



SEMMMS A6 to Ringway Road West

B002 – Hazel Grove to Buxton
Feasibility Report Study
Report No. 1007/7.04/082

December 2011

Hazel Grove to Buxton Line

Feasibility Study Report

December 2011

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1007/3D/DF5/A6-MA/B02/702-3
1007/3D/DF5/A6-MA/B02/702-4
1007/3D/DF5/A6-MA/B02/702-5

Appendix C: 3D Model for the overbridge

Figure 1: Hazel Grove to Buxton Line Overbridge
Figure 2: Hazel Grove to Buxton Line Overbridge
Figure 3: Hazel Grove to Buxton Line Underbridge
Figure 4: Hazel Grove to Buxton Line Underbridge

EXECUTIVE SUMMARY

The feasibility study commenced with a desk study gathering all the relevant available information which might affect the scheme. Previous available reports on the scheme were studied. Continual consultation with Stockport Metropolitan County Council and Network Rail has enabled a better understanding of the constraints affecting the development of viable and suitable engineering solutions.

Two options have been considered, one locating the new road route within a cutting, running beneath the old A6 and the main railway line and an alternative of a similar route running along a raised embankment over the old A6 and railway line.

Any raised embankment used as part of a 'flyover' would significantly impair the general relatively flat landscape, whereas the use of a cutting will effectively conceal the road and have negligible effect on the general views and vistas across the area.

The land taken as a result of going over the railway line is significant and the implications are considerable. The Sausage Factory gardens will be affected. A huge retaining wall is needed to retain the embankment fill. In addition Norbury Brook which runs almost parallel to the scheme on the south side will also be affected. Similarly a long retaining wall is either required to keep the fill away from the Brook or alternatively a concrete culvert will need to be constructed for the Brook.

In terms of noise pollution levels it is apparent that a raised roadway set upon an essentially high embankment would broadcast noise to adjacent residential property and would invariably require some acoustic roadside barriers in order to limit the worst of the traffic generated noise.

The proposal locating the new road within a cutting is clearly the most favoured option.

The principal constraints affecting the solutions are the availability of track possession times. The maximum known available possession times are 54 hours and this is available during the Christmas week. It is apparent from the study that a number of solutions have developed and some of requiring more than 54 hours.

Ground conditions at the formation level are relatively strong. A 350- 400 KN/m² allowable bearing pressure is anticipated. Such that only relatively medium size pad foundations are required.

Groundwater was encountered in seven exploratory holes. The overall depths ranged from 3.8mbgl and 22.3mbgl. Exploratory hole located in close proximity to the proposed bridge indicated groundwater at depths of 5.8mbgl and 5.6mbgl, these are both above the proposed foundation level and therefore consideration will be needed during construction (temporary measures) and for the design in the form of drainage. There is currently no known groundwater monitoring information for the site. Therefore further investigation into the groundwater levels and changes with seasons, along with flow rates is recommended for the design and drainages methods, along with temporary mitigation measures during construction.

A number of options have been considered in detail against the criteria of how long it takes to construct the option, the cost in general terms, the risks and any other relevant factors including whether that method of construction has been undertaken in practice.

The preferred bridge option is the reinforced concrete cantilever abutments slid into place together with a standard Network Steel Half Through underbridge E- type.

1. INTRODUCTION

1.1 South East Manchester Multi Modal Strategy (SEMMMS)

The proposed SEMMMS A6 to Manchester Airport Relief Road will provide a new approximately 10km long dual carriageway, with new sections of road built from the A6 at Hazel Grove to the eastern end of the existing A555 at Woodford Road, Bramhall and from the western end of the existing A555 at Wilmslow Road, Handforth to Manchester Airport and the spur road to the M56.

A pedestrian and cycle route is proposed for the whole length including retrofitting it to the 4km existing section of the A555.

The scheme is located within three local authority boundaries Stockport, Manchester, and East Cheshire with the majority of the scheme being in Stockport.

The scheme is anticipated to require approximately 15 bridge structures (highways bridges, accommodation bridges and footbridges) and 17 retaining walls. Four of the bridges will cross railway lines.

1.2 The Need for the Scheme

The aim of the scheme is to reduce levels of traffic in local communities including Stockport, Wythenshawe, Heald Green, Hazel Grove, Poynton and Bramhall, which will bring benefits for everyone in these areas:

- Existing roads will be to be improved to help create safer, friendlier neighbourhoods
- Walking and cycling routes are being considered as part of the new road scheme as well as on those existing roads where traffic congestion will have been relieved.
- Access to local shops and work places will be made easier and safer for those without cars, while those who choose to use, or need to use, their car will benefit as congestion will be reduced.
- The space created on existing roads will allow for the development of public transport services as an attractive alternative to using the car.
- Local air quality will be improved as there will be less pollution from traffic.
- Car drivers who presently travel along the existing roads in and around Greater Manchester should have easier journeys.
- Local centres and the services and facilities they provide for residents will be made more accessible for everyone, including those with mobility difficulties.
- Communities and shopping centres will be relieved of the impact of heavy goods vehicles which will transfer to the new road.
- Freight traffic will benefit, both from the reduced congestion on existing roads and the provision of new, less congested routes, helping to promote existing and new business in the area.

1.3 Hazel Grove to Buxton Railway Line

The Hazel Grove to Buxton Rail Line crossing will be approximately 340m south of the A6/Relief Road at-grade interchange. The current A6 is less than 50m north of the rail crossing but the trunk road is to be relocated northwards and the existing route will be retained only as a grade separated combined bus/footpath and cycleway.

The Hazel Grove to Buxton Line runs roughly west to east and is a twin track non-electrified line providing a commuter route between Buxton and Manchester. Network Rail has advised it will not be electrified and that this assumption can be adopted for

developing the Relief Road Scheme. Rail level is approximately 111.5m AOD which is roughly the same as the general ground level either side of the rail boundary.

There are no known services to be accommodated over the crossing other than lighting and communication ducting as required for the Relief Road.

The **Buxton Line** is a railway line in Northern England, connecting Manchester Piccadilly, Hazel Grove in Cheshire, and Buxton in Derbyshire. Passenger services on the line are currently operated by **Northern Rail**. There is one service per hour.

National Grid reference for the crossing is E393334, N385654. Scheme chainage at Design Freeze 4A is approximately 8575m.

1.4 URS Scott Wilson Commission

URS Scott Wilson was commissioned by Stockport Metropolitan County Council in November 2011 to prepare a report on the feasibility of constructing a bridge at the crossing, with the following being included in the report:

- Introduction
- Need for Scheme
- Scheme Sponsor/ Description of Scheme/ Consultation/ Programme/ Estimated Cost
- Overbridge/ Underbridge Options
- Justification for Preferred Option
- Potential affect on NR Assets:
 - NR land easement/ license needs
 - NR Level Crossing usage &/ or changes
 - NR Signalling
 - Street lighting
- Geological Considerations
- Environmental Considerations
- Design Resource Strategy
- Construction Methodology Proposed
- Other Relevant Information
- Project Risks
- Conclusions & Recommendations
- Elevations & Sections Drawings

The following is also required to progress the feasibility study:

- To liaise with Network Rail to assess the required possessions, and advance notice required, for various bridge options

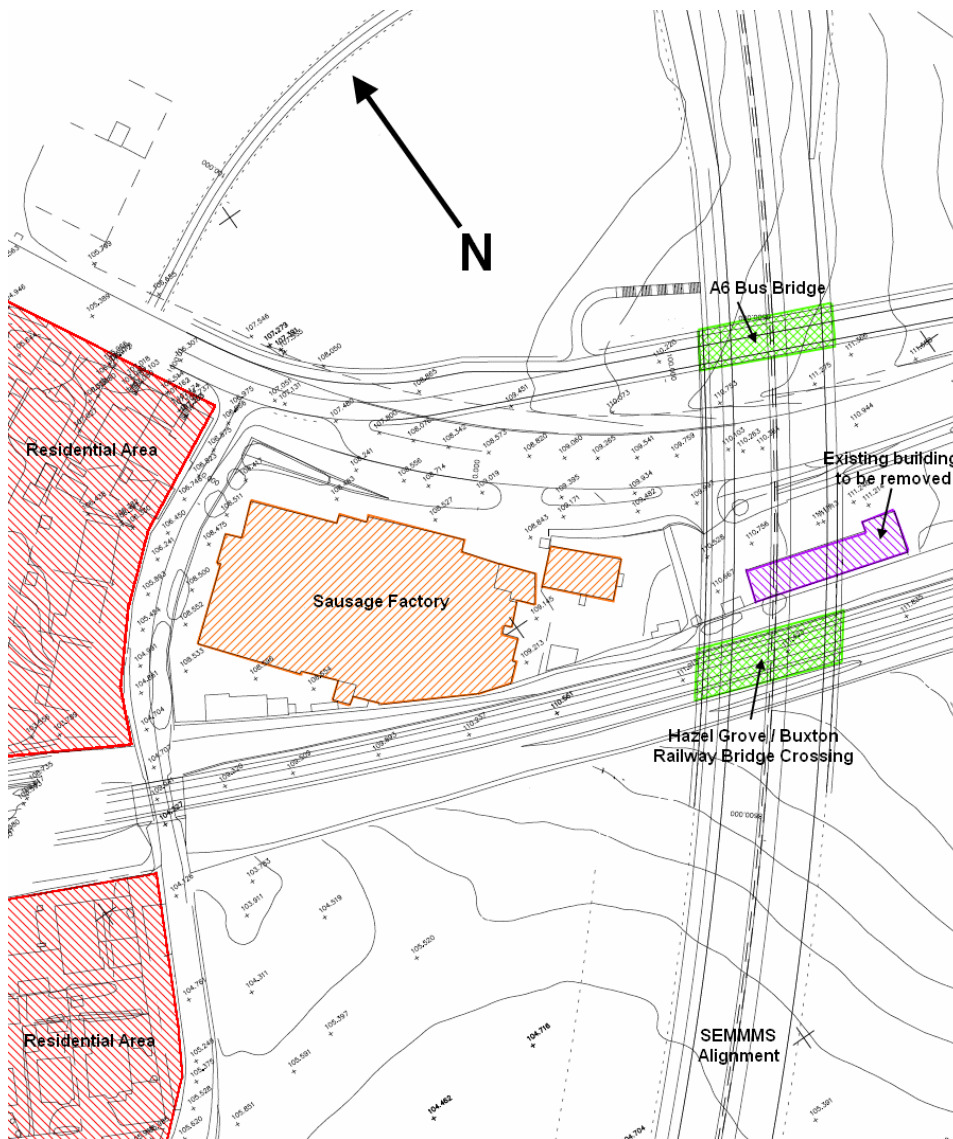
2. SITE DESCRIPTION

2.1 Existing topography

The location of the proposed bridge crossing is relatively in a flat site. Existing topography along the line of the Relief Road is roughly level to the north of the crossing but falling at approximately 6% to the immediate south towards Norbury Brook.

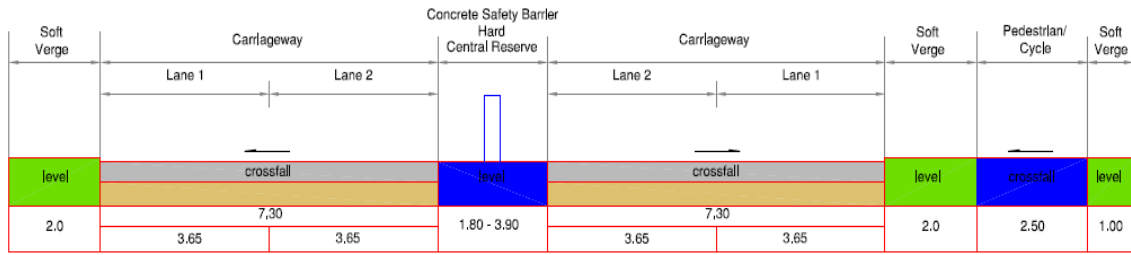
There are four residential properties in the close vicinity as well as farm buildings and the former Simpson Sausage Factory to the immediate northwest. Otherwise the

surrounding area is open farm land to the north and to the south as far as Norbury Brook Valley.



2.2 Road Geometry

The proposed road crosses the railway line at a skew of 18 degrees. The road comprises of dual 7.3m carriageways, 2.0m verges on either side of the carriageways, 2.5m cycleway on one side with another 1.0m soft verge to the cycleway side and a central reserve varying between 1.8-3.9m as shown below. The central reserve at the crossing is 3.9m giving a total crossing width of 26.0m.



Cross Section for D2UAP Road mainline (Speed Limit 50 mph)

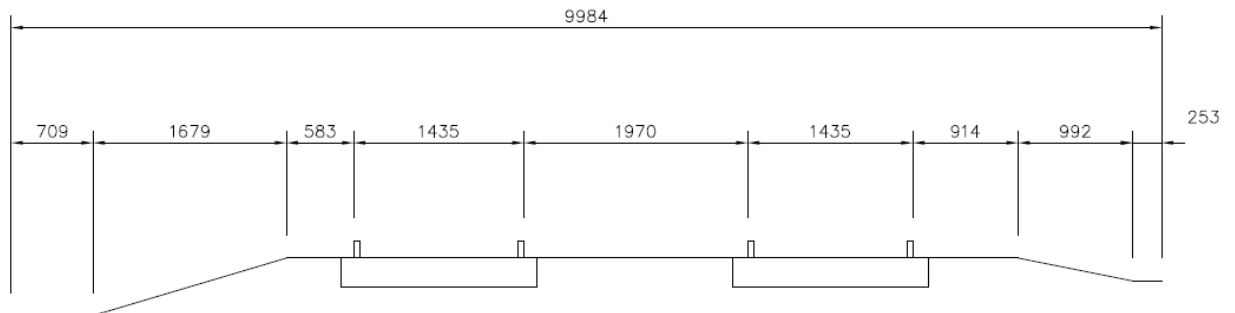
Total Width is 26.0m taking into account the central reserve is 3.9m at the crossing

2.3 Railway

Historically the line was built for the Stockport, Disley and Whaley Bridge Railway by the London and North Western Railway and opened on 9 June 1857. From 1923 until 1948 it was owned by the London Midland and Scottish Railway and following nationalisation it was operated by the London Midland Region of British Railways.

At the crossing the tracks are carried on embankment. The height of the embankment at the crossing varies between 1.5 to 0.5m towards Buxton.

The railway is none electrified line and comprises of twin tracks on concrete sleepers on minimum 300mm ballast (this needs to be confirmed). There are also some clearances to either side of the tracks as shown below to either side of the tracks giving a total of approximately 10.0m wide embankment.



Typical Cross Section Looking North West

The railway is on a vertical curve with a general fall approximately 2.14% from Buxton towards A6.

Similarly the horizontal alignment is on the start of a horizontal curve with an approximate radius of 3000m at the site of the proposed bridge.

Signalling and telecommunication (S&T) cables run alongside the tracks.



Top view of the bridge crossing



General view of the Hazel Grove to Buxton Line

2.4 Ground Condition

The ground and groundwater conditions for the Hazel Grove/Buxton Railway Bridge have been assessed using relevant geological maps (Stockport Sheet 98, Solid and Drift Scale 1:50,000) and 15 No. Exploratory hole logs provided by a number of phases of GI for the area.

Topsoil/Made Ground

Topsoil and Made Ground was identified at ground surface level in 9 No. Exploratory holes and is recorded thicknesses between 0.1m and 0.4m. The Made Ground was typically described as topsoil with brick and ash, with the Topsoil described as Firm sandy Clay, with a little fine to medium gravel and frequent roots.

No groundwater strikes were encountered within the Topsoil/Made Ground material.

Glacial Till Deposits

The glacial till deposits underlying the Topsoil/Made Ground comprised of cohesive and granular materials, and were encountered from 0.1mbgl to rock head.

The cohesive glacial till deposits were encountered in all but one exploratory hole. The logs generally indicate a Soft to Firm becoming Firm to Stiff yellow and red, or brown/grey sandy CLAY with the gravel comprising of sub-angular to sub-rounded, fine and occasionally medium grained, with thicknesses of up to 3.5m.

The granular glacial till deposits were encountered in six exploratory holes with thickness of 0.3m and 2m, and are typically described as medium dense red-brown, very clayey SAND or very clayey sandy SILT and angular to sub-angular (occ. sub-rounded) fine to coarse GRAVEL of sandstone.

Only 3 No. Standard Penetration Testing (SPT) were carried out within the glacial till deposits, two within the granular material, providing SPT 'N' values of 10 and 28, confirming the medium dense material described on the logs and one within the cohesive strata given a reading of 29 confirming a Stiff material. No groundwater strikes were encountered within the Glacial Till material.

Coal Measures Strata

Rock head was encountered at depths between 2.4mbgl (110.49mAOD) and 5mbgl (103.39mAOD), indicating the proposed formation level (102.4mAOD) to be at least 1m into rock. Rock is described as Westphalian Coal Measures of siltstones/mudstones/sandstones and coal. The material at foundation level is largely described as very weak to weak, moderately to highly weathered siltstone with closely to medium spaced discontinuities.

Five exploratory holes encountered coal at depths of between 18.8mbgl (94mAOD) to 38.1mbgl (71.2mAOD). All seams were intact, with no indications of voids/broken ground where recorded in any other exploratory holes. It is therefore unlikely that Coal Mining has been carried out in the area underlying the proposed bridge. However, a Coal Authority licence will be required for any excavation/drilling within the seams. Groundwater strikes were recorded within the Coal Measures strata and as discussed in more detail below.

The ground conditions encountered within the ground investigation confirm the descriptions on the geological maps of Boulder Clay of Recent and Pleistocene age overlying Westphalian, Coal Measures of Carboniferous age, with various coal seams at depth. The area is indicated to be highly faulted, in north-south general trend across the route. One fault is indicated to cross the proposed bridge location on the northern carriageway with a down-throw to the west. The faulting will need to be considered further at detailed design stage.

For locations of these faults refer to Geological maps or Geological Long Section dwg: - 60186094-GEO-003 B, from Ground Investigation Report, Aecom, February 2011.

Groundwater

Groundwater was encountered in seven exploratory holes, four of which indicated strikes at more than one depth. The overall depths ranged from 3.8mbgl (108.7mAOD) and 22.3mbgl (90.2mAOD).

Exploratory hole NWH MAIN GI 223 and NWH MAIN GI 227 located in close proximity to the proposed bridge indicated groundwater at depths of 5.8mbgl (104.81mAOD) and 5.6mbgl (103.38mAOD), these are both above the proposed foundation level and therefore consideration will be needed during construction (temporary measures) and for the design in the form of drainage.

There is no known groundwater monitoring information for the site.

Preliminary Geotechnical Assessment

It is anticipated that a box or pad foundation founded on very weak to weak Coal Measures strata will provide a suitable foundation method for the proposed bridge; however settlements will need to be considered.

Alternatively piled foundations could be adopted due to constraints of working next to live railway.

Based on engineering descriptions only, a presumed maximum allowable bearing capacity in the range of 350-400kN/m² is considered appropriate for founding structural loads at or below 101 mAOD in the very weak to weak Coal Measures. However, subject to the structural design criteria, the presumed allowable bearing capacities may subsequently be revised upon calculation of differential settlements by the foundation designer.

The faulting will need to be considered further at detailed design stage. It is possible that the fault gauge material is present and treatment of this for Pad foundation would be required. It should also be noted that the current exploratory holes are off-line due to the existing railway.

It should be noted that due to the presence of Coal Measures strata and the possibility of encountering Coal seams during construction a Coal Authority licence will be required for any excavation/drilling in the seams. It may also be required that a topsoil strip is undertaken along the scheme in advance of construction to reduce the risk of encountering un-recorded shafts/ shallow workings. Additional investigation may also be required at structural locations prior to detailed design.

The in-situ material should be capable of being excavated by conventional excavators with toothed buckets; however the use of rock breakers may be required to ease excavation.

The upper slopes will be in glacial till and a slope angle of 1v 2.5h is recommended to ensure adequate FOS.

The potential for chemical attack on buried concrete within the ground has not been assessed. This will be the responsibility of the foundation designer.

Given that groundwater has been identified in a number of exploratory holes above the formation level (at relatively shallow depths within the Coal Measures strata) drainage methods will need to be considered in the design. Further investigation into the groundwater levels and changes with seasons, along with flow rates is recommended for the design and drainages methods, along with temporary mitigation measures during construction.

Geotechnical information relevant to the site is included in Appendix A.

2.5 Level Crossing

The level crossing is situated at approximately 170m to the East side of the crossing. It is hoped that the level crossing to be removed and an alternative crossing is provided- this needs to be confirmed. It should be noted that Network Rail are in favour of removing the level crossing as part of improving the health and safety of the line. Obviously there are a number of issues that need to be sorted out such as land owners and public right of way.

2.6 Land Ownership

The compulsory purchase Order (CPO) is in place for the entire scheme.

2.7 Site Access

Access to the North side of the railway line at the crossing is currently difficult. Clearances and some buildings need to be removed so that proper access could be gained to the North side of the railway line.

Access to the South side of the railway line is currently via Mill Lane and through the fields. It is anticipated that some part of the scheme on the South side of the railway line is required to be in place to facilitate access to the vicinity of the site/crossing.

2.8 Topographical Survey

Topographical survey has been provided by the client (SMBC) and has been used to develop the options.

3. BACKGROUND REPORTS

| Date | Report Number | Report Name |
|-------------|-------------------------|--|
| August 2005 | N/A (by Faber Maunsell) | New Relief Road Scheme: West Coast Main Line, Hazel Grove to Buxton Line and Hazel Grove to Midland Line |

4. CONSULTATION

4.1 Stockport Metropolitan Borough Council (SMBC)

4.1.1 Planning

Planning for the scheme has not been granted yet. One of the aims of this study is to apply for planning approval.

4.1.2 Existing Statutory Undertakers Equipment and New Services. Existing Statutory Undertakers Equipment

Information is available re any diversion as part of the work.

4.1.3 New Services

Unless stated otherwise, for all Underbridges provision shall be made for statutory undertaker equipment within the two outermost verges of the carriageway. These are to be available to carry highway communications and lighting. Services that are installed below or within the deck structure shall not adversely affect the appearance of the structure. Services shall not be installed on the outside face of deck edges.

4.1.4 Environmental

SMBC has advised that all environmental issues will be dealt with by Environmental Consultant, Mouchel.

4.2 Network Rail

Network Rail has appointed Nigel Downes as a project manager and Ian Fairfoot as the Asset Protection Engineer for the scheme and SMBC has liaised with them.

4.2.1 Infrastructure Records

This information has to be provided by Network Rail

4.2.2 Technical Constraints

SMBC has liaised with NR Civil Engineer for the Scheme to determine any technical constraints for the proposed scheme.

NR's over-riding objective is to minimise the disruption to the operational railway.

The minimum headroom normally required by NR to underline bridges is 5.7m. However the vertical alignment of the proposed scheme allows the provision of such headroom. Therefore no protection is required to be provided to the superstructure to cater for superstructure collision loading.

4.2.3 Operations and Possessions

Railway possessions are coordinated by NR's Possession Optimization Manger Dave Murphy. The time available is dependent on the usage of the line.

5. DESIGN CONSTRAINTS

5.1 Railway Possessions

5.1.1 Rules of Route Possessions

Normal Rules of Route possessions: 6.0 hours and 20 minutes (23:10- 5:30) night time possession are available 9 weeks per year and a 9.0 hour possession is available 23.20 Saturday to 08.15 Sunday. Allowing approximately 1.0 hour for handover by and hand back to NR, this will leave approximately 5.5 hours and 8.0 hours for productive work-time respectively. This is shown pictorially below.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Mon | Green | Green | Green | Green | Green | Green | Green | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Tue | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Wed | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Thu | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Fri | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Sat | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |
| Sun | Green | Green | Green | Green | Green | Green | Green | Green | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange | Orange |

5.1.2 Longer Possessions (Outside Rules of Route Possessions)

The 54 hour possessions (23:10 Christmas Eve to 5:30 Boxing day) is available during Christmas week. As far as the NR is concerned it is a special situation where although it is a disruptive possession it doesn't incur any schedule 4 (TOC) costs. Following the meeting with Network Rail on the 15th December 2011 it was acknowledged that another 54 hour possession time might be available during the Easter week. However this needs to be confirmed. It should be noted that this study has been developed based on one available blockade during Christmas week. Granting these possessions is dependent on the method of construction to be adopted. Qualitative risk assessments are required to demonstrate a viable method of construction.

| | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------|------|------|------|------|------|
| Saturday | 22 | 21 | 20 | 19 | 24 |
| Sunday | 23 | 22 | 21 | 20 | 25 |
| Monday | 24 | 23 | 22 | 21 | 26 |
| Tuesday | 25 | 24 | 23 | 22 | 27 |
| Wednesday | 26 | 25 | 24 | 23 | 28 |
| Thursday | 27 | 26 | 25 | 24 | 29 |
| Friday | 28 | 27 | 26 | 25 | 30 |
| Saturday | 29 | 28 | 27 | 26 | 31 |
| Sunday | 30 | 29 | 28 | 27 | 1 |
| Monday | 31 | 30 | 29 | 28 | 2 |
| Tuesday | 1 | 31 | 30 | 29 | 3 |
| Max Possession | 52 | 52 | 52 | 52 | 52 |

The Outside Rules of the Route (ORoR) possessions require a 2.0 year advance booking. Therefore it is essential that the method of construction is achievable in these blockades.

5.2 Highway Alignment

5.2.1 Horizontal Alignment

At the bridge crossing the horizontal alignment comprises of 720.0m radius curve. In addition the proposed road crosses the railway line at 18 degree skew. Obviously the span of the bridge going under the railway line is dictated by the above two factors. It is less influential if the proposed road is going over the railway line.

5.2.2 Vertical Alignment

The vertical alignment gradient of the proposed scheme at the crossing should it go under the railway line is 2.14%. The gradient for the scheme should the scheme go over the railway line is 4.8%

5.2.3 Headroom and Construction Depth

The MX model has been progressed by SMBC. The highway alignment work was based on 5.7m headroom. The highway alignment also assumed 2.0m deep construction depth. Generally the form of construction determines the construction depth. Half-through girders offers

5.3 Ground Conditions

From the geotechnical report it is envisaged that pad and piled foundations are suitable in this location. It is anticipated that a box or pad foundation founded on very weak to weak Coal Measures strata will provide a suitable foundation method for the proposed bridge; however settlements will need to be considered. Alternatively piled foundations could also be adopted due to constraints of working next to live railway.

