bands of clay that have been softened by saturated granular bands or there may be errors or anomalies in the limited tests that have been carried out.

It should be noted that in BH02 where soft bands were noted, the sampler for the undisturbed sample took 419 blows to be driven in. This is abnormally high. Also at 3.5m depth, the strength is based on an SPT of 1, which is abnormally low in that material.

In broad terms, there is up to 0.5m of fill, coupled with a general cut of 0.5m. Localised the cut and fill does increase to 1m.

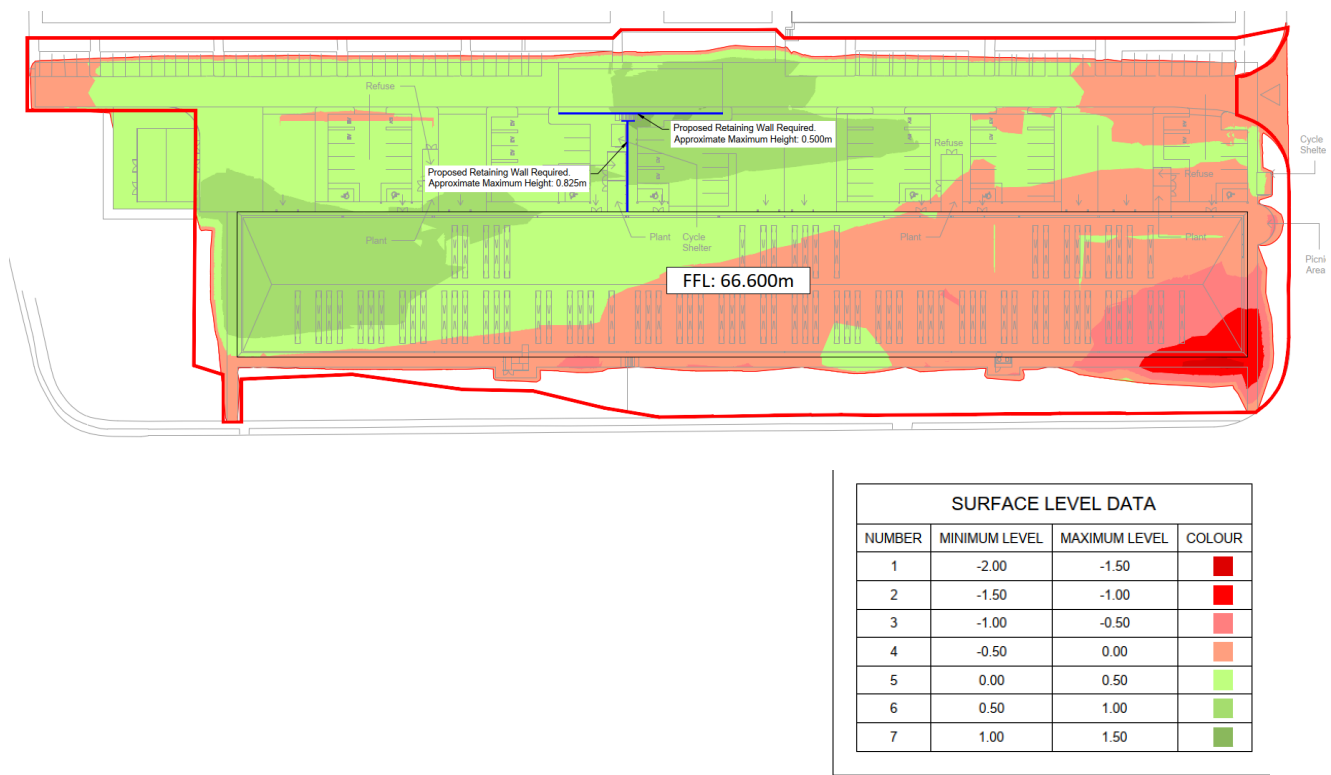


Figure 2.1 – Summary of cut and fill works for the Argosy works.

Groundwater was encountered throughout the ground investigation works and it was monitored post the investigation. The depth to the groundwater varies with the highest levels being encountered across the site ranging from 1.2m to 2.0m. When the levels are cross referenced with the boreholes, the water that was encountered is at the base of the Made Ground, resting on the Till.

For the purposes of temporary works design, it is recommended that any excavation deeper than 1.0m be expected to encounter groundwater. That said, due to the nature of the strata, the groundwater will be encountered as slight seepages and low influxes of surface water and/or precipitation. Therefore, dewatering in the form of sump and pumps be allowed for.

4.0 Bearing Capacity - Foundations

- 4.1 Given the tested and confirmed parameters, the foundations can achieve an ultimate limit state bearing capacity between 180kPa and 260kPa. However, due to the lack of credible design data at present, the low strengths that are questioned and the material variability, then it is recommended that the foundations are designed for the prescribed 150kPa.

- 4.2 There are restrictions on where the underside of the foundations will be. They will need to be designed for existing desiccation and also new planting schemes. At present, foundation depths of 1.25m should be allowed for.
- 4.3 The foundations will still meet the minimum design criteria related to settlement of total post construction settlement being less than 25mm, with the differential being less than 1 in 750. This is due, in part, to the shallow depth to bedrock, which makes settlement a low risk.
- 4.4 It is essential that the ground parameters are proven pre-construction with CPT testing. The CPT testing should be undertaken immediately if at all possible.

