

## Appendices

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## Appendix A: Outline Design Drawings:

[4021883-BUK-ZZ-00-DR-GE-00001](#)

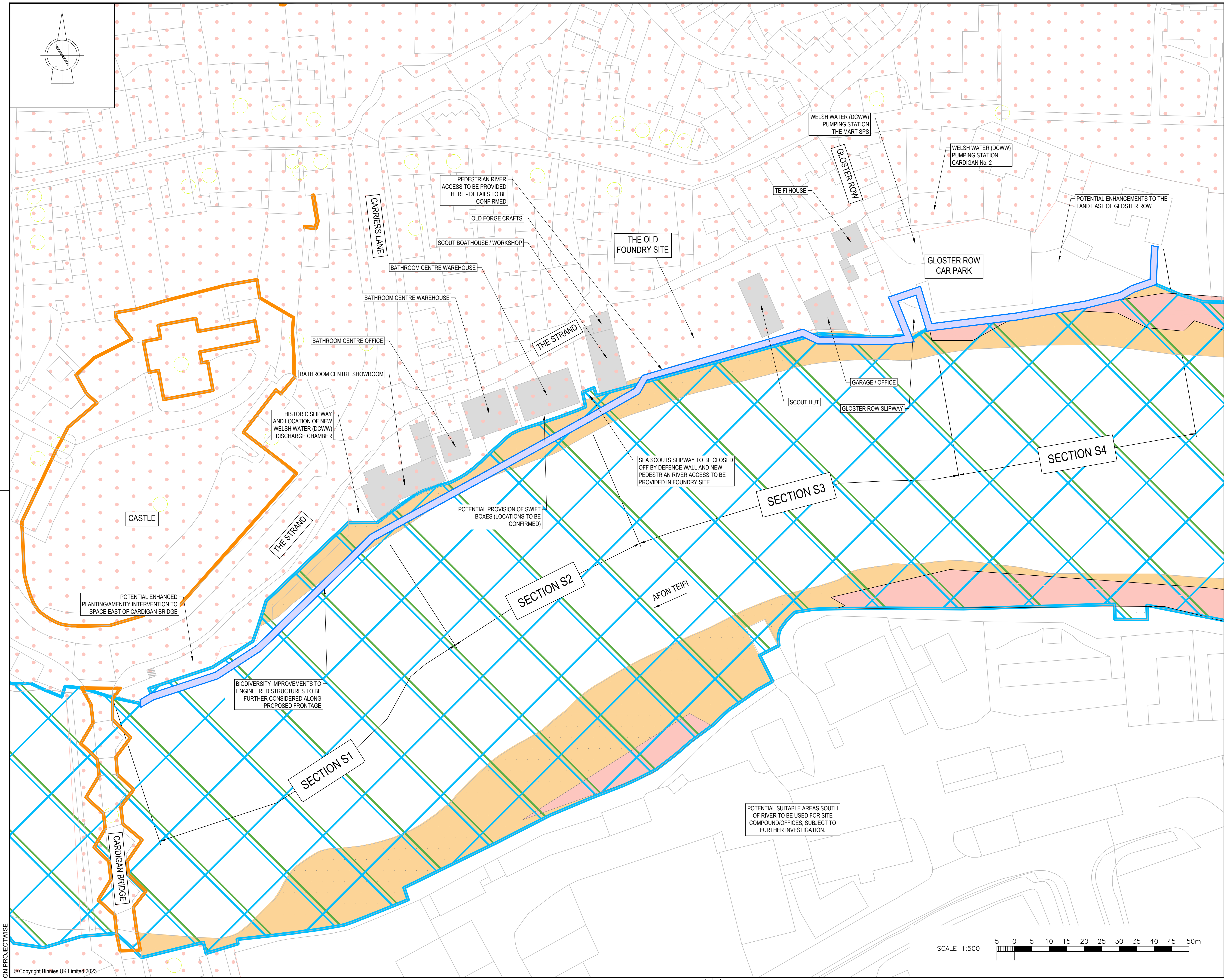
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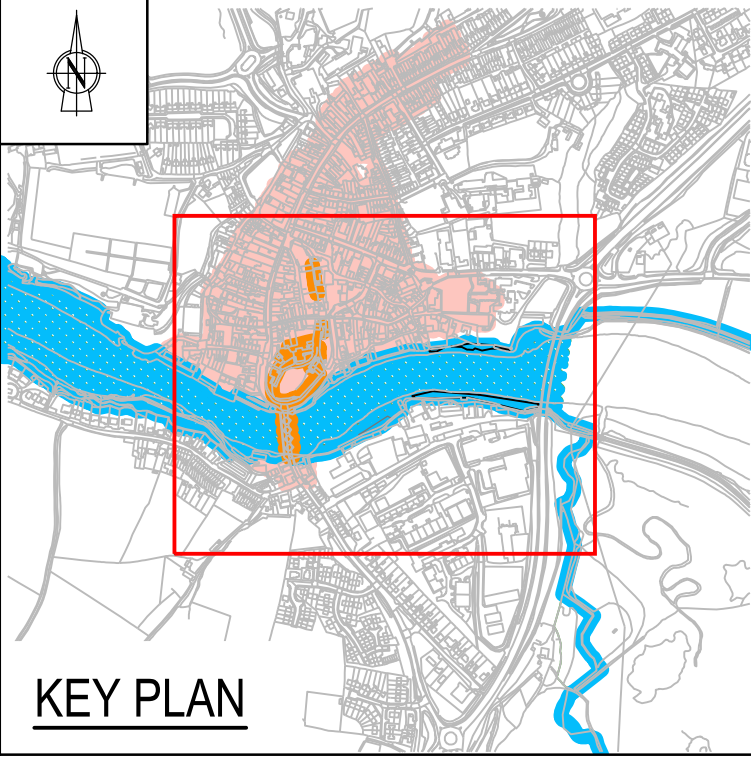
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[4021883-BUK-ZZ-00-DR-GE-00006](#)



Note: The limits, including the height and depths of the Works, shown in this drawing are not to be taken as limiting the obligations of the contractor under Contract.



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- GENERAL LEGEND:**
- PREFERRED FLOOD DEFENCE ALIGNMENT
  - SCHEDULED MONUMENTS
  - SPECIAL AREAS OF CONSERVATION (SAC)
  - SITES OF SPECIAL SCIENTIFIC INTEREST (SSSI)
  - CONSERVATION AREAS
  - H1.1 INTERTIDAL - MUD/SAND
  - H2.6 SALT MARSH - DENSE/CONTINUOUS

- NOTES ON PREFERRED FLOOD DEFENCE ALIGNMENT:**
- FLOOD DEFENCE ALIGNMENT MAY VARY AS A RESULT OF GEOTECHNICAL AND STRUCTURAL ASSESSMENTS.
  - THE PREFERRED ALIGNMENT INCLUDES SOME ENCROACHMENT INTO THE SAC IN SECTIONS 1 AND 2:
    - IN SECTION 1 THE ENCROACHMENT AVOIDS AN ABRUPT CHANGE IN ALIGNMENT ADJACENT TO THE BATHROOM CENTRE, WHICH WOULD ADVERSELY AFFECT RIVER FLOW PATTERNS.
    - IN SECTION 2, THE ENCROACHMENT IS NECESSARY TO AVOID DEMOLISHING THE BATHROOM CENTRE BUILDINGS.

| Rev | Drawn | Chkd | Rvwd | Appvd | Date     | Description        |
|-----|-------|------|------|-------|----------|--------------------|
| P01 | RT    | RPT  | AH   | AH    | 27/09/23 | For Check          |
| P02 | CR    | RPT  | AH   | AH    | 18/12/23 | For Stage Approval |

Designed by: PC Date: 31/08/23  
Status: S4 Suitable for stage approval  
Client:



Client Project No. CE0587 Revision

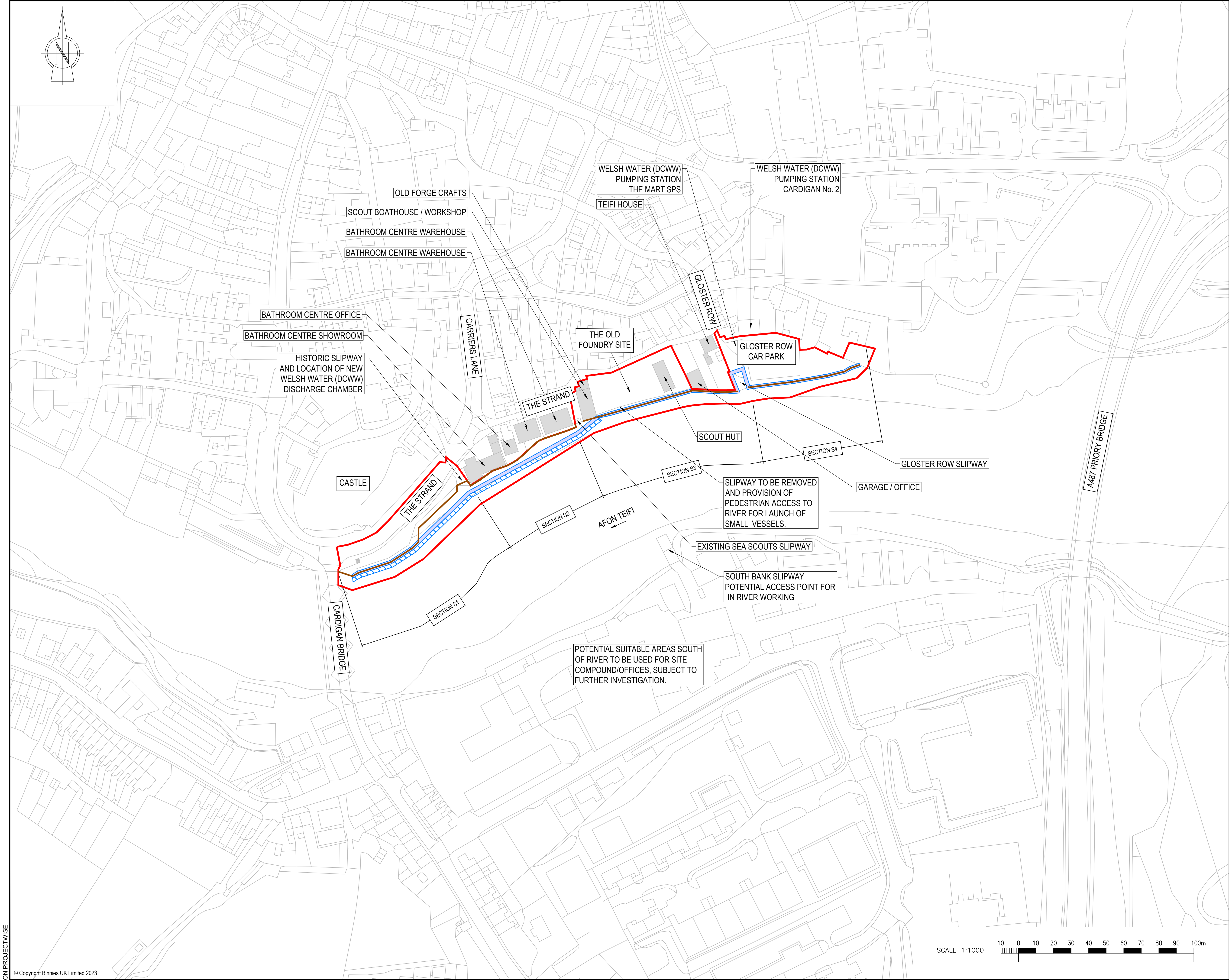


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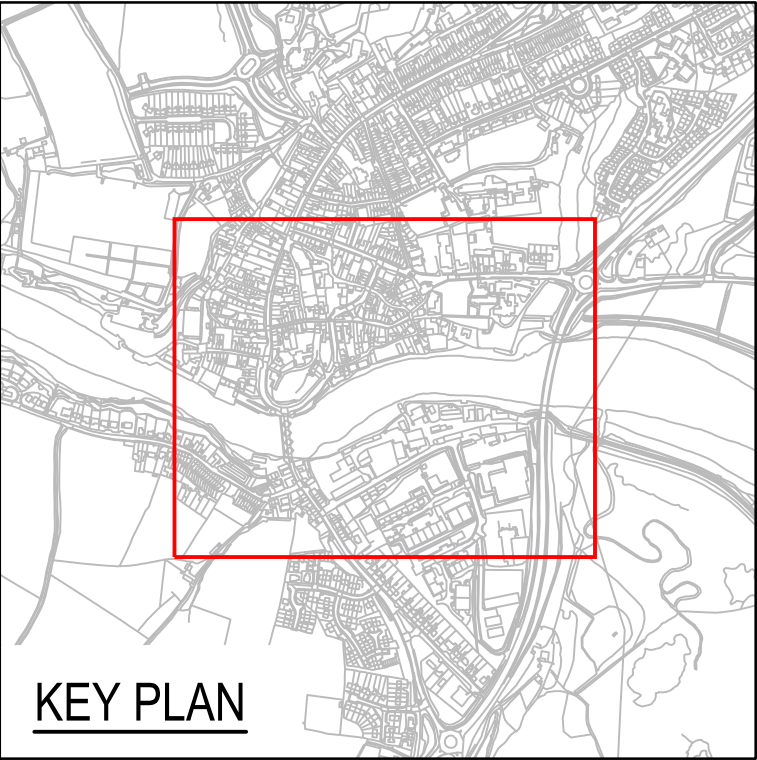
Project: NRW NGF CARDIGAN TIDAL FRMS

Drawing title: OUTLINE DESIGN  
LOCATION PLAN

Drawing scale: 1:500 Sheet size: A1  
Drawing no. 123666-BUK-ZZ-00-DR-C-00021 Revision: P02



Note: The limits, including the height and depths of the Works, shown in this drawing are not to be taken as limiting the obligations of the contractor under Contract.



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- GENERAL LEGEND:**
- EXISTING RIVER WALL AND SAC BOUNDARY
  - PREFERRED FLOOD DEFENCE ALIGNMENT
  - INDICATIVE EXTENT OF TEMPORARY WORKS PILING MAT
  - SITE BOUNDARY

- NOTES ON PREFERRED FLOOD DEFENCE ALIGNMENT:**
- THE PREFERRED ALIGNMENT GENERALLY FOLLOWS THE OPTION 2 ALIGNMENT ON DRG No. 123666-BUK-ZZ-00-DR-C-00016 ALONG THE EXISTING RIVER WALL WITH MINIMUM ENCROACHMENT INTO THE AFON TEIFI SAC.
  - THE PREFERRED ALIGNMENT INCLUDES SOME ENCROACHMENT INTO THE SAC IN SECTIONS 1 AND 2:
    - IN SECTION 1 THE ENCROACHMENT AVOIDS AN ABRUPT CHANGE IN ALIGNMENT ADJACENT TO THE BATHROOM CENTRE, WHICH WOULD ADVERSELY AFFECT RIVER FLOW PATTERNS.
    - IN SECTION 2, THE ENCROACHMENT IS NECESSARY TO AVOID DEMOLISHING THE BATHROOM CENTRE BUILDINGS.

| Rev    | Drawn | Chkd | Rvwd | Apprvd | Date     | Description     |
|--------|-------|------|------|--------|----------|-----------------|
| P01    | CR    | RPT  | AH   | AH     | 21/07/23 | For Information |
| P02.03 | CR    | ---  | ---  | ---    | ---      | 0<br>0<br>0     |

Designed by: NDe Date: 02/06/23

Status: S0 Initial Status or WIP

Client:

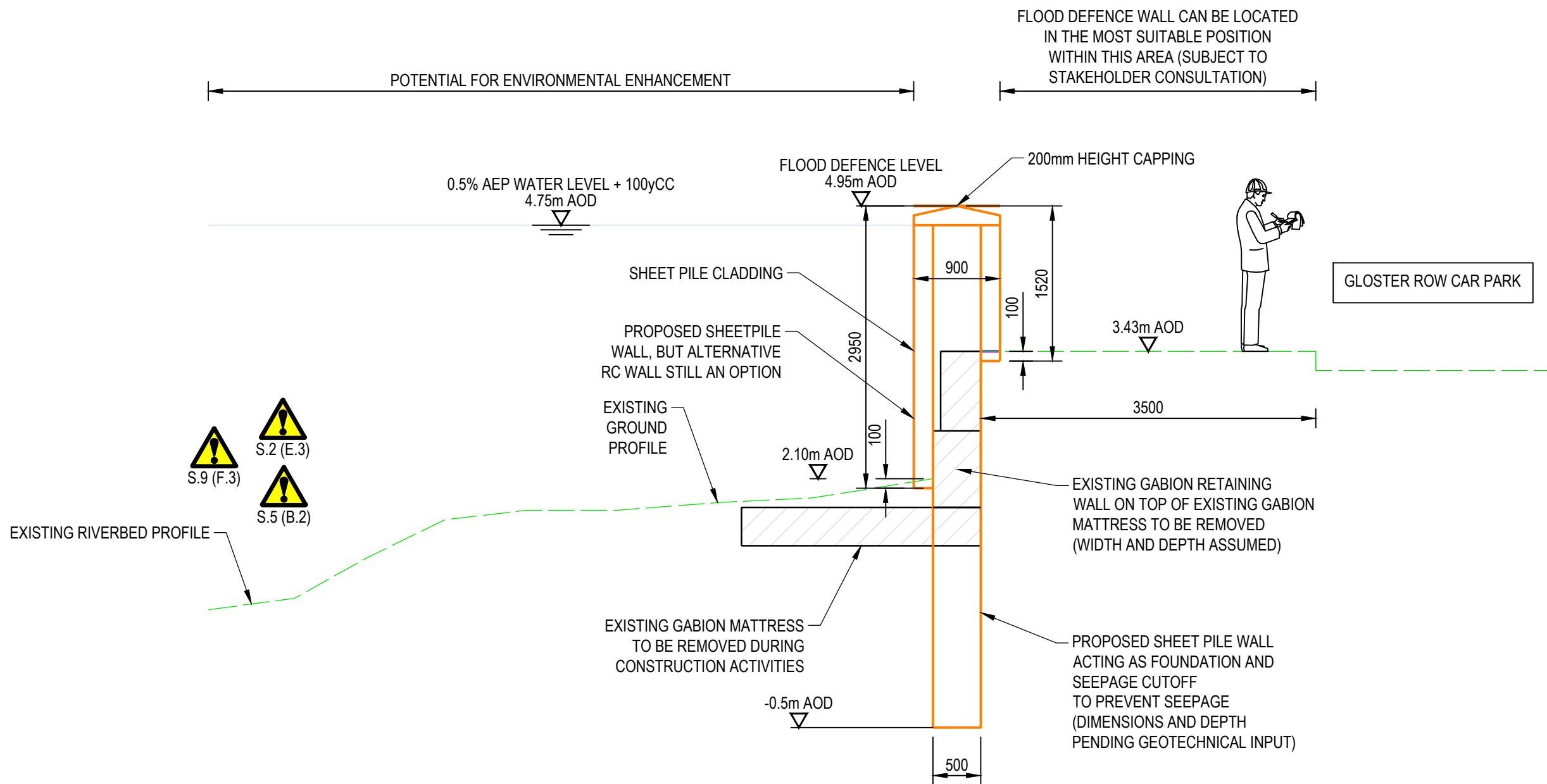
Client Project No. CE0587 Revision

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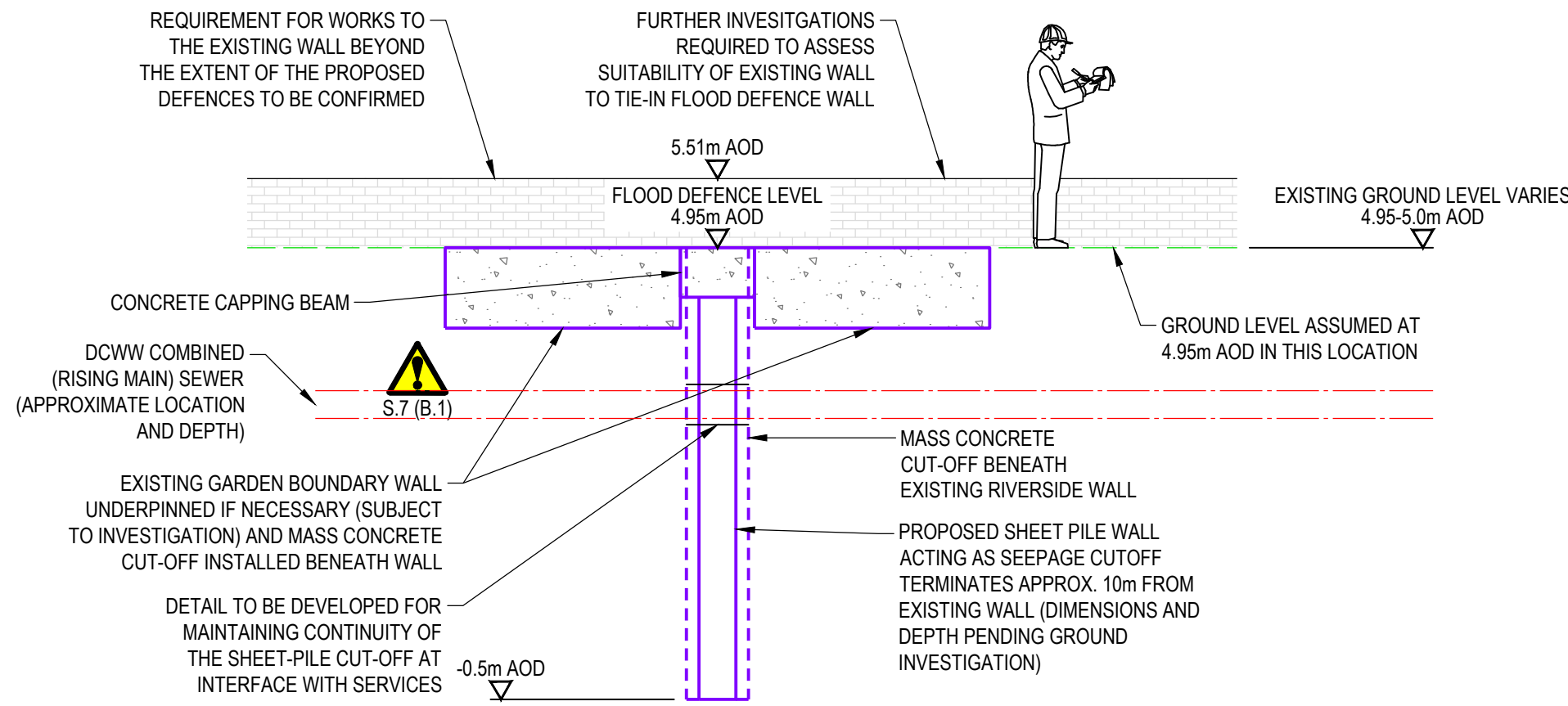
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Drawing title: OUTLINE DESIGN SCHEME AREA

Drawing scale: 1:1000 Sheet size: A1  
Drawing no. 123666-BUK-ZZ-00-DR-C-00020 Revision P02.03



SECTION S4-A  
SCALE 1:50



SECTION S4-B  
SCALE 1:50



Note: The limits, including the height and depths of the Works, shown in this drawing are not to be taken as limiting the obligations of the contractor under Contract.

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES AOD, UNLESS NOTED OTHERWISE.
2. EXACT LOCATION AND DEPTH OF EXISTING UTILITIES UNKNOWN. THESE SHALL BE CONFIRMED THROUGH SURVEY AND TRIAL PITS.
3. GROUND LEVELS SHOWN IN SECTIONS ARE BASED ON TOPOGRAPHIC SURVEY.
4. DEPTH OF EXISTING WALLS SHOWN IN SECTIONS ARE UNKNOWN AND SHALL BE CONFIRMED BY ADDITIONAL SURVEY AS REQUIRED.
5. RIVER BED LEVELS ARE ASSUMED FROM TOPOGRAPHIC SURVEY (WHERE DATA IS AVAILABLE), RIVER PROFILE IS INDICATIVE.
6. LOCATION OF PROPOSED SHEET PILE CUT-OFF IS INDICATIVE. THE PROPOSED SHEET PILE CUT-OFF SHALL BE EXTENDED TO THE LOCATION WHERE THE EXISTING GROUND LEVEL IS HIGHER THAN THE REQUIRED DEFENCE LEVEL.
7. EXISTING GROUND LEVELS ON THE RESIDENTIAL PROPERTY GARDEN ASSUMED FROM LIDAR DATA. THIS SHALL BE CONFIRMED IN THE NEXT STAGE OF THE DESIGN.
8. COPING AND CLADDING DETAILS ARE ONLY SHOWN INDICATIVELY.
9. FOUNDATION DETAILS AND DIMENSIONS ARE ASSUMED AND LIKELY TO CHANGE FOLLOWING GEOTECHNICAL AND STRUCTURAL CALCULATIONS.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION:

IN ADDITION TO THE HAZARDS OR RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, THE FOLLOWING SIGNIFICANT RESIDUAL RISKS SHOULD BE NOTED. FURTHER DETAILS ARE INCLUDED IN THE CDM DESIGN RISK MANAGEMENT REGISTER

CONSTRUCTION:

- S.1 (A.8) - EXISTING RIVER WALL ALIGNMENT IN POOR CONDITION
- S.2 (E.3) - TIDAL LEVELS
- S.3 (A.9) - LISTED STRUCTURE
- S.4 (A.11) - UNKNOWN DETAILS OF STRUCTURE
- S.5 (B.2) - ASBESTOS MATERIALS ON FORESHORE
- S.6 (A.1) - RESTRICTED ACCESS AND WORKING AREAS FOR CONSTRUCTION TRAFFIC
- S.7 (B.1) - SHEET PILES POTENTIAL CLASHES WITH EXISTING BURIED SERVICES
- S.9 (F.3) - SAC/SSSI SITES OF NATIONAL AND INTERNATIONAL SIGNIFICANCE - REFER TO SUPPORTING ENVIRONMENTAL LITERATURE
- S.10 (F.7) - POTENTIAL FOR ARCHAEOLOGICAL FINDS

MAINTENANCE, CLEANING AND OPERATION:

OTHER RISKS ARE LIKELY TO BE SIMILAR TO THE CONSTRUCTION STAGE

DECOMMISSIONING OR DEMOLITION:

RISKS ARE LIKELY TO BE SIMILAR TO THE CONSTRUCTION STAGE BUT SHOULD BE RECONSIDERED IN ADVANCE OF DECOMMISSIONING, DEMOLITION, FUTURE REFURBISHMENT OR REPLACEMENT.

| Rev | Drawn | Chkd | Rwd | Apprvd | Date     | Description        |
|-----|-------|------|-----|--------|----------|--------------------|
| P01 | CR    | RPT  | AH  | AH     | 26/09/23 | For Information    |
| P02 | CR    | RPT  | AH  | AH     | 18/12/23 | For Stage Approval |

Designed by: PC Date: 02/06/23

Status: S4 Suitable for stage approval

Client:



Client Project No.  
CE0587

Revision



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Project:

NRW NGF CARDIGAN TIDAL FRMS

Drawing title

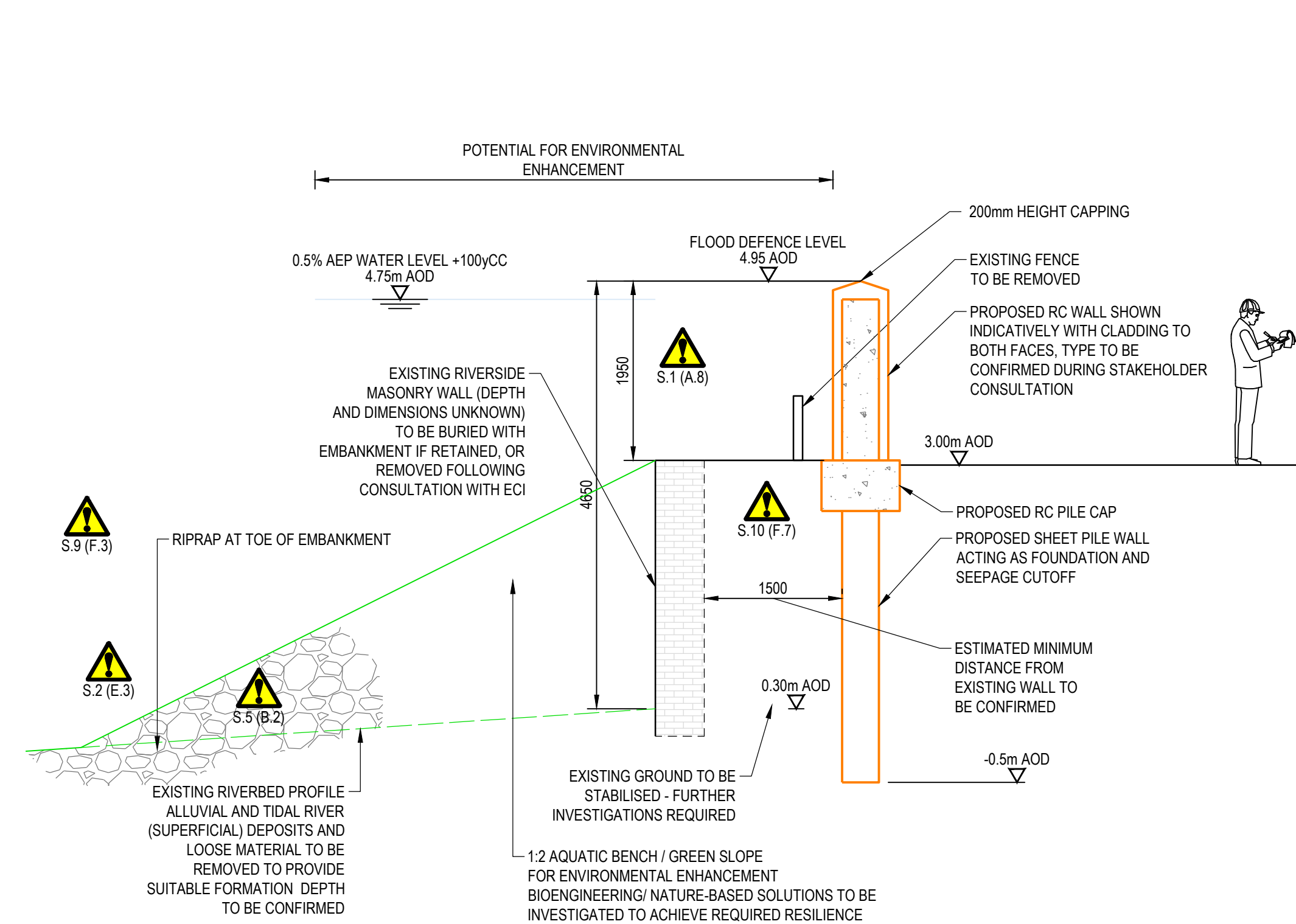
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CROSS SECTIONS

Drawing scale: 1:50

Sheet size: A1

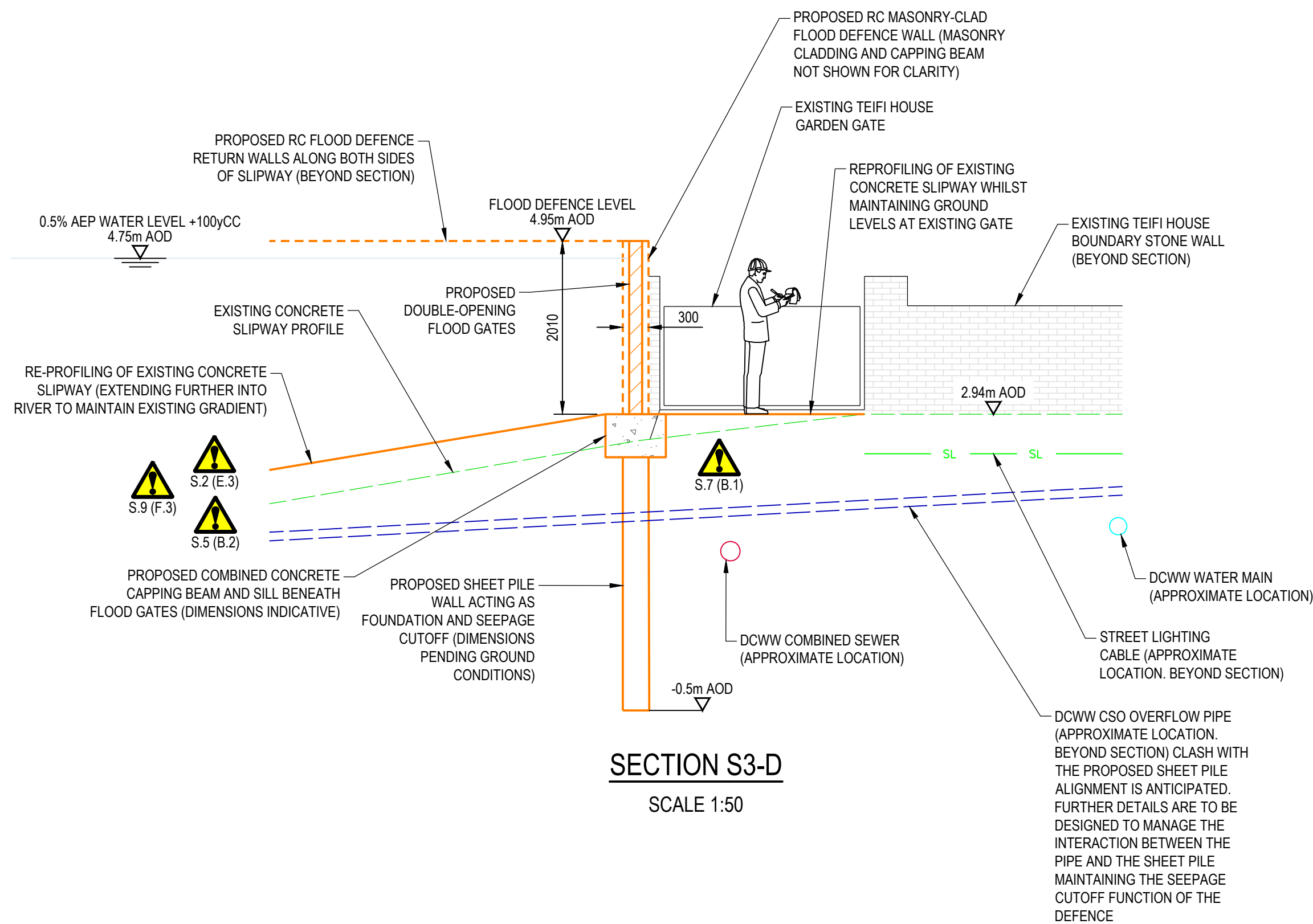
Drawing no.  
123666-BUK-ZZ-00-DR-C-00032

Revision  
P02



SECTION S3-C

SCALE 1:50



SECTION S3-D

SCALE 1:50



Note: The limits, including the height and depths of the Works, shown in this drawing are not to be taken as limiting the obligations of the contractor under Contract.