The in-situ material should be capable of being excavated by conventional excavators with toothed buckets; however the use of rock breakers may be required to ease excavation.

The upper side slopes in an open excavation needed to construct the relevant bridge type will be in glacial till and a slope angle of 1v 2.5h is recommended to ensure adequate FOS.

The area is indicated to be highly faulted, in north-south general trend across the route. One fault is indicated to cross the proposed bridge location on the northern carriageway with a down-throw to the west. The faulting will need to be considered further at detailed design stage. It is possible that the fault gauge material is present and treatment of this for Pad foundation would be required.

5.4 Ground Water Conditions

As discussed above in section 2.4 that groundwater was encountered in seven exploratory holes. The overall depths ranged from 3.8mbgl (108.7mAOD) and 22.3mbgl (90.2mAOD).

Exploratory hole located in close proximity to the proposed bridge indicated groundwater at depths of 5.8mbgl (104.81mAOD) and 5.6mbgl (103.38mAOD), these are both above the proposed foundation level and therefore consideration will be needed during construction (temporary measures) and for the design in the form of drainage.

There is currently no known groundwater monitoring information for the site. Therefore further investigation into the groundwater levels and changes with seasons, along with

flow rates is recommended for the design and drainages methods, along with temporary mitigation measures during construction.

5.5 Other Constraints- Access

At the crossing the existing A6 runs parallel to the railway line and is about 25m away. The new proposed Bus Bridge is to carry the new A6 will be 50m away. It would not be possible to transport or slide the railway bridge under the new A6 Bridge so the new railway bridge would need to be constructed on the south side of the line and then installed during a blockade. Access to the south side of the line would require some of the relief road to be in place.

6. BRIDGE OPTION IDENTIFICATION

6.1 Parameters for the Identification of Suitable Options

6.1.1 Possessions Times

It is evident from the information provided by NR that there are some available short RoR possessions times (refer to section 5.1) during the week and the weekend. The longer possessions are only available during the Christmas week. There is a possibility that there is another longer possession time during Easter week- this needs to be confirmed. Obviously there must be convincing arguments to justify that longer possessions are required. The possession time is one of the most important determining factors in the choice of the structure.

For the purpose of this report it is assumed that longer than 54 hour possession is available should our options require longer possession times. If longer than 54 hour possession is not available then this will put additional restriction on construction methods. Methods with minimal disruption such as jacked boxes might then be the only methods of construction acceptable to NR.

In the following sections for each considered construction method/option assumptions will be made to how long each relevant associated activity would take so that the total hours for that particular option are determined. Therefore it is important to make some logical assumptions to the length of the long possession based on past experience.

6.2 Highway Alignment

6.2.1 Vertical Alignment Going Over

The vertical alignment of the scheme (SEMMMS) is on the limits of the design standard. It is obviously constrained by the headroom required over the railway line and also by the construction depth required for the overbridge. The vertical alignment has to comply with the Design Manual for Roads and Bridges (DMRB) requirements in terms of sag and hog curvature.

6.2.2 Vertical Alignment Going Under

Similarly the vertical alignment of the scheme (SEMMMS) is on the limits of the design standard. It is obviously constrained by the headroom required over the road (5.7m) and also by the construction depth required for the underbridge carrying the railway line. The vertical alignment has also to comply with the Design Manual for Roads and Bridges (DMRB) requirements in terms of sag and hog curvature.

6.2.3 Horizontal Alignment

The horizontal alignment of the scheme (SEMMMS) is constrained by many existing natural and man made constraints. On the North side the alignment is constrained by the presence of the houses and on the South is dictated by the Norbury Brook. The alignment is fixed at the intersection with the railway line. The alignment crosses the railway line at 18 degree skew and this has an impact on the span configuration.

6.3 Ground Topography at the crossing

Along the proposed scheme, from the North to the crossing, the ground rises at a slight gradient, less than 1%. But from the crossing to immediately southward the ground falls relatively steeply at approximately 7%. This is obviously will have an impact on the height of the embankment should we go over the railway line.

The existing railway line is on a very low embankment.

6.4 Rail Crossing Bridges

The types of bridges required for the scheme in such crossing whether to take the new road over or under the existing railway line differ from other normal road bridges due to the fact that that the overriding requirement is to minimise disruption to the operational rail services.

Due to the availability of short possession times of the track, it is necessary to have pre-constructed structural elements of the bridge alongside the tracks ready to be moved into place over closure periods.

Rail overbridges are general straightforward due to the fact that the substructure is usually positioned away from the tracks so that they can be constructed without needing possession times. For the superstructure a relatively shorter possession (compared with the one required for the underbridge) is required to lift into place over the tracks.

Rail underbridges are not straightforward and they are usually more complicated. They all require (apart from box jacking) some how removing the tracks, ballast and demolishing/excavating part of the embankment during possession times to enable either constructing the substructure (example piling) or moving the substructure into place as well as the superstructure. Similar to the overbridge superstructure some construction activities could be done away from the tracks outside possession times, when the rail services are operational, whether an overbridge or underbridge is adopted.

It should be noted that each method has differing requirements, some require single long possessions and others multiple possessions.

6.5 Central Support in the Central Reserve of the Proposed Scheme

Central supports are not permitted in the central reserve of the scheme. This will have an influence on the choice of the type of the structure and the span configurations. For example a two span structure is less likely to be incorporated in this location and also a twin box structure is not acceptable.

7. OPTIONS CONSIDERED

7.1 Overline: Option 1 Single Span Over Line Precast Concrete Deck with Integral Abutments

Subject to confirmation by Network Rail regarding the distance from the running line for construction of the abutments without a possession or blockade, other than overnight closures under the rules of route, a single span portal frame is feasible. This would use reinforced concrete integral abutments and a deck of prestressed, pretensioned concrete beams with an insitu reinforced concrete deck slab.

With abutment faces at 4.5m from the track the span would be 15.2m. Using prestressed TY9 beams @765 centres (Construction Depth 895mm) with an insitu infill deck slab would be feasible. With abutment faces at 5m from the track (3m+1m working space+1m toe) the larger span of 16.7m would need TY10 beams @765 centres or Y2 beams. (Construction Depth is 960mm). Side by side beams with a continuous soffit would offer a better solution both in terms of maintenance and to facilitate construction over the live railway. The beams would be erected under possessions (for the general arrangement of the overbridge option, refer to drawing 1007/3D/DF5/A6-MA/B02/702-1 in Appendix B).

Although construction of an overline bridge would be simple the topography is such that a very high approach embankment would be required. The minimum headroom

Construction sequences:

The following sequences are anticipated:

- Excavate to the formation level (outside the railway boundary and the support zones) and make sure the ground is sound
- Construct the reinforced concrete abutments on both sides of the railway line to the underside of the precast beams. This could be done without the need for possession times
- Lift in the precast prestressed beams with the permanent formwork. This could be done during the RoR possession times
- Install safety screens
- Cast the insitu deck slab
- Erect the high containment parapets (H4a)

Discussions (implications of the overline solution):

Highway Alignment

The highway alignment of the scheme going over is mainly dictated by the headroom required over the tracks and also satisfying the Design Manual for Roads and Bridges (DMRB) requirements in terms of sag and hog curvature. The highway alignment has been designed taking into account the above. Two 3D models of the proposal showing the overline alignment has been produced to assist understanding (refer to Figures 1 and 2 in Appendix C and also refer to drawing 1007/3D/DF5/A6-MA/B02/702-2 in Appendix B). It is apparent from the drawing that the alignment requires high embankments to carry the proposed scheme over the railway line. The height of the embankment extends up to 12.0m immediately to the south of the crossing. It should be noted that the Bus Bridge will also be affected. It is not going to be an overbridge any more. It will be an under bridge. The Old Mill Lane footbridge will also be a subway rather than an over bridge.

Land take

The land taken as a result of going over the railway line is significant as shown on drawing 1007/3D/DF5/A6-MA/B02/702-2 in Appendix B. It is apparent from the drawing

that the implications are considerable. The width of the footprint of the embankment could vary between approximately 26.00m at the start of the scheme and 90.0m immediately to the South of the crossing. The gardens of the Sausage Factory will almost be covered by the embankment unless a huge retaining wall is constructed to retain the fill.

Norbury Brook runs almost parallel to the scheme and as a result of this proposal the Brook will be affected. In fact a long retaining wall is required to keep the fill away from the Brook. Unless a concrete culvert is constructed for the Brook.

Planning

It is problematic to get planning approval for such a proposal.

Environment

The noise pollution levels would significantly be controlled when the scheme is within a cutting whereas a raised roadway set upon an essentially high embankment would broadcast noise to adjacent residential property. This in return might require some acoustic roadside barriers in order to limit the worst of the traffic generated noise.

Aesthetic

Any raised embankment used as part of a 'flyover' would significantly impair the general relatively flat landscape, whereas the use of a cutting will effectively conceal the road and have negligible effect on the general views and vistas across the area.

Possession times

This proposal though it is not taking as long as the underline bridge still requires some possession times. The proposal requires RoR possession times to lift the beams into place.

7.2 Underline: General

The existing railway line is on a very low embankment. The space required for construction work alongside the line without a possession is governed by ensuring that nothing could fall within 3m of the track. To meet this requirement piles can be installed from a properly designed and certified piling platform using specialist short-masted, and low centre of gravity piling equipment. In order to construct the bridge alongside the railway a construction platform would have to be excavated down to the formation level of the new road. A temporary sheet pile wall could be installed along the existing railway boundary. This may need to be installed in short overnight possessions (rules of route) depending on Network Rail requirements. This sheet pile wall may not be required but the new bridge would need to be constructed further away to allow for a temporary batter. The presence of the temporary batter would increase the amount of fill to be excavated during the possession and increase the time necessary to slide the bridge.

At this location there is approximately 3 to 4m of glacial till overlying weathered coal measures generally consisting of sandstone. The presence of sandstone in the coal measures could delay excavation or delay installation of any type of pile. The main risks to over run of possessions are the excavation and backfilling operations. The estimates for the excavation and backfilling operations at Crewe Green Bridge were 24 hours each, a scheme with considerably smaller volumes of fill to be excavated/backfilled. The process of excavating for the construction platform will establish an excavation rate for

the sandstone in advance so that sufficient plant can be deployed during the possession to complete the task on time.

The main methods available for installation of the superstructure are as follows:-

Lifting by crane
Sliding/rolling
Transporting and jacking from below

Lifting

Lifting is feasible for single span steel half through options and individual precast beams for over line options.

Sliding

This utilises a system whereby the structure is pushed sideways on sliding interfaces such as phosphor/bronze or a PTFE sledge on stainless steel. 'Rolling' replaces the low friction surfaces with ball bearings on proprietary rollers. Both techniques involve construction of the complete deck off to one side of the final position and then jacking or winching this sideways during the possession. Extensive temporary works would be required adjacent to the track to support the slide path of the new deck.

This solution is considered to be relatively low risk as the entire deck, fully waterproofed and partially ballasted, along with much of the temporary installation equipment can be fabricated off to one side of the structure prior to the rail possession.

Transporting

This is a relatively new technique first used on railway bridges in the early 1990's. Multi-axle highly manoeuvrable vehicles are used to move and lift the complete deck from temporary works at a remote site and transport it to its final position. This method requires a good surface upon which to run the transporter vehicles. Construction of a suitable running surface below the excavated embankment and installation of the deck may be too time consuming to be carried out in a single 54 hour possession.

7.3 Underline: Option 1 Single Span Standard Network Rail Half Through Steel Girder

For the deck, a standard Network Rail half through girder of either the Trapezoidal Box type or the Type E is feasible.

7.3.1 Superstructure

The strategy for the highway scheme includes keeping the central reserve clear of all obstructions including bridge piers. This results in a minimum span of 27.5m with full height abutments set at the back of the verges. In order to limit the effects of displacements on the track, the construction depth needs to be minimised. This limits the choice of deck to a through or half through type. The current track alignment will be assumed to be retained. This precludes the use of any deck type with a girder running between the tracks. The structure must therefore comprise 2 girders or trusses positioned along each side. The proposals have been developed assuming the following allowances:-

| | |
|-------------------------|-------|
| Track (UIC 60) | 172mm |
| Sleepers including pads | 220mm |

| | |
|---------------|-------|
| Ballast | 300mm |
| Waterproofing | 25mm |
| Total | 717mm |

Typical maximum span ranges for twin track half through deck construction are:-

| | |
|--|-----|
| NR Standard trapezoidal box girder | 39m |
| NR Standard half through plate girder Type E | 30m |
| Non standard half through plate girder | 45m |
| Half through truss | 80m |

Single Span Options

The absolute minimum span does not permit access for inspection of bearings and joints except via ladders from the verge. This would require closure of one lane of the highway to form a safety zone.

An access gallery will be required, either behind the bearings or in front. Access for inspection could be provided in the form of a raised walkway in front of the abutment. The walkway width would need to be at least 800mm wide, allowing for installation of a suitable pedestrian railing system. Consequently the span is increased to the limit of the trapezoidal box beam.

The steelwork will be painted in order to disguise the difference in style from the adjacent Bus Bridge carrying the new aligned A6 and other bridges on the scheme. The half through form of the proposed structure is not well suited for the use of weathering steel as the wide flanges are directly exposed to rain, should any areas remain permanently wet due to water ponding, saturated debris or similar. This could inhibit protective patina formation and result in continued corrosion.

Multi Span Options

Adoption of a multi span arrangement with open side spans would minimise the work required during a possession to form the abutments or bank seats but additional supports would be required so extra or longer possessions will be needed for construction (refer to drawing 1007/3D/DF5/A6-MA/B02/702-5 in Appendix B). For the land take available a three span structure would require short side spans. The additional piers would increase the cost of the structure and provide additional maintenance liability. A two span structure would need a pier in the central reserve that would provide additional maintenance liability subject to expensive traffic management.

The single span half through options would require full height abutments across the tracks. It would be possible to span the full width of the cutting with a through truss type solution, and hence utilise piles installed outside the tracks and low height abutments; however this would be a very high structure and is not considered acceptable from an aesthetic point of view.

7.3.2 Substructure

Option 1a

Construct the complete bridge off line and slide into position during a single long possession or slide each abutment and the deck into position under separate shorter possessions (refer to drawing Z007/3D/DF5/A6-MA/B02/702-3 in Appendix B).

Option 1b

At each abutment position a precast box type structure of sufficient height and width to allow access to a mini-piling rig could be installed under the tracks using tunnelling/jacking techniques. Mini-piles could then be installed from within the box.

Option 1c

At each abutment position large diameter piles are installed clear of the tracks. A precast concrete cill beam to carry the bridge deck would span between the piles. This beam must carry both vertical loads from the deck horizontal loads due to the earth pressures and railway braking/traction loads. In order to resist this biaxial bending, some form of precast box section would offer the best solution as it would provide a high inertia in both directions whilst keeping down the weight of the beam to facilitate lifting by crane.

A mechanical connection between the precast beam and the piling, comprising an arrangement of post-tensioned bars or tendons would be required. An in-situ connection would not be viable within the possession timescale. Alternatively the beam could be installed using tunnelling/jacking techniques as previously discussed. This would permit construction of an in-situ connection in advance of installing the deck.

The deck could then be installed on the beam, and the track re-opened with minimum excavation below the deck.

Option 1d

Large diameter piles are installed as close as possible to the existing tracks during short duration possessions. These piles would support the main deck girders directly without need for any form of transverse beam other than that included within the deck steelwork design; this significantly reduces the amount of work required adjacent the railway prior to the main deck installation.

With this arrangement the fill between the piles would have to be retained with precast concrete wall units. This arrangement is not suitable for a single span option requiring full height abutments and is better suited to a multi span structure with low bank seats. This form of substructure has been recently installed on the A46 at Bingham. At Bingham each pile needed a 36 hour possession, although 2 could be constructed in the same possession with one rig working at each end of the bridge. The piles could also be constructed either side of the tracks (similar to Elderly Edge Railway Bridge) with adequate clearances proving all NR requirements are met including certifying piling platform without the need for possession times. This construction methodology has been labelled as option 3 in this report (refer to drawing 1007/3D/DF5/A6-MA/B02/702-5 in Appendix B).

The construction methodology is anticipated to be as follows:

Without RoR possessions (except where minor preliminary works for access are necessary)

- Construct large diameter piles on either side of the tracks in 8 locations. This could be done without the need of possession times providing it meets NR requirements including certifying the piling platform

During a blockade of the railway

- Excavate to the underside of the cross beams

- Lift into place the precast concrete members (2 cross beams over the internal supports and 2 bank seats at the ends) and connect them structurally to the piles.
- The superstructure could be slid into place via transporters or lifted into place in three sections. Concrete deck is more suitable and appropriate with sliding and battle deck is more suitable with lifting
- Reinstate the ballast and the tracks

Option 1e

A top down solution with abutments formed on contiguous bored pile walls across the track would require several possessions to construct. Such piles would have to be large in order to meet the criteria for resistance to horizontal displacement.

Option 1f

At each abutment position construct two rows of piles to support temporary way beams and to create a cofferdam in which the abutment could be constructed without affecting railway traffic. Upon completion of the abutments the bridge deck can be installed and the remainder of the excavation can be carried out under the bridge.

7.4 Underline: Option 2 Insitu Concrete Underline Portal Frame Bridge

Reinforced concrete portal frame: the deck would be a half though section to minimize the construction depth. It would weigh approximately 2600 tonnes (including ballast) so it would be too heavy to move with a transporter and would probably have to be installed by sliding.

This option would only need one long possession to install it. The biggest risks to over run of possessions are the excavation and backfilling operations (for the general arrangement, refer to drawing 1007/3D/DF5/A6-MA/B02/702-4 in Appendix B).

The anticipated construction sequences are as follows:

Without RoR possessions (except where minor preliminary works for access are necessary)

- Excavate cutting to form construction platform outside the railway boundary and track support zone
- (if necessary a temporary sheet pile wall at least 5m from the track could be installed to protect the track support zone)
- Install safety screens where required
- Construct concrete launching platform (including precast runway units for use in bridge slide)
- Construct reinforced concrete abutments
- Construct deck on false work
- Assemble bridge slide infrastructure

During a blockade of the railway

- Remove track and ballast
- Excavate embankment and ground in railway support zone
- Install temporary precast concrete bridge slide runway units and slide rails
- Slide complete bridge into place by jacking

- Backfill abutments
- Reinstate track and ballast

8. CONCLUSIONS

8.1 Bridge going under or over the railway line

The location of the new road way and junction is on the edge of 'green belt' and deserves due consideration in order to mitigate its environmental impact.

Two options have been considered, one locating the new road route within a cutting, running beneath the old A6 and the main railway line and an alternative of a similar route running along a raised embankment over the old A6 and railway line. The height of such an embankment is determined by the clearances over the railway, including the essential safety clearances required to accommodate potential future overhead electrification and gantry systems.

Any raised embankment used as part of a 'flyover' would significantly impair the general relatively flat landscape, whereas the use of a cutting will effectively conceal the road and have negligible effect on the general views and vistas across the area.

Also if the roadway were to be located within a cutting, its noise pollution levels would be significantly controlled whereas a raised roadway set upon an essentially high embankment would broadcast noise to adjacent residential property and would invariably require some acoustic roadside barriers in order to limit the worst of the traffic generated noise.

Either option would of course be effectively landscaped to the satisfaction of the Planning and Environmental bodies, but the version using a cutting would have the least visual concerns.

Any potential problems in respect of drainage, flooding and lighting would be adequately dealt with either option. Any underpass involved with the 'cutting' option would of course require some minimal 'daytime' street lighting but any general road lighting would be primarily concealed within the cutting, whereas any road-lighting located on the raised embankment, despite control measures, would still add to the general level of light pollution in the area.

It should be noted that the road under the Rail Line also provides a potential means of reducing incidents and risk at the existing level crossing, east of proposed bridge. The level crossing provides vehicular access to private land and also forms part of Footpath FP75 as indicated on attached plan and photo. Diversion of FP75 is to be investigated by SMBC and Public Rights of Way section

The proposal locating the new road within a cutting is clearly the most favoured option.

8.2 The merits and demerits of potential bridge options

| Ref. | Description | Construction | Possessions | Merits | Risks |
|------|---|--|---|---|---|
| | <i>Preferred Options</i> | | | | |
| 1 | Superstructure Under line steel half through deck (NR Standard E Type or Trapezoidal Box Type) | | | Use of standard NR deck could aid approval process. Deck can be crane lifted into place or erected on abutments prior to sliding in, or erected with a transporter. | |
| 1a | Substructure RC Full height abutment | RC cantilever abutments constructed on platform at highway formation level. Deck installed on abutments and whole structure installed by sliding / strand jacking. | Single 105 hour possession | Abutments and deck could be installed in separate shorter possessions. | Excavation in hard sandstone could delay works. |
| 2 | Under line, RC half through portal frame | Integral abutments and deck fully constructed on platform at highway formation level. Whole structure installed by sliding / strand jacking. | Single 105 hour possession. | Structure weighs approximately 2600 tonnes so too heavy for installation with a transporter. | Excavation in hard sandstone could delay works. |
| 3 | Over line, prestressed precast beam and RC slab on full height integral abutments | Construct abutments alongside railway. Install beams and safety screens. Construct deck. | Can be constructed under a series of RoR possessions. Weekend closure may be required for deck installation. | Simple to construct. Liability for maintenance remains with the Highway Authority. Substantial embankment required. | |
| | <i>Rejected Options</i> | | | | |
| 1b | RC Abutments or cill beams constructed inside precast box. | Precast box thrust bored under embankment. Construct wall within the box. Install bridge deck by crane lifting or using a transporter | Extent of possessions required during thrust boring is not known and would need to be discussed with NR. Separate possession required for deck installation. Deck can be installed during a weekend possession. | Work can be carried out under the live railway. Thrust boring is an expensive operation; measures necessary to safeguard the railway are extensive. Excavation of cutting can be carried out after railway is re-opened. | Excavation in hard sandstone could delay works. |
| 1c | Precast RC cill beam on large diameter piles | Install large diameter piles at minimum distance from track. Carry out excavation and install deck using transporter. | A series of 36 hour possessions may be required for piling unless they are far enough away from the track. Separate 72 hour possession required for deck installation. | Not suitable for abutment at back of verge due to difficulty in retaining fill between piles. Abutment would have to be set back to accommodate safe slope. Suitable for a multi span structure or a single span truss / deep girder over spanning the cutting. Single span truss / deep girder rejected on aesthetic grounds. Two span bridge requires pier in central reserve so rejected on aesthetic grounds and due to maintenance liability requiring expensive traffic management. | Piling in hard sandstone could delay works. |
| 1d | Deck supported directly on | Install large diameter piles at minimum distance | A series of 36 hour possessions | Not suitable for abutment at back of verge | Excavation in hard sandstone |

| | | | | | |
|-------------|--|---|--|--|---|
| | large diameter piles. | from track. Carry out excavation and install deck using transporter. | is required for piling. Separate 72 hour possession required for excavation and deck installation. | due to difficulty in retaining fill between piles. Abutment would have to set back to accommodate safe slope. Suitable for a multi span structure or a single span truss / deep girder over spanning the cutting. Single span truss / deep girder rejected on aesthetic grounds. Two span bridge requires pier in central reserve so rejected on aesthetic grounds and due to maintenance liability requiring expensive traffic management. | could delay works. |
| Ref. | Description | Construction | Possessions | Merits | Risks |
| 1e | Contiguous bored piles. | Install bored concrete piles across the track. Install pile cap. Install bridge deck by crane lifting or using a transporter. | Separate possessions required for piling and deck installation operations. Several days will be required for boring operations. Deck can be installed during a weekend possession. | Track removal and reinstatement required more than once. Cannot be carried out in short possessions without several track movements / reinstatements. Excavation of cutting can be carried out after railway is re-opened. | Piling in hard sandstone could delay works. |
| 1f | RC Abutments or cill beams constructed in coffer dams. | Two rows of sheet piles across the track at each abutment with temporary way beams to support railway. Construct wall within the cofferdam. Remove temporary piling. Install bridge deck by crane lifting or using a transporter. | Separate possessions required for piling and deck installation operations. Several days will be required for piling operations. Deck can be installed during a weekend possession. | Speed restrictions required while way beams are in place. Cannot be carried out in short possessions without several track movements / reinstatements. Excavation of cutting can be carried out after railway is re-opened. | Sheet pile refusal in hard sandstone could delay works. |

8.3 Preferred Option

8.3.1 Substructure

Taking into account all the constraints discussed above our preferred option is the precast reinforced concrete (RC) full height cantilever abutments. This requires the RC cantilever abutments to be constructed on a platform at the formation level off line and slide each abutment into position during a single long possession. This is going to be similar to Rugeley Bridge slide shown below



Rugeley Bridge Slide

8.3.2 Superstructure

Our preferred option for the superstructure is the standard Network Rail deck. The deck can be crane lifted into place or erected on abutments prior to sliding. The deck comprises two plate girder beams with transverse girders connected rigidly to the bottom flanges to form a U frame action. Obviously the superstructure will be fabricated away and transported to site.

8.3.3 Construction sequences

Without RoR possessions (except where minor preliminary works for access are necessary)

- Excavate cutting to form construction platform outside the railway boundary and track support zone

- (if necessary a temporary sheet pile wall at least 5m from the track could be installed to protect the track support zone)
- Install safety screens where required
- Construct concrete launching platform (including precast runway units for use in bridge slide)
- Construct reinforced concrete abutments
- Assemble girders cross beams and deck
- Lift deck into place on abutments
- Assemble bridge slide infrastructure

During a blockade of the railway

- Remove track and ballast
- Excavate embankment and ground in railway support zone
- Install temporary precast concrete bridge slide runway units and slide rails
- Slide complete bridge into place by jacking
- Backfill abutments
- Reinstate track and ballast

9. RECOMMENDATIONS

- The most important factor that controls the cost and the risk for an underbridge is the length of time taken to construct the bridge. It is therefore recommended that, once funding for the scheme is in place, the construction period is known with more certainty.
- Initial paper regarding this proposal is required to be submitted to NR Governance Panel in London, prior to design works for the SEMMMS scheme as a whole. This scheme design, of medium to high risk, requires Panel Authority. It is recommended to speed up the process so that some feedback can be received as soon as possible.
- The 54 hour possession time is available during Christmas week. As far as the NR is concerned it is a special situation where although it is a disruptive possession it doesn't incur any schedule 4 (TOC) costs. Granting these possessions is dependent on the method of construction to be adopted. As it is apparent from the study that Outside RoR possession times are required to construct the bridge (approximately 105 hours are required). Therefore it is very important that NR is made aware of it from the outset to make sure that it is not problematic to acquire such possession times and the necessary arrangement required in advance. During the meeting with NR on 15th December 2011 it has been mentioned that it is possible that Easter blockade might also be available. This needs to be confirmed as it has significant effect on the chosen construction methodology.
- It is recommended that ground water monitoring to be undertaken to ascertain the baseline data for the detailed design.
- Trail pits are required to verify the 300mm existing ballast assumed in the report.
- Effects of constructing cutting and highway below ground level need to be considered.