5.0 Bearing Capacity – Ground Bearing Floor Slabs

Ground bearing floor slabs can be adopted throughout. They will adequately support the imposed load of 50kPa.

It is recommended that given the ground risks involved that the subbase construction is of a stabilized construction. The subgrade can be taken as a design CBR of 3% for the natural materials, however, given the ground improvements herein, then the CBR of the subgrade can be improved to 5%.

There will be a subbase replacement layer of 300mm thick, with a Cement Bound Layer (CBM) of 30% CBR.

6.0 Bearing Capacity – External Works Slabs

In relation to the external works, the same recommendation in relation to the ground bearing floor slabs can be taken.

The existing subgrade can be taken as a 5% CBR with the improvement measures.

It should be noted that in the slab and pavement specification there are no geotechnical separators noted between the Type 1 etc. and the underlying subgrade. This is in error and it is recommended that a geotechnical separator is placed, if a traditional construction is progressed. If the CBM measures are implemented, then no separators will be required.

7.0 Slope Stability

Assessing the site levels and boundaries, it is envisaged that there will be no slope stability issues.

8.0 Retaining Structures

There are minor retaining walls noted on the drawings and they are to be contractor designed.

In the absence of any other data, it is recommended that for reasons of buildability, pre-cast units should be allowed for. Care should be taken to ensure that the surcharges that the precast units are designed for enable any temporary works to take place. Retaining walls can be designed for a bearing capacity of 150kPa.

9.0 Concrete Classification

The concrete classification can be taken as Design Sulphate Class DS-1 and Aggressive Chemical Environment for Concrete ACEC class of AC-1.

10.0 Earthworks and Ground Improvement

The following methods are recommended throughout the building area and site:

10.1 Rolling Dynamic Compaction (RDC):

- 10.1.1 This should be undertaken throughout the area to be filled first. The main point of undertaken the exercise will be to improve the Made Ground where possible;
- 10.1.2 Other goals of the RDC will be to highlight any soft spots and to tests and report on the subgrade stiffness of the soils;

- 10.1.3 Following improvement of the area to be filled, then the cut area should be treated with RDC. The main aspect of it will be to improve the variable thickness of Made Ground where it remained and again to prove soft spots and the stiffness of the subgrade.

10.2 Lime/cement modification:

- 10.2.1 The soils have been proven to have a design moisture content of 21%. In places (near surface) it does increase to 24%;
- 10.2.2 When lab testing has been undertaken it has been proven to have low CBR's below 3% at these moisture levels;
- 10.2.3 No earthworks testing has been undertaken but from a strength perspective then undrained shear strengths of 75kPa and 3% CBR are generally required for adequate compaction of further layers. Strengths have been proven below these values, therefore traditional earthworks cannot take place.

10.3 Lime/cement stabilisation – it is recommended that a 30% CBR subbase replacement layer is installed for both the ground bearing floor slabs and also the external yard slabs.

10.4 The existing site won materials from the hardstandings can be crushed and reused as site won Type 1 stone materials and/or a regulating layer across the 30% CBR CBM layer.

The following other risk items pertain to the earthworks exercise for the proposed development:

- 10.5 Existing platform and weathering – there would be weathering of the existing platform during the works, therefore, there should be an extra/over allowance of modifying/drying of the platform materials when any filling works taking place. The materials at surfaced used in the cut may also require modification;

11.0 Material Management

No specific material management measures are envisaged, other than the crushing of the existing hardstanding materials.

12.0 Services and Trench Backfill

It is recommended that no materials are imported for the trench backfill as site won materials can be modified via lime modification for the use of trench backfill.

13.0 Roads and Pavements

The design CBR can be taken as 5% across the site. This is also subject to the recommendations in the earthworks and ground improvement sections.

14.0 Temporary Works

From a temporary works perspective the following recommendations are made:

- 14.1 Temporary cut/batters – it is recommended that temporary cuts and batters are formed as near vertical in the temporary case as possible, however from a working space perspective, slopes of 1 in 1 should be allowed for. These cuts/batters should be inspected at the beginning and end of each working day by a competent person and the appropriate height of the cut should be designed by a geotechnical engineer. When the cut/batters are cut, the area should also be inspected and tested for localised soft clay bands and also bands of granular materials. These may require the works to be at a slightly shallower angle or benching;

- 14.2 Dewatering – as stated previously groundwater was at various levels during the investigation and earthworks, from 1.0m below ground level. The groundwater was slight seepages and not

sudden or large influxes of water. Therefore, an allowance should be made to pump perched water from excavations from any excavation and it may be that there is locally perched water on the dense sands and gravels (in places) from say 1m onwards.

15.0 Preparatory Works

No other comments other than those in the earthworks section.

16.0 Further Site Investigation Works

The current site investigation is not suitable for construction and there are anomalies within the site investigation as to the actual strength of the Till materials. These should be verified by CPT testing as soon as practical.

It is also recommended that various trial pits are undertaken with an excavator up front of the actual construction works. This will be to gain samples for laboratory testing; to better design and understand the near surface materials for earthworks and modification/stabilisation works.

Therefore the following should be allowed for:

16.1 1 No. days trial pitting. This can be undertaken by a minimum of a JCB 3CX;

16.2 Earthworks testing including suitable re-use testing;

16.3 1 day of CPT testing.