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES AOD, UNLESS NOTED OTHERWISE.
2. EXACT LOCATION AND DEPTH OF EXISTING UTILITIES UNKNOWN. THESE SHALL BE CONFIRMED THROUGH SURVEY AND TRIAL PITS.
3. GROUND LEVELS SHOWN IN SECTIONS ARE BASED ON TOPOGRAPHIC SURVEY.
4. DEPTH OF EXISTING WALLS SHOWN IN SECTIONS ARE UNKNOWN AND SHALL BE CONFIRMED BY ADDITIONAL SURVEY AS REQUIRED.
5. RIVER BED LEVELS ARE ASSUMED FROM TOPOGRAPHIC SURVEY (WHERE DATA IS AVAILABLE). RIVER PROFILE IS INDICATIVE.
6. COPING AND CLADDING DETAILS ARE ONLY SHOWN INDICATIVELY.
7. FOUNDATION DETAILS AND DIMENSIONS ARE ASSUMED AND LIKELY TO CHANGE FOLLOWING GEOTECHNICAL AND STRUCTURAL CALCULATIONS.
8. DISTANCE OF PROPOSED SHEET PILE WALL FROM EXISTING RIVER BANK WALL WILL BE DETERMINED BY RESULTS FROM GEOTECHNICAL AND STRUCTURAL ASSESSMENTS.
9. PROPOSED DESIGN FOR SECTION S3-C IS SUBJECT TO EXISTING RIVER WALL STRUCTURAL ASSESSMENT. IMPROVEMENT WORKS ON EXISTING WALL MIGHT BE REQUIRED.
10. FLOOD GATES WITH POSSIBLE PAINTED OR TIMBER CLAD FINISHES.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION:

IN ADDITION TO THE HAZARDS OR RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, THE FOLLOWING SIGNIFICANT RESIDUAL RISKS SHOULD BE NOTED. FURTHER DETAILS ARE INCLUDED IN THE CDM DESIGN RISK MANAGEMENT REGISTER

CONSTRUCTION:

- S.1 (A.8) - EXISTING RIVER WALL ALIGNMENT IN POOR CONDITION
- S.2 (E.3) - TIDAL LEVELS
- S.3 (A.9) - LISTED STRUCTURE
- S.4 (A.11) - UNKNOWN DETAILS OF STRUCTURE
- S.5 (B.2) - ASBESTOS MATERIALS ON FORESHORE
- S.6 (A.1) - RESTRICTED ACCESS AND WORKING AREAS FOR CONSTRUCTION TRAFFIC
- S.7 (B.1) - SHEET PILES POTENTIAL CLASHES WITH EXISTING BURIED SERVICES
- S.9 (F.3) - SAC/SSSI SITES OF NATIONAL AND INTERNATIONAL SIGNIFICANCE - REFER TO SUPPORTING ENVIRONMENTAL LITERATURE
- S.10 (F.7) - POTENTIAL FOR ARCHAEOLOGICAL FINDS

MAINTENANCE, CLEANING AND OPERATION:

- S.8 (J.1) - OPERATION OF FLOOD GATES
- OTHER RISKS ARE LIKELY TO BE SIMILAR TO THE CONSTRUCTION STAGE

DECOMMISSIONING OR DEMOLITION:

RISKS ARE LIKELY TO BE SIMILAR TO THE CONSTRUCTION STAGE BUT SHOULD BE RECONSIDERED IN ADVANCE OF DECOMMISSIONING, DEMOLITION, FUTURE REFURBISHMENT OR REPLACEMENT.

| Rev | Drawn | Chkd | Rvwd | Apprvd | Date     | Description        |
|-----|-------|------|------|--------|----------|--------------------|
| P01 | RT    | RPT  | AH   | AH     | 26/09/23 |                    |
| P02 | CR    | RPT  | AH   | AH     | 18/12/23 | For Stage Approval |

Designed by: PC Date: 31/08/23

Status: S4 Suitable for stage approval

Client



Client Project No.  
CE0587

Revision



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Project

NRW NGF CARDIGAN TIDAL FRMS

Drawing title

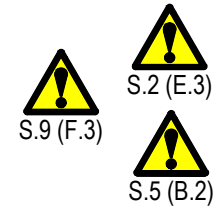
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CROSS SECTIONS

Drawing scale: AS SHOWN

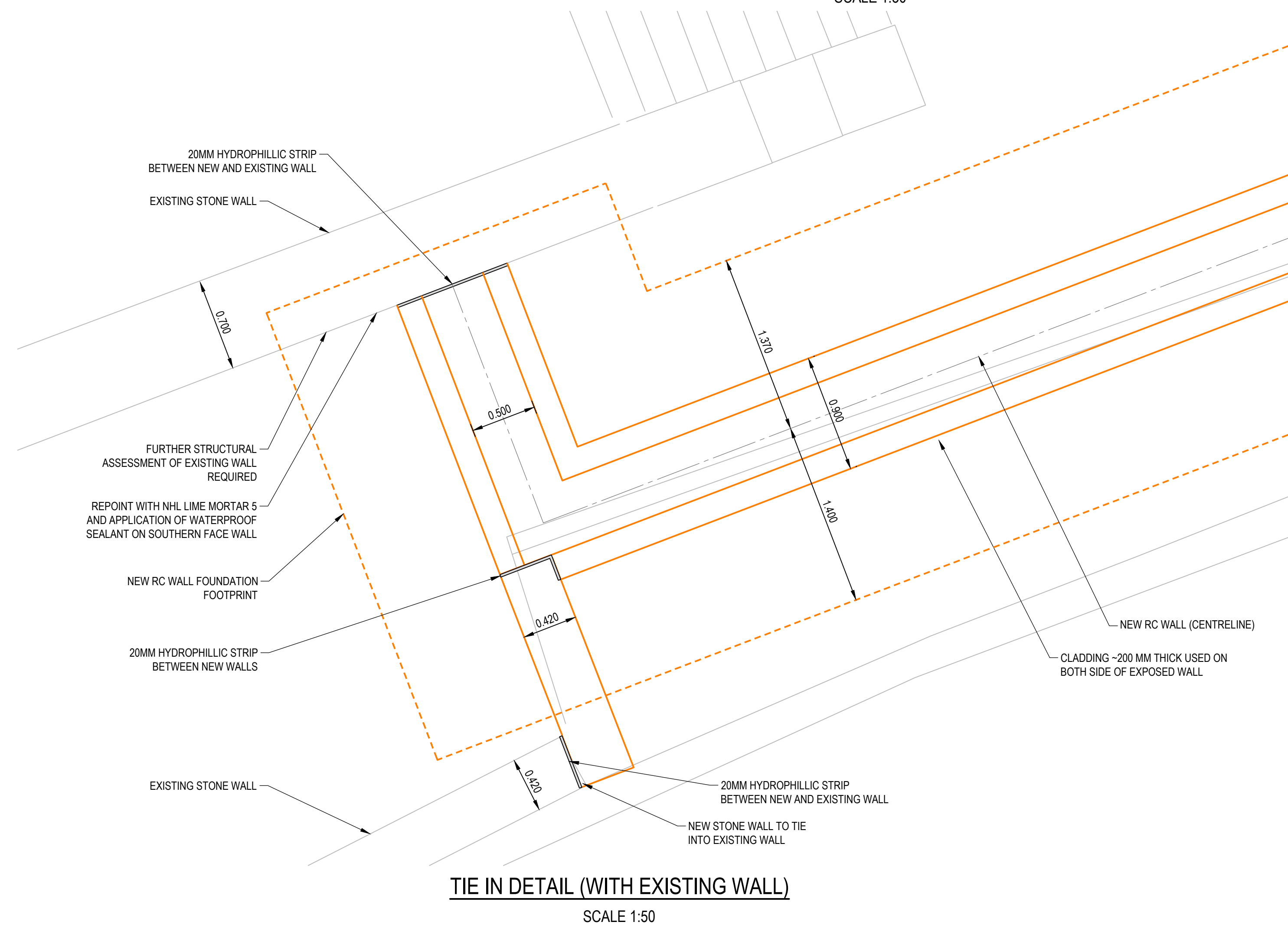
Sheet size: A1

Drawing no.  
123666-BUK-ZZ-00-DR-C-00030

Revision  
P02



SCALE 1:50



|        |                                                                                                                               |
|--------|-------------------------------------------------------------------------------------------------------------------------------|
| NOTES: |                                                                                                                               |
| 1.     | ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES EXACT, UNLESS NOTED OTHERWISE.                                         |
| 2.     | ADDITIONAL LOCATION AND DEPTH OF EXISTING UTILITIES UNKNOWN. THESE SHALL BE CONFIRMED THROUGH SURVEY AND TRIAL PITS.          |
| 3.     | GROUND LEVELS SHOWN IN SECTIONS ARE BASED ON TOPOGRAPHIC SURVEY.                                                              |
| 4.     | DEPTH OF EXISTING WALLS SHOWN IN SECTIONS ARE UNKNOWN AND SHALL BE CONFIRMED BY ADDITIONAL SURVEY AS REQUIRED.                |
| 5.     | RIVER BED LEVELS ARE ASSUMED FROM TOPOGRAPHIC SURVEY (WHERE DATA IS AVAILABLE). RIVER PROFILE IS INDICATIVE.                  |
| 6.     | THE WALL ALIGNMENT AND DESIGN REQUIREMENTS ASSOCIATED WITH ITS LOCATION ARE TO BE DEVELOPED FURTHER AT DETAILED DESIGN STAGE. |
| 7.     | COPING AND CLADDING DETAILS ARE ONLY SHOWN INDICATIVELY.                                                                      |
| 8.     | ALL DIMENSIONS ARE SUBJECT TO GROUND INVESTIGATION.                                                                           |
| 9.     | ACCESS REQUIREMENTS FOR THE DOWW OUTFALL CHAMBER AREA TO BE CONFIRMED PENDING DISCUSSION WITH DOWW.                           |
| 10.    | ARCHAEOLOGICAL INVESTIGATIONS MAY BE REQUIRED IN THIS LOCATION.                                                               |

IN ADDITION TO THE HAZARDS OR RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, THE FOLLOWING SIGNIFICANT RESIDUAL RISKS SHOULD BE NOTED. FURTHER DETAILS ARE INCLUDED IN THE CDM DESIGN RISK MANAGEMENT REGISTER

- S.1 (A.8) - EXISTING RIVER WALL ALIGNMENT IN POOR CONDITION
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- S.9 (F.3) - SAC/SSSI SITES OF NATIONAL AND INTERNATIONAL SIGNIFICANCE- REFER TO SUPPORTING ENVIRONMENTAL LITERATURE
- S.10 (F.7) - POTENTIAL FOR ARCHAEOLOGICAL FINDS

|     |
|-----|
| N/A |
|-----|

RISKS ARE LIKELY TO BE SIMILAR TO THE CONSTRUCTION STAGE BUT SHOULD BE RECONSIDERED IN ADVANCE OF DECOMMISSIONING, DEMOLITION, FUTURE REFURBISHMENT OR REPLACEMENT.

|        |       |      |      |        |          |                       |
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|        |       |      |      |        |          |                       |
| P01    | RT    | RPT  | AH   | AH     | 26/09/23 |                       |
| P02    | CR    | RPT  | AH   | AH     | 18/12/23 | For Stage Approval    |
| P03.04 | CF    | ---  | ---  | ---    | ---      | FOR COMMENT<br>0<br>0 |
| Rev    | Drawn | Chkd | Rwdd | Apprvd | Date     | Description           |

Designed by: BP Date: 31/08/23

|        |    |                                 |
|--------|----|---------------------------------|
| Status | S3 | Suitable for Review and Comment |
|--------|----|---------------------------------|

Client  **Cyfeeth**



|                              |          |
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Project \_\_\_\_\_

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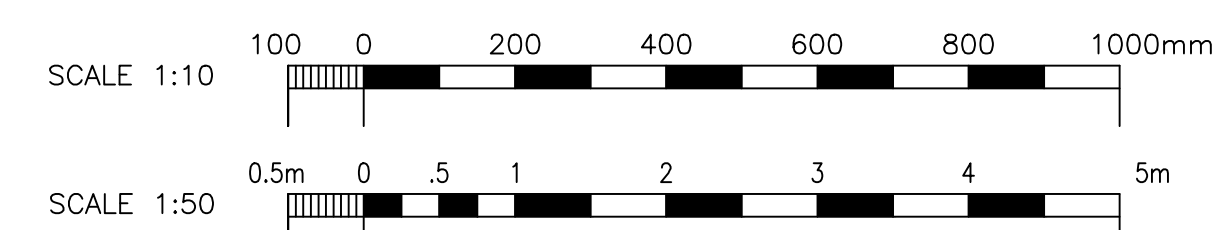
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## OUTLINE DESIGN - SECTION 1

### CROSS SECTIONS & DETAILS

Drawing scale: AS SHOWN Sheet size: A1

|                                            |                    |
|--------------------------------------------|--------------------|
| Drawing no.<br>123666-BUK-ZZ-00-DR-C-00026 | Revision<br>P03.04 |
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## **Appendix B: WYG Ground Investigation Report (2015)**

[A088137 - Cardigan FAS factual GI Report April 15 DRAFT.pdf](#)

[A088137\\_2 \(Proposed Site Investigation Layout Plan 1.pdf](#)



**Cyfoeth  
Naturiol  
Cymru**  
**Natural  
Resources  
Wales**

Natural Resources Wales

# **Cardigan Flood Alleviation Scheme (FAS)**

## **Ground Investigation Report**

April 2015



## Document Control

Document: Ground Investigation Interpretive Report

Project: Cardigan FAS

Client: Natural Resources Wales

Job Number: A088137

File Origin: N:\Environmental\projects\A088137 - Cardigan FAS\Report\A088137 - Cardigan DRAFT.docx

Revision: - Draft

Date:

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**Chris Pugh**  
**Associate Director**

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**Graduate Geo-environmental Engineer**

Description of Revision

Revision:

Date:

Prepared by

Checked by

Approved By

Description of Revision

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Figure 1 – Site Location Plan

Figure 2 – Site Investigation Layout Plan

Appendix A – Report Conditions

Appendix B – Exploratory Hole Logs and Pit Sketches

Appendix C – Geotechnical Laboratory Testing Results

Appendix D – Environmental Laboratory Testing Results

Appendix E – Variable Head Permeability Testing

Appendix F – Land gas and groundwater monitoring results

Appendix G – Levellogger groundwater monitoring results



## 1 Introduction

### 1.1 Instruction

WYG Environment Planning Transport Ltd (WYG) were commissioned by Natural Resources Wales to undertake intrusive ground investigation work along the northern and southern bank of the River Teifi. Contract instructions to proceed were included in an email from Mark Davies (Natural Resources Wales) the clients representative dated 12<sup>th</sup> February 2015.