- Existing retained buildings in the vicinity of the crossing will require safeguarding and monitoring.
- The effects of lowering ground water table need to be assessed.
- Track construction and jointing have to be verified prior to the detailed design.
- Railway S & T troughs/cables may require temporary service bridge or centenaries support during works.
- Detailed track survey information is required to determine joints rail condition suitability of re-using track component. Track curvature and cant should be provided.

APPENDIX A

Geotechnical Information



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-03-1984/29-03-1984 | | Co-ordinates: E 393324.0 N 385650.0 | | Ground Level: 108.98 (m) NWH MAIN GI 227 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 1 of 2 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|------------------------------|-------------------------------|-------------|----------------|-----------------------|------------|-------------------|---|-------------------------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 0.40 | D D 200 U 600 | | | | | 108.68 | 0.30 | TOPSOIL | |
| | | | | | | | (0.90) | Soft light grey, brown mottled, clayey very sandy SILT, with occasional fine subrounded gravel. | |
| 1.30 | D B 101 D 600 U 601 | | | | | 107.78 | 1.20 | mid brown, slightly clayey, silty, medium, with some fine and occasional coarse SAND, with some fine, medium and coarse subrounded gravel. | |
| 2.30 | D D 201 D 601 U 602 | | | | | 106.98 | 2.00 | Red brown completely weathered SILTSTONE, very weak. | |
| | | | | | | | (2.00) | | |
| 3.40 | D D 602 U 603 | | | | | 104.98 | 4.00 | Red brown moderately weathered SILTSTONE, weak. | |
| 4.00 | | C N = 0(450mm) 0 0/0 0 0 0 | | | | 104.48 | 4.50 | Purple-brown, very muddy, highly to completely weathered SILTSTONE. Very weak and very highly fractured, with occasional very thin bedding. | |
| 4.50-5.10 | | | | 100.00 0.00 | | | | | |
| 5.10-5.90 | | | | 100.00 0.00 | | | | | |
| 5.90-6.70 | | | | 44.00 0.00 | | | | | |
| 6.70-7.70 | | | | 30.00 0.00 | | | | | |
| 7.70-8.60 | | | | 100.00 0.00 | | 101.28 | 7.70 | Red-brown, muddy, completely weathered SILTSTONE. Very weak and clayey. Highly weathered band from 8.60m to 8.90m. | |
| 8.60-10.00 | | | | 100.00 0.00 | | | | | |
| | | | | | | | (2.10) | | |
| | | | | | | 99.18 | 9.80 | See next page. | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|---------------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 5.60 | 4.30 | 20 | 5.60 | Slight water inflow | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:28



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-03-1984/29-03-1984 | | Co-ordinates: E 393324.0 N 385650.0 | | Ground Level: 108.98 (m) NWH MAIN GI 227 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 2 of 2 |

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument | | |
|-----------------|------------|-----------------|-------------------|------------|-----------------------------|---------------|--|---|--------|-------------------------|--|--|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | | | |
| 10.00-11.00 | | | 100.00 0.00 | | | (1.10) | Purple brown, micaceous, very thinly bedded, slightly muddy, highly to completely weathered SILTSTONE. Very weak and very highly fractured. <i>(continued)</i> | x | | | | |
| | | | | | | 98.08 - 10.90 | | | | | | |
| 11.00-12.40 | | | 100.00 17.00 | | | (0.40) | Light grey, micaceous silty, fine grained, highly weathered SANDSTONE. Moderately weak with some quartz veining. | | | | | |
| | | | | | | 97.68 - 11.30 | | | | | | |
| | | | | | | (0.45) | Purple-brown, slightly micaceous, very thinly bedded, slightly muddy, completely to highly weathered SILTSTONE. Very weak. | x | | | | |
| 12.40-15.00 | | | 94.00 0.00 | | | (0.45) | Purple-brown, highly weathered SILTSTONE. Very weak and moderately to highly fractured. Many moderately tight, silt dusted, horizontal joints. | x | | | | |
| | | | | | | 97.23 - 11.75 | | | | | | |
| | | | | | | (1.40) | Red-brown, muddy, completely weathered SILTSTONE. Very weak and very highly fractured. | x | | | | |
| 15.00-17.60 | | | 100.00 0.00 | | | 95.38 - 13.60 | | | | | | |
| | | | | | | (0.40) | Light grey, calcitic, highly weathered SILTSTONE. Weak with completely weathered band 13.75 to 13.85m. | x | | | | |
| | | | | | | 94.98 - 14.00 | Light grey, calcitic, highly weathered SILTSTONE. Very weak. | x | | | | |
| 17.60-18.00 | | | 100.00 0.00 | | | (1.20) | | | | | | |
| | | | | | | 93.78 - 15.20 | | | | | | |
| | | | | | | (1.90) | Light grey, calcitic, highly weathered SILTSTONE. Weak and highly fractured. | x | | | | |
| | | | | | | (0.90) | Purple-brown, micaceous, thinly bedded, slightly muddy, highly weathered SILTSTONE. | x | | | | |
| | | | | | | 90.98 - 18.00 | End of Borehole | | | | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|--------------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 11.00 | 4.30 | 20 | 11.50 | Rapid water inflow | | |

AGS3_NEW GLEB | SW BH LOG (CP/RG) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GP | AGS3_NEW GDT | 23/11/2011 | 09:46:28



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 12-03-1984/16-03-1984 | | Co-ordinates: E 393366.0 N 385638.0 | | Ground Level: 111.38 (m) NWH MAIN GI 226 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 1 of 2 |

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|--|-----------------|-------------------|------------|-----------------------------|---------------|--|---|--------|-------------------------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 1.00 | D U 600 | | | | 111.28 | 0.10 | TOPSOIL | | | |
| | | | | | | (1.50) | Firm to stiff mid-brown fine and medium sandy CLAY, with occasional fine, subrounded gravel. | | | |
| | | | | | | 109.78 | 1.60 | Mid-brown fine, medium and coarse SAND and fine, medium and coarse subrounded GRAVEL. | | |
| 2.40 | D B 300 B 400 B 401 B 402 B 403 B 404 D 600 | | | | 109.48 | (0.40) | Stiff brown CLAY with occasional cobbles. | | | |
| | | | | | | 109.08 | 2.30 | Purple brown thinly laminated slightly muddy highly weathered SILTSTONE, weak to very weak and very highly fractured. Completely 5.20-5.25, 5.50-6.00, 6.50-6.80, 6.90-7.35m. | | |
| 3.50 | D D 404 U 601 | | | | | | | | | |
| 4.30-4.80 | | | 0.00 0.00 | | | (5.05) | | | | |
| 4.80-5.50 | | | 77.00 0.00 | | | | | | | |
| 5.50-6.50 | | | 87.00 0.00 | | | | | | | |
| 6.50-7.10 | | | 92.00 0.00 | | | | | | | |
| 7.10-8.50 | | | 100.00 0.00 | | 104.03 | 7.35 | Purple brown very thinly laminated slightly muddy highly weathered SILTSTONE, very weak and highly fractured. Completely weathered from 8.30-9.00 and 10.80-11.10. Smooth moderately tight silty joints at 8.20m (30 deg.), 9.30m (30 deg.), 9.40m (30 deg.) | | | |
| 8.50-10.80 | | | 98.00 0.00 | | | (4.85) | | | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:26

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| | | | | | | |



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 12-03-1984/23-03-1984 | | Co-ordinates: E 393417.0 N 385623.0 | | Ground Level: 112.89 (m) NWH MAIN GI 225 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 1 of 3 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|-------------------------------|-------------------------------|-------------|---------|-----------------------|------------|-------------------|---|-------------------------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 0.30 | D D 200 U 600 | | | | | 112.69 | 0.20 | TOPSOIL | |
| | | | | | | | (0.60) | soft, brown, silty fine, medium sandy CLAY. | |
| 1.00 | D B 101 D 600 U 6707 | | | | | 112.09 | 0.80 | Stiff, brown, grey mottled, silty sandy CLAY. | |
| | | | | | | | (1.30) | | |
| 2.10 | SPT | N = 10(450mm) 1 2/3 3 2 2 | | | | 110.79 | 2.10 | Loose, mid-brown, slightly clayey, silty, fine with some medium, coarse SAND and fine, medium, occasionally coarse, subrounded GRAVEL. | |
| 2.40 | D B 102 D 6707 | | | | 110.49 | 2.40 | | | |
| 3.60 | D D 102 U 601 | | | | | | | Purple grey, highly weathered clayey SILTSTONE, very weak. Completely weathered bands at 5.70-5.90 and thinly laminated from 5.30-5.60. | |
| | | | | | | | (3.60) | | |
| 4.90 | SPT | N = 0(600mm) 38 63/0 0 0 0 | | | | | | | |
| 5.30-6.30 | | | 90.00 | 0.00 | | 106.89 | 6.00 | Light brown slightly silty fine grained moderately weathered SANDSTONE, moderately weak. Moderately fractured from 6.70m to 6.90m. Moderately open joint clay filled and vertical form 6.30m-6.55m and moderately tight fine sandy and silty dusted joints from 7.20m - 7.25m at 10 deg. + 7.30m-7.40m at 45 deg. | |
| 6.30-7.40 | | | 100.00 | 25.00 | | | (1.40) | | |
| 7.40-9.00 | | | 100.00 | 0.00 | | 105.49 | 7.40 | Light orange-brown slightly muddy fine grained completely to highly weathered SANDSTONE, weak. Highly fractured 7.45 to 8.10 very highly fractured 8.10 to 8.40m. Moderately tight iron stained silty fine sand dusty joints 45 deg: 8.85m, 9.00m at 50 deg. Moderately weathered from 8.40m-10.20 with highly weathered band 8.50-8.60m and very highly fractured from 9.10m-9.20m and 9.50m to 9.70m. | |
| 9.00-9.50 | | | 100.00 | 28.00 | | | (2.80) | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 6.00 | 5.20 | 20 | 6.00 | Water struck | | |
| 9.00 | 13.00 | 20 | 9.00 | Heavy inflow | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:24



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 12-03-1984/23-03-1984 | | Co-ordinates: E 393417.0 N 385623.0 | | Ground Level: 112.89 (m) NWH MAIN GI 225 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 2 of 3 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|-----------------|---------------------------------|-----------------------------|---------------|----------------------|---|--|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 9.50-10.80 | | | 85.00 0.00 | | 102.69 | 10.20 (0.80) | Purple-brown slightly clayey highly to complete weathered SILTSTONE, very weak. Highly fractured with occasional iron staining. | x x x x x x x x x x x x x x x x x x | |
| 10.80-11.30 | | | 100.00 0.00 | | 101.89 | 11.00 | Dark grey and black slightly carbonaceous silty completely weathered MUDSTONE, soft to firm with much clay. Highly weathered, very weak and highly fractured below 13.30m. | | |
| 11.30-13.00 | | | 100.00 0.00 | | | (2.60) | | | |
| 13.00-13.60 | | | 100.00 0.00 | | 99.29 | 13.60 | | | |
| 13.60-14.30 | | | 64.00 0.00 | | | (0.50) | Grey brown very muddy completely weathered SILTSTONE, very weak with much CLAY. | x x x x x x x x x | |
| 14.30-14.80 | | | 100.00 0.00 | | 98.79 | 14.10 | | | |
| 14.80-15.50 | | | 86.00 0.00 | | 98.59 | 14.30 | Dark grey and red-brown mottled, muddy highly weathered SILTSTONE, very weak, very highly fractured with occasional slickensiding. | x x x x x x x x x | |
| 15.50-17.00 | | | 97.00 9.00 | | 98.29 | 14.60 | Light brown slightly silty fine and medium grained moderately weathered SANDSTONE, moderately strong. Highly fractured with much clay smear. | | |
| 17.00-17.30 | | | | | | (0.90) | Dark grey slightly silty moderately weathered MUDSTONE, weak. Highly fractured. | | |
| 17.30-18.80 | | | 67.00 0.00 | | 97.39 | 15.50 | | | |
| 18.80-20.90 | | | 98.00 0.00 | | 97.19 | 15.70 | Light brown slightly silty fine and medium grained moderately weathered SANDSTONE, moderately strong. Highly fractured with much clay smear. | x x x | |
| | | | | | 96.99 | 15.90 | Light grey friable muddy completely weathered SILTSTONE, very weak. | x x x | |
| | | | | | 96.69 | 16.20 | Dark grey highly carbonaceous moderately weathered MUDSTONE, weak, with coal partings and occasional plant traces and pyrites, moderately fractured. | | |
| | | | | | | (2.60) | Dark grey to grey silty highly weathered MUDSTONE, very weak. Thickly laminated from 16.20-17.00, highly fractured from 16.70-17.00 + 17.50-17.60, occasional plant traces. | | |
| | | | | | 94.09 | 18.80 | | | |
| | | | | | | (0.40) | Black, impure occasionally lustrous muddy COAL with occasional pyrite. | | |
| | | | | | 93.69 | 19.20 | | | |
| | | | | | | (0.40) | Light grey silty completely weathered MUDSTONE, very weak with occasional plant traces and slickenside (seat earth) | | |
| | | | | | 93.29 | 19.60 | | | |
| | | | | | | | See next page. | | |

| Water Strikes | | | | | Method, Equipment and Remarks |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| 15.50 | 16.50 | 20 | 20.00 | Moderate inflow | |

AGS3_NEW_ELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GP | AGS3_NEW_GDT | 23/11/2011 | 09:46:24

BOREHOLE LOG

| | | | | |
|---|--|--|-------------------------------------|---|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. |
| Date: 12-03-1984/23-03-1984 | | Co-ordinates: E 393417.0 N 385623.0 | | Ground Level: 112.89 (m) NWH MAIN GI 225 |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | |
| | | | | Sheet: 3 of 3 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 20.90-22.20 | | | 96.00 0.00 | | | 90.69 | 22.20 | Dark grey to grey silty highly weathered MUDSTONE, very weak with occasional plant traces. Highly fractured 20.90 to 22.20m thinly laminated 20.50 to 20.80m, moderately weathered and weak from 19.70 to 20.40m. <i>(continued)</i> | | |
| | | | | | | | | End of Borehole | | |

AGS3_NEW_ELB | SW BH LOG (CP/RG) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GP | AGS3_NEW_GDT | 23/11/2011 | 09:46:24

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|--------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| | | | | | |



BOREHOLE LOG

| | | | | |
|---|--|--|-------------------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. |
| Date: 20-03-1984/04-04-1984 | | Co-ordinates: E 393338.0 N 385678.0 | | Ground Level: 110.61 (m) NWH MAIN GI 223 |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | |
| | | | | Sheet: 1 of 2 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------------------|---------------------------------|-------------|---------|-----------------------|------------|-------------------|---|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 0.50 | D U 600 | | | | | 110.31 | 0.30 | MADE GROUND: Black topsoil, brick and ash. | | |
| | | | | | | | (1.10) | soft to firm mid brown grey mottled very sandy CLAY | | |
| 1.50 | D D 600 U 601 | | | | | 109.21 | 1.40 | soft to firm, brown with some black mottling, clayey, very sandy, SILT with some fine and medium, occasionally coarse, subrounded gravel. | | |
| | | | | | | | (1.25) | | | |
| 2.50 | D D 601 U 602 | | | | | 107.96 | 2.65 | Soft to firm dark brown, very silty CLAY with occasional fine, subrounded gravel. | | |
| | | | | | | | (1.55) | | | |
| 3.50 | SPT | N = 29(600mm) 34 11/29 0 0 0 | | | | 106.41 | 4.20 | Dark grey-brown, muddy, completely weathered SILTSTONE. Very weak with highly weathered fragments between 5.10m and 5.30m. | | |
| | | | | | | | (1.75) | | | |
| 4.65-5.80 | | | | | | 39.00 | | | | |
| | | | | | | 0.00 | | | | |
| 5.80-6.80 | | | | | | 42.00 | | | | |
| | | | | | | 0.00 | | | | |
| 6.80-7.80 | | | | | | 58.00 | | | | |
| | | | | | | 0.00 | | | | |
| 7.80-9.30 | | | | | | 93.00 | | | | |
| | | | | | | 0.00 | | | | |
| | | | | | | 102.76 | 7.85 | Purple-grey, poorly thinly laminated, fine sandy, moderately weathered SILTSTONE. Weak and moderately to highly fractured. Highly weathered band 8.10m to 8.20m, completely weathered band 8.30m to 8.70m. Moderate tight, clean, vertical joint at 7.90m. Moderately tight, clean, rough joint 8.50m to 8.65m. 80 deg. | | |
| | | | | | | 101.01 | 9.60 | Light grey, thinly laminated, muddy highly weathered SILTSTONE. Weak to very weak and very highly fractured. | | |
| | | | | | | | (0.50) | | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|-----------------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 5.80 | | 20 | 6.50 | Moderate water inflow | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GI\NWT\7060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:21

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|---------------------------------|-----------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/04-04-1984 | | Co-ordinates: E 393338.0 N 385678.0 | | Ground Level: 110.61 (m) | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | NWH MAIN GI 223 |
| | | | | | Sheet: 2 of 2 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|-----------------|-------------------|-----------------------------|------------|---------------|---|-------------|-------------------------|
| Depth | Type No | Test Results | TCR SCR Rqd | | If (mm) | O.D. Level | Depth (Thickness) | Description | |
| 9.30-10.90 | | | 95.00 0.00 | | 100.51 | 10.10 | Purple grey, slightly muddy, moderately to slightly weathered SILTSTONE. Moderately weak, becomes grey below 10.25m. | x x x | |
| | | | | | 100.21 | 10.40 | | x x x | |
| 10.90-12.30 | | | 100.00 7.00 | | (0.50) | 10.90 | Light grey, silty, fine grained, moderately to highly weathered SANDSTONE. Moderately weak to weak. Moderately open, rough, iron stained, silty fine sand filled, vertical joint 10.40m to 10.90m. | x x x | |
| | | | | | 99.71 | 10.90 | | x x x | |
| 12.30-15.30 | | | 96.00 34.00 | | 97.16 | 13.45 | Dark purple-grey, poorly thinly laminated, muddy, moderately weathered SILTSTONE. Weak. Completely weathered bands 11.25m to 11.35m and 13.35m to 13.45m. Highly weathered and highly fractured from 11.65m to 11.80m. Open, rough, iron stained, vertical joint 10.90m to 11.35m. Moderately tight, rough, clean, joint 80 deg from 12.90m to 13.35m. Light grey, silty, fine grained sandstone bands 13.10m to 13.15m and 13.30m to 13.40m. | x x x | |
| | | | | | (2.55) | 97.16 | | 13.45 | |
| 15.30-16.20 | | | 97.00 74.00 | | 94.41 | 16.20 | Light grey, silty, fine occasionally medium grained, slightly weathered SANDSTONE. Moderately weak to moderately strong, with occasional iron stained fractures. | x x x | |
| | | | | | (2.75) | 94.41 | | 16.20 | |
| 16.20-16.30 | | | 50.00 0.00 | | 93.31 | 17.30 | Dark grey, slightly carbonaceous, slightly silty, completely weathered MUDSTONE. Very weak. | x x x | |
| | | | | | (1.10) | 93.31 | | 17.30 | |
| 16.30-17.30 | | | 100.00 0.00 | | 93.31 | 17.30 | End of Borehole | x x x | |

AGS3_NEW GLEB | SW BH LOG (CP/RG) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:22

| Water Strikes | | | | | Method, Equipment and Remarks | | | | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|--|--|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | | | | |
| | | | | | | | | | |

BOREHOLE LOG



| | | | |
|---|--|-------------------------------------|-----------------|
| Project: SEMMS | | Job No: 37732ISG | Borehole No. |
| Date: 20-03-1984/30-03-1984 | Co-ordinates: E 393390.0 N 385658.0 | Ground Level: 111.61 (m) | NWH MAIN GI 222 |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | Engineer: Faber Maunsell Ltd | Sheet: 2 of 3 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | Backfill/ Instrument |
|-----------------|------------|-----------------|-------------------|-----------------------------|---------------|----------------------|---|---|
| Depth | Type No | Test Results | TCR SCR RGD | | O.D. Level | Depth (Thickness) | Description | |
| 10.10-11.50 | | | 86.00 0.00 | | 100.11 | 11.50 | Reddish brown and grey, thinly laminated, moderately weathered SILTSTONE, weak, highly fractured from 7.70m to 7.80m and 8.45m to 8.70m. Highly to completely weathered from 8.90-9.00m, 9.45m-9.60m, and 11.10m-11.20m. <i>(continued)</i> | x |
| 11.50-12.10 | | | 100.00 0.00 | | | | Pinkish grey, silty, slightly weathered fine grained SANDSTONE, moderately strong. Thin siltstone laminations below 12.10m. Highly weathered from 13.70m to 15.40m. Highly fractured from 12.40m to 12.90m. | . |
| 12.10-13.90 | | | 97.00 19.00 | | | (4.95) | | |
| 13.90-15.40 | | | 80.00 27.00 | | | | | |
| 15.40-17.40 | | | 88.00 0.00 | | 95.16 | 16.45 | Red-brown-grey silty, completely weathered MUDSTONE, very weak, very highly fractured. | - |
| 17.40-18.70 | | | 100.00 0.00 | | 94.51 | 17.10 | Pinkish grey, highly weathered fine sandy SILTSTONE, weak, highly fractured. Occasional iron staining along fractured joints. | x x x x x x x x x |
| | | | | | 94.21 | 17.40 | Red brown, silty, completely weathered MUDSTONE, very weak. Clayey from 17.40m to 17.60m. | - |
| | | | | | 93.91 | 17.70 | Purple grey, clayey, slightly fine, sandy moderately to highly weathered SILTSTONE, weak, with occasional fine and medium grained sandstone nodules. | x x x x x x x x x |
| 18.70-19.40 | | | 86.00 0.00 | | 93.61 | 18.00 | Red brown, silty, highly to completely weathered MUDSTONE, weak and highly fractured. | - |
| | | | | | (0.60) | | Light grey, silty, fine grained, highly weathered SANDSTONE. Weak. | x |
| | | | | | 93.01 | 18.60 | Purple brown, muddy, fine, sandy, highly to completely weathered SILTSTONE, very weak and highly fractured from 19.35m to 21.20m. | - |
| | | | | | 92.91 | 18.70 | | |
| | | | | | | (1.50) | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:19

| Water Strikes | | | | |
|-----------------|-----------------|--------------|---------------|-----------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Method, Equipment and Remarks | |
|-------------------------------|--|
| Method: CP | |
| | |



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/30-03-1984 | | Co-ordinates: E 393390.0 N 385658.0 | | Ground Level: 111.61 (m) NWH MAIN GI 222 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 3 of 3 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|---|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 19.40-20.50 | | | 70.00 0.00 | | | 91.41 | 20.20 | Dark grey-black silty, highly to completely weathered MUDSTONE, weak to very weak and highly fractured. | x x x x x x |
| 20.50-21.70 | | | 92.00 0.00 | | | | (1.50) | | |
| | | | | | | 89.91 | 21.70 | End of Borehole | |

AGS3_NEW_ELEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:19

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|--------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/28-03-1984 | | Co-ordinates: E 393432.0 N 385650.0 | | Ground Level: 113.09 (m) NWH MAIN GI 221 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 1 of 5 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|------------------------------|---------------------------------|-------------|---------------|-----------------------|------------|-------------------|--|-------------------------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 0.50 | D U 600 | | | | | 112.79 | 0.30 | TOPSOIL | |
| | | | | | | | (2.90) | Firm brown grey mottled slightly silty fine sandy CLAY with occasional fine, medium subrounded to subangular gravel. Becoming very sandy (fine, medium and coarse) at 2.50m, with less frequent gravel. | |
| 2.50 | D B 101 D 600 | | | | | | | | |
| 3.20 | D D 101 U 601 | | | | | 109.89 | 3.20 | purple brown completely weathered clayey SILTSTONE - very weak. | |
| 3.80 | SPT | N = 50(600mm) 35 43/50 0 0 0 | | | | | (2.80) | | |
| 5.00 | D D 200 D 601 U 602 | | | | | | | | |
| 5.90 | SPT | N = 0(525mm) 50 0/0 0 0 0 | | | | 107.09 | 6.00 | Red brown muddy highly weathered SILTSTONE, very weak and highly fractured containing light brown fine grained moderately weathered SANDSTONE band at 6.90 to 6.95m. | |
| 6.00-7.00 | | | | 50.00 0.00 | | | (1.00) | | |
| 7.00-8.50 | | | | 40.00 0.00 | | 106.09 | 7.00 | Light brown silty fine grained moderately weathered SANDSTONE, moderately weak, highly fractured and highly weathered from 8.40m-8.50m. 9.30m-9.60m. Moderately open vertical joint with silt infilling from 9.10m -9.20m, 9.70m-9.90m. Moderately open 45 deg. clean joints at 9.90-9.95m and 10.90-10.95m. | |
| 8.50-9.50 | | | | 55.00 0.00 | | | (4.10) | | |

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|-----------------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| 6.00 | | 20 | 6.00 | Moderate water inflow | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:16

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/28-03-1984 | | Co-ordinates: E 393432.0 N 385650.0 | | Ground Level: 113.09 (m) NWH MAIN GI 221 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 2 of 5 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | Backfill/ Instrument |
|-----------------|------------|-----------------|---------------------------------|-----------------------------|---------------|----------------------|---|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD If (mm) | | O.D. Level | Depth (Thickness) | Description | |
| 9.50-10.50 | | | 55.00 13.00 | | | | Light brown silty fine grained moderately weathered SANDSTONE, moderately weak, highly fractured and highly weathered from 8.40m-8.50m. 9.30m-9.60m. Moderately open vertical joint with silt infilling from 9.10m -9.20m, 9.70m-9.90m. Moderately open 45 deg. clean joints at 9.90-9.95m and 10.90-10.95m. <i>(continued)</i> | |
| 10.50-11.50 | | | 80.00 14.00 | | 101.99 | 11.10 | Black occasionally reddish brown silty, completely weathered MUDSTONE, very weak and poorly thinly laminated from 12.60-13.50m. Light brown fine grained moderately weathered SANDSTONE bands from 12.50-12.60m, 13.50-13.60m and 14.80-15.00m. Highly fractured from 13.60-15.00m. | |
| 11.50-12.50 | | | 40.00 0.00 | | | | | |
| 12.50-13.50 | | | 65.00 0.00 | | | (3.90) | | |
| 13.50-14.50 | | | 100.00 0.00 | | | | | |
| 14.50-14.80 | | | 100.00 0.00 | | | | | |
| 14.80-15.80 | | | 70.00 0.00 | | 98.09 | 15.00 | Dark grey poorly laminated silty fine grained completely weathered MUDSTONE, very weak. Highly fractured from 16.05-16.40m. | |
| 15.80-16.80 | | | 85.00 16.00 | | | | | |
| | | | | | 96.69 | 16.40 | Grey silty fine grained slightly weathered SANDSTONE, moderately weak. Very weak from 16.70-16.80m. Moderately open, clean 20 deg. Joint from 16.65 to 16.70m. | |
| | | | | | 96.29 | 16.80 | Red and grey SANDSTONE. | |

AGS3_NEW GLEB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:16

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| | | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/28-03-1984 | | Co-ordinates: E 393432.0 N 385650.0 | | Ground Level: 113.09 (m) NWH MAIN GI 221 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 3 of 5 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|--|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| <div style="font-size: 8px; text-align: center;"> 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000 </div> | | | | | | (15.20) | | Red and grey SANDSTONE. <i>(continued)</i> | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| | | | | | | |

AGS3_NEW_ELB | SW BH LOG (CP/RG) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:16

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|--|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 20-03-1984/28-03-1984 | | Co-ordinates: E 393432.0 N 385650.0 | | Ground Level: 113.09 (m) NWH MAIN GI 221 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 4 of 5 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|-------------------------------------|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 16.80-45.00 | | | | | | | | Red and grey SANDSTONE. (continued) | | |
| | | | | | | 81.09 | 32.00 | | | |
| | | | | | | | (1.30) | Grey MUDSTONE and COAL. | | |
| | | | | | | 79.79 | 33.30 | | | |
| | | | | | | | (0.70) | Light grey MUDSTONE | | |
| | | | | | | 79.09 | 34.00 | | | |
| | | | | | | | (0.50) | COAL | | |
| | | | | | | 78.59 | 34.50 | | | |
| | | | | | | | (1.00) | Light grey MUDSTONE | | |
| | | | | | | 77.59 | 35.50 | | | |
| | | | | | | 77.29 | 35.80 | | | |
| | | | | | | | (0.50) | Grey MUDSTONE | | |
| | | | | | | 76.79 | 36.30 | | | |
| | | | | | | | | Red and grey SANDSTONE. | | |

AGS3_NEW_ELB | SW BH LOG (CP/RG) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:16

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| | | | | | | |

BOREHOLE LOG

| | | | | |
|---|--|--|-------------------------------------|---|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. |
| Date: 20-03-1984/28-03-1984 | | Co-ordinates: E 393432.0 N 385650.0 | | Ground Level: 113.09 (m) NWH MAIN GI 221 |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | |
| | | | | Sheet: 5 of 5 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| | | | | | | | (8.70) | Red and grey SANDSTONE. <i>(continued)</i> | | |
| | | | | | | 68.09 | 45.00 | End of Borehole | | |

AGS3_NEW_ELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:17

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|--------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| | | | | | |

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|---|--------------------------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 01-07-1992/06-07-1992 | | Co-ordinates: E 393294.0 N 385660.5 | | Ground Level: 107.90 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | 3RD SUPP 711 Sheet: 1 of 4 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|--------------------------|---------|-----------------------|------------|-------------------|---|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| | | | | | | | (2.25) | Yellow and red CLAY. | | |
| 2.25-3.16 | | | 77.00 59.00 53.00 | | | 105.65 | 2.25 | Red-brown and yellow-brown medium bedded fine, medium and coarse grained moderately weathered SANDSTONE, moderately weak. Very closely spaced subhorizontal planar, rough and vertical rough discontinuities with some iron staining. | | |
| 3.16-4.20 | | | 61.00 42.00 43.00 | | | 105.35 | 2.55 | Grey banded black, red and dark grey completely weathered silty MUDSTONE, very weak. Irregular subhorizontal boundary with overlying sandstone. 2.75m: inclined (30 deg) healed clayey discontinuity, light grey above, red below. 3.85m to 3.95: black, non intact with angular gravel-sized fragments having smooth stepped and striated surfaces. Below 3.95m: dark grey, black and carbonaceous. | | |
| 4.20-5.64 | | | 96.00 74.00 74.00 | | | 103.75 | 4.15 | Red-brown occasionally banded grey and light grey thickly laminated to very thinly bedded moderately to highly weathered SILTSTONE, weak, occasionally very weak and moderately weak. Grading in places to silty mudstone and fine sandstone. Apparent dip of bedding 5 deg. Closely occasionally very closely and medium spaced subhorizontal (parallel to bedding) open, closed and clayey discontinuities, core occasionally fragmented and non intact adjacent. Many subhorizontal and subvertical irregular closed or clayey discontinuities, core fragmented and non-intact adjacent. 5.64 to 5.80m: black carbonaceous angular smooth and striated gravel-sized fragments (possible cavings from 3.16m to 4.20m core run). Below 8.29m: dark red-brown and red-brown occasionally banded grey and light grey, moderately weak. Below 9.66m: interlaminated siltstone and fine sandstone. Below 10.10m: highly fractured with many vertical and subvertical irregular closed occasionally healed or non intact discontinuities, laminae and beds showing having been offset. 12.05m to 12.27m: band of light brown-grey medium grained thinly bedded, slightly weathered sandstone, moderately strong. Below 12.27m: siltstone grading in places to fine sandstone and with many subvertical irregular clayey closed discontinuities. | | |
| 5.64-6.33 | | | 90.00 46.00 46.00 | | | | | | | |
| 6.33-7.44 | | | 97.00 76.00 63.00 | | | | | | | |
| 7.44-8.29 | | | 112.00 35.00 35.00 | | | | | | | |
| 8.29-9.66 | | | 89.00 18.00 12.00 | | | | (9.30) | | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:13

| Water Strikes | | | | | Method, Equipment and Remarks | | | | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|--|--|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RC | | | | |
| | | | | | | | | | |

BOREHOLE LOG

| | | | | |
|---|--|--|-------------------------------------|---------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. |
| Date: 01-07-1992/06-07-1992 | | Co-ordinates: E 393294.0 N 385660.5 | | EA |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | 3RD SUPP 711 |
| | | | | Sheet: 3 of 4 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | Backfill/ Instrument |
|----------------------------|---------|--------------|--------------------------|--------------------------|------------|-------------------|---|---|
| Depth | Type No | Test Results | TCR SCR RQD If (mm) | | O.D. Level | Depth (Thickness) | Description | |
| 19.05-21.05 | | | 104.00 80.00 77.00 | | 87.18 | 20.72 | | |
| 21.05-22.04 | | | 100.00 64.00 56.00 | | | (2.33) | Dark grey onto grey thickly laminated to very thinly bedded moderately weathered SILTSTONE, weak. Grading in places to silty mudstone. Apparent dip of bedding 5 deg. Closely occasionally very closely spaced subhorizontal (parallel to bedding) planar smooth occasionally clayey discontinuities. 21.80m to 22.44m: non-intact. Below 22.40m: dark grey thinly laminated grey and light grey, very closely and closely spaced discontinuities, with occasional ironstone nodules (<15mm) and bands (<30mm thick). | x |
| 22.04-22.44 | | | 50.00 0.00 0.00 | | | | | x |
| 22.44-24.10 | | | 111.00 0.00 0.00 | | | (1.30) | light grey fine graiend thickly laminated to very thinly bedded grey and dark grey silty slightly weathered SANDSTONE, moderately weak to moderately strong. 23.05m to 23.25m: many thick laminae of grey siltstone. 23.05m to 23.35m: inclined (70 deg) healed discontinuity with a 5mm wide non intact zone, showing bed offsetting. 23.40m to 23.90m: inclined (70 deg) 10mm wide calcite vein with randomly orientated veining adjacent (<2mm wide). | x |
| 24.10-24.28 24.28-24.32 | | | 111.00 0.00 0.00 | | 83.55 | 24.35 | Sandstone fractured with subhorizontal and subvertical rough irregular rough discontinuities. 24.10m to 24.15m: dark red-brown, grey and dark grey completely weathered silty mudstone, very weak. 24.15m to 24.35m: non intact with several calcite veins (<5mm wide). | x |
| 24.32-25.82 | | | 90.00 57.00 46.00 | | | (1.47) | Grey thinly laminated dark grey, light grey and dark red-brown slightly weathered SILTSTONE, weak and moderately weak, occasionally very weak. Grading in places to mudstone and fine sandstone. Apparent sip of bedding 5 deg. Occasional ironstone bands (<30mm thick). Very closely spaced subhorizontal (parallel to bedding) occasionally clayey discontinuities. 24.35m to 24.65m: inclind (70 deg) closed discontinuity with bed offsetting. Siltstone fragments at top of drill run. | x |
| 25.82-27.74 | | | 106.00 45.00 41.00 | | | (1.28) | Grey fine grained thinly to thickly laminated dark grey and dark red-brown silty slightly weathered SANDSTONE, moderately strong. Apparent dip of bedding 5 deg. Occasionally interlaminated with siltstone. Closely spaced subhorizontal (parallel to bedding) open occasionally non intact adjacent discontinuities. 26.80m to 27.10m: inclined (70 deg) planar, rough discontinuity. | x |
| 27.74-29.34 | | | 99.00 59.00 46.00 | | | (0.70) | Dark red-brown thinly laminated moderately weathered clayey SILTSTONE, weak. Grading in places to silty mudstone. Apparent dip of bedding 5 deg. Closely spaced subhorizontal (parallel to bedding) clayey discontinuities. 27.10m to 27.15m: non intact. | x |
| 27.74-29.34 | | | 99.00 59.00 46.00 | | 79.70 | 28.20 | Light grey and grey fine grained very thinly bedded slightly weathered SANDSTONE, moderately strong. 90 deg. Becoming 70 deg. Below 27.80m: vertical to inclined (70 deg), planar, rough discontinuity with medium spaced, subhorizontal planar, open discontinuities. | x |
| 27.74-29.34 | | | 99.00 59.00 46.00 | | 78.75 | 29.15 | Dark red-brown thinly laminated dark grey and grey slightly weathered SILTSTONE, weak and moderately weak. Gradin in palces to silty mudstone and fine sandstone. Apparnet dip of bedding 5 deg. Closely to medium spaced subhorizontal (parallel to bedding) clayey discontinuities. 0.05m wide non intact zone at top of stratum. Light grey and red-brown at base of stratum. | x |
| 29.34-29.58 | | | 92.00 0.00 0.00 | | 78.20 | 29.70 | Light grey fine and medium grained medium bedded slightly weathered SANDSTONE, moderately strong. Inclined (70 deg) randomly orientated planar rough discontinuities. Below 29.58m: light grey and red-brown, very thinly bedded with | x |

| Water Strikes | | | | | Method: RC |
|---------------|--------------|-----------|------------|--------------|------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | |
| | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|--|---|---------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-07-1992/16-07-1992 | | Co-ordinates: E 393318.0 N 385652.5 | | Ground Level: 109.30 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | | Engineer: Faber Maunsell Ltd | |
| | | | | | 3RD SUPP 710 |
| | | | | | Sheet: 1 of 5 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|--------------------------|---------|-----------------------|------------|-------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| | | | | | | | | Stiff yellow and red CLAY. | | |
| | | | | | | | (2.50) | | | |
| | | | | | | 106.80 | 2.50 | | | |
| 2.50-3.50 | | | 11.00 11.00 0.00 | | | | (1.00) | Light grey-brown thickly laminated completely weathered SILTSTONE, very weak. | | |
| | | | | | | 105.80 | 3.50 | | | |
| 3.50-4.25 | | | 100.00 37.00 3.00 | | | | | Red-brown and dark red-brown thickly laminated highly and moderately weathered SILTSTONE, weak. Apparent dip of bedding 5 deg. Grading in places to highly weathered silty mudstone and layers of light grey fine sandstone. Medium occasionally widely and closely spaced subhorizontal (parallel to bedding) occasionally subvertical clayey discontinuities, non-intact adjacent to some discontinuities. Occasional ironstone bands (<50mm thick). Below 7.35m: moderately weathered and weak to moderately weak. Below 8.69m: closely and medium spaced and occasionally very thin and thinly bedded. | | |
| 4.25-5.23 | | | 88.00 74.00 67.00 | | | | | | | |
| 5.23-6.69 | | | 100.00 56.00 52.00 | | | | | | | |
| 6.69-8.69 | | | 95.00 74.00 73.00 | | | | (7.45) | | | |
| 8.69-9.84 | | | 95.00 40.00 37.00 | | | | | | | |

AGS3_NEW_ELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:09

| Water Strikes | | | | | Method, Equipment and Remarks | | | | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|--|--|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RC | | | | |
| | | | | | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|---|--------------------------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-07-1992/16-07-1992 | | Co-ordinates: E 393318.0 N 385652.5 | | Ground Level: 109.30 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | 3RD SUPP 710 Sheet: 2 of 5 |

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|-----------------|--------------------------|------------|-----------------------------|---------------|---|--|--------|---|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 9.84-11.63 | | | 100.00 58.00 48.00 | | 98.35 | 10.95 | Dark red-brown thinly and thickly laminated silty fine grained slightly and moderately weathered SANDSTONE, moderately weak and moderately strong. Many laminae of siltstone. Apparent dip of bedding 5 deg. Closely spaced subhorizontal clayey discontinuities. Below 11.36m: vertical, sub-vertical and sub-horizontal randomly orientated clayey discontinuities. Below 13.10m: closely and very closely spaced subhorizontal and subvertical clayey open discontinuities with adjacent non-intact zones. | x | | |
| 11.63-12.48 | | | 78.00 0.00 0.00 | | | (3.65) | | | | |
| 12.48-13.62 | | | 84.00 17.00 12.00 | | | | | | | |
| 13.62-14.60 | | | 55.00 35.00 19.00 | | 94.70 | 14.60 | | | | |
| 14.60-15.12 | | | 83.00 15.00 0.00 | | | (1.20) | | | | light grey thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. Recovered as ironstained angular gravel. 15.00m to 15.12m: light grey and red-brown thinly laminated with siltstone laminae. Apparent dip of bedding 5 deg. |
| 15.12-16.52 | | | 64.00 0.00 0.00 | | 93.50 | 15.80 | | | | Dark red-brown and red-brown thinly and thickly laminated silty fine grained slightly weathered SANDSTONE, moderately weak. Many bands and laminae of siltstone and occasionally mudstone. Apparent dip of bedding 5 deg. Closely to medium spaced subhorizontal (parallel to bedding) open occasionally clayey discontinuities, many irregular randomly orientated healed clayey discontinuities with some laminae showing offsetting. |
| 16.52-17.50 | | | 86.00 47.00 41.00 | | | (2.80) | | | | |
| 17.50-17.81 | | | 65.00 0.00 0.00 | | 90.70 | 18.60 | | | | |
| 17.81-19.94 | | | 98.00 62.00 49.00 | | | (1.85) | See next page. | | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GP | AGS3_NEW GDT | 23/11/2011 | 09:46:09

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RC | |
| | | | | | | |

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|---|--------------------------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-07-1992/16-07-1992 | | Co-ordinates: E 393318.0 N 385652.5 | | Ground Level: 109.30 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | 3RD SUPP 710 Sheet: 4 of 5 |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|---------|--------------|--------------------------|-----------------------------|--------------------|----------------------|--|--|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 30.34-31.64 | | | 96.00 49.00 42.00 | | 78.96 77.66 | 30.34 31.64 | Light grey discoloured red-brown very thinly and thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. Apparent dip of bedding 5 deg. Closely spaced subhorizontal (parallel to bedding) rough open discontinuities. 28.55m to 28.85m: 70 deg irregular rough partially calcite mineralised discontinuity. 29.21m to 29.35m: 90 deg. rough irregular partially calcite mineralised discontinuity. Below 29.35m: light grey thinly laminated red-brown and grey silty fine sandstone, medium and closely spaced discontinuities. 30.20m to 30.34m: irregular randomly orientated rough discontinuities (possibly drilling induced) (continued) | x | |
| 31.64-33.72 | | | 95.00 50.00 50.00 | | 74.95 | 33.72 | Grey thickly laminated slightly weathered fine sandy SILTSTONE, moderately weak. Occasional ironstone bands (<30mm thick) and some thin light grey fine and medium grained moderately strong sandstone layers (<50mm thick). Apparent dip of bedding 5 deg. Medium spaced subhorizontal (parallel to bedding) clayey discontinuities. 90 deg irregular rough discontinuities in sandstone layers. Light grey and red-brown thickly laminated to thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. Many beds and laminae of siltstone. Apparent dip of bedding 5 deg. Medium spaced subhorizontal and subvertical open occasionally clayey or non-intact zoned discontinuities. 31.64m to 32.00m 90 deg becoming 80 deg rough irregular partially calcite mineralised open discontinuity. | x | |
| 33.72-35.57 | | | 92.00 60.00 33.00 | | 74.45 | 35.57 | Red-brown and dark red-brown thinly and thickly laminated moderately weathered clayey SILTSTONE, weak. Apparent dip of bedding 5 deg. Medium spaced subhorizontal (parallel to bedding) and subvertical clayey discontinuities. | x x x x x x x x x x x x | |
| 35.57-36.28 | | | 85.00 49.00 41.00 | | 73.00 | 36.28 | Red-brown and dark red-brown thickly laminated slightly weathered silty MUDSTONE, weak. Apparent dip of bedding 5 deg. Medium and closely spaced sub-horizontal (parallel to bedding) open or clayey discontinuities and subvertical clayey closed discontinuities. below 36.20m : grey. | | |
| 36.28-38.81 | | | 100.00 65.00 55.00 | | 72.50 72.15 | 38.81 | Black and dark grey cleated dusty dull thickly laminated slightly weathered fine sandy COAL, weak. Occasional light grey fine sandstone laminae. Apparent dip of bedding 5 deg. Black vitreous cleated slightly weathered COAL, weak. Some disseminated and veined pyrite. Apparent dip of bedding 5 deg. Grey and dark grey thickly laminated slightly weathered silty MUDSTONE, weak. Apparent dip of bedding 5 deg. Closely and medium spaced subhorizontal (parallel to bedding) clayey discontinuities. 37.15m to 37.20m: highly weathered and very weak. | | |
| 38.81-40.35 | | | 92.00 71.00 71.00 | | 70.49 | 40.35 | Black vitreous cleated slightly weathered COAL, weak. Some disseminated and veined pyrite. Apparent dip of bedding 5 deg. Dark grey and grey thinly and thickly laminated moderately weathered silty MUDSTONE, weak. Many laminae of black vitreous coal and carbonaceous mudstone. Apparent dip of bedding 5 deg. Very closely and closely spaced occasionally medium spaced subhorizontal (parallel to bedding) clayey or closed discontinuities. | | |

AGS3_NEW_GLB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:10

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RC | |
| | | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 13-07-1992/16-07-1992 | | Co-ordinates: E 393318.0 N 385652.5 | | EA 3RD SUPP 710 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 5 of 5 | | | | | |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|--------------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 40.35-42.00 | | | 100.00 85.00 81.00 | | | 69.15 | 40.15 | Grey discoloured red-brown and light grey thickly laminated slightly weathered silty MUDSTONE, weak and moderately weak. Grading in places to siltstone and silty fine sandstone. Apparent dip of bedding 5 deg. Medium and closely spaced subhorizontal and subvertical clayey or closed discontinuities, occasionally non-intact adjacent. | | |
| | | | | | | 67.30 | 42.00 | End of Borehole | | |

AGS3_NEW_ELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:10

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RC | |
| | | | | | | |



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 08-07-1992/10-07-1992 | | Co-ordinates: E 393344.0 N 385645.5 | | EA 3RD SUPP 709 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 5 of 5 | | | | | |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|---------|--------------|------------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 40.34-41.55 | | | | | | 70.16 | (0.54) 40.34 | Dark red-brown thickly laminated to very thinly bedded slightly weathered SILTSTONE, moderately weak. Apparent dip of bedding 5 deg. Grading in places to fine sandstone. Below 40.20m: closely spaced suz-horizontal (parallel to bedding) planar, smooth discontinuities. <i>(continued)</i> | x x x x x x x x x |
| | | | 83.00 16.00 0.00 | | | | (1.21) | Dark red-brown thickly laminated moderately to highly weathered silty MUDSTONE, weak. Grading in places to siltstone. Occasional grey fine sandstone bands. Apparent dip of bedding 5 deg. Fractured with many randomly orientated irregular, rough discontinuities. | |
| | | | | | | | 68.95 | 41.55 | End of Borehole |

AGS3_NEW_ELB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:06

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|--------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RO |
| | | | | | |

BOREHOLE LOG

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|---|--|--|-------------------------------------|------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 09-07-1992/15-07-1992 | | Co-ordinates: E 393385.5 N 385664.0 | | EA 3RD SUPP 708 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 1 of 5 | | | | | |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|-------------------|------------|-----------------------------|---------------|----------------------|--|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RGD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| | | | | | | | (3.50) | Soft brown boulder CLAY | | |
| | | | | | | 108.20 | 3.50 | Soft red clay bound silty MUDSTONE | | |
| | | | | | | | (3.90) | | | |
| | | | | | | 104.30 | 7.40 | | | |
| 7.40-8.40 | | | 100.00 | 29.00 | | | | Dark red-brown thickly laminated to thinly bedded silty fine grained moderately weathered SANDSTONE, moderately weak. Apparent dip of bedding 5 deg. Grading in places to highly weathered non-intact weak siltstone. Very closely and closely spaced sub-horizontal and sub-vertical open or clayey discontinuities, occasionally non-intact adjacent to discontinuities. | | |
| | | | 13.00 | | | | (2.55) | | | |
| 8.40-10.10 | | | 95.00 | 44.00 | | | | | | |
| | | | 25.00 | | | 101.75 | 9.95 | | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RO | |
| | | | | | | |

AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785 - SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:02

BOREHOLE LOG

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|---|--|--|-------------------------------------|---|---------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 09-07-1992/15-07-1992 | | Co-ordinates: E 393385.5 N 385664.0 | | Ground Level: 111.70 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| | | | | | 3RD SUPP 708 |
| | | | | | Sheet: 2 of 5 |

| Samples & Tests | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|--------------------------|--------------------------|------------|-------------------|--|--|--------|
| Depth | Type No | Test Results | TCR SCR RGD If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 10.10-12.10 | | | 100.00 19.00 19.00 | | 99.60 | 12.10 | Light grey occasionally red-brown and dark red-brown thickly laminated to thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. Apparent dip of bedding 5 deg. 9.95m to 10.80m: inclined (90 deg) irregular closed healed calcite veins (<4mm wide). Several 60-80 deg. open rough irregular calcite mineralised discontinuities. Occasional mineralised vugs (up to 8mm wide). 10.80m to 11.05m and 11.65m to 11.75m: dark red-brown and dark grey thinly alminated moderately weathered weak siltstone and moderately weak fine sandstone. 11.05m to 11.55m: inclined (90 deg) rough irregular partially calcite mineralised discontinuity with closely spaced sub-horizontal (parallel to bedding) open discontinuities occasionally non-intact adjacent to discontinuities. 11.75m to 12.10m: inclined (90 deg) stepped partially calcite mineralised closed and open discontinuity with closely spaced subhorizontal (parallel to bedding) open discontinuities. (continued) | | |
| 12.10-14.10 | | | 100.00 54.00 29.00 | | 97.25 | 14.45 | Red-brown thickly laminated silty fine graiend moderately weathered SANDSTONE, moderately weak. Apparent dip of bedding 5 deg. Grading in paces to siltstone and occasionally mudstone. Closely to medium spaced 45 deg to 70 deg clayey closed discontinuities. Occasional very closely to medium spaced sub-horizontal (parallel to bedding) closed discontinuities. 13.10m to 13.30m: inclined (80 deg) open discontinuity. 13.80m to 14.10m: inclined (90 deg) irregular closed discontinuity with subhorizontal discontinuities. | | |
| 14.10-16.10 | | | 83.00 21.00 18.00 | | 96.25 | 15.45 | Red-brown and grey thinly and thickly laminated highly weathered SILTSTONE, weak. Apparent dip of bedding 5 deg. Grading in places to non-intact mudstone and fine sandstone. Many randomly orientated clayey closed discontinuities. | x | |
| 16.10-16.90 | | | 144.00 31.00 15.00 | | 95.95 | 15.75 | Light grey and red-brown thickly laminated fine and medium grained moderately weathered SANDSTONE, moderately strong. 90 deg calcite vein with adjacent non-intact rock. | x | |
| 16.90-18.40 | | | 92.00 11.00 11.00 | | 94.80 | 16.90 | Red-brown and dark red-brown occasionally grey thinly and thickly laminated highly and moderately weathered SILTSTONE, weak and moderately weak. Many red-brown fine grained slightly weathered moderately weak and moderately strong sandstone bands. Grading in places to silty mudstone. Apparent dip of bedding 5 deg. Very closely and closely spaced sub-horizontal (parallel to bedding) closed clayey discontinuities. | x | |
| 18.40-19.50 | | | 100.00 38.00 30.00 | | 94.15 | 17.55 | Red-brown discoloured yellow-brown thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. 90 deg. Open partially calcite mineralised discontinuities, non-intract adjacent from 16.90m to 17.10m, with randomly orientated discontinuities from 17.10m to 17.35m and closed from 17.35m to 17.55m. | x | |
| 19.50-20.00 | | | 100.00 0.00 0.00 | | 92.30 | 19.40 | Red-brown, dark red-brown and light grey thickly laminated highly weathered SILTSTONE, weak. Occasional thin bands of yellow-brown fine grained moderately weathered moderately weak sandstone and highly weathered very weak mudstone. Apparent dip of bedding 5 deg. 90 deg non-intact discontinuities in sandstone layers. | x | |
| | | | | | | | Black, dark grey and dark red-brown banded, thinly and thickly laminated highly weathered silty MUDSTONE, very weak. Structureless, non intact zones between corestones. Below 21.85m : Apparent dip of bedding 5 deg. | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RO | |
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AGS3_NEW GELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:02