### 1.2 Brief

The ground investigation is part of proposed improvement works to the existing flood defences in Cardigan along the River Teifi.

The scope of the site investigation works was devised by the Natural Resources Wales representative and detailed in the Cardigan Tidal Flood Alleviation Scheme, Site Investigation Brief IMWA001477. In summary the scope comprised the following key elements:

- 11 No. Dynamic sampling boreholes utilising rotary percussive rig.
- 8 No. Hand pits to investigate existing flood defence foundations
- In situ testing of the superficial deposits and bedrock
- Collection of disturbed and undisturbed soil samples
- Geotechnical and chemical laboratory testing of soil samples
- Installation of groundwater monitoring standpipe piezometers and level loggers to monitor ground gas, groundwater levels and to sample groundwater.

### 1.3 Report Scope

This report presents full factual records of the site work carried out, the ground conditions encountered in the exploratory holes, the in situ test results the geotechnical and contamination laboratory test results along with groundwater and gas monitoring results.



## 1.4 Limitations

This report has been prepared in accordance with the requirements of Natural Resources Wales. It is subject to the report conditions contained in Appendix A.

The information contained in this report is intended for the use of Natural Resources Wales. WYG can take no responsibility for the use of this information by any third party or for uses other than that described in this report.



## 2 Site Information

### 2.1 Location

The site is located in Cardigan, Ceredigion along the northern and southern bank of the River Teifi. The site is bounded to the north by Cardigan town centre made up of a mixture of commercial and residential properties. The site is bounded to the south by an industrial estate and Cardigan cattle market. The proposed development site covers an area of approximately 5 hectares.

A site location plan is presented as Figure 1 of this report.

### 2.2 Site description

The site is located on a variety of environments and ground conditions, including tarmac, concrete slabs and paving, granular made ground, cohesive estuarine deposits and grassed areas. The southern site area is accessed from the industrial estate and cattle market off Station Road. The northern site is accessed from a number of different roads around the Cardigan town centre including Quay Street, The Strand and Cardigan Hospital on Pont Y Cleifion. The hand dug pits were accessed from a number of different slipways and public footpaths along both the northern and southern sites.

### 2.3 Geology

The anticipated geology at the site has been inferred from a review of England & Wales Geological Map Sheet 193: Cardigan (Solid & Drift Edition) and the online Geoindex, published by the BGS. This indicates that the underlying geology comprises superficial deposits of Alluvial or Tidal Creek Deposits and Devensian Till, the Nantmel or Netpool Mudstone Formation.

### 2.4 Hydrogeology

Hydrogeological information has been gathered from the Environment Agency.

According to the Natural Resources Wales groundwater vulnerability maps the southern site is underlain by bedrock classified as minor aquifers of low and intermediate vulnerability. The Nantmel mudstone and Netpool Mudstone are classified as Secondary B aquifers. The superficial deposits have not been classified in terms of their vulnerability but the glacial till has been classified as a secondary undifferentiated aquifer.



No groundwater Source Protection Zones (SPZs) can be found within 1km of the site.

## 2.5 Hydrology

The northern and southern edges of the site are bounded by the River Teifi. The River Teifi near the site extent is estuarine and tidally controlled. The data gathering undertaken in the boreholes will be used to show how the tide affects the groundwater regime around the River Tefi.



### 3 Site investigation

The site investigation was undertaken between the 2nd March and 20th March 2015. Details of the fieldwork methods used are given in the Notes section at the end of this report. The scope of the completed investigation is given below:

- 10 No. Dynamic sampling boreholes undertaken using a rotary rig designated PBH2 to PBH11 to a maximum depth of 11m bgl.
- 12 No. Hand excavated inspection pits designated TT1 to TT8B to a maximum depth of 1.10m bgl.
- 1 No. Machine excavated trial pit designated TT4A to a depth of 2.80m bgl
- 1 No. hand held windowless sample designated WS1 to a depth of 1.30m bgl
- Collection of disturbed and undisturbed soil samples
- Geotechnical and chemical laboratory testing of soil samples
- Return visits to undertake gas and groundwater monitoring and groundwater sampling

Figure 2 shows the layout of the exploratory holes advanced during the site investigation. Exploratory hole logs including photographic plates and sections of exposed structures are presented in Appendix B.



## 4 Ground Conditions Encountered

### 4.1 Strata encountered

Table 1 provides a summary of the strata encountered and the depths at which they were encountered in the exploratory holes. Strata encountered can generally be described as:

- Top Soil
- Made Ground
- Alluvial Deposits (Fine and coarse grained)
- Nantmel Mudstone Formation

**Table 1 - Summary of Strata depths (m) for exploratory holes**

| Borehole | Top Soil  | Made Ground              | Fine Grained Alluvial Deposits | Coarse Grained Alluvial Deposits | Nantmel Mudstone |
|----------|-----------|--------------------------|--------------------------------|----------------------------------|------------------|
| PBH2     | -         | GL – 3.30                | 5.00 – 6.55                    | 3.30 – 5.00 & 6.55 – 11.0*       | -                |
| PBH3     | -         | GL – 2.00                | 2.80 – 4.20                    | 2.00 – 2.80 & 4.20 – 8.80*       | -                |
| PBH4     | GL – 0.50 | 0.50 – 5.30              | 7.00 – 9.00*                   | 5.30 – 7.00                      | -                |
| PBH5     | GL – 0.50 | 0.50 – 0.95              | 0.95 – 1.70                    | -                                | 1.70 – 2.00*     |
| PBH6     | -         | GL – 1.90                | 1.90 – 5.70                    | -                                | 5.70 – 6.00*     |
| PBH7     | -         | GL – 4.30                | 4.30 – 6.50                    | 6.50 – 7.50                      | 7.50 – 7.60*     |
| PBH8     | -         | GL – 3.00                | 3.00 – 4.00                    | 4.00 – 9.15                      | 9.15 – 9.25*     |
| PBH9     | -         | GL – 1.40                | 3.10 – 9.00*                   | 1.40 – 3.10                      | -                |
| PBH10    | -         | GL – 4.00                | 4.70 – 5.00 & 8.00 – 9.00*     | 4.00 – 4.70 & 5.00 – 8.00        | -                |
| PBH11    | -         | GL – 0.21                | -                              | -                                | 0.21 – 0.50      |
| TT1      | GL – 0.05 | 0.05 – 1.00*             | -                              | -                                | -                |
| TT2B     | -         | GL – 0.05 (0.73 – 0.80*) | 0.05 – 0.73                    | -                                | -                |
| TT2      | -         | GL – 0.50                | -                              | 0.50 – 1.10*                     | -                |
| TT3      | -         | GL – 1.00*               | -                              | -                                | -                |
| TT4A     | -         | GL – 0.56                | -                              | 0.56 – 2.80*                     | -                |
| TT4B     | GL – 0.12 | 0.12 – 0.55*             | -                              | -                                | -                |
| TT5      | GL – 0.70 | 0.70 – 1.15*             | -                              | -                                | -                |
| TT6A     | -         | -                        | GL – 0.60*                     | -                                | -                |
| TT6B     | GL – 0.10 | 0.10 – 1.10*             | -                              | -                                | -                |
| TT7      | GL – 0.05 | 0.05 – 1.05*             | -                              | -                                | -                |
| TT8A     | -         | GL – 0.40*               | -                              | -                                | -                |
| TT8B     | -         | GL – 0.40*               | -                              | -                                | -                |

Details of each stratum are discussed in the subsequent sections below.

#### 4.1.1 Top Soil

Top soil was encountered in seven of the twenty two positions to depths as indicated in Table 1.

The top soil encountered consisted of brown silty gravelly clays, sandy gravelly silts and silty gravelly sands. All areas where top soil was encountered were overlain with turf or a degree of minor vegetation with associated roots and rootlets. The topsoil was encountered to a maximum depth of 0.70m in trial trench TT5 within the boundary of the scout hall.



## 4.1.2 Made Ground

Made Ground was encountered in the majority of the exploratory holes to depths as indicated in Table 1. It was highly variable across the entirety of the site extent which is to be expected given the overall size of the working area. The Made Ground consisted of sandy gravelly clays, brick, sandstone, tile and mudstone cobbles, gravels and boulders some of which contained elements of general waste such as plastic wrapping and woody fragments. The Made Ground was encountered to a maximum depth of 5.30m bgl in PBH4. Where the trial trenches were excavated within the active tidal zone of the estuary, made ground was encountered under alluvial deposits. Olfactory contamination was encountered in PBH7 at a depth of 2.45 to 2.65m bgl. The silty sandy gravel encountered at this depth was black further suggesting localised contamination.

The consistency of the fine grained Made Ground was assessed as soft to firm. The density of the coarse grained Made Ground, as determined by the SPT data, have been assessed as loose to medium dense.

## 4.1.3 Fine Grained Alluvial Deposits

Fine grained Alluvial Deposits were encountered in eleven of the twenty two exploratory holes, to depths as indicated in Table 1. The fine grained deposits consisted of grey sandy gravelly silts and clays with woody fragments. Where woody material was present the smell of sulphur was detected typical of organic material breaking down within an anoxic environment.

The consistency of the fine grained Alluvial Deposits ranged from soft to firm. The strength of the fine grained deposits, as determined by the triaxial data have been assessed as extremely low to very low strength.

## 4.1.4 Coarse Grained Alluvial Deposits

Coarse grained Alluvial Deposits were encountered in nine of the twenty two exploratory positions to depths as indicated in Table 1. The coarse grained deposits encountered consisted of silty gravelly fine sands and grey silty sandy mudstone gravels, black and grey silty coarse sand with woody fragments and grey white sandstone, mudstone and quartzite gravels and cobbles.

The density of the coarse grained coarse grained deposits, as determined from the SPT data have been assessed as very loose to dense.



## 4.1.5 Nantmel/Netpool Mudstone Formation

The Nantmel Mudstone Formation was encountered in five of the twenty two exploratory holes to depths as indicated in Table 1. The Nantmel Mudstone Formation is a grey weak very fine grained laminated mudstone that was recovered as a fine to coarse angular gravel. The mudstone was encountered as shallow as 0.21m bgl in PBH11 the Netpool site to 9.15m bgl in PBH8 the boatbuilding yard on Station Road Industrial Estate.

A one hundred blow standard penetration test was undertaken on all suspected bedrock prior to the hole being terminated following instructions from the engineer.

## 4.2 Groundwater

Groundwater strikes were recorded in eight of the ten boreholes within the Made Ground and Alluvial Deposits. Groundwater was also recorded in three of the twelve trial trenches including TT2B, TT3 and TT4A, again in both the Made Ground and Alluvial Deposits. Many of the groundwater levels fell following any standing time which is likely due to tidal influences on the groundwater table. The groundwater data is summarised in Table 2 below.

**Table 2 - Summarised Water Strike Data**

| Investigation point | Water strike (m bgl) | Residual water level (m bgl) after 20 minutes | Stratum           |
|---------------------|----------------------|-----------------------------------------------|-------------------|
| PBH2                | 2.00                 | 2.20                                          | Made Ground       |
| PBH3                | 2.50                 | 2.40                                          | Alluvial Deposits |
| PBH4                | 2.40                 | 2.30                                          | Alluvial Deposits |
| PBH6                | 3.00                 | 3.15                                          | Made Ground       |
| PBH7                | 2.60                 | 2.50                                          | Made Ground       |
| PBH8                | 3.00                 | 3.20                                          | Alluvial Deposits |
| PBH9                | 4.00                 | 4.00                                          | Alluvial Deposits |
| PBH10               | 2.40                 | 2.70                                          | No Recovery       |
| TT2B                | 0.58                 | -                                             | Alluvial Deposits |
| TT3                 | 0.60                 | -                                             | Made Ground       |
| TT4B                | 1.25 & 2.00          | -                                             | Alluvial Deposits |

### 4.3 In Situ Testing

#### 4.3.1 Standard Penetration Testing

Standard Penetration Tests (SPT) were undertaken within the rotary percussive/dynamically sampled boreholes, the results are presented on the borehole logs in Appendix B.

#### 4.3.2 Monitoring of Land Gases and Groundwater Levels

One return visit to site has been completed to monitor land gas concentrations and groundwater levels on the 13<sup>th</sup> April 2015. The table below summarises the land gas concentrations recorded in the standpipes. A full record of the monitoring visit is included in Appendix F. Level logger groundwater monitoring data is presented in Appendix G.

**Table 3 - Summary of Land Gas Monitoring Results (Steady State Readings)**

| Location | Flow (l/hr) | Atmospheric Pressure (mbar) | CH <sub>4</sub> (%v/v) | CO <sub>2</sub> (%v/v) |
|----------|-------------|-----------------------------|------------------------|------------------------|
| PBH02    | 0.2         | 1031                        | <0.1                   | 0.1                    |
| PBH03    | 0.2         | 1029                        | <0.1                   | 0.1                    |
| PBH06    | 0.4         | 1031                        | <0.1                   | <0.1                   |
| PBH07    | 0.6         | 1028                        | <0.1                   | 0.1                    |
| PBH08    | 0.1         | 1029                        | <0.1                   | 0.1                    |
| PBH10    | 0.2         | 1029                        | <0.1                   | 0.1                    |

**Table 4 - Summary of Groundwater Monitoring Results (13<sup>th</sup> April 2015)**

| Location | Groundwater Level (m) | Depth to Base of Hole (m) |
|----------|-----------------------|---------------------------|
| PBH02    | 2.11                  | 5.36                      |
| PBH03    | 2.33                  | 4.11                      |
| PBH06    | 2.37                  | 4.06                      |
| PBH07    | 2.74                  | 4.14                      |
| PBH08    | 2.62                  | 3.95                      |
| PBH10    | 2.52                  | 3.72                      |

#### 4.3.3 Variable Head Permeability Test

Five variable head permeability tests were carried out on site in the boreholes. The table below summarises the permeability of the ground beneath the site. The calculation sheets for the variable head permeability tests can be found in Appendix E.

**Table 5 - Summary of Variable Head Permeability Tests**

| Location | Groundwater Level (m) | Depth to Base of Test Section (m) | Depth to Top of Test Section (m) | Permeability (m/s)   |
|----------|-----------------------|-----------------------------------|----------------------------------|----------------------|
| PBH2     | 3.60                  | 10.9                              | 6.9                              | $8.8 \times 10^{-6}$ |
| PBH3     | 3.19                  | 5.9                               | 5.35                             | $3.0 \times 10^{-5}$ |
| PBH3B    | 3.10                  | 8.4                               | 8.0                              | $3.6 \times 10^{-5}$ |
| PBH6     | 3.00                  | 6.00                              | 5.50                             | $3.2 \times 10^{-5}$ |
| PBH10    | 2.80                  | 4.20                              | 4.00                             | $4.6 \times 10^{-5}$ |

## 5 Laboratory Testing

### 5.1 Geotechnical Testing

A programme of laboratory testing was carried out on samples taken from the various strata encountered during the site investigation. Geotechnical testing was scheduled by WYG and undertaken by GSTL Ltd, an approved supplier in accordance with the requirements of WYG quality system and are UKAS accredited for a range of geotechnical tests. The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given in Table 6. Laboratory geotechnical test results are given in Appendix C.

**Table 6 - Summary of Geotechnical Tests**

| Test                                                                                         | Standard (BS1377:1990) | No |
|----------------------------------------------------------------------------------------------|------------------------|----|
| 4 Point Liquid Plastic Limit                                                                 | Part 2, Clause 3 & 5.3 | 17 |
| Moisture Content                                                                             | Part 2, Clause 3.2     | 17 |
| PSD Wet Sieve Method                                                                         | Part 2, Clause 9.2     | 30 |
| PSD: Sedimentation by Pipette                                                                | Part 2, Clause 9.5     | 15 |
| pH                                                                                           | Part 3, Clause 9.0     | 27 |
| Sulphate Content of Water Extract                                                            | Part 3, Clause 5.0     | 27 |
| Sulphate Content of Acid Extract                                                             | Part 3, Clause 5.0     | 27 |
| One-dimensional Consolidation<br>75mm or 50mm diameter<br>specimens (5 days)                 | Part 5, Clause 3       | 3  |
| Quick Undrained Triaxial<br>Compression Test – Multi Stage<br>Loading of single 100mm sample | Part 7, Clause 9       | 2  |

### 5.2 Environmental Testing

The environmental chemistry of the ground was investigated by specialist chemical analysis of selected soil and groundwater samples carried out by Jones Environmental Forensics Ltd, which is an approved supplier in accordance with the requirements of WYG quality system and is UKAS accredited for a range of chemical analyses. The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given in Table below. The test result certificates are included in Appendix D.