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|------------------------|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 09-07-1992/15-07-1992 | | Co-ordinates: E 393385.5 N 385664.0 | | EA 3RD SUPP 708 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 4 of 5 |

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument | |
|-----------------|------------|-----------------|--------------------------|------------|-----------------------------|---------------|----------------------|---|--|-------------------------|--|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | | |
| | | | | | | 81.00 | 30.70 | | x x x x x x x x x x x x x x x | | |
| 30.70-32.30 | | | 100.00 62.00 41.00 | | | | (1.65) | Light grey thickly laminated to thinly bedded fine and medium grained slightly weathered SANDSTONE, moderately strong. Many laminae and beds of dark red-brown and red-brown siltstone. Apparent dip of bedding 5 deg. Closely, occasionally very closely spaced sub-horizontal (parallel to bedding) rough open discontinuities. 30.85m to 31.20m: inclined (90 deg) open rough partially calcite mineralised discontinuity. 31.55m to 31.60m: calcite vug. | x x x x x x x x x x x x x x x | | |
| | | | | | | 79.35 | 32.35 | | | | |
| 32.30-34.30 | | | 98.00 57.00 28.00 | | | | (1.05) | Red-brown and dark red-brown occasionally grey and light grey thinly laminated fine grained slightly weathered SANDSTONE, moderately weak. Many siltstone laminae. Apparent dip of bedding 5 deg. Closely to medium spaced subhorizontal (parallel to bedding) open discontinuities, non-intact adjacent. 32.95m to 33.10m; vertical iron stained discontinuity. | x x x x x x x x x x x x x x x | | |
| | | | | | | 78.30 | 33.40 | | | | |
| | | | | | | 77.85 | 33.85 | | | | |
| | | | | | | | (2.35) | Dark grey and dark red-brown thinly laminated highly weathered clayey SILTSTONE, weak. Grading in places to silty mudstone. | x x x x x x x x x x x x x x x | | |
| 34.30-36.20 | | | 100.00 64.00 58.00 | | | | (0.45) | Red-brown banded dark red-brown and light grey thinly laminated to thinly bedded fine grained slightly weathered SANDSTONE, moderately weak. Many siltstone laminae and beds (up to 0.25m thick). Apparent dip of bedding 5 deg. Closely and medium occasionally very closely spaced subhorizontal (parallel to bedding) open discontinuities non-intact adjacent. 34.35m to 34.70m: 90 deg, rough irregular partially calcite mineralised discontinuity. | x x x x x x x x x x x x x x x | | |
| | | | | | | 75.50 | 36.20 | | | | |
| 36.20-37.20 | | | 100.00 44.00 10.00 | | | | (0.95) | Dark red-brown thinly laminated red-brown and grey moderately weathered clayey SILTSTONE, weak. Apparent dip of bedding 5 deg. Grading in places highly weathered very weak mudstone. Non-intact zones between corestones. | x | | |
| | | | | | | 74.55 | 37.15 | | | | |
| 37.20-39.00 | | | 100.00 43.00 31.00 | | | | (1.55) | Red-brown and grey thinly and thickly laminated fine grained slightly weathered SANDSTONE, moderately weak. Apparent dip of bedding 5 deg. Closely spaced subhorizontal (parallel to bedding) closed or open planar discontinuities. 37.15 to 37.65m: inclined (90 deg) rough open discontinuity non-intact adjacent with associated randomly orientated discontinuities 37.65m to 37.90m; closed. Below 37.70m: red-brown occasional laminated grey and light grey silty fine grained. | x | | |
| | | | | | | 73.00 | 38.70 | | | | |
| 39.00-40.70 | | | 100.00 45.00 0.00 | | | | | | | | |

AGS3_NEW GELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785 - SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:46:03

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RO | |
| | | | | | | |

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|---|---------------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 09-07-1992/15-07-1992 | | Co-ordinates: E 393385.5 N 385664.0 | | Ground Level: 111.70 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| | | | | | 3RD SUPP 708 |
| Sheet: 5 of 5 | | | | | |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|--------------------------|------------|-----------------------------|---------------|----------------------|-------------|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 40.70-41.30 | | | 42.00 0.00 0.00 | | | | | | | |
| 41.30-41.80 | | | 100.00 78.00 40.00 | | | | | | | |
| 41.80-42.40 | | | 100.00 30.00 18.00 | | | | | | | |
| 42.40-44.40 | | | 63.00 21.00 0.00 | | | | | | | |
| 44.40-45.00 | | | 0.00 0.00 0.00 | | | | | | | |
| 45.00-46.50 | | | 87.00 36.00 36.00 | | | | | | | |
| End of Borehole | | | | | | | | | | |

AGS3_NEW_ELEB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:46:03

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: RO | |
| | | | | | | |

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|------------------------|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 23-06-1992/30-06-1992 | | Co-ordinates: E 393396.5 N 385628.5 | | EA 3RD SUPP 707 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | Sheet: 1 of 5 |

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|-----------------|----------------------------|------------|-----------------------------|---------------|----------------------|--|--------|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | |
| | | | | | | | | Stiff yellow CLAY. | | |
| | | | | | | 111.50 | 1.00 | | | |
| | | | | | | 110.50 | 2.00 | Soft brown CLAY | | |
| | | | | | | 109.87 | 2.63 | Soft red-brown CLAY | | |
| | | | | | | 109.54 | 2.96 | Stiff red-brown silty very sandy CLAY with some subangular and subrounded fine and occasionally medium gravel. | | |
| 2.63-3.63 | | | 109.00 109.00 109.00 | | | 109.00 | 3.50 | Very stiff red-brown silty CLAY with many angular fine and occasionally medium gravel-sized lithorelicts of mudstone (completely to highly weathered mudstone). | | |
| | | | | | | 108.38 | 4.12 | Red, occasionally red-grey thinly laminated highly weathered MUDSTONE, very weak. Occasionally sandy laminations. | | |
| 3.63-4.12 | | | 65.00 65.00 65.00 | | | 108.20 | 4.30 | Light grey occasionally mottled yellow and light red fine and medium grained thinly to thickly bedded moderately weathered SANDSTONE, moderately strong. Non intact. | | |
| 4.12-4.16 | | | 100.00 0.00 0.00 | | | | | Grey weathered red fine grained thickly laminated to thinly bedded highly to moderately weathered silty SANDSTONE, very weak to weak. Apparent dip of bedding variable 30-60 deg. 5.40-5.95m: highly fractured zone, many angular fine, medium and coarse gravel-sized fragments of sandstone in a firm red silty sandy clay matrix. 5.95-6.69m: very closely to closely spaced, inclined (45 to 85 deg.), irregular occasionally stepped, rough, tight to annealed discontinuities with some red and yellow discolouration. Below 6.60m: weathered light yellow grey. | | |
| 4.16-4.58 | | | 67.00 0.00 0.00 | | | | | | | |
| 4.58-5.40 | | | 0.00 0.00 0.00 | | | | | | | |
| 5.40-5.55 | | | 80.00 60.00 0.00 | | | | (2.39) | | | |
| 5.55-6.69 | | | 86.00 46.00 32.00 | | | | | | | |
| | | | | | | 105.81 | 6.69 | | | |
| 6.69-7.02 | | | 61.00 42.00 0.00 | | | | | Grey weathered red thinly to thickly laminated highly to moderately weathered MUDSTONE, very weak. Apparent dip of bedding variable, generally 40 deg. Highly fractured with many very closely to closely spaced irregular, rough annealed discontinuities with clayey infilling. 8.17-8.45m: band of grey-red silty mudstone. 9.25-9.45m: band of grey weathered red thinly laminated siltstone. Generally non intact. | | |
| 7.02-8.54 | | | 97.00 89.00 81.00 | | | | | | | |
| | | | | | | | | | | |
| 8.54-9.61 | | | 70.00 59.00 49.00 | | | | (4.50) | | | |
| | | | | | | | | | | |
| 9.61-9.91 | | | 100.00 100.00 40.00 | | | | | | | |

AGS3_NEW GLEB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:45:58

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 3.80 | | 5 | 3.57 | | | |

BOREHOLE LOG



| | | | | | |
|---|--|--|-------------------------------------|---|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 23-06-1992/30-06-1992 | | Co-ordinates: E 393396.5 N 385628.5 | | Ground Level: 112.50 (m) EA | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| | | | | | Sheet: 2 of 5 |

3RD SUPP 707

| Samples & Tests | | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|-----------------|--------------------------|------------|-----------------------------|---------------|--|-------------|--------|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 9.91-11.29 | | | 96.00 91.00 86.00 | | 101.31 | 11.19 | Grey weathered red thinly to thickly laminated highly to moderately weathered MUDSTONE, very weak. Apparent dip of bedding variable, generally 40 deg. Highly fractured with many very closely to closely spaced irregular, rough annealed discontinuities with clayey infilling. 8.17-8.45m: band of grey-red silty mudstone. 9.25-9.45m: band of grey weathered red thinly laminated siltstone. Generally non intact. <i>(continued)</i> | | | |
| 11.29-11.57 | | | 71.00 57.00 0.00 | | | (2.57) | Grey weathered red thinly to thickly laminated silty MUDSTONE, very weak to weak with occasional laminations of silty fine sandstone. Apparent dip of bedding 15 to 20 deg. 11.57-11.83m: non intact. Generally closely spaced inclined (15 to 25 deg.), (parallel to bedding), planar, smooth tight discontinuities. 11.98-12.10m, 13.00-13.20m, and 13.62-13.76m: highly fractured zones with many angular fine, medium and coarse gravel sized clasts in a mudstone matrix. | | | |
| 11.57-13.00 | | | 70.00 42.00 7.00 | | | | | | | |
| 13.00-14.59 | | | 67.00 46.00 35.00 | | 98.74 | 13.76 | Red-grey occasionally weathered red and light yellow fine and medium grained thinly to medium bedded highly to moderately weathered SANDSTONE, weak to moderately strong. 13.90-15.65m: vertical and subvertical, subplanar and irregular, rough, open to annealed discontinuities with occasional quartz infilling (up to 2mm thick) and red and light yellow discolouration. 16.10-16.40m: band of grey weathered red and orange fine grained thinly laminated micaceous sandstone, weak. Apparent dip of bedded <10 deg. 16.75-16.95m: inclined (75-80 deg)subplanar rough, open discontinuity. 17.13-17.35m: band of grey weathered red fine graiend thinly laminated micaceous sandstone, weak. Apparent dip of bedding <10. deg. | | | |
| 14.59-15.65 | | | 98.00 81.00 40.00 | | | (3.59) | | | | |
| 15.65-16.47 | | | 100.00 65.00 39.00 | | | | | | | |
| 16.47-17.55 | | | 91.00 68.00 37.00 | | 95.15 | 17.35 | Dark grey and dark red moderately weathered MUDSTONE, very weak. 18.11-18.21m and 18.45-18.61m: highly fractured zones with many angular fine, medium and coarse gravel-sized clasts in a mudstone matrix. Generally medium spaced sub-horizontal, irregular, rough, open to tight discontinuities. | | | |
| 17.55-19.02 | | | 86.00 86.00 67.00 | | | (2.25) | | | | |
| 19.02-20.23 | | | 54.00 32.00 10.00 | | 92.90 | 19.60 | Black thinly laminated highly to moderately weathered carbonaceous MUDSTONE, very weak with some shiny coaly laminations. (Possibly old mine workings) | | | |
| | | | | | 92.63 | 19.87 | | | | |

AGS3_NEW GLEB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:45:59

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 14.30 | 10.95 | 20 | 14.30 | Ingress | | |



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|-------------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 23-06-1992/30-06-1992 | | Co-ordinates: E 393396.5 N 385628.5 | | EA 3RD SUPP 707 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 3 of 5 | | | | | |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | Legend | Backfill/ Instrument |
|-----------------|------------|-----------------|-------------------|-----------------------------|---------------|----------------------|---|-----------|-------------------------|
| Depth | Type No | Test Results | TCR SCR RGD | | O.D. Level | Depth (Thickness) | Description | | |
| 20.23-20.58 | | | 77.00 | | (0.55) | 20.42 | Light grey fine grained moderately weathered silty SANDSTONE, moderately weak to moderately strong thickly interlaminated with dark grey siltstone. <i>(continued)</i> | [Pattern] | |
| | | | 60.00 | | 92.08 | | | | |
| 20.58-20.88 | | | 60.00 | | (1.22) | 20.58 | Light grey moderately weathered silty MUDSTONE, very weak to weak with many angular coarse gravel-sized clasts of red grey siltstone. Highly fractured with many irregular, annealed discontinuities. | [Pattern] | |
| | | | 20.00 | | | | | | |
| 20.88-21.08 | | | 0.00 | | (1.22) | 21.80 | Dark grey thinly laminated highly to moderately weathered carbonaceous silty MUDSTONE, very weak to weak. Occasional black shiny coaly bands. | [Pattern] | |
| | | | 0.00 | | | | | | |
| 21.08-21.80 | | | 75.00 | | (1.50) | 21.80 | Dark grey thinly to thickly laminated moderately weathered silty MUDSTONE, very weak to weak with some thick laminations of light grey fine grained sandstone and light grey siltstone. Apparent dip of bedding <10 deg. Many very closely to closely spaced, irregular tight to annealed discontinuities (some drill induced?) | [Pattern] | |
| | | | 0.00 | | | | | | |
| 21.80-23.18 | | | 0.00 | | (1.50) | 23.30 | Black friable COAL, very weak. Apparent dip of bedding <10 deg. | [Pattern] | |
| | | | 0.00 | | | | | | |
| 23.18-24.08 | | | 93.00 | | (4.55) | 23.48 | Light grey occasionally thin to thickly laminated moderately weathered SILTSTONE, very weak with occasional bands of dark grey carbonaceous mudstone and grey fine grained sandstone. Traces of black carbonaceous plant fossils. Many very closely to closely spaced, irregular tight to annealed discontinuities (some drill induced?) | [Pattern] | |
| | | | 77.00 | | | | | | |
| 23.18-24.08 | | | 61.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 96.00 | | | | | | |
| 24.08-25.61 | | | 70.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 31.00 | | | | | | |
| 24.08-25.61 | | | 73.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 67.00 | | | | | | |
| 25.61-27.53 | | | 56.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 100.00 | | | | | | |
| 25.61-27.53 | | | 66.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 44.00 | | | | | | |
| 27.53-29.58 | | | 100.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 76.00 | | | | | | |
| 27.53-29.58 | | | 27.00 | | (4.55) | 28.03 | Light grey and dark grey, occasionally red grey thinly laminated moderately weathered SILTSTONE, very weak. Apparent dip of bedding <10 deg. 28.40m-28.90m, 29.28m-29.58m and 29.75m-30.00m: beds of light grey fine grained sandstone, moderately weak to moderately strong. Generally very closely spaced subhorizontal (parallel to bedding), planar smooth, tight discontinuities (some drill induced?) 29.82m-30.00m: inclined (70 deg.), subplanar, rough, open discontinuity. 31.30m-31.48m: inclined (80 deg.), planar, annealed discontinuity. | [Pattern] | |
| | | | 100.00 | | | | | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|-----------------|-----------------|--------------|---------------|-----------------|-------------------------------|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP | |
| 22.30 | 21.80 | 20 | 22.30 | Ingress | | |

AGS3_NEW_GLB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:45:59

BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|------------------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 23-06-1992/30-06-1992 | | Co-ordinates: E 393396.5 N 385628.5 | | EA 3RD SUPP 707 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 5 of 5 | | | | | |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument | |
|-----------------|---------|--------------|----------------------------|------------|-----------------------------|---------------|----------------------|-----------------|-------------------------|--------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | | Legend |
| 39.95-41.20 | | | 96.00 78.00 60.00 | | | | | | | |
| 41.20-43.02 | | | 71.00 53.00 29.00 | | | | | | | |
| 43.02-44.61 | | | 88.00 81.00 60.00 | | | | | | | |
| 44.61-45.00 | | | 100.00 100.00 100.00 | | | | | End of Borehole | | |

AGS3_NEW_ELB | SW BH LOG (CP/R/C) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:45:59

| Water Strikes | | | | | Method, Equipment and Remarks |
|---------------|--------------|-----------|------------|--------------|-------------------------------|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | Method: CP |
| | | | | | |

BOREHOLE LOG



CLIENT STOCKPORT METROPOLITAN BOROUGH COUNCIL

BH1104

SITE SEMMMS

Sheet 1 of 2

Start Date March 30, 2005

Easting 390373.5

Scale 1 : 50

End Date March 31, 2005

Northing 384183.6 Ground level 90.62mOD

Depth 15.45 m

| progress date/time water depth | sample no & type | depth (m) from to | casing depth (m) | test type & value | samp. /core range | instru -ment | description | depth (m) | reduced level (m) | legend |
|--------------------------------|--------------------------|---|------------------|-------------------|-------------------|--------------|---|-----------|-------------------|--------|
| 30/03/05 | | | | | | / / | TOPSOIL. (Drillers description) (TS - TOPSOIL) | 0.30 | 90.32 | |
| | 1D* 2B | 0.50 0.50 - 1.00 | | | | | Firm locally stiff light grey mottled orange-brown slightly sandy CLAY with rare subangular to rounded fine and medium siltstone gravel. Occasional fine rootlets and fragments of coal. (CT - COHESIVE TILL) | | | |
| | 3D* 4U | 1.00 1.20 - 1.70 | nil | | | | 0.50 - 1.00m: With rare fine gravel size pockets of yellow-grey micaceous silt. | | | |
| | 5D 7D 6B | 1.70 2.00 - 2.45 2.00 - 2.50 | nil | S 18 | | | Stiff red-brown mottled grey slightly sandy CLAY with a little subangular to subrounded fine and medium gravel of various lithologies including sandstone, siltstone and coal. (CT - COHESIVE TILL) | 1.70 | 88.92 | |
| | | | | | | | 2.00 - 3.00m: With occasional fine rootlets. | | | |
| | 8U 9D 11D 10B | 3.00 - 3.50 3.50 4.00 - 4.45 4.00 - 4.50 | nil | S 17 | | | Stiff brown occasionally mottled grey locally slightly sandy CLAY with a little subangular to subrounded fine and medium gravel of various lithologies including sandstone, mudstone and quartz. (CT - COHESIVE TILL) | 3.00 | 87.62 | |
| | | | | | | | | | | |
| | 12U 13D 15D 14B | 5.00 - 5.50 5.50 6.00 - 6.45 6.00 - 6.50 | nil | S 17 | | | 6.00 - 6.50m: Recovered as brown sandy clay and brown slightly silty fine and medium sand. | 6.60 | 84.02 | |
| | | | | | | | | | | |
| 30/03/05 1700hrs dry | 16D 17B | 7.00 - 7.45 7.00 - 7.50 | nil | S 28 | | | Medium dense becoming dense brown becoming red-brown slightly silty fine and medium SAND. (GFS - GLACIO-FLUVIAL SAND) | | | |
| | | | | | | | 7.00 - 7.50m: With occasional medium gravel size pockets of firm red-brown slightly sandy clay. | | | |
| 31/03/05 0800hrs dry | 18D | 8.00 - 8.45 | 8.00 | S 34 | | | 7.50 - 10.00m: With occasional becoming frequent fine gravel size fragments of coal. | | | |
| | | | | | | | Continued Next Page | {8.00} | | |

EQUIPMENT: Light cable percussive (shell and auger) rig.
 METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-15.50m.
 CASING: 150mm diam to 15.00m.
 BACKFILL: On completion, a standpipe piezometer (19mm) was installed with tip at 14.00m, bentonite seal 15.00-14.00m, granular response zone 14.00-13.50m, bentonite seal 13.50-20.00m, concrete and raised cover 0.20-0.00m.
 REMARKS: Water added to assist boring 6.60-9.90m, 12.70-15.00m.

| | | | | | | |
|------------------|------------|-------------|--------------------|--|--------------|---------|
| water strike (m) | casing (m) | rose to (m) | time to rise (min) | remarks | CONTRACT | CHECKED |
| | | | | Groundwater not encountered prior to water being added to assist boring. | 17360 | |

BOREHOLE LOG



CLIENT STOCKPORT METROPOLITAN BOROUGH COUNCIL

BH1104

SITE SEMMMS

Sheet 2 of 2

Start Date March 30, 2005

Easting 390373.5

Scale 1 : 50

End Date March 31, 2005

Northing 384183.6 Ground level 90.62mOD

Depth 15.45 m

| progress date/time water depth | sample no & type | depth (m) from to | casing depth (m) | test type & value | samp. /core range | instru -ment | description | depth (m) | reduced level (m) | legend |
|--------------------------------|------------------|--------------------------------|------------------|-------------------|-------------------|--------------|--|-----------|-------------------|--------|
| | 19B | 8.00 8.50 | | | | | | | | |
| | 20D 21B | 9.00 - 9.45 9.00 - 9.50 | 9.00 | S 29 | | | | | | |
| | 22D 23B | 10.00 - 10.45 10.00 - 10.50 | 10.00 | S 9 | | | Firm brown slightly sandy micaceous CLAY with frequent fine silt partings. Locally tending to a silt:clay. (GFC - GLACIO-FLUVIAL COHESIVE) | 9.90 | 80.72 | |
| | 24U | 11.00 - 11.50 | 11.00 | | | | | | | |
| | 25D | 11.50 | | | | | 11.50 - 12.50m: Becoming sandy, locally tending to a very clayey fine sand. | | | |
| | 26D 27B | 12.00 - 12.45 12.00 - 12.50 | 12.00 | S 9 | | | | | | |
| | 28D 29B | 13.00 - 13.45 13.00 - 13.50 | 13.00 | S 32 | | | Dense red-brown very silty fine to coarse SAND. (GFS - GLACIO-FLUVIAL SAND) | 12.70 | 77.92 | |
| | 30D 31B | 14.00 - 14.45 14.00 - 14.50 | 14.00 | S 35 | | | | | | |
| 31/03/05 1700hrs dry | 32D | 15.00 - 15.45 | 15.00 | S 33 | | | 15.00m: Becoming silty. | 15.45 | 75.17 | |
| | | | | | | | Borehole completed at 15.45m. | | | |
| | | | | | | | | {18.00} | | |

Geotechnical Engineering Ltd. Tel. 01452 527743 17360.GPJ TRIAL\JH.GPJ GEOENG\49.GLB 9/5/05

| | | | | | | |
|------------------|------------|-------------|------------------|--|--------------|---------|
| water strike (m) | casing (m) | rose to (m) | time to rise (m) | remarks | CONTRACT | CHECKED |
| | | | | Groundwater not encountered prior to water being added to assist boring. | 17360 | |



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|---------------------|---------------|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 11-04-2005/12-04-2005 | | Co-ordinates: E 393305.6 N 385649.3 | | BH1002 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| | | | | | Sheet: 1 of 2 |

| Samples & Tests | | | | | Strata | | | | Backfill/ Instrument |
|-----------------|-------------|----------------------------------|-------------|---------|-----------------------|------------|-------------------|---|-------------------------|
| Depth | Type No | Test Results | TCR SCR RQD | If (mm) | Water/ (Flush Return) | O.D. Level | Depth (Thickness) | Description | |
| 0.00 | D 1 D* 1 | | | | | 108.09 | 0.30 | TOPSOIL: Firm friable dark brown sandy clay with a little fine and medium gravel of various lithologies and frequent fine rootlets. | |
| 0.50 | D 2 D* 2 | | | | | 107.59 | 0.80 | CLAY and GRAVEL. (Drillers description) | |
| 1.00 | D 3 D* 3 | | | | | 107.19 | 1.20 | Sandy GRAVEL. (Drillers description) | |
| 1.20-2.30 | X 4 | C N = 28(450mm) 5 7/8 8 7 5 | | | | | | Medium dense red-brown very clayey SAND and angular to subangular fine to coarse GRAVEL size sandstone lithorelicts. | |
| 2.30-3.30 | C 5 | C N = 50(80mm) 25 /50 | | | | 106.09 | 2.30 | Moderately strong and strong grey discoloured yellow-brown fine and medium grained SANDSTONE. NI, with very closely spaced randomly orientated irregular rough open orange-brown stained fractures. | |
| 2.30-3.30 | | | 100.00 | 0.00 | | | (0.90) | 3.00 - 3.00 Grading to a clayey sand. | |
| 3.30-4.00 | C 6 | C N = 39(450mm) 5 7/7 8 10 14 | | | 1.16 | 105.19 | 3.20 | Very stiff very closely fissured grey locally red-brown slightly sandy CLAY. | |
| 3.30-4.00 | | | 100.00 | | | | | 3.60 - 3.60 Becoming locally dark grey/black and carbonaceous. | |
| 4.00-5.00 | C 7 | | | | | | (1.80) | 4.50 - 5.10 Drilling disturbed, recovered as coarse gravel and cobble size fragments of sandstone and clay. | |
| 4.00-5.00 | | | 80.00 | | | | | | |
| 5.00-6.50 | C 8 | C N = 50(90mm) 25 /50 | | | 1.26 | 103.39 | 5.00 | Moderately weak red-brown and light grey sandy SILTSTONE with frequent fine sandstone interlaminae. Predominantly NI, with extremely to very closely spaced randomly orientated irregular rough tight fractures. Fractures are often red clay smeared. | |
| 5.00-6.50 | | | 100.00 | 5.00 | | | | 6.00 - 6.50 Locally tending to a mudstone. | |
| 6.50-8.00 | C 9 | C N = 50(60mm) 25 /50 | | | 1.31 | | | 6.50 - 6.50 Becoming strong and thinly bedded. Bedding discontinuities are horizontal planar rough and open. Fractures become extremely closely to closely spaced. | |
| 6.50-8.00 | | | 100.00 | 25.00 | | | | | |
| 8.00-9.50 | C 10 | C N = 50(40mm) 25 /50 | | | 1.50 | | (6.00) | 8.00 - 10.50 Locally tending to a strong fine grained sandstone and thinly interlaminated siltstone and sandstone. Rare green medium gravel size sandy reduction pockets. 8.30 - 10.40 Locally disintegrated to gravel size lithorelicts with a hard matrix. | |
| 8.00-9.50 | | | 93.00 | 11.00 | | | | | |
| 9.50-11.00 | C 11 | C N = 50(50mm) 25 /50 | | | 1.54 | | | 9.30 - 9.60 Bed of strong fine grained sandstone discoloured orange-brown. | |
| 9.50-11.00 | | | | | | | | | |

| Water Strikes | | | | | Method, Equipment and Remarks | |
|---------------|--------------|-----------|------------|--------------|---|--|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | | |
| | | | | | EQUIPMENT: Geotechnical Pioneer rig. METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-2.30m. Waterflush rotary core drilled (116mm) 2.30-14.60m. CASING: 143mm diam to 4.00m. BACKFILL: On completion, a standpipe piezometer (19mm) was installed with tip at 12.00m, bentonite seal 14.60-13.00m, granular response zone 13.00-11.00m, bentonite seal 11.00-4.00m. A second standpipe piezometer (19mm) was installed with tip at 3.00m, granular response zone 4.00-2.00m, bentonite seal 2.00-0.40m, concrete and raised cover 0.40-0.00m. Method: RC | |

AGS3_NEW GELB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:45:56



BOREHOLE LOG

| | | | | | |
|---|--|--|-------------------------------------|---------------|--|
| Project: SEMMS | | Job No: 37732ISG | | Borehole No. | |
| Date: 11-04-2005/12-04-2005 | | Co-ordinates: E 393305.6 N 385649.3 | | BH1002 | |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | | Engineer: Faber Maunsell Ltd | | |
| Sheet: 2 of 2 | | | | | |

| Samples & Tests | | | | Water/ (Flush Return) | Strata | | | | Backfill/ Instrument |
|-----------------|------------|--------------------------|--------------------------|-----------------------------|---------------|----------------------|--|--|--|
| Depth | Type No | Test Results | TCR SCR RQD | | O.D. Level | Depth (Thickness) | Description | Legend | |
| 9.50-11.00 | | | 100.00 35.00 14.00 | 1.59 | 97.39 | 11.00 | Moderately weak red-brown and light grey sandy SILTSTONE with frequent fine sandstone interlaminae. Predominantly NI, with extremely to very closely spaced randomly orientated irregular rough tight fractures. Fractures are often red clay smeared. <i>(continued)</i> 10.40 - 10.40 Fractures become predominantly closely spaced and inclined at 55-75o planar and clay smeared. | x | |
| 11.00-12.13000 | C 12 | C N = 50(50mm) 25 /50 | | | (0.80) | | Strong red-brown and grey thinly interlaminated SILTSTONE and SANDSTONE. | x | |
| 11.00-12.50 | | | 100.00 90.00 49.00 | 1.61 | 96.59 | 11.80 | Moderately weak red-brown slightly sandy SILTSTONE with frequent thin often impersistent sandstone interlaminae. | x | |
| 12.50-13.12050 | C 13 | C N = 50(40mm) 25 /50 | | | (0.70) | 95.89 | 12.50 | 12.35 - 12.50 NI, disintegrated to gravel size lithorelicts with a hard matrix. | x |
| 12.50-13.20 | | | 93.00 28.00 0.00 | | | (0.80) | Strong thinly laminated green-grey fine grained SANDSTONE. Predominantly NI, recovered as coarse gravel and cobble size fragments. | x | |
| 13.20-14.60 | C 14 | | | | 95.09 | 13.30 | Moderately weak to moderately strong indistinctly thinly laminated sandy SILTSTONE locally tending to a strong fine grained sandstone. | x | |
| 13.20-14.60 | | | 100.00 30.00 7.00 | 1.65 | | (1.30) | 14.00 - 14.60 Grading to a strong thinly interlaminated sandstone and siltstone, locally NI. Thinly bedded with occasional 70o and subvertical irregular rough tight fractures. | x | |
| 14.60 | C | C N = 50(50mm) 25 /50 | | | 93.79 | 14.60 | End of Borehole | x | |

| Water Strikes | | | | | Method, Equipment and Remarks |
|-----------------|-----------------|--------------|---------------|-----------------|---|
| Strike Depth | Casing Depth | Post Mins | Post Depth | Flow Remarks | |
| | | | | | EQUIPMENT: Geotechnical Pioneer rig. METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-2.30m. Waterflush rotary core drilled (116mm) 2.30-14.60m. CASING: 143mm diam to 4.00m. BACKFILL: On completion, a standpipe piezometer (19mm) was installed with tip at 12.00m, bentonite seal 14.60-13.00m, granular response zone 13.00-11.00m, bentonite seal 11.00-4.00m. A second standpipe piezometer (19mm) was installed with tip at 3.00m, granular response zone 4.00-2.00m, bentonite seal 2.00-0.40m, concrete and raised cover 0.40-0.00m. Method: RC |
| | | | | | |

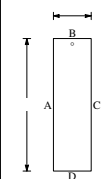
AGS3_NEW GLEB | SW BH LOG (CP/RC) | K:\47060785 - SEMMS\050 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW GDT | 23/11/2011 | 09:45:56

TRIAL PIT LOG

| | | | |
|---|--|-------------------------------------|--------------------------|
| Project: SEMMS | | Job No: 37732ISG | Trial Pit No. |
| Date: 23-01-1990/23-01-1990 | Co-ordinates: E 393276.0 N 385665.5 | Ground Level: 107.50 (m) | SM 2ND SUPP TP510 |
| Contractor: GEOTECHNICAL ENGINEERING LIMITED | | Engineer: Faber Maunsell Ltd | Sheet: 1 of 1 |

| Samples & Tests | | | Strata | | | | Backfill/ Instrument |
|-----------------|---------|-------------|---------------|-------------------|---|--------|-------------------------|
| Depth | Type No | Test Result | Reduced Level | Depth (Thickness) | Description | Legend | |
| 0.35 0.40 | D D | | 107.31 | 0.19 | Firm brown slightly sandy TOPSOIL with a little angular to rounded fine to medium gravel and occasional cobbles. Some rootlets and occasional root tracks to 0.70m | | |
| | | | | (0.56) | Firm orange brown mottled red brown and blue grey CLAY with some to much angular to subrounded medium to coarse sandstone gravel and cobbles. Occasional rootlets and brown root tracks | | |
| 1.00 | D | | 106.75 | 0.75 | Stiff red brown sandy CLAY with some to much angular to subrounded medium to coarse sandstone gravel. | | |
| | | | 106.40 | 1.10 | Grey weathering red and orange brown, fine to medium thinly laminated to thinly bedded moderately to highly weathered SANDSTONE and SILTSTONE, very weak to moderately strong (inc with depth). Extremely closely to closely spaced discontinuities. Probable bedding 260/37W;230/20SW;266/36W;065/72NE;065/48NE;051/70NE;037/90NE;124/73SE;138/78E | | |
| | | | 105.50 | 2.00 | End of Trial Pit | | |

AGS3_NEW_ELB | SW_TP_LOG | K:\47060785 - SEMMS\05.0 PROJECT INFORMATION\GINT\47060785-SEMMS.GPJ | AGS3_NEW_GDT | 23/11/2011 | 09:55:40

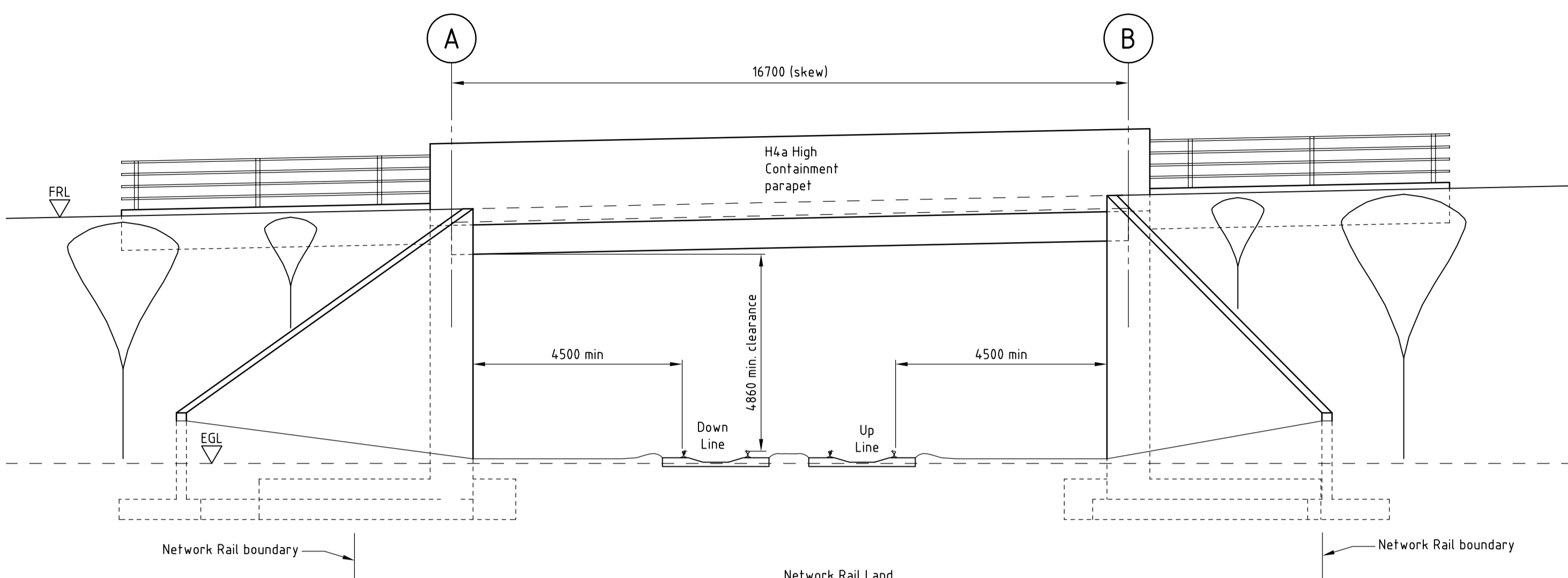
| | | | | |
|---------------------------------|-------------|---|--------------------------------------|-------------------|
| Groundwater Observations | | Orientation  | Method, Equipment and Remarks | Stability: |
| Depth | Flow | | Method / Equipment: | Shoring: |
| | | | | |

APPENDIX B

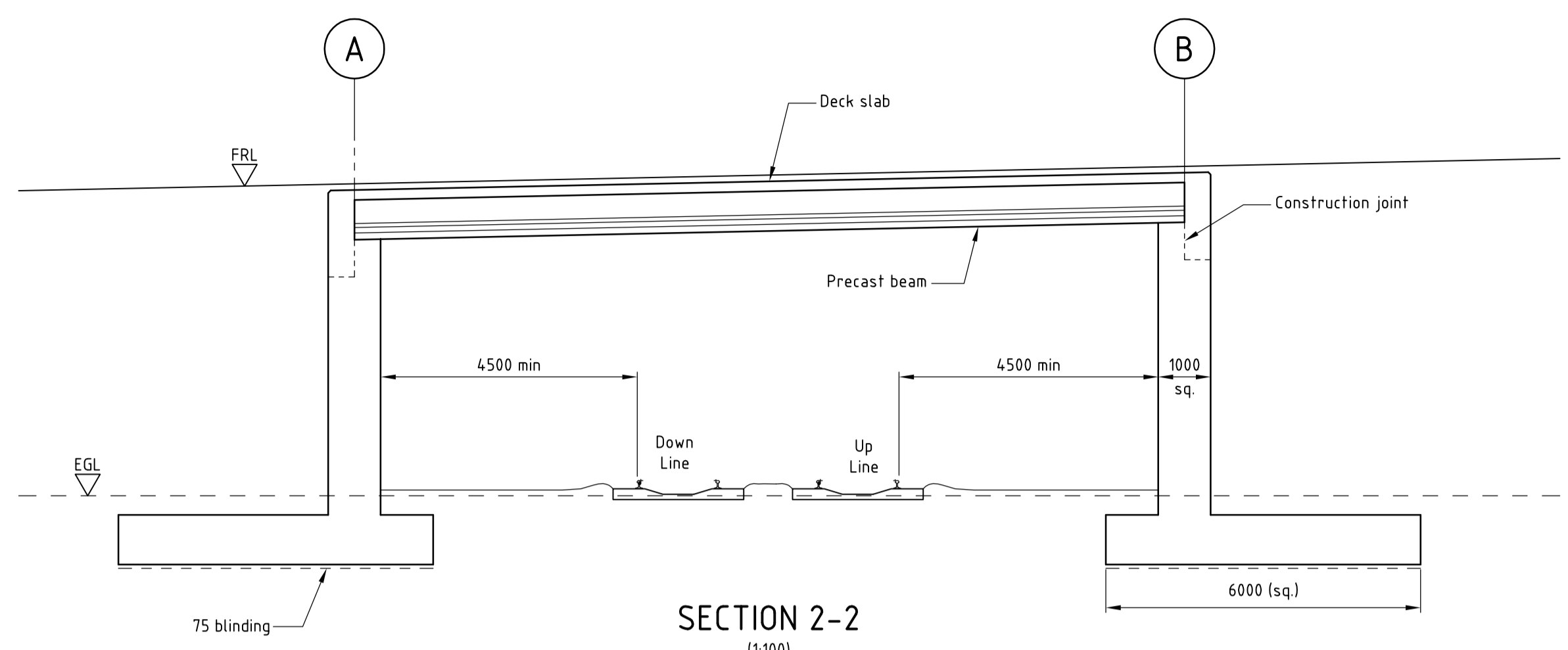
Option Drawings

NOTES

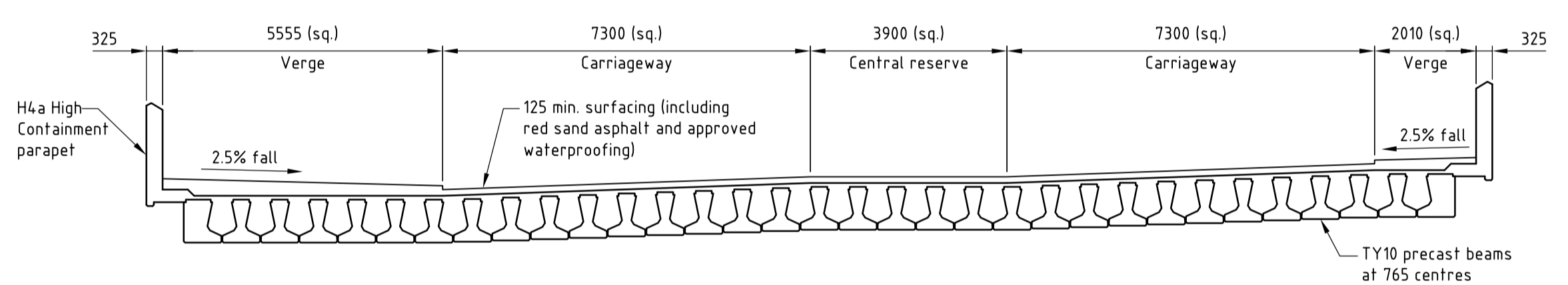
1. This drawing has been produced based on the latest MX highway model - Draft Design Freeze 5, as provided by the client.
2. This drawing has been produced mainly for the purpose of planning application and the feasibility study.
3. Levels are in metres and above Ordnance Datum.
4. All dimensions are in millimetres.
5. The option shown in this drawing is not for construction.
6. The foundation type shown on the drawing is based on the latest available geotechnical information.
7. Basic preliminary design has been undertaken to determine the geometry of the section sizes as per client's instruction.
8. The Railway line is not electrified.
9. Mileage : 3 miles 32 yards



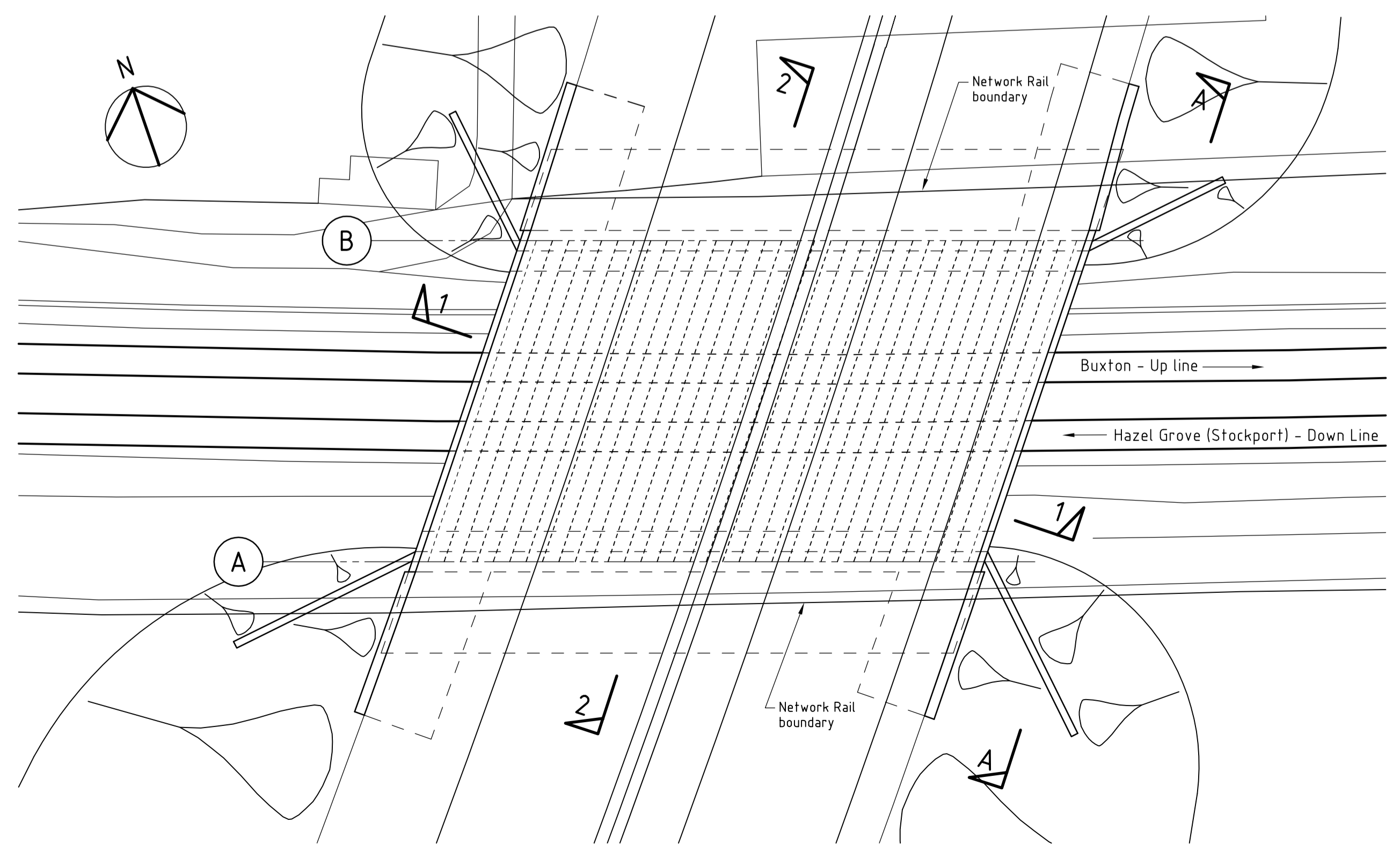
ELEVATION A-A
(1:100)



SECTION 2-2
(1:100)



SECTION 1-1
(1:100)



PLAN
(1:200)

| Rev. | Drawn | Checked | Date | Revision Details |
|------|-------|---------|------|------------------|
| | | | | |

south east manchester multi modal strategy

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Jim McMahon BS: C.Eng. MICE
SERVICE DIRECTOR, MAJOR PROJECTS

**SEMMS
RELIEF ROAD SCHEME
A6 - AIRPORT**

Drawing Title

**HAZEL GROVE/BUXTON
RAILWAY OVER LINE BRIDGE
OPTION 1**

| Drawn | Engineer | Checked | Approved |
|---------|----------|---------|----------|
| BDJ | OP | OP/NS | NS |
| Date | Date | Date | Date |
| DEC '11 | DEC '11 | DEC '11 | DEC '11 |
| Size | Scale | | |
| A1 | AS SHOWN | | |
| SCG No. | Filename | | |

Drawing No. 1007/3D/DF5/A6-MA/B002/702-1 Revision

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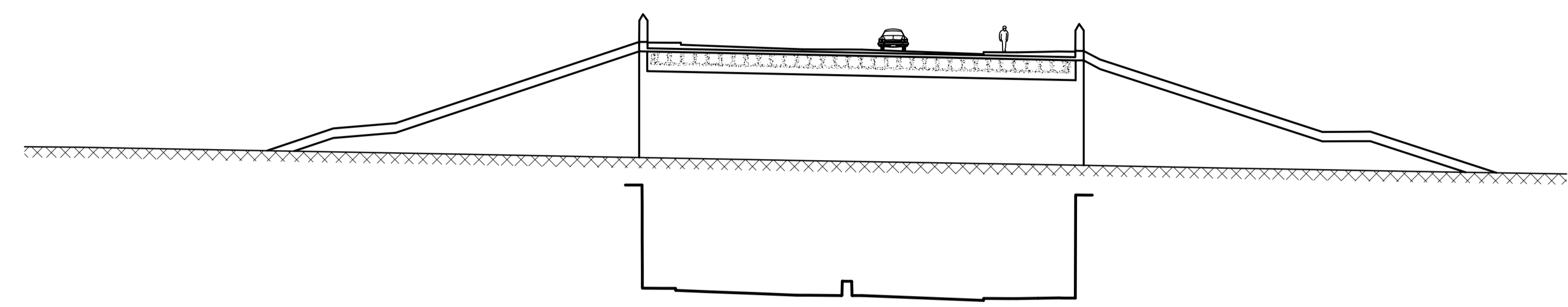
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NOTE

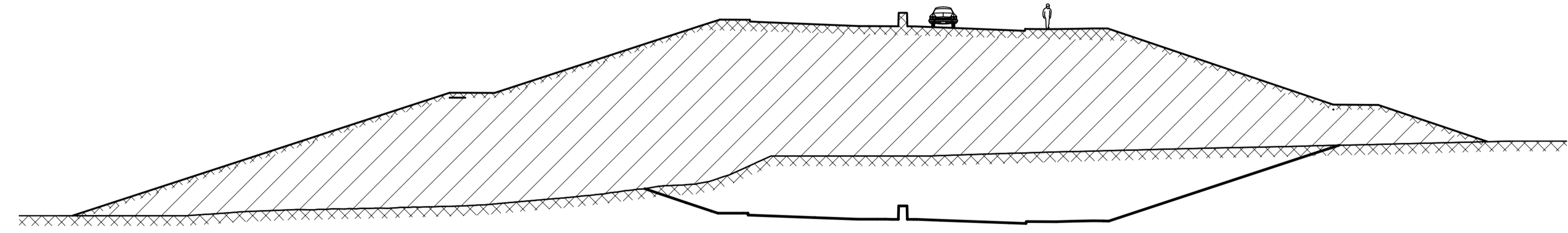
This drawing is produced to show the difference between the 2 scenarios; going over the line or under the line



PLAN ON SCHEME (SCALE 1:5000)



SECTION A-A ALONG HAZEL GROVE BUXTON LINE (SCALE 1:250)



SECTION B-B THROUGH EMBANKMENT (SCALE 1:250)

HIGHWAY DESIGN SPEED 85KPH (50mph SPEED LIMIT)
 DESIGN MANUAL FOR ROADS AND BRIDGES STIPULATES FOR THE ABOVE DESIGN SPEED
 1. VERTICAL ALIGNMENT - DESIRABLE MIN CREST CURVE 5500m RADIUS
 2. VERTICAL ALIGNMENT - DESIRABLE MAX 4% GRADE FOR ALL PURPOSE DUAL CARRIAGEWAYS
 3. VERTICAL ALIGNMENT - NO REDUCTION IN DESIRABLE MIN SIGHT STOPPING DISTANCE ON THE APPROACH TO JUNCTIONS
 THIS ALIGNMENT HAS THE FOLLOWING RELAXATION AND DEPARTURES
 1. VERTICAL ALIGNMENT - CREST CURVE 3000m RADIUS USED TO REDUCE EXTENT AND ENVIRONMENTAL IMPACT OF EARTHWORKS (departure when linked with item 3 below)
 2. VERTICAL ALIGNMENT - A MAX GRADE OF 5% (relaxation)
 3. VERTICAL ALIGNMENT - SIGHT STOPPING DISTANCE REDUCED (departure)

| Rev. | Drawn | Checked | Date | Revision Details |
|------|-------|---------|------|------------------|
| | | | | |

South east manchester multi modal strategy

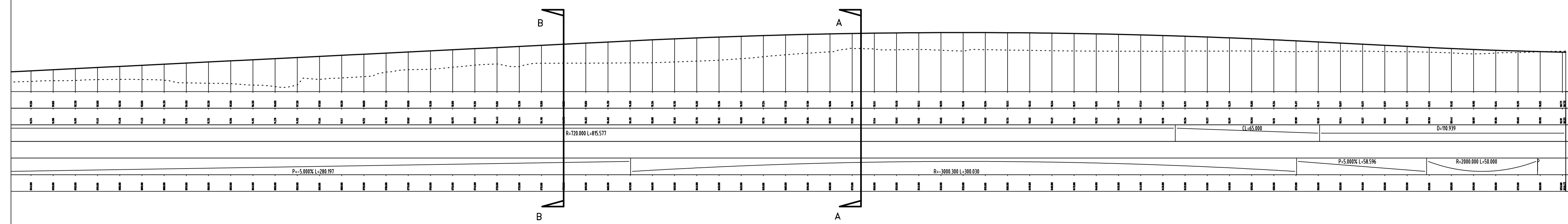
STOCKPORT MANCHESTER CITY COUNCIL

STOPFORD HOUSE STOCKPORT S16 5UE
 Jim McMahon BS: C.Eng. MICE
 SERVICE DIRECTOR, MAJOR PROJECTS
 TEL: 0161 474 1111 FAX: 0161 474 1112