**Table 7 - Summary of Soil Testing**

| Test                    | No. of tests |
|-------------------------|--------------|
| Metals                  | 16           |
| PAHs                    | 16           |
| EPHs                    | 16           |
| pH                      | 16           |
| Asbestos Screen         | 16           |
| Asbestos Quantification | 16           |
| BTEX                    | 16           |



## 6 References

- 1) BS5930:1999, British Standard Code of Practice for Site Investigations, BSI.
- 2) BS1377:1990, British Standard Methods of Test for Soils for Civil Engineering Purposes, BSI.
- 3) BS 10175: 2001, British Standard Code of Practice for Investigation of Potentially Contaminated Sites.

## Notes

### 1. Standards

All boring operations, sampling of soils, *in situ* testing and geotechnical laboratory testing have been carried out in accordance with the recommendations of the British Standards BS 5930+A2 (2010)<sup>(1)</sup>, BS 1377 (1990)<sup>(2)</sup> and BS10175 (2001)<sup>(3)</sup>.

Soil and rock descriptions follow the recommendations of BS 5930+A2. Where descriptions or classifications are based on other documents (e.g. BS 8004 (1986) or CIRIA Project Report 11 (1993)), this is stated in the report text.

### 2. Site methods

Unless specifically stated otherwise, the following methods are used for exploratory holes.

- Holes described as cable percussive are bored using a light cable percussive rig. Standard penetration tests are carried out where appropriate, as shown in the logs. Disturbed and undisturbed samples are taken from the exploratory holes at the depths on the records.
- Window sampling generally uses the windowless sampling method, using a tracked Geotool.
- Dynamic probes are usually heavy dynamic probes, using the same tracked Geotool used for window sampling.
- 

### 3. Definitions and abbreviations

The following terms are used in the exploratory hole logs

#### Samples

|     |                                                                         |
|-----|-------------------------------------------------------------------------|
| U   | Undisturbed 102mm dia. sample                                           |
| TW  | Thin Walled undisturbed 102mm dia. sample                               |
| B   | Bulk sample                                                             |
| D   | Small disturbed sample                                                  |
| W   | Water sample                                                            |
| CBR | California Bearing Ratio test or CBR value obtained from Mexiprobe test |

#### In situ tests

|     |                                                                  |
|-----|------------------------------------------------------------------|
| S   | Standard penetration test (SPT)                                  |
| N   | SPT N value (blows/300mm)                                        |
| HP  | Hand penetrometer – shear strength                               |
| SV  | Hand shear vane – shear strength                                 |
| VOC | Volatile organic compounds (ppm)                                 |
| PID | Photo-ionisation detector – used to detect the presence of VOCs. |

#### Core recovery and rock quality

|     |                              |
|-----|------------------------------|
| TCR | Total core recovery (%)      |
| SCR | Solid core recovery (%)      |
| RQD | Rock quality designation (%) |
| FI  | Fracture index               |
| NR  | No recovery                  |
| NI  | Not intact                   |

#### Rotary drilling sizes

| Index letter | Nominal diameter (mm) |      |
|--------------|-----------------------|------|
|              | Borehole              | Core |
| N            | 75                    | 54   |
| H            | 99                    | 76   |
| P            | 120                   | 92   |
| S            | 146                   | 113  |

#### Water strikes

|   |                                                                         |
|---|-------------------------------------------------------------------------|
| ▽ | Level of water strike                                                   |
| ▼ | Water level rose to this level (see Remarks at foot of log for details) |

Depth means depth below existing ground level unless otherwise specified. Values specified in soil descriptions given in the exploratory hole logs are depths unless otherwise specified.



## Figures

### Figure 1 – Site Location Plan



## Figure 2 – Site Investigation Layout Plan



## Appendices



## Appendix A – Report Conditions



## **APPENDIX A - REPORT CONDITIONS GROUND INVESTIGATION**

This report is produced solely for the benefit of Natural Resources Wales and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.



## Appendix B – Exploratory Hole Logs and Pit Sketches

# WYG ENVIRONMENT

## Ground Engineering Services

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 2082 9200, Fax: 02920 2045 5321.

Exploratory Hole Number

**PBH2**



**Preliminary**

**Project** : Cardigan FAS, Cardigan  
**Project Number:** A088137  
**Client** : Natural Resources Wales  
**Method** : Rotary Rig  
**Co-ordinates** : 217939.63E - 245960.61N  
**Level** : 2.87 mAOD

**Scale** 1:60 **Sheet** 1 of 1

**Logged By** : NEB  
**Checked By** : PV  
**Start Date** : 11/03/15  
**Finish Date** : 11/03/15

| Strata Description                                                                                                                                                                                                                                                                                                            | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |             | Notes / Remarks    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|-------------|-------------|--------------------|
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | Depth       | Type        |                    |
| Brown silty sandy gravelly CLAY. Gravel of fine to coarse angular mudstone with plastic packaging. (MADE GROUND)                                                                                                                                                                                                              |                       | 2.37                | 0.50      |            |                  |                       | 0.40        | ES1         |                    |
| Orange angular brick COBBLES (MADE GROUND)                                                                                                                                                                                                                                                                                    |                       | 2.17                | 0.70      |            |                  |                       |             |             |                    |
| Loose grey sandy angular fine to coarse mudstone GRAVEL (MADE GROUND)                                                                                                                                                                                                                                                         |                       |                     |           |            |                  |                       | 1.00        | S           | N=8 (1,3,1,1,4,2)  |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 1.00-1.45   | D1          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 1.20-1.55   | B1          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | 1.32                | 1.55      |            |                  |                       | 1.55-2.00   | B2          |                    |
| Loose light brown clayey silty sandy angular fine to coarse mudstone and sandstone GRAVEL (MADE GROUND)                                                                                                                                                                                                                       |                       |                     |           |            |                  |                       | 1.80        | ES2         |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 2.00        | S           | N=5 (1,1,2,1,1,1)  |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 2.00-2.45   | D2          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 2.00-2.90   | B3          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 3.00        | S           | N=17 (2,4,6,6,3,2) |
| . . . 3.00m medium dense.                                                                                                                                                                                                                                                                                                     |                       |                     |           |            |                  |                       | 3.00-3.45   | D3          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | -0.43               | 3.30      |            |                  |                       | 3.30-4.00   | B4          |                    |
| Medium dense grey clayey silty gravelly SAND with woody fragments (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                                         |                       |                     |           |            |                  |                       | 4.00        | S           | N=12 (1,1,3,3,3,3) |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 4.00-4.45   | D4          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 4.00-5.00   | B5          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | -2.13               | 5.00      |            |                  |                       | 5.00        | S           | N=1 (1,0,0,0,1,0)  |
| Soft grey clayey sandy slightly gravelly SILT. (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                                                            |                       |                     |           |            |                  |                       | 5.00-5.45   | D5          |                    |
| . . . 5.00-6.00m very loose.                                                                                                                                                                                                                                                                                                  |                       |                     |           |            |                  |                       | 5.00-6.00   | B6          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 6.00        | S           | N=8 (2,3,2,1,2,3)  |
| . . . 6.00m loose.                                                                                                                                                                                                                                                                                                            |                       |                     |           |            |                  |                       | 6.00-6.45   | D6          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 6.00-6.50   | B7          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | -3.68               | 6.55      |            |                  |                       | 6.50-7.00   | B8          |                    |
| Grey silty sandy fine to medium rounded to subangular mudstone, sandstone and quartzite GRAVEL (ALLUVIAL DEPOSITS)                                                                                                                                                                                                            |                       |                     |           |            |                  |                       | 7.00        | S           | N=10 (1,1,2,2,3,3) |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 7.00-7.45   | D7          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | -4.23               | 7.10      |            |                  |                       | 7.10-8.00   | B9          |                    |
| Medium dense grey clayey silty gravelly fine to coarse SAND with woody fragments. Gravel of fine to medium angular to subrounded mudstone, sandstone and quartz. (ALLUVIAL DEPOSITS)                                                                                                                                          |                       |                     |           |            |                  |                       | 8.00        | S           | N=9 (1,2,2,2,2,3)  |
| . . . 8.00 to 9.00m loose.                                                                                                                                                                                                                                                                                                    |                       |                     |           |            |                  |                       | 8.00-9.00   | B10         |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 8.00-8.45   | D8          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 9.00        | S           | N=10 (1,2,3,2,3,2) |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 9.00-10.00  | B11         |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 9.00-9.45   | D9          |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 10.00       | S           | N=15 (1,2,3,3,5,4) |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 10.00-10.45 | D10         |                    |
|                                                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       | 10.00-10.50 | B12         |                    |
|                                                                                                                                                                                                                                                                                                                               |                       | -7.73               | 10.60     |            |                  |                       | 10.60-11.00 | B13         |                    |
| Grey sandy rounded to subrounded sandstone, mudstone and quartzite GRAVEL & COBBLES (ALLUVIAL DEPOSITS )                                                                                                                                                                                                                      |                       | -8.13               | 11.00     | 11.00      |                  |                       |             |             |                    |
| End of Window Sample at 11.00 m                                                                                                                                                                                                                                                                                               |                       |                     |           |            |                  |                       |             |             |                    |
| <b>Observations / Remarks</b><br><br>1. Hand dug pit to 1.2m bgl.<br>2. Groundwater encountered at 2.0m at 09:39am.<br>3. Install 50mm plain peizometer to 3.5m bgl with bentonite surround, 50mm slotted peizometer with gravel surround from 3.5m bgl to 5.0m bgl and backfilled with bentonite from 5.0m bgl to 11.0m bgl. | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to   | Time (mins) | Remarks            |
|                                                                                                                                                                                                                                                                                                                               | 1.00m                 | 2.00m               | 92mm      | 70%        |                  | 2.00m                 | 2.20m       | 20          | Tidal              |
|                                                                                                                                                                                                                                                                                                                               | 2.00m                 | 3.00m               | 92mm      | 90%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 3.00m                 | 4.00m               | 92mm      | 90%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 4.00m                 | 5.00m               | 92mm      | 100%       |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 5.00m                 | 6.00m               | 92mm      | 60%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 6.00m                 | 7.00m               | 92mm      | 80%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 7.00m                 | 8.00m               | 92mm      | 55%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 8.00m                 | 9.00m               | 92mm      | 45%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 9.00m                 | 10.00m              | 92mm      | 75%        |                  |                       |             |             |                    |
|                                                                                                                                                                                                                                                                                                                               | 10.00m                | 11.00m              | 92mm      | 66%        |                  |                       |             |             |                    |



**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Rotary Rig**  
**Co-ordinates : 218023.8E - 245961.22N**  
**Level : 3.38 mAOD**

**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 10/03/15**  
**Finish Date : 10/03/15**

| Strata Description                                                                                                                                                                                                                                                                        | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |             | Notes / Remarks       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|-------------|-------------|-----------------------|
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | Depth       | Type        |                       |
| Light brown silty sandy gravelly CLAY. Gravel of fine to coarse angular mudstone (MADE GROUND)                                                                                                                                                                                            |                       | 2.93                | 0.45      |            |                  |                       | 0.40        | ES1         | N=11 (1,0,0,4,4,3)    |
| Medium dense grey sandy angular slate COBBLES & BOULDERS (MADE GROUND)                                                                                                                                                                                                                    |                       |                     |           |            |                  |                       | 1.00        | S           |                       |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 1.20-2.00   | B1          |                       |
| Grey black clayey silty SAND / fine to medium angular mudstone GRAVEL. (ALLUVIAL DEPOSITS)<br>. . . mudstone cobble at 2.4m bgl                                                                                                                                                           |                       | 1.38                | 2.00      |            |                  |                       | 2.00        | S           | N=6 (1,2,1,1,2,2)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 2.00-3.00   | B2          |                       |
| Soft grey sandy gravelly SILT. (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                                        |                       | 0.58                | 2.80      |            |                  |                       | 3.00        | S           | N=6 (1,2,3,1,1,1)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 3.00-4.00   | B3          |                       |
| Very loose grey clayey silty gravelly fine SAND (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                       |                       | -0.82               | 4.20      |            |                  |                       | 4.00        | S           | N=8 (2,3,1,2,2,3)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 4.30-5.00   | B4          |                       |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 5.00        | S           | N=4 (1,1,1,1,1,1)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 5.00-6.00   | B5          |                       |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 6.00        | S           | N=1 (1,0,0,1,0,0)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 6.00-7.00   | B6          |                       |
| . . . 7.00m loose.                                                                                                                                                                                                                                                                        |                       |                     |           |            |                  |                       | 7.00        | S           | N=9 (6,4,3,3,2,1)     |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       |             |             |                       |
| Dense grey white rounded to subrounded fine to coarse sandstone, mudstone and quartzite GRAVEL (ALLUVIAL DEPOSITS)                                                                                                                                                                        |                       | -4.62               | 8.00      |            |                  |                       | 8.00        | S           | N=46 (12,9,9,12,18,7) |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       | 8.40-8.80   | B7          |                       |
| End of Window Sample at 8.80 m                                                                                                                                                                                                                                                            |                       | -5.42               | 8.80      |            |                  |                       |             |             |                       |
| Observations / Remarks                                                                                                                                                                                                                                                                    | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |             |             |                       |
|                                                                                                                                                                                                                                                                                           | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to   | Time (mins) | Remarks               |
| 1. Hand pit to 1.2m bgl.<br>2. Groundwater encountered at 2.5m bgl at 10:00am.<br>3. Installed 50mm plain peizometer to 2.0m bgl with bentonite surround, 50mm slotted peizometer from 2.0m bgl to 4.0m bgl with gravel surround and backfilled with bentonite from 4.0m bgl to 8.8m bgl. | 1.00m                 | 2.00m               | 92mm      | 50%        |                  | 2.50m                 | 2.40m       | 20          | Tidal                 |
|                                                                                                                                                                                                                                                                                           | 2.00m                 | 3.00m               | 92mm      | 70%        |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 3.00m                 | 4.00m               | 92mm      | 40%        |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 4.00m                 | 5.00m               | 92mm      | 85%        |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 5.00m                 | 6.00m               | 92mm      | 100%       |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 6.00m                 | 7.00m               | 92mm      | 90%        |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 7.00m                 | 8.00m               | 92mm      | 0%         |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           | 8.00m                 | 9.00m               | 92mm      | 0%         |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       |             |             |                       |
|                                                                                                                                                                                                                                                                                           |                       |                     |           |            |                  |                       |             |             |                       |

# WYG ENVIRONMENT

## Ground Engineering Services

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.

Tel: 02920 2082 9200, Fax: 02920 2045 5321.