Job Title
SEMMS RELIEF ROAD SCHEME A6 - AIRPORT

Drawing Title
HAZEL GROVE/BUXTON HIGHWAY ALIGNMENT FOR THE RAILWAY OVER LINE OPTION

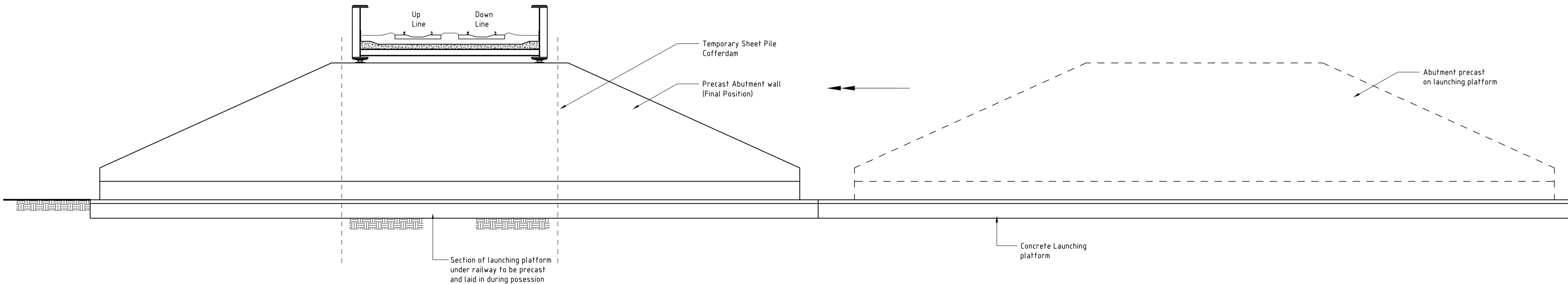
| Drawn | Engineer | Checked | Approved |
|----------|----------|----------|----------|
| LF | LF | NS | NS |
| Date | Date | Date | Date |
| 12/12/11 | 12/12/11 | 21/12/11 | 21/12/11 |
| Size | Scale | | |
| A1 | AS SHOWN | | |
| SCG No. | Filename | | |



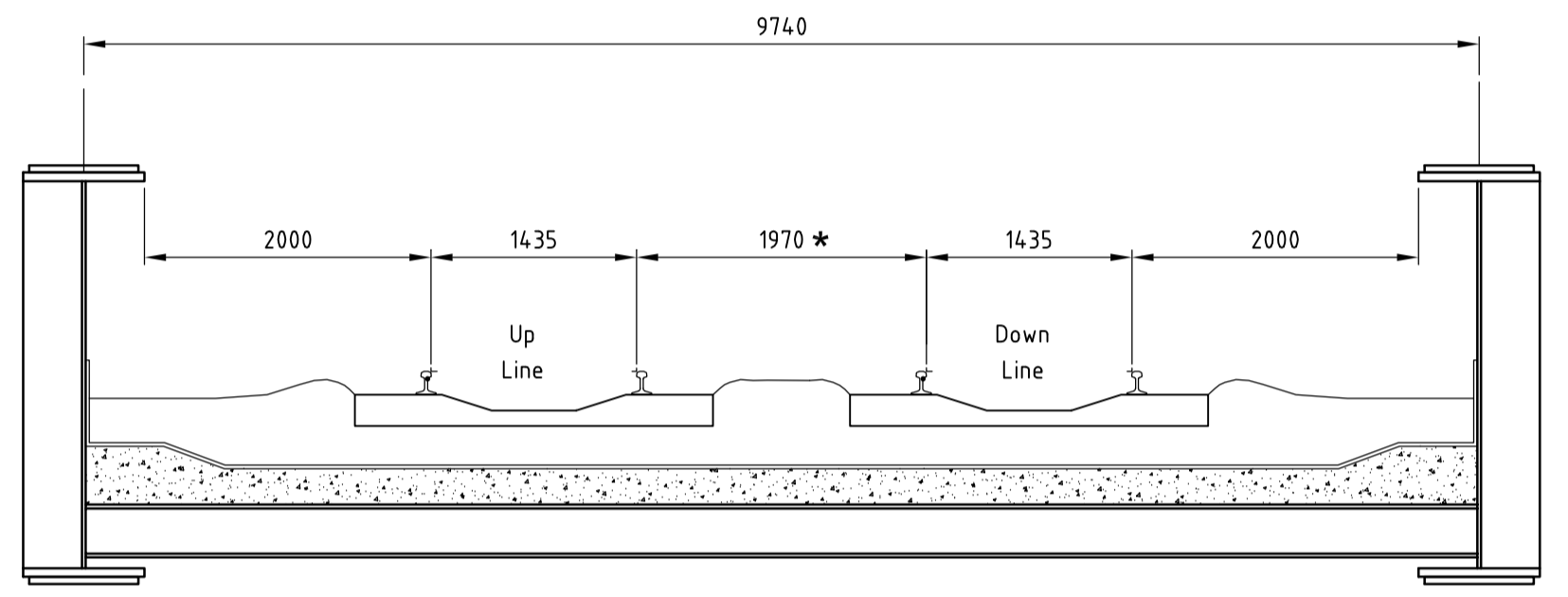
SECTION ALONG SEMMS ALIGNMENT (SCALE 1:1000)

NOTES

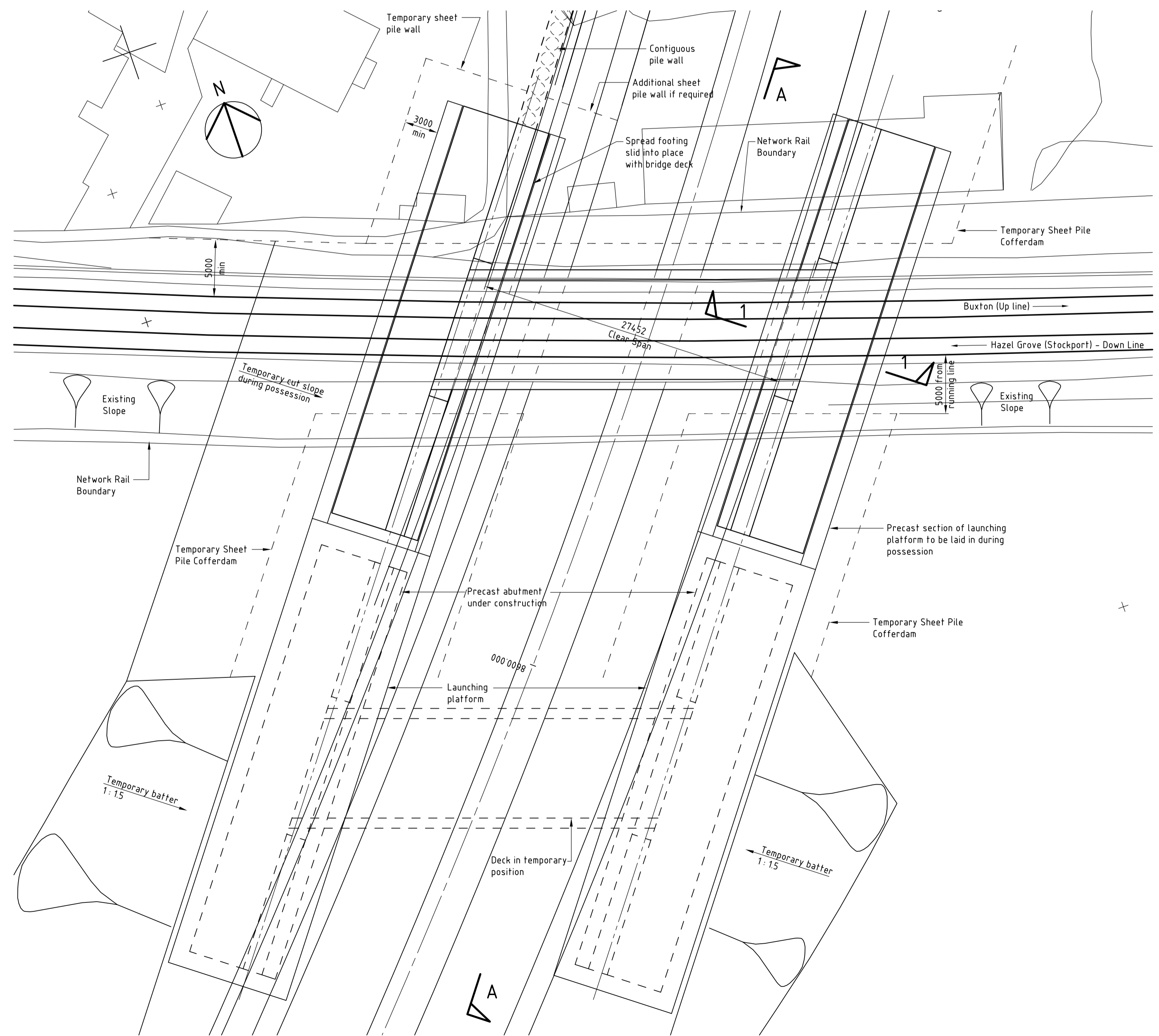
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7. Basic preliminary design has been undertaken to determine the geometry of the section sizes as per client's instruction.
8. The Railway line is not electrified.
9. Mileage : 3 miles 32 yards
10. The arrangement of the temporary sheet pile walls is indicative and may be subject to change during the detail design stage.



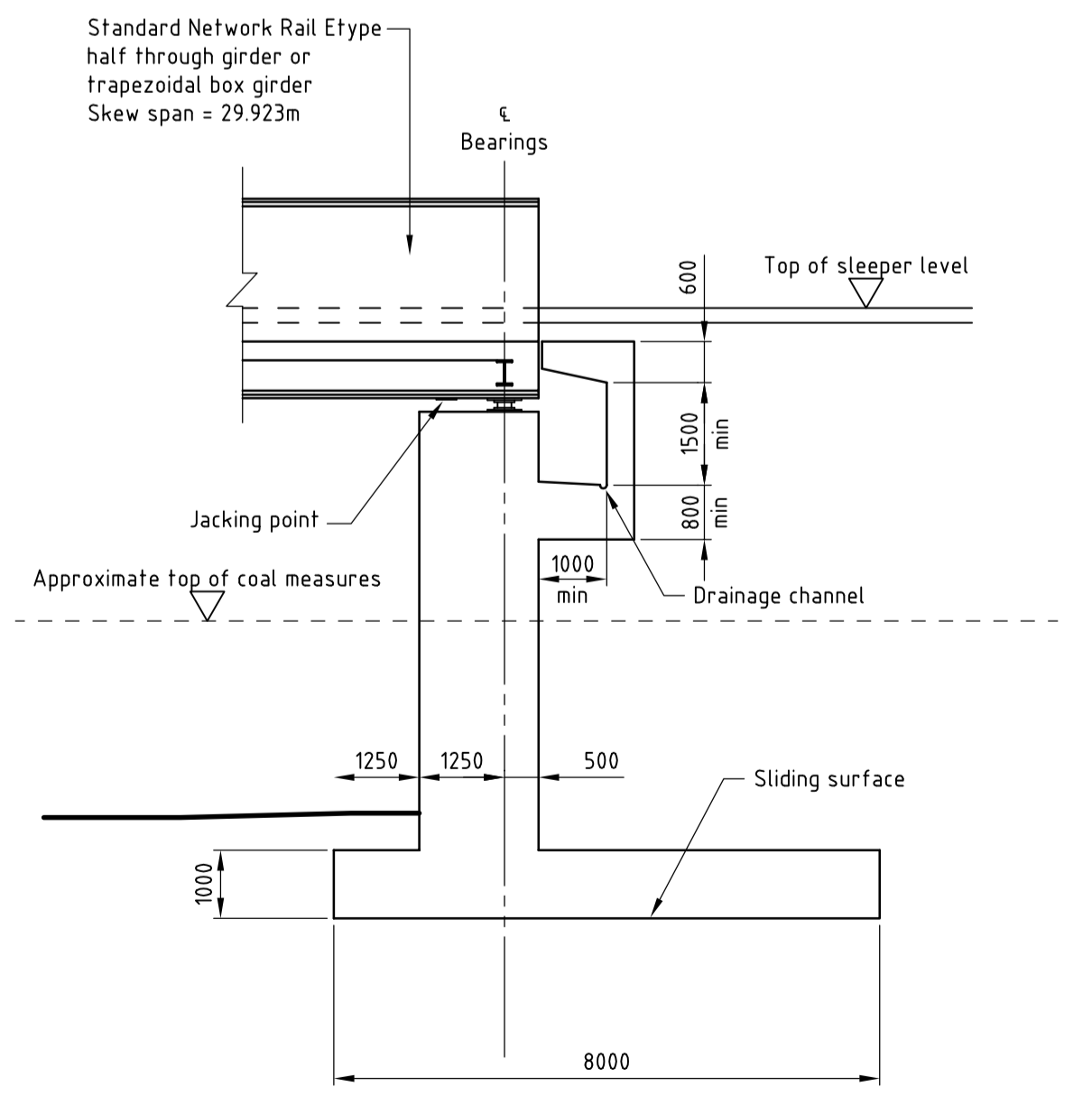
ELEVATION A-A
(1:125)



Typical Deck Cross Section
(1:150)



PLAN
(1:250)



SECTION 1-1
(1:100)

| Rev. | Drawn | Checked | Date | Revision Details |
|------|-------|---------|------|------------------|
| | | | | |

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semms
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 Jim McMahon BS: C.Eng. MICE SERVICE DIRECTOR, MAJOR PROJECTS
 STOPFORD HOUSE STOCKPORT SKEW: SKEW TEL: 0161 472 FAX: 0161

Job Title
SEMMS RELIEF ROAD SCHEME A6 - AIRPORT

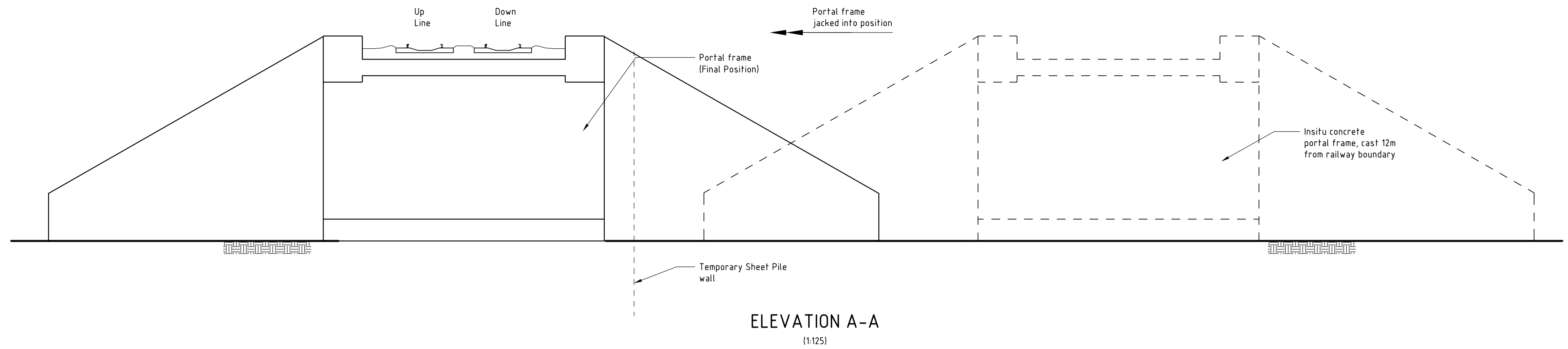
Drawing Title
HAZEL GROVE/BUXTON RAILWAY UNDER LINE BRIDGE OPTION 1

| Drawn | Engineer | Checked | Approved |
|---------|----------|---------|----------|
| DSH | OP | NS | NS |
| Date | Date | Date | Date |
| DEC '11 | DEC '11 | DEC '11 | DEC '11 |
| Size | Scale | | |
| A1 | AS SHOWN | | |
| SCG No. | Filename | | |

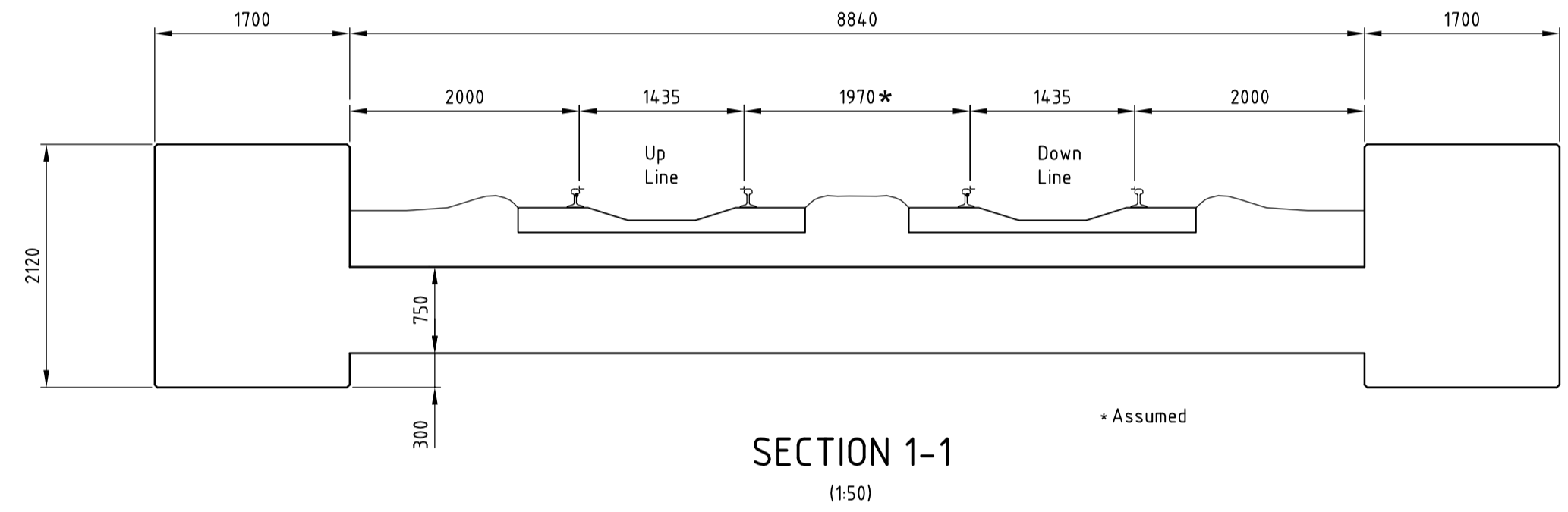
Drawing No. **1007/3D/DF5/A6-MA/B002/702-3** Revision

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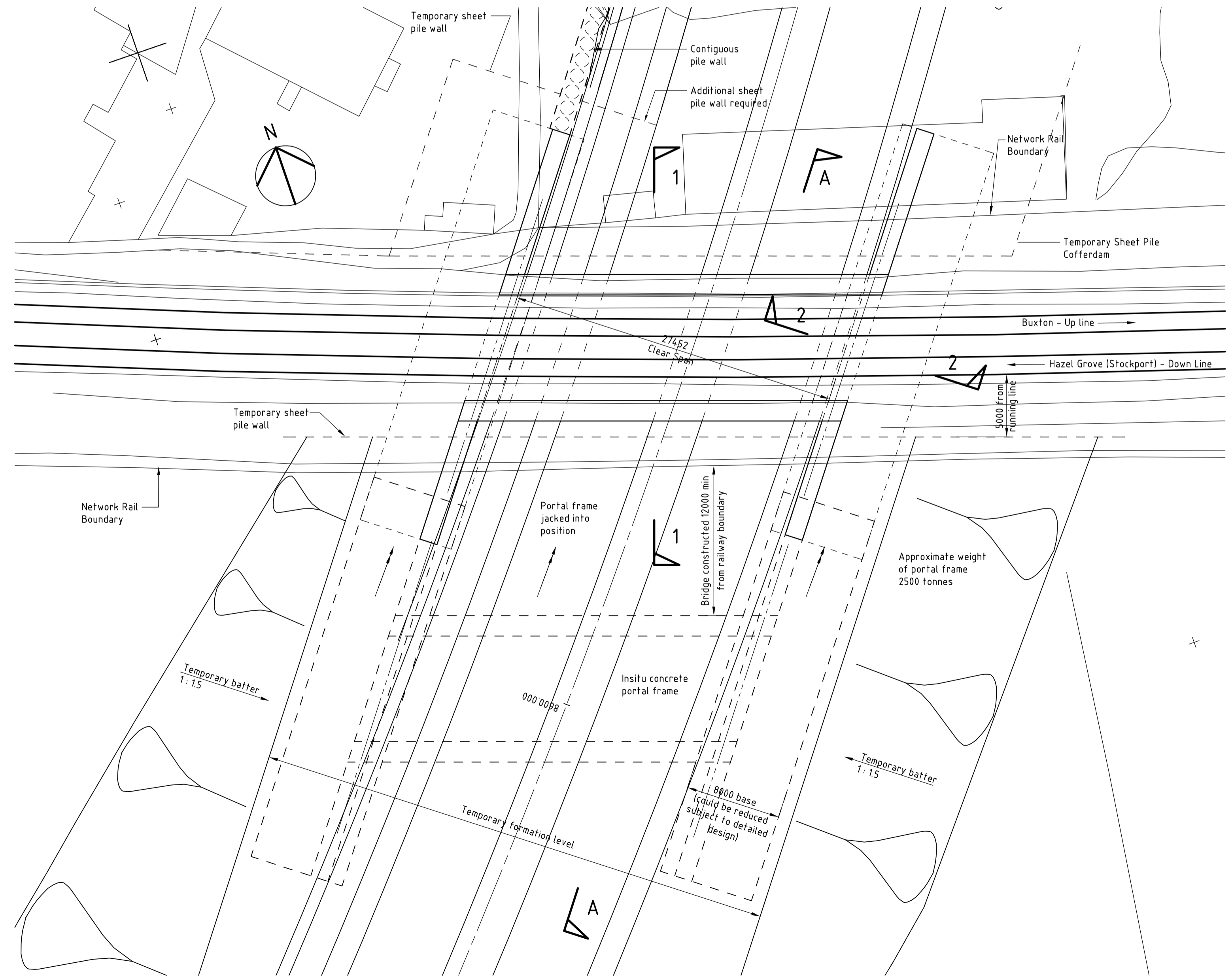
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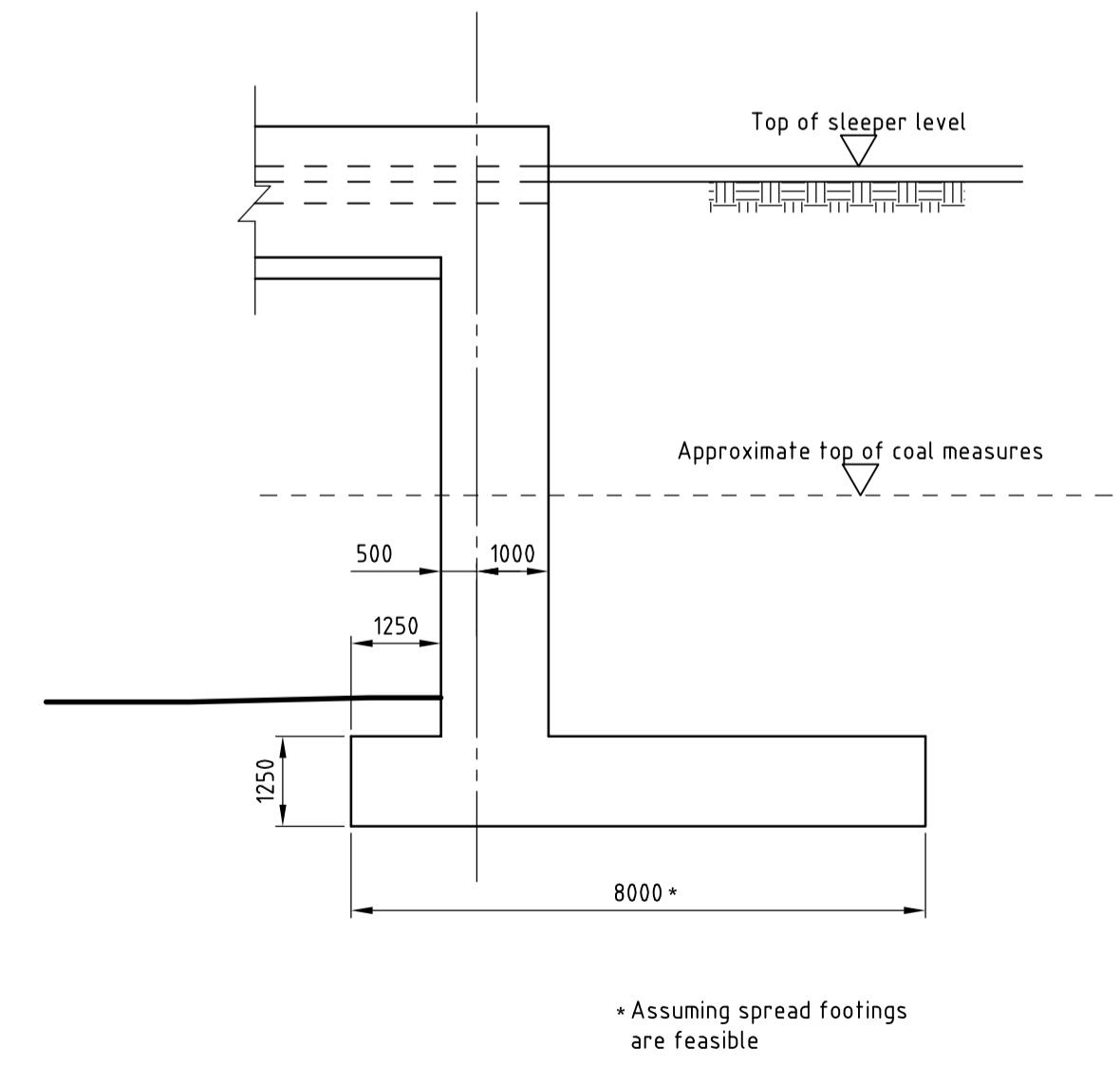
ELEVATION A-A
(1:125)



SECTION 1-1
(1:150)



PLAN
(1:250)



SECTION 2-2
(1:100)

| Rev. | Drawn | Checked | Date | Revision Details |
|------|-------|---------|------|------------------|
| | | | | |



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**SEMMS
RELIEF ROAD SCHEME
A6 - AIRPORT**