Exploratory Hole Number

**PBH4**



**Preliminary**

**Project** : Cardigan FAS, Cardigan  
**Project Number:** A088137  
**Client** : Natural Resources Wales  
**Method** : Rotary Rig  
**Co-ordinates** : 218056.21E - 245966.70N  
**Level** : 3.85 mAOD

**Scale** 1:60 **Sheet** 1 of 1

**Logged By** : NEB  
**Checked By** : PV  
**Start Date** : 06/03/15  
**Finish Date** : 06/03/15

| Strata Description                                                                                                                                   | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |             | Notes / Remarks    |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|-------------|-------------|--------------------|
|                                                                                                                                                      |                       |                     |           |            |                  |                       | Depth       | Type        |                    |
| Brown gravelly silty CLAY with many roots and rootlets. (TOPSOIL)                                                                                    |                       | 3.35                | 0.50      |            |                  |                       | 0.50-1.00   | ES1         |                    |
| Loose brown clayey silty sandy angular GRAVEL & COBBLES of mudstone, brick and tile. (MADE GROUND)                                                   |                       |                     |           |            |                  |                       | 1.00-1.45   | S D1        | N=4 (1,1,1,1,1,1)  |
|                                                                                                                                                      |                       | 2.15                | 1.70      |            |                  |                       | 1.70-2.00   | B1          |                    |
| Loose brown grey silty sandy fine to medium angular mudstone GRAVEL. (MADE GROUND)                                                                   |                       |                     |           |            |                  |                       | 2.00-2.80   | S B2        | N=5 (1,0,0,1,2,2)  |
|                                                                                                                                                      |                       | 1.05                | 2.80      |            |                  |                       | 2.00-2.45   | D2          |                    |
| Medium dense brown silty fine to coarse mudstone GRAVELS & COBBLES (MADE GROUND)                                                                     |                       |                     |           |            |                  |                       | 3.00-4.00   | S B3        | N=19 (1,1,2,4,6,7) |
|                                                                                                                                                      |                       | 0.40                | 3.45      |            |                  |                       | 3.00-3.45   | D3          |                    |
| Medium dense grey silty angular mudstone GRAVEL & COBBLES (PROBABLE MADE GROUND)                                                                     |                       |                     |           |            |                  |                       | 4.00-5.00   | S B4        | N=16 (2,2,4,4,3,5) |
|                                                                                                                                                      |                       |                     |           |            |                  |                       | 4.00-4.45   | D4          |                    |
| . . . sandstone cobble and coal fragments suggest made ground                                                                                        |                       |                     |           |            |                  |                       | 5.00-5.45   | S D5        | N=12 (1,2,3,3,3,3) |
|                                                                                                                                                      |                       | -1.45               | 5.30      |            |                  |                       | 5.30-6.00   | B5          |                    |
| Medium dense grey silty gravelly SAND with wood fragments. (ALLUVIAL DEPOSITS)                                                                       |                       |                     |           |            |                  |                       | 6.00-7.00   | S B6        | N=11 (1,2,2,3,3,3) |
| . . . smell of sulphur associated with rotting organic matter                                                                                        |                       |                     |           |            |                  |                       | 6.00-6.45   | D6          |                    |
|                                                                                                                                                      |                       | -3.15               | 7.00      |            |                  |                       | 7.00-8.00   | S B7        | N=0 (0,0,0,0,0,0)  |
| Very soft dark grey sandy SILT with large wooden fragments (ALLUVIAL DEPOSITS)                                                                       |                       |                     |           |            |                  |                       | 7.00-7.45   | D7          |                    |
|                                                                                                                                                      |                       |                     |           |            |                  |                       | 8.00-9.00   | S B8        | N=0 (0,0,0,0,0,0)  |
|                                                                                                                                                      |                       |                     |           |            |                  |                       | 8.00-8.45   | D8          |                    |
|                                                                                                                                                      |                       | -5.15               | 9.00      | 9.00       |                  |                       |             |             |                    |
| End of Window Sample at 9.00 m                                                                                                                       |                       |                     |           | 114mm      |                  |                       |             |             |                    |
| <b>Observations / Remarks</b><br><br>1. Hand pit to 1.2m bgl.<br>2. Groundwater encountered at 2.4m bgl at 10:30am.<br>3. Backfilled with bentonite. | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |             |             |                    |
|                                                                                                                                                      | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to   | Time (mins) | Remarks            |
|                                                                                                                                                      | 1.00m                 | 2.00m               | 92mm      | 60%        |                  |                       |             |             |                    |
|                                                                                                                                                      | 2.00m                 | 3.00m               | 92mm      | 70%        |                  |                       |             |             |                    |
|                                                                                                                                                      | 3.00m                 | 4.00m               | 92mm      | 85%        |                  | 2.40m                 | 2.30m       | 20          | Tidal              |
|                                                                                                                                                      | 4.00m                 | 5.00m               | 92mm      | 100%       |                  |                       |             |             |                    |
|                                                                                                                                                      | 5.00m                 | 6.00m               | 92mm      | 100%       |                  |                       |             |             |                    |
|                                                                                                                                                      | 6.00m                 | 7.00m               | 92mm      | 100%       |                  |                       |             |             |                    |
|                                                                                                                                                      | 7.00m                 | 8.00m               | 92mm      | 100%       |                  |                       |             |             |                    |
|                                                                                                                                                      | 8.00m                 | 9.00m               | 92mm      | 100%       |                  |                       |             |             |                    |

# WYG ENVIRONMENT

## Ground Engineering Services

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 2082 9200, Fax: 02920 2045 5321.

Exploratory Hole Number

**PBH5**



**Preliminary**

**Project** : Cardigan FAS, Cardigan  
**Project Number:** A088137  
**Client** : Natural Resources Wales  
**Method** : Rotary Rig  
**Co-ordinates** : 218123.35E - 245985.29N  
**Level** : 3.74 mAOD

**Scale** 1:60 **Sheet** 1 of 1

**Logged By** : NEB  
**Checked By** : PV  
**Start Date** : 09/03/15  
**Finish Date** : 09/03/15

| Strata Description                                                                                                                       | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test                            |                      | Notes / Remarks    |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|----------------------------------------|----------------------|--------------------|
|                                                                                                                                          |                       |                     |           |            |                  |                       | Depth                                  | Type                 |                    |
| Brown clayey slightly sandy slightly gravelly SILT with roots and rootlets. Gravel of fine angular mudstone. (TOPSOIL)                   |                       | 3.24                | 0.50      |            |                  |                       | 0.50                                   | ES1                  |                    |
| Light brown clayey silty sandy subrounded to angular fine to coarse mudstone and sandstone GRAVEL with occasional cobbles. (MADE GROUND) |                       | 2.79                | 0.95      |            |                  |                       | 1.00<br>1.00-1.45<br>1.00<br>1.20-1.70 | S<br>D1<br>ES2<br>B1 | N=25 (1,2,4,6,8,7) |
| Firm light brown slightly sandy slightly gravelly CLAY. Gravel of fine to coarse angular mudstone. (ALLUVIAL DEPOSITS)                   |                       | 2.04                | 1.70      |            |                  |                       | 1.80-2.00                              | B2                   |                    |
| Grey weak very fine grained laminated MUDSTONE recovered as fine to coarse angular GRAVEL. (NANTMEL MUDSTONE FORMATION)                  |                       | 1.74                | 2.00      |            |                  |                       | 2.00<br>2.00-2.17                      | S<br>D2              | 50/35mm (25,50,50) |
| End of Window Sample at 2.00 m                                                                                                           |                       |                     |           |            |                  |                       |                                        |                      |                    |
| Observations / Remarks<br><br>1. Hand dug pit to 1.2m.<br>2. Groundwater not encountered.<br>3. Hole backfilled with bentonite.          | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |                                        |                      |                    |
|                                                                                                                                          | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to                              | Time (mins)          | Remarks            |
|                                                                                                                                          | 1.00m                 | 2.00m               | 92mm      | 90%        |                  |                       |                                        |                      |                    |

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 2082 9200, Fax: 02920 2045 5321.

# PBH6

## Preliminary



**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Rotary Rig**  
**Co-ordinates : 218167.39E - 245839.58N**  
**Level : 4.27 mAOD**

**Scale 1:60      Sheet 1 of 1**

**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 03/03/15**  
**Finish Date : 03/03/15**

| Strata Description                                                                                                                                                                       | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill          | Sample Test                    |                    | Notes / Remarks       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|--------------------------------|--------------------------------|--------------------|-----------------------|
|                                                                                                                                                                                          |                       |                     |           |            |                  |                                | Depth                          | Type               |                       |
| ASPHALT (MADE GROUND)                                                                                                                                                                    |                       | 4.12                | 0.15      |            |                  |                                |                                |                    |                       |
| Brown clayey silty sandy angular fine to coarse sandstone GRAVEL (MADE GROUND)                                                                                                           |                       | 3.57                | 0.70      |            |                  |                                | 0.50                           | ES1                |                       |
| Firm grey mottled brown sandy gravelly CLAY. Gravel of fine to coarse angular siltstone and mudstone. (MADE GROUND)<br>. . . mudstone cobble from 1.2 to 1.4m bgl                        |                       |                     |           |            |                  |                                | 1.00<br>1.00-1.45              | S D1               | N=19 (8,9,5,5,5,4)    |
| . . . mudstone cobble at 1.8m bgl                                                                                                                                                        |                       | 2.37                | 1.90      |            |                  |                                | 1.40-1.80                      | B1                 |                       |
| Soft grey brown slightly sandy slightly gravelly SILT. Gravel of fine angular mudstone with woody fragments and other organics (ALLUVIAL DEPOSITS)                                       |                       | 1.67                | 2.60      |            |                  |                                | 2.00<br>2.00-2.60<br>2.00-2.45 | S B2<br>D2         | N=5 (1,0,2,1,1,1)     |
| Soft to firm dark grey silty slightly sandy slightly gravelly CLAY. Gravel of fine to coarse mudstone with woody fragments. (ALLUVIAL DEPOSITS)<br><br>. . . becoming firm from 3.5m bgl |                       |                     |           |            |                  | 3.00<br>3.15                   | 3.00<br>3.00-4.00<br>3.00-3.45 | S B3<br>D3         | N=8 (1,1,2,2,2,2)     |
|                                                                                                                                                                                          |                       |                     |           |            |                  | 4.00<br>4.00-4.65<br>4.00-4.45 | S U1<br>D4                     | N=11 (1,1,3,3,3,2) |                       |
|                                                                                                                                                                                          |                       |                     |           |            |                  | 5.00<br>5.00-5.50<br>5.00-5.45 | S B4<br>D5                     | N=12 (1,2,3,3,3,3) |                       |
|                                                                                                                                                                                          |                       | -1.43               | 5.70      |            |                  |                                |                                |                    |                       |
| Grey weak very fine grained MUDSTONE recovered as fine to coarse angular GRAVEL (NANTMEL MUDSTONE FORMATION)                                                                             |                       | -1.73               | 6.00      | 6.00       | 114mm            |                                | 6.00                           | S D6               | 100/85mm (25,0,73,27) |
| End of Window Sample at 6.00 m                                                                                                                                                           |                       |                     |           |            |                  |                                | 6.00-6.45                      |                    |                       |
| Observations / Remarks                                                                                                                                                                   | Dynamic Sampling Runs |                     |           |            |                  | Groundwater                    |                                |                    |                       |
|                                                                                                                                                                                          | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                         | Rising to                      | Time (mins)        | Remarks               |
|                                                                                                                                                                                          | 1.00m                 | 2.00m               | 92mm      | 100%       |                  | 3.00m                          | 3.15m                          | 20                 | Tidal                 |
|                                                                                                                                                                                          | 2.00m                 | 3.00m               | 92mm      | 70%        |                  |                                |                                |                    |                       |
|                                                                                                                                                                                          | 3.00m                 | 4.00m               | 92mm      | 100%       |                  |                                |                                |                    |                       |
|                                                                                                                                                                                          | 5.00m                 | 6.00m               | 92mm      | 80%        |                  |                                |                                |                    |                       |

# WYG ENVIRONMENT

## Ground Engineering Services

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 2082 9200, Fax: 02920 2045 5321.

Exploratory Hole Number

**PBH7**



**Preliminary**

**Project** : Cardigan FAS, Cardigan  
**Project Number:** A088137  
**Client** : Natural Resources Wales  
**Method** : Rotary Rig  
**Co-ordinates** : 218082.89E - 245868.48N  
**Level** : 3.75 mAOD

**Scale** 1:60 **Sheet** 1 of 1

**Logged By** : NEB  
**Checked By** : PV  
**Start Date** : 02/03/15  
**Finish Date** : 02/03/15

| Strata Description                                                                                                                                                   | Legend | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |        | Notes / Remarks        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------|-----------|------------|------------------|-----------------------|-------------|--------|------------------------|
|                                                                                                                                                                      |        |                     |           |            |                  |                       | Depth       | Type   |                        |
| Dark brown silty sandy fine to coarse angular to subrounded slate, mudstone, brick and concrete GRAVEL with occasional cobbles (MADE GROUND)<br><br>... 1.00m dense. |        | 2.15                | 1.60      |            |                  |                       | 1.00        | C      | 50/45mm (20,5,50)      |
| Dark brown clayey silty sandy angular slag GRAVEL (MADE GROUND)                                                                                                      |        | 1.75                | 2.00      |            |                  |                       | 1.60        | B1 ES1 |                        |
| Black angular slag COBBLE (MADE GROUND)                                                                                                                              |        | 1.70                | 2.05      |            |                  |                       | 2.00        | D1     |                        |
| Brown sandy gravelly CLAY. Gravel of fine to medium angular mudstone. (MADE GROUND)                                                                                  |        | 1.30                | 2.45      |            |                  |                       | 2.05-2.45   | B3     |                        |
| Black silty angular fine to coarse mudstone GRAVEL. (MADE GROUND)<br>... hydrocarbon odour from 2.45 to 2.65m bgl                                                    |        | 1.10                | 2.65      |            |                  |                       | 2.45-2.65   | ES2    |                        |
| Brown sandy gravelly CLAY. Gravel of fine to medium angular mudstone. (MADE GROUND)                                                                                  |        | -0.25               | 4.00      |            |                  |                       | 2.65-3.00   | B4 ES3 |                        |
| Grey silty fine to coarse angular mudstone GRAVEL (MADE GROUND)                                                                                                      |        | -0.55               | 4.30      |            |                  |                       | 3.00-3.65   | S U1   | N=6 (1,1,2,1,1,2)      |
| Soft grey silty sandy gravelly CLAY. Gravel of fine angular mudstone. (ALLUVIAL DEPOSITS)                                                                            |        | -0.25               | 6.00      |            |                  |                       | 3.00-3.45   | D2     |                        |
| Orange brown fibrous organic PEAT (ALLUVIAL DEPOSITS)                                                                                                                |        | -2.25               | 6.00      | 6.00       |                  |                       | 3.45        | D3     |                        |
| Grey silty CLAY with woody fragments (ALLUVIAL DEPOSITS)                                                                                                             |        | -2.55               | 6.30      |            |                  |                       | 4.00        | S D4   | N=8 (1,2,2,2,2,2)      |
| Medium dense grey clayey sandy angular fine to coarse mudstone GRAVEL. (ALLUVIAL DEPOSITS)                                                                           |        | -2.75               | 6.50      |            |                  |                       | 4.50-5.00   | B6     |                        |
| Grey weak very fine grained laminated MUDSTONE recovered as fine to coarse angular GRAVEL. (NANTMEL MUDSTONE FORMATION)                                              |        | -3.75               | 7.50      |            |                  |                       | 5.00        | S      | N=9 (1,1,2,2,2,3)      |
| End of Window Sample at 7.60 m                                                                                                                                       |        | -3.85               | 7.60      |            |                  |                       | 5.00-5.65   | U2     |                        |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 5.00        | D5     |                        |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 6.00        | D6     | N=7 (1,1,2,2,2,1)      |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 6.00-6.30   | B7     |                        |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 6.50-7.00   | B8     |                        |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 7.00        | S      | N=11 (1,2,2,2,3,4)     |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 7.00-7.50   | D7 B9  |                        |
|                                                                                                                                                                      |        |                     |           |            |                  |                       | 7.60        | S D8   | 100/140mm (25,0,49,51) |

**Observations / Remarks**

- Hand dug pit to 1.2m bgl.
- Groundwater encountered at 2.6m bgl.
- Installed plain 50mm peizometer with bentonite surround to 3.0m bgl, slotted peizometer with gravel surround from 3.0m bgl to 4.0m bgl and bentonite backfill from 4.0m bgl to 7.5m bgl.
- U1 sample recovery 85%, U2 100%

| Dynamic Sampling Runs |       |          |          |         |        | Groundwater |             |         |  |
|-----------------------|-------|----------|----------|---------|--------|-------------|-------------|---------|--|
| From                  | To    | Diameter | Recovery | Remarks | Struck | Rising to   | Time (mins) | Remarks |  |
| 2.00m                 | 3.00m | 92mm     | 70%      |         |        |             |             |         |  |
| 4.00m                 | 5.00m | 92mm     | 65%      |         |        |             |             |         |  |
| 6.00m                 | 7.00m | 92mm     | 100%     |         | 2.60m  | 2.50m       | 20          | Tidal   |  |
| 7.00m                 | 7.60m | 92mm     | 100%     |         |        |             |             |         |  |



**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Rotary Rig**  
**Co-ordinates : 217976.90E - 245856.78N**  
**Level : 3.68 mAOD**