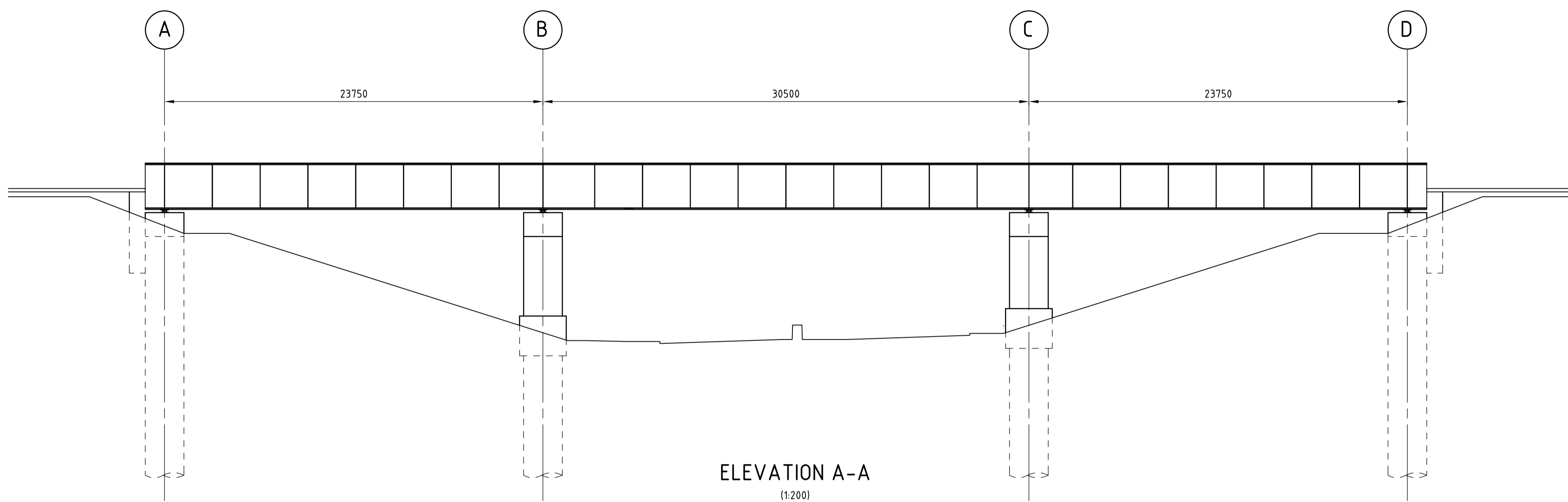
Drawing Title
**HAZEL GROVE/BUXTON
RAILWAY UNDER LINE BRIDGE
OPTION 2**

| Drawn | Engineer | Checked | Approved |
|-----------------|-------------------|-----------------|-----------------|
| DSH | OP | NS | NS |
| Date DEC '11 | Date DEC '11 | Date DEC '11 | Date DEC '11 |
| Size A1 | Scale AS SHOWN | | |
| SCG No. | Filename | | |

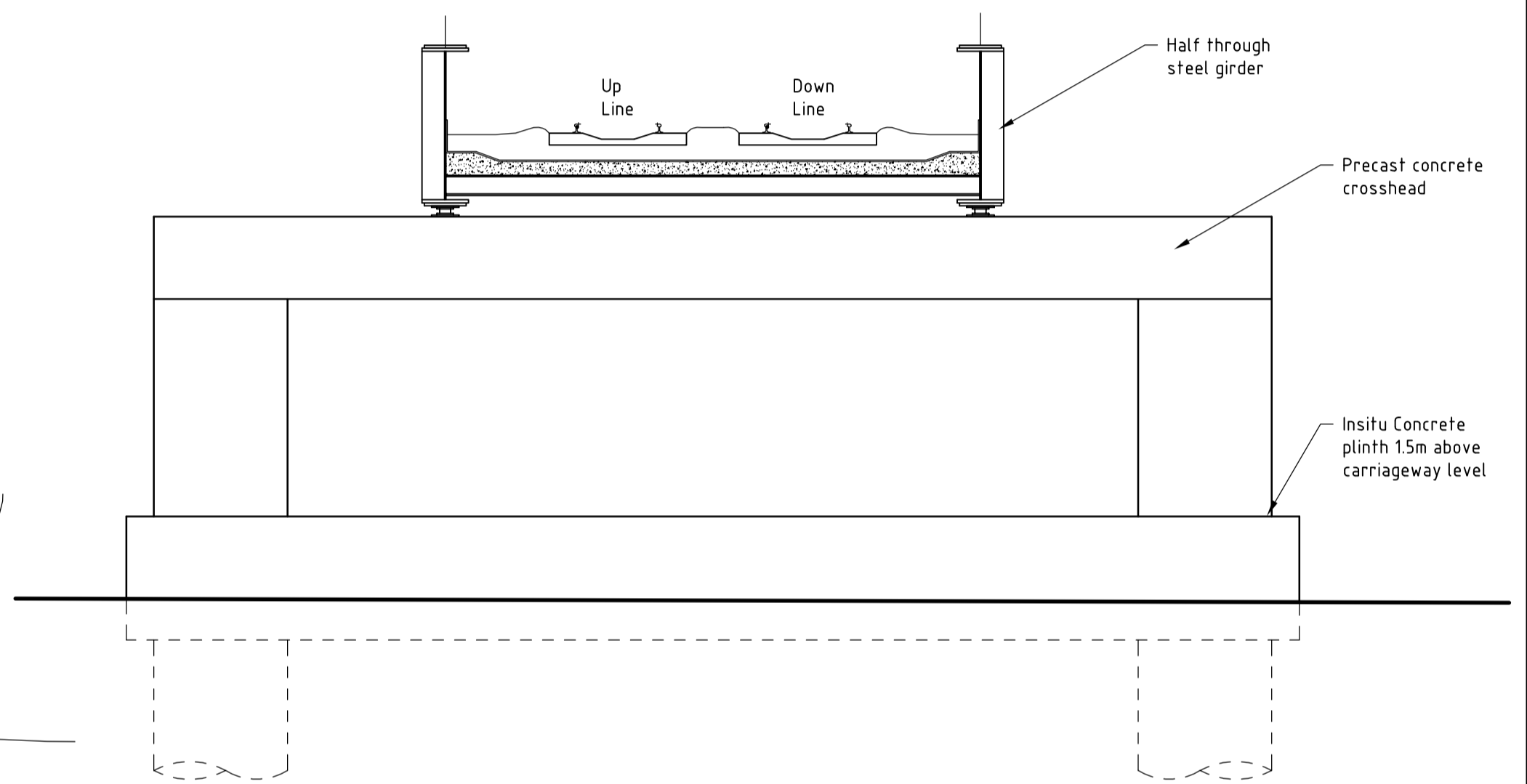
Drawing No. 1007/3D/DF5/A6-MA/B002/702-4 Revision

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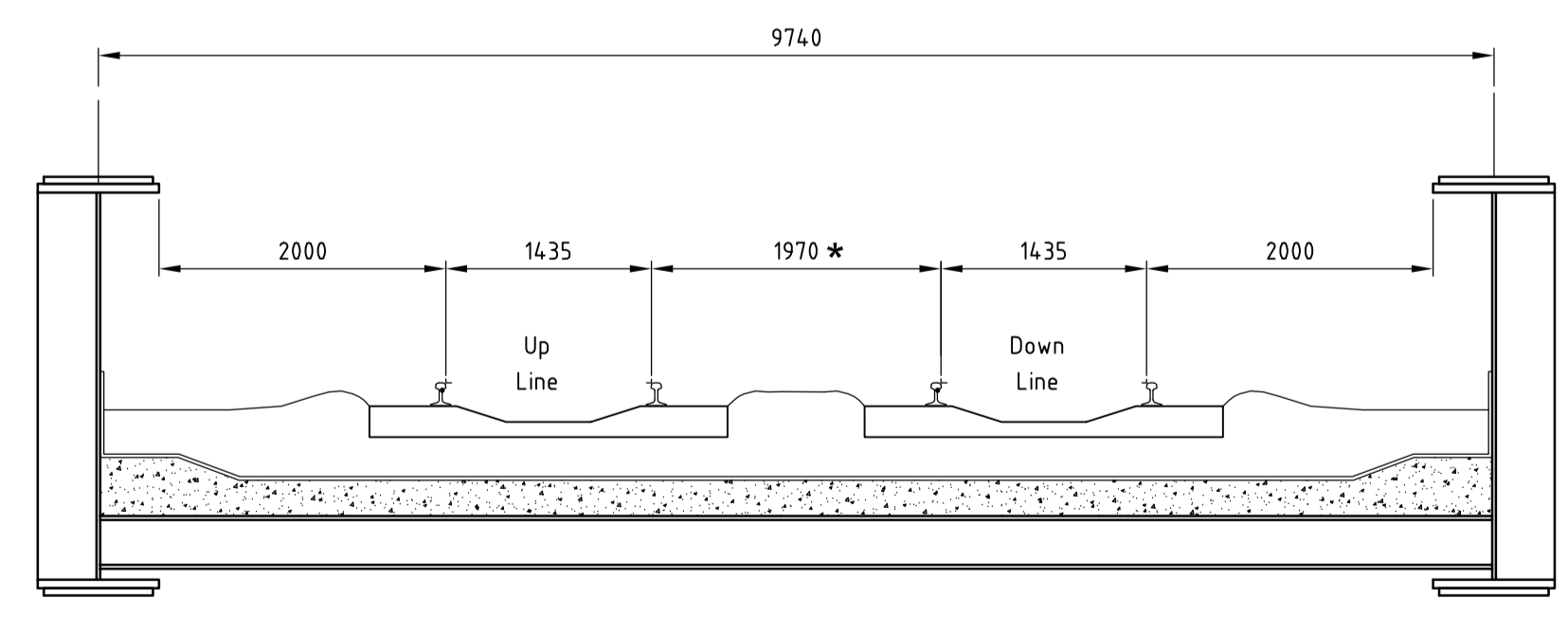
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9. Mileage : 3 miles 32 yards



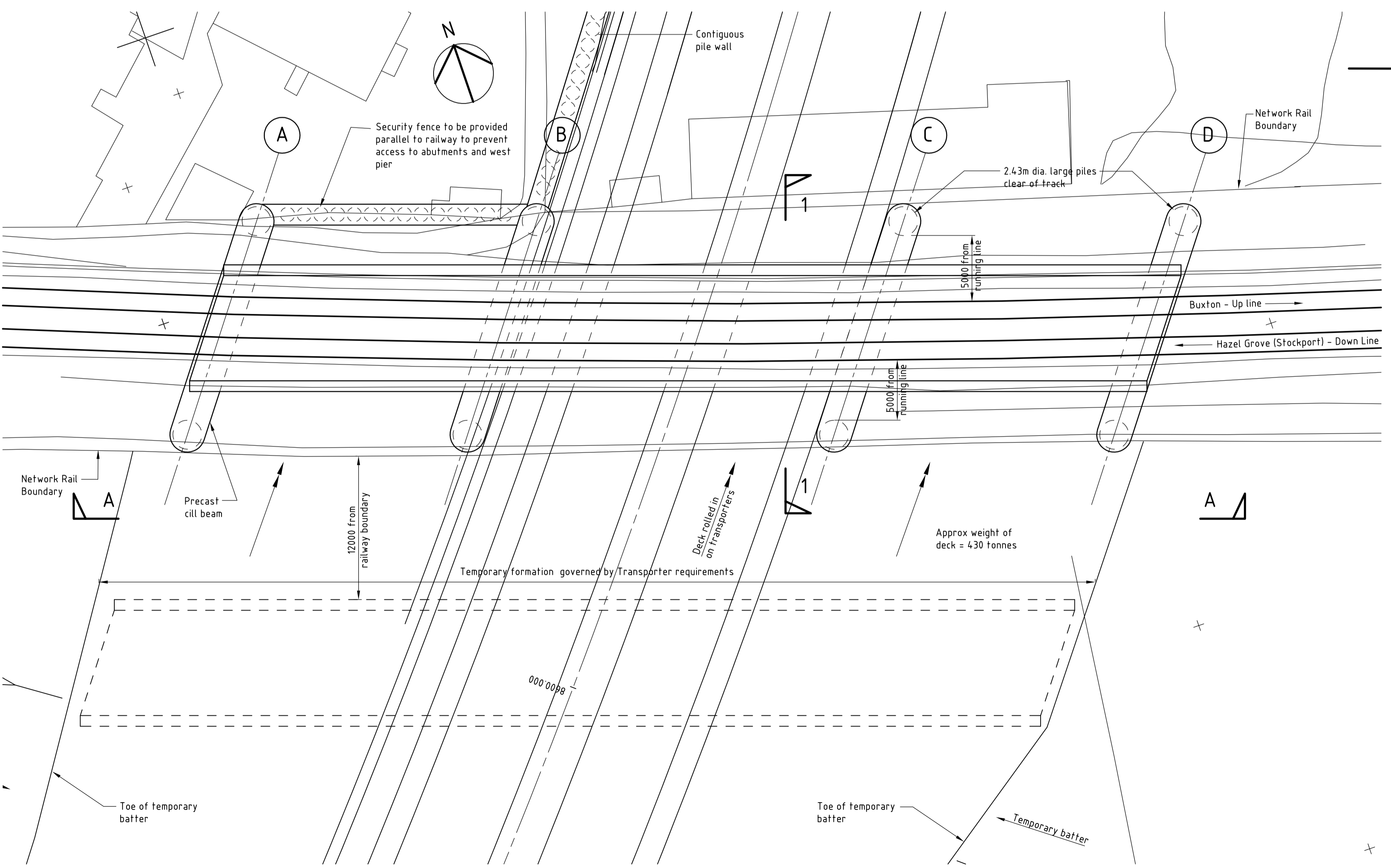
ELEVATION A-A
(1:200)



SECTION 1-1
(1:100)



Typical Deck Cross Section
(1:50)



PLAN
(1:250)

| Rev. | Drawn | Checked | Date | Revision Details |
|------|-------|---------|------|------------------|
| | | | | |

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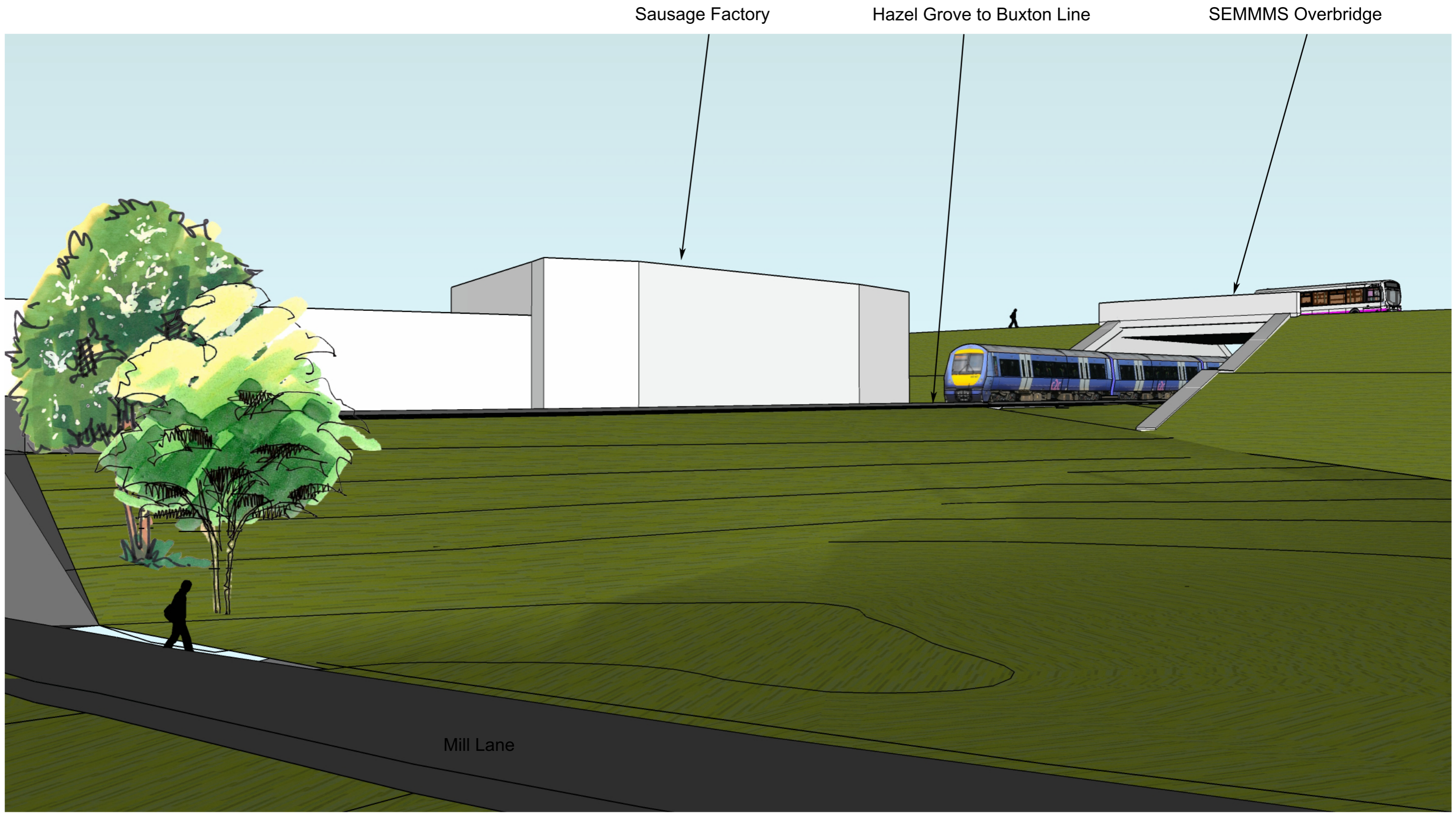
SEMMS RELIEF ROAD SCHEME A6 - AIRPORT

HAZEL GROVE/BUXTON RAILWAY UNDER LINE BRIDGE OPTION 3

| Drawn | Engineer | Checked | Approved |
|---------|----------|---------|----------|
| DSH | OP | NS | NS |
| Date | Date | Date | Date |
| DEC '11 | DEC '11 | DEC '11 | DEC '11 |
| Size | Scale | | |
| A1 | AS SHOWN | | |
| SCG No. | Filename | | |

Appendix C

3D Model of the Underbridge



Hazel Grove to Buxton Line Overbridge
View towards Overbridge from Residential Area

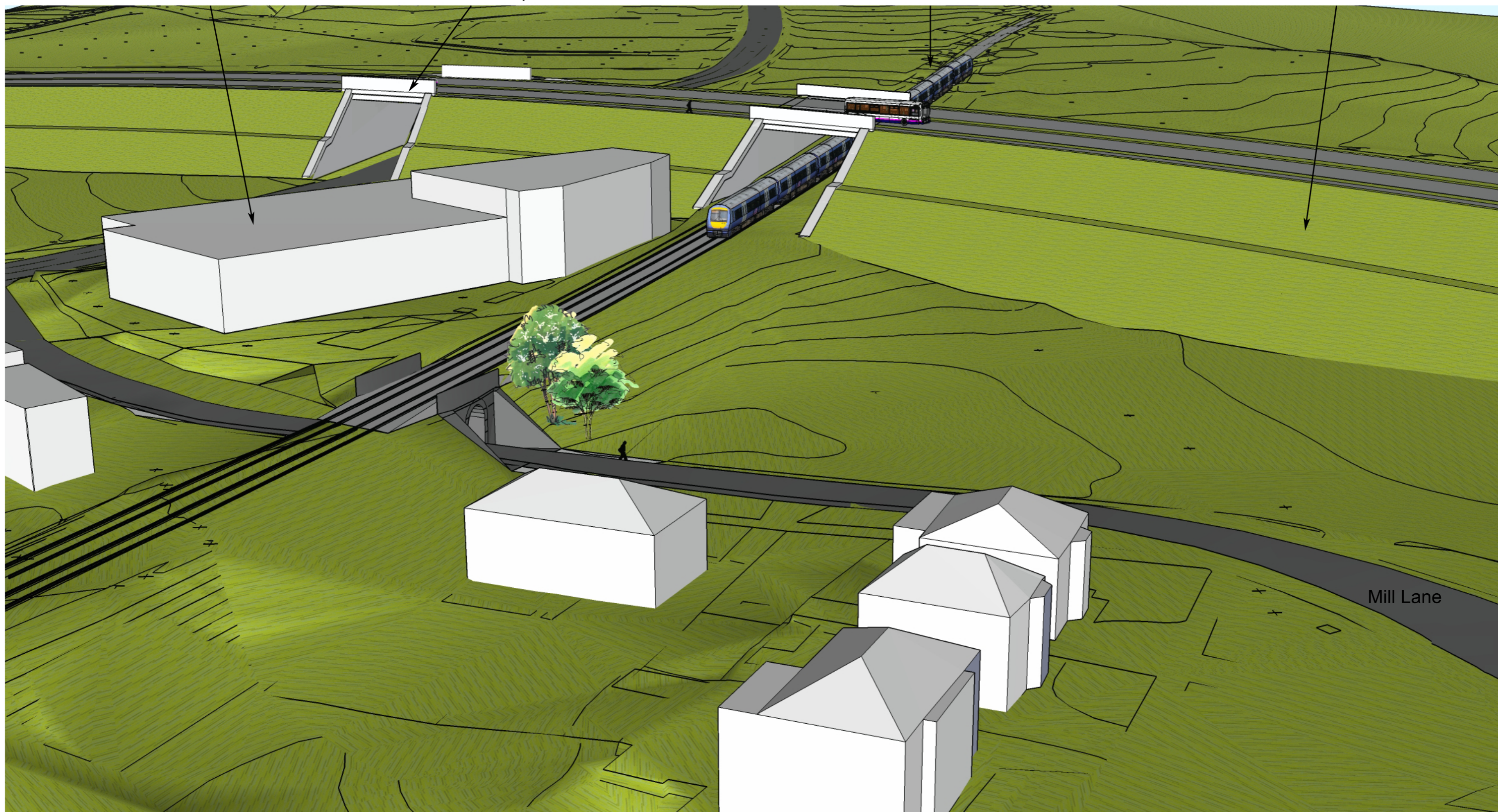
FIGURE 1

Sausage Factory

A6 Bus Underpass

Hazel Grove to Buxton Line

SEMMMS Embankment

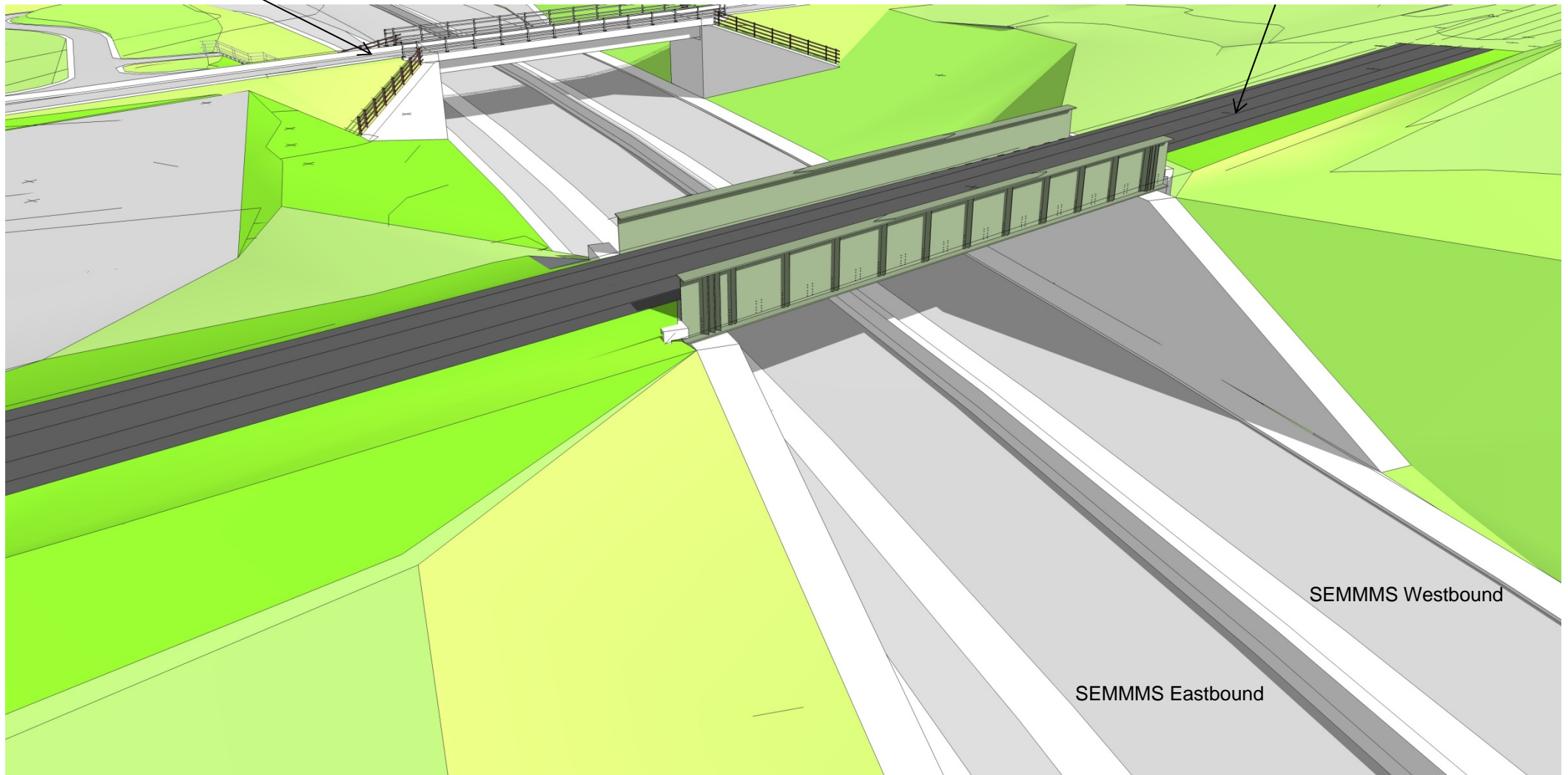


Hazel Grove to Buxton Line Overbridge
Aerial View Looking East

FIGURE 2

B001 A6 Bus Bridge

Hazel Grove to Buxton Line



SEMMMS Westbound

SEMMMS Eastbound

B002 – Hazel Grove to Buxton Railway Bridge

View Looking East