**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 19/03/15**  
**Finish Date : 20/03/15**

| Strata Description                                                                                                                                                                                                                                                                           | Legend                                             | Reduced Level (mOD)                                | Depth (m)                                    | Casing (m)                             | Water Strike (m) | Installation Backfill | Sample Test                    |                      | Notes / Remarks      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|----------------------------------------------|----------------------------------------|------------------|-----------------------|--------------------------------|----------------------|----------------------|
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | Depth                          | Type                 |                      |
| Brown sandy angular fine to coarse sandstone GRAVEL (MADE GROUND)                                                                                                                                                                                                                            |                                                    | 3.48                                               | 0.20                                         |                                        |                  |                       | 0.00-0.50<br>0.20-0.50         | B1<br>ES1            | N=7 (1,1,3,2,1,1)    |
| Grey clayey silty sandy subrounded to angular fine to coarse mudstone, sandstone and brick GRAVEL (MADE GROUND)<br>. . . 1.00m loose.                                                                                                                                                        |                                                    |                                                    |                                              |                                        |                  |                       | 0.50-1.20                      | ES2                  |                      |
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | 1.00<br>1.00-1.45<br>1.20-2.00 | S<br>D1<br>B2        |                      |
| Loose brown clayey silty sandy angular fine to coarse mudstone and brick GRAVEL (MADE GROUND)                                                                                                                                                                                                |                                                    | 1.58                                               | 2.10                                         |                                        |                  |                       | 2.00<br>2.00-2.45<br>2.10-3.00 | S<br>D2<br>B3<br>ES3 | N=4 (1,1,1,1,1,1)    |
| Soft black silty slightly sandy slightly gravelly CLAY.<br>Gravel of fine angular mudstone. (ALLUVIAL DEPOSITS)                                                                                                                                                                              |                                                    | 0.68                                               | 3.00                                         |                                        |                  | 3.00<br>3.20          | 3.00<br>3.00-3.45<br>3.00-3.80 | S<br>D3<br>B4        | N=1 (1,1,0,1,0,0)    |
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | 3.80-4.00                      | B5                   |                      |
| Medium dense grey clayey silty SAND / angular to subrounded mudstone and sandstone GRAVEL. (ALLUVIAL DEPOSITS)                                                                                                                                                                               |                                                    | -0.32                                              | 4.00                                         |                                        |                  |                       | 4.00<br>4.00-4.45<br>4.00-5.00 | S<br>D4<br>B6        | N=16 (2,3,3,4,4,5)   |
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | 5.00<br>5.00-5.45<br>5.00-5.70 | S<br>D5<br>B7        | N=12 (1,3,2,3,3,4)   |
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | 5.70-6.00                      | B8                   |                      |
| Brown slightly clayey slightly silty mudstone COBBLES (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                    |                                                    | -2.02                                              | 5.70                                         |                                        |                  |                       | 6.00<br>6.00-6.45<br>6.00-7.00 | S<br>D6<br>B9        | N=10 (1,1,2,2,3,3)   |
| Medium dense light brown clayey silty sandy fine to medium sandstone and mudstone GRAVEL with medium cobble content. (ALLUVIAL DEPOSITS)                                                                                                                                                     |                                                    | -2.32                                              | 6.00                                         |                                        |                  |                       | 7.00<br>7.00-8.00<br>7.00-7.45 | S<br>B10<br>D7       | N=11 (1,2,2,3,3,3)   |
|                                                                                                                                                                                                                                                                                              |                                                    |                                                    |                                              |                                        |                  |                       | 8.00<br>8.00-9.00<br>8.00-8.45 | S<br>B11<br>D8       | N=14 (1,2,2,3,4,5)   |
| Grey MUDSTONE recovered as medium to coarse gravel. (NANTMEL MUDSTONE FORMATION)                                                                                                                                                                                                             |                                                    | -5.47                                              | 9.15                                         | 9.00                                   |                  |                       | 9.00<br>9.00-9.15<br>9.15-9.25 | D9<br>B12            | 50/125mm (8,9,21,29) |
|                                                                                                                                                                                                                                                                                              |                                                    | -5.57                                              | 9.25                                         | 114mm                                  |                  |                       |                                |                      |                      |
| End of Window Sample at 9.45 m                                                                                                                                                                                                                                                               |                                                    |                                                    |                                              |                                        |                  |                       |                                |                      |                      |
| Observations / Remarks                                                                                                                                                                                                                                                                       | Dynamic Sampling Runs                              |                                                    |                                              |                                        |                  | Groundwater           |                                |                      |                      |
|                                                                                                                                                                                                                                                                                              | From                                               | To                                                 | Diameter                                     | Recovery                               | Remarks          | Struck                | Rising to                      | Time (mins)          | Remarks              |
| 1. Hand dug pit to 1.2m bgl.<br>2. Groundwater encountered at 3.00m at 15:20.<br>3. Installed 50mm plain piezometer with bentonite surround from GL to 3.00m bgl and 50mm slotted peizometer with gravel surround from 3.00m to 4.00m bgl. Backfilled with bentonite from 4.00 to 9.25m bgl. |                                                    |                                                    |                                              |                                        |                  |                       |                                |                      |                      |
|                                                                                                                                                                                                                                                                                              | 1.00m<br>2.00m<br>3.00m<br>4.00m<br>5.00m<br>6.00m | 2.00m<br>3.00m<br>4.00m<br>5.00m<br>6.00m<br>7.00m | 92mm<br>92mm<br>92mm<br>92mm<br>92mm<br>92mm | 45%<br>50%<br>70%<br>70%<br>70%<br>65% |                  | 3.00m                 | 3.20m                          | 20                   | Tidal                |

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# PBH9



## Preliminary

**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Rotary Rig**  
**Co-ordinates : 217887.15E - 245780.82N**  
**Level : 3.32 mAOD**

**Scale 1:60    Sheet 1 of 1**

**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 04/03/15**  
**Finish Date : 04/03/15**

| Strata Description                                                                                                                                | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test                    |               | Notes / Remarks    |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|--------------------------------|---------------|--------------------|
|                                                                                                                                                   |                       |                     |           |            |                  |                       | Depth                          | Type          |                    |
| CONCRETE (MADE GROUND)                                                                                                                            |                       | 3.22                | 0.10      |            |                  |                       |                                |               |                    |
| Brown sandy rounded to sub-rounded sandstone GRAVEL (MADE GROUND)                                                                                 |                       | 3.02                | 0.30      |            |                  |                       |                                |               |                    |
| Loose dark brown silty sandy fine to coarse angular to subangular mudstone GRAVEL with occasional mudstone, slate, siltstone GRAVEL (MADE GROUND) |                       | 1.92                | 1.40      |            |                  |                       | 0.50-1.00                      | ES1           | N=4 (3,2,1,1,1,1)  |
| Loose brown mottled orange clayey silty sandy fine to medium angular mudstone GRAVEL. (ALLUVIAL DEPOSITS)                                         |                       |                     |           |            |                  |                       | 1.00<br>1.00-1.40<br>1.00-1.45 | S<br>B1<br>D1 | N=5 (2,2,1,2,1,1)  |
|                                                                                                                                                   |                       |                     |           |            |                  |                       | 1.60-2.00                      | B2            |                    |
|                                                                                                                                                   |                       |                     |           |            |                  |                       | 2.00<br>2.00-2.45<br>2.00-2.65 | S<br>D2<br>U1 | N=0 (1,0,0,0,0,0)  |
| Soft black clayey slightly sandy gravelly SILT with organic fragments. Gravel is fine angular coal. (ALLUVIAL DEPOSITS)                           |                       | 0.22                | 3.10      |            |                  |                       | 3.00<br>3.00-3.45<br>3.20-4.00 | S<br>B3<br>B3 | N=4 (1,1,1,1,1,1)  |
|                                                                                                                                                   |                       |                     |           |            | 4.00             |                       | 4.00<br>4.00-4.45<br>4.00-4.65 | S<br>D4<br>U2 | N=5 (1,1,1,2,2,0)  |
| Soft light grey SILT (ALLUVIAL DEPOSITS)                                                                                                          |                       | -1.78               | 5.10      |            |                  |                       | 5.00<br>5.00-5.70<br>5.00-5.45 | S<br>B4<br>D5 |                    |
| Stiff brown mottled grey silty slightly sandy slightly gravelly dry friable CLAY with woody fragments. (ALLUVIAL DEPOSITS)                        |                       | -2.38               | 5.70      |            | 6.00<br>114mm    |                       | 5.70-6.00                      | B5            | N=21 (1,2,3,5,6,7) |
|                                                                                                                                                   |                       |                     |           |            |                  |                       | 6.00<br>6.00-7.00<br>6.00-6.45 | S<br>B6<br>D6 |                    |
| . . . sandstone cobble at 7.1m bgl                                                                                                                |                       |                     |           |            |                  |                       | 7.00-7.65                      | U3            | N=23 (2,3,4,6,6,7) |
|                                                                                                                                                   |                       |                     |           |            |                  |                       | 7.50<br>7.50-8.00<br>7.50-7.95 | S<br>B7<br>D7 |                    |
| . . . sand lense 8.2 - 8.3                                                                                                                        |                       |                     |           |            |                  |                       | 8.50                           | S             | N=23 (2,3,4,6,6,7) |
| End of Window Sample at 9.00 m                                                                                                                    |                       | -5.68               | 9.00      |            |                  |                       |                                |               |                    |
|                                                                                                                                                   |                       |                     |           |            |                  |                       |                                |               |                    |
| Observations / Remarks                                                                                                                            | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |                                |               |                    |
|                                                                                                                                                   | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to                      | Time (mins)   | Remarks            |
| 1. Hand dug pit to 1.2m bgl.                                                                                                                      | 1.00m                 | 2.00m               | 92mm      | 85%        |                  | 4.00m                 | 4.00m                          | 20            | Tidal              |
| 2. Groundwater encountered at 4.0m bgl at 11:30.                                                                                                  | 3.00m                 | 4.00m               | 92mm      | 80%        |                  |                       |                                |               |                    |
| 3. Hole backfilled on completion with bentonite.                                                                                                  | 5.00m                 | 6.00m               | 92mm      | 100%       |                  |                       |                                |               |                    |
|                                                                                                                                                   | 6.00m                 | 7.00m               | 92mm      | 100%       |                  |                       |                                |               |                    |
|                                                                                                                                                   | 7.50m                 | 8.50m               | 92mm      | 100%       |                  |                       |                                |               |                    |



**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Rotary Rig**  
**Co-ordinates : 217847.21E - 245779.40N**  
**Level : 3.09 mAOD**

**Scale 1:60    Sheet 1 of 1**

**Logged By : NEB**  
**Checked By : PV**  
**Start Date : 05/03/15**  
**Finish Date : 05/03/15**

| Strata Description                                                                                                                                             | Legend                | Reduced Level (mOD) | Depth (m) | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |             | Notes / Remarks     |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------|------------|------------------|-----------------------|-------------|-------------|---------------------|--|
|                                                                                                                                                                |                       |                     |           |            |                  |                       | Depth       | Type        |                     |  |
| REINFORCED CONCRETE (MADE GROUND)                                                                                                                              |                       | 2.94                | 0.15      |            |                  |                       |             |             |                     |  |
| Grey sandy fine to coarse angular sandstone GRAVEL (MADE GROUND)                                                                                               |                       | 2.84                | 0.25      |            |                  |                       |             |             |                     |  |
| Loose dark grey clayey silty sandy fine to coarse angular mudstone GRAVEL with occasional mudstone, slate, siltstone GRAVEL (MADE GROUND)                      |                       |                     |           |            |                  |                       | 0.50        | ES1         |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 1.00        | S           | N=9 (1,2,2,3,2,2)   |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 1.00-1.45   | D1          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 1.20-2.00   | B1          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 2.00        | S           | N=23 (1,9,5,3,7,8)  |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 2.00-2.30   | B2          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 2.00-2.45   | D2          |                     |  |
| NO RECOVERY pushing probable mudstone BOULDER                                                                                                                  |                       | 0.79                | 2.30      |            | 2.70             |                       |             |             |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 3.00        | S           | N=12 (1,0,2,3,4,3)  |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 3.00-3.45   | D3          |                     |  |
| Medium dense black silty gravellycoarse SAND with silt lenses. (ALLUVIAL DEPOSITS)                                                                             |                       | -0.91               | 4.00      |            |                  |                       | 4.00        | S           | N=11 (9,6,4,3,2,2)  |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 4.00-4.70   | B3          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 4.00-4.45   | D4          |                     |  |
| Soft grey SILT with woody fragments (ALLUVIUM)                                                                                                                 |                       | -1.61               | 4.70      |            |                  |                       | 4.70-4.90   | B4          |                     |  |
| Orange to black fibrous organic PEAT. (ALLUVIAL DEPOSITS)                                                                                                      |                       | -1.81               | 4.90      |            |                  |                       | 5.00        | S           | N=17 (4,5,5,5,4,3)  |  |
| Medium dense black silty gravelly SAND. Gravel is angular of mudstone. (ALLUVIAL DEPOSITS)                                                                     |                       | -1.91               | 5.00      |            |                  |                       | 5.00-5.50   | B5          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 5.00-5.45   | D5          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 5.60-6.00   | B6          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 6.00-6.65   | U8          | 0%                  |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 6.50-7.00   | B7          |                     |  |
| . . . 7.00m dense                                                                                                                                              |                       |                     |           |            |                  |                       | 7.00        | S           | N=30 (1,3,5,9,9,7)  |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 7.00-7.45   | D6          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 7.00-8.00   | B8          |                     |  |
| Firm to stiff orange mottled red clayey sandy gravelly SILT. Gravel of fine to medium rounded to angular sandstone, mudstone and siltstone (ALLUVIAL DEPOSITS) |                       | -4.91               | 8.00      |            |                  |                       | 8.00        | S           | N=34 (5,7,7,8,8,11) |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 8.00-8.45   | D7          |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       | 8.00-9.00   | B9          |                     |  |
| End of Window Sample at 9.00 m                                                                                                                                 |                       | -5.91               | 9.00      |            |                  |                       |             |             |                     |  |
|                                                                                                                                                                |                       |                     |           |            |                  |                       |             |             |                     |  |
| Observations / Remarks                                                                                                                                         | Dynamic Sampling Runs |                     |           |            |                  | Groundwater           |             |             |                     |  |
|                                                                                                                                                                | From                  | To                  | Diameter  | Recovery   | Remarks          | Struck                | Rising to   | Time (mins) | Remarks             |  |
|                                                                                                                                                                | 1.00m                 | 2.00m               | 92mm      | 50%        |                  | 2.40m                 | 2.70m       | 20          | Tidal               |  |
|                                                                                                                                                                | 2.00m                 | 2.30m               | 92mm      | 100%       |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 3.00m                 | 4.00m               | 92mm      | 0%         |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 4.00m                 | 5.00m               | 92mm      | 100%       |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 5.00m                 | 6.00m               | 92mm      | 100%       |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 6.00m                 | 7.00m               | 92mm      | 100%       |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 7.00m                 | 8.00m               | 92mm      | 55%        |                  |                       |             |             |                     |  |
|                                                                                                                                                                | 8.00m                 | 9.00m               | 92mm      | 100%       |                  |                       |             |             |                     |  |

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**PBH11**



## Preliminary

**Project : Cardigan FAS, Cardigan**  
**Project Number: A088137**  
**Client : Natural Resources Wales**  
**Method : Hand dug pit**  
**Co-ordinates : 217558.09E - 245979.06N**  
**Level : 2.95 mAOD**

**Scale 1:60    Sheet 1 of 1**

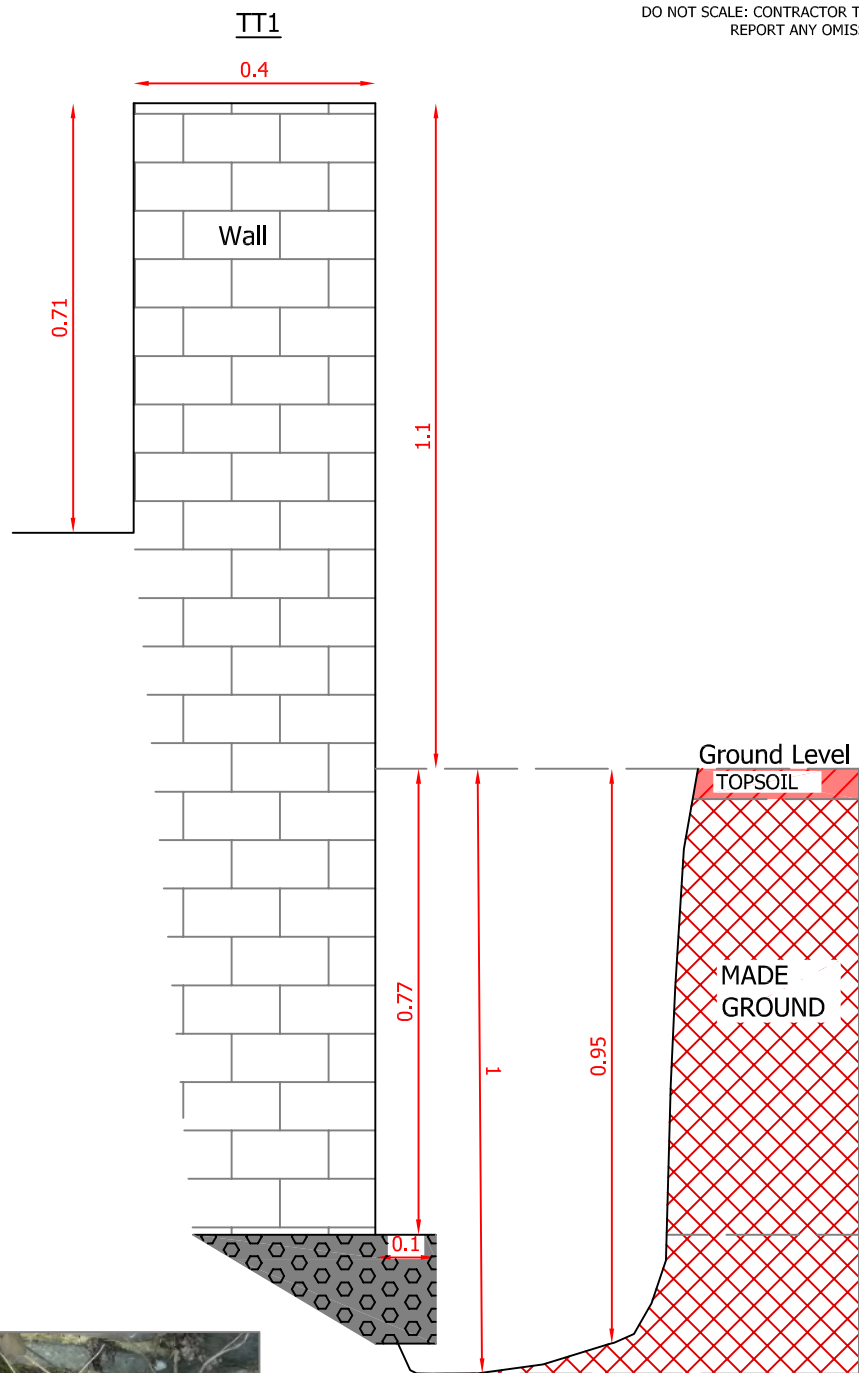
**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 19/03/15**  
**Finish Date : 19/03/15**

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**Project : Cardigan FAS**  
**Project Number : A088137**  
**Client : Natural Resources Wales**  
**Method : Hand dug trial pit**  
**Co-ordinates : 217844E - 245908N**  
**Level : 2.80 mAOD**

**Logged By : LK**  
**Checked By: PV**  
**Start Date : 03/03/15**  
**Finish Date : 03/03/15**

| Strata Description                                                                         | Legend | Reduced Level (mOD) | Depth (m) | Water Strike (m) | Installation/ Backfill | Sample Test |      | Notes / Remarks |
|--------------------------------------------------------------------------------------------|--------|---------------------|-----------|------------------|------------------------|-------------|------|-----------------|
|                                                                                            |        |                     |           |                  |                        | Depth       | Type |                 |
| TOPSOIL                                                                                    |        | 2.75                | 0.05      |                  |                        |             |      |                 |
| Dark brown mottled beige silty slightly gravelly SAND (MADE GROUND)                        |        | 2.03                | 0.77      |                  |                        |             |      |                 |
| Dark brown slightly gravelly sandy SILT. Gravel is fine sub-angular mudstone (MADE GROUND) |        | 1.80                | 1.00      |                  |                        |             |      |                 |
| End of Trial Pit at 1.00 m bgl.                                                            |        |                     |           |                  |                        |             |      |                 |
|                                                                                            |        |                     |           |                  |                        |             |      |                 |
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DRAFT ISSUE

| REV                 |  | DESCRIPTION |               |                 |               | BY          | CHK           | APP | DATE |
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| Scale @ A4 1:12.5   |  | Drawn PP    | Date 26.03.15 | Checked UK      | Date 30.03.15 | Approved PV | Date 22.04.15 |     |      |
| Project No. A088137 |  | Office CDF  | Type GEO      | Drawing No. TT1 |               | Revision 00 |               |     |      |

**WYG ENVIRONMENT****Ground Engineering Services**

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: admin.cardiff@wyg.com

Exploratory Hole Number

**TT2****Preliminary**

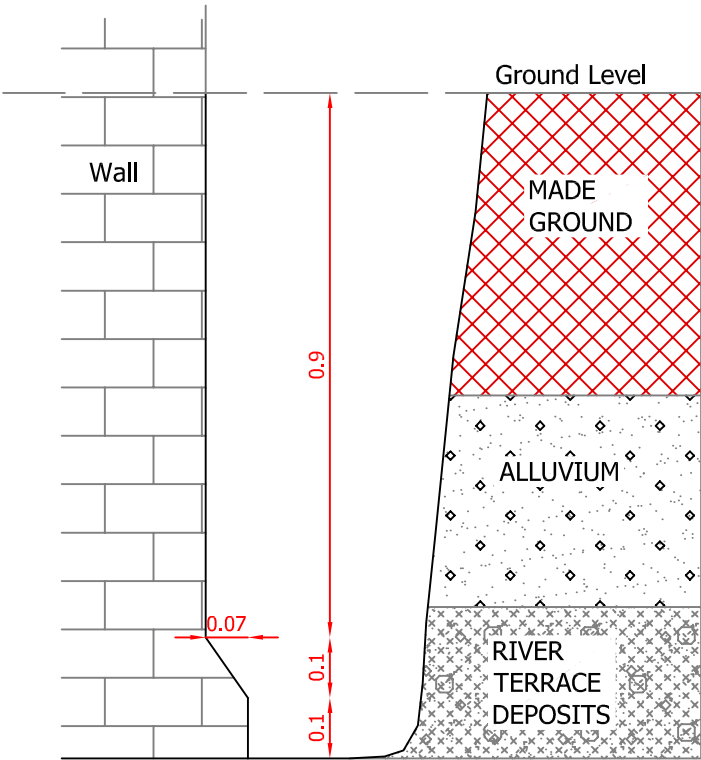
**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : Hand dug pit  
**Co-ordinates** : 217850E - 245906N  
**Level** : 1.88 mAOD

Scale 1:15 Sheet 1 of 1

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 03/03/15  
**Finish Date** : 03/03/15

| Strata Description                                                                                                                                                                                            | Legend                                                                                   | Reduced Level (mOD) | Depth (m)   | Water Strike (m) | Installation/Backfill | Sample Test |           | Notes / Remarks |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-------------|------------------|-----------------------|-------------|-----------|-----------------|
|                                                                                                                                                                                                               |                                                                                          |                     |             |                  |                       | Depth       | Type      |                 |
| Brown silty gravelly SAND with occasional brick cobbles (MADE GROUND)                                                                                                                                         |                                                                                          |                     |             |                  |                       |             |           |                 |
| . . . sleeper with metal shackle oriented parallel to wall at ca. 0.45m bgl.                                                                                                                                  |                                                                                          | 1.38                | <b>0.50</b> |                  |                       |             |           |                 |
| Black silty slightly gravelly SAND. Gravel is fine sub-angular mudstone. (ALLUVIAL DEPOSITS)                                                                                                                  |                                                                                          | 1.03                | <b>0.85</b> |                  |                       |             |           |                 |
| Grey slightly silty sandy gravelly angular mudstone COBBLES. Gravel is fine to coarse sub-angular mudstone (ALLUVIAL DEPOSITS)                                                                                |                                                                                          | 0.78                | <b>1.10</b> |                  |                       |             |           |                 |
| End of Trial Pit at 1.10 m bgl.                                                                                                                                                                               |                                                                                          |                     |             |                  |                       |             |           |                 |
|                                                                                                                                                                                                               |                                                                                          |                     |             |                  |                       |             |           |                 |
| <b>Observations / Remarks</b><br>1. Backfilled with arisings.<br>2. No groundwater encountered. Soils wet from 0.85m bgl.<br>3. Base of wall encountered at 1.1m bgl. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |             |                  |                       | Groundwater |           |                 |
|                                                                                                                                                                                                               | Length : 0.40m<br>Width : 0.40m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |             |                  |                       | Struck      | Rising to | Time (mins)     |
|                                                                                                                                                                                                               |                                                                                          |                     |             |                  |                       |             |           |                 |

TT2



DRAFT ISSUE

| REV | DESCRIPTION         | BY         | CHK           | APP             | DATE          |
|-----|---------------------|------------|---------------|-----------------|---------------|
|     | Scale @ A4 1:12.5   | Drawn PP   | Date 26.03.15 | Checked UK      | Date 30.03.15 |
|     | Project No. A088137 | Office CDF | Type GEO      | Drawing No. TT2 | Revision 00   |

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CF24 0AD  
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FAX: +44 (0)29 2045 5321  
e-mail: cardiff@wyg.com



Client:  
NATURAL RESOURCES WALES

Project:  
CARDIFAN FAS

Drawing Title:  
PIT SKETCH - TT2

**WYG ENVIRONMENT****Ground Engineering Services**

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: admin.cardiff@wyg.com

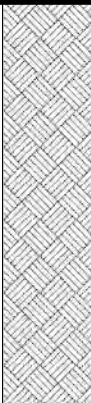
Exploratory Hole Number

**TT2B****Preliminary**

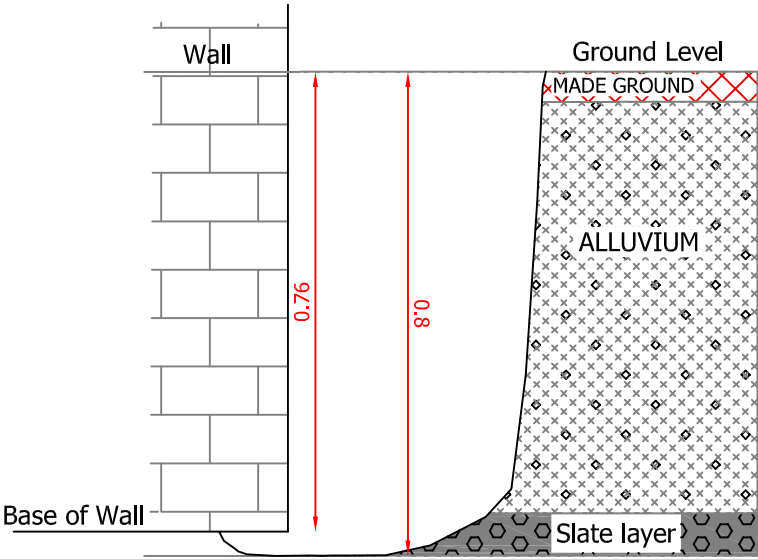
**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : Hand dug trial pit  
**Co-ordinates** : 217854E - 245901N  
**Level** : 0.56 mAOD

Scale 1:15 Sheet 1 of 1

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 04/03/15  
**Finish Date** : 04/03/15

| Strata Description                                                                  | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m)                                                                            | Installation/ Backfill                                                              | Sample Test |           | Notes / Remarks |               |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|-----------|-----------------|---------------|
|                                                                                     |                                                                                          |                     |           |                                                                                             |                                                                                     | Depth       | Type      |                 |               |
| Grey silty COBBLES of shale (MADE GROUND)                                           |         | 0.51                | 0.05      | <br>0.58 |  |             |           |                 |               |
| Black sandy slightly gravelly SILT. Gravel is fine sub-angular mudstone. (ALLUVIUM) |         | -0.17               | 0.73      |                                                                                             |                                                                                     |             |           |                 |               |
| Silty COBBLES of slate (POSSIBLE MADE GROUND)                                       |         | -0.24               | 0.80      |                                                                                             |                                                                                     |             |           |                 |               |
| End of Trial Pit at 0.80 m bgl.                                                     |                                                                                          |                     |           |                                                                                             |                                                                                     |             |           |                 |               |
| Observations / Remarks                                                              | Excavation Information                                                                   |                     |           |                                                                                             |                                                                                     | Groundwater |           |                 |               |
|                                                                                     | Length : 0.40m<br>Width : 0.30m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |           |                                                                                             |                                                                                     | Struck      | Rising to | Time (mins)     | Remarks       |
|                                                                                     |                                                                                          |                     |           |                                                                                             |                                                                                     | 0.58        | -         | -mins           | Moderate flow |
|                                                                                     |                                                                                          |                     |           |                                                                                             |                                                                                     |             |           |                 |               |

TT2B



DRAFT ISSUE

| REV | DESCRIPTION         | BY         | CHK           | APP              | DATE          |
|-----|---------------------|------------|---------------|------------------|---------------|
|     | Scale @ A4 1:12.5   | Drawn PP   | Date 26.03.15 | Checked UK       | Date 30.03.15 |
|     | Project No. A088137 | Office CDF | Type GEO      | Drawing No. TT2B | Revision 00   |



**WYG ENVIRONMENT****Ground Engineering Services**

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: admin.cardiff@wyg.com

Exploratory Hole Number

**TT3****Preliminary**

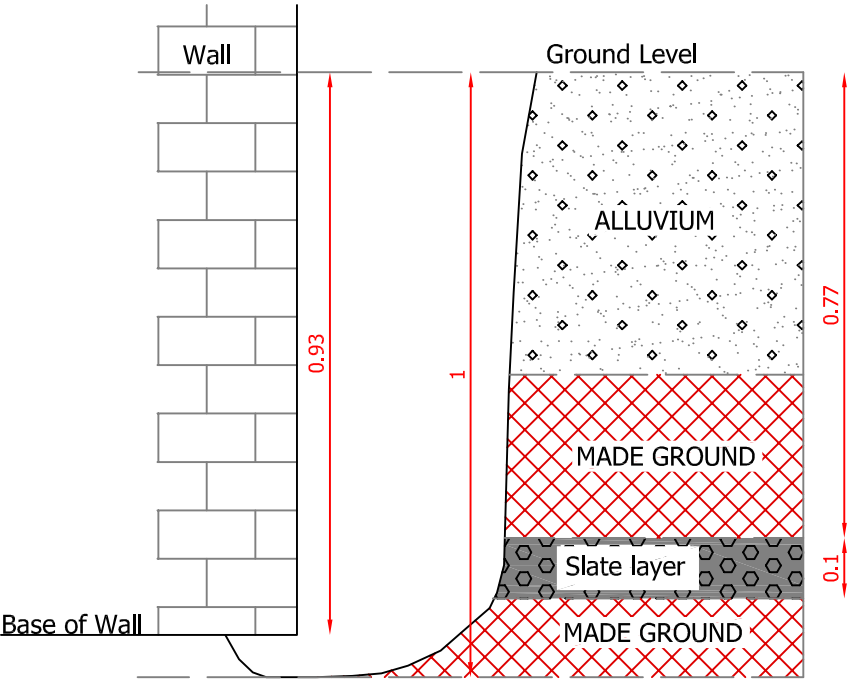
**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : Hand dug pit  
**Co-ordinates** : 217869E - 245910N  
**Level** : 0.66 mAOD

Scale 1:15 Sheet 1 of 1

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 03/03/15  
**Finish Date** : 03/03/15

| Strata Description                                                                                                                                                                               | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m) | Installation/Backfill | Sample Test |             | Notes / Remarks   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|------------------|-----------------------|-------------|-------------|-------------------|
|                                                                                                                                                                                                  |                                                                                          |                     |           |                  |                       | Depth       | Type        |                   |
| Grey brown silty gravelly angular mudstone COBBLES.<br>Gravel is fine to coarse sub-angular mudstone and pieces of china. (ALLUVIUM)                                                             |                                                                                          | 0.16                | 0.50      |                  |                       |             |             |                   |
| Grey silty gravelly SAND (MADE GROUND)                                                                                                                                                           |                                                                                          | -0.11               | 0.77      | ▽<br>0.60        |                       |             |             |                   |
| Grey mudstone COBBLES (MADE GROUND)                                                                                                                                                              |                                                                                          | -0.21               | 0.87      |                  |                       |             |             |                   |
| Black silty gravelly SAND with occasional cobbles of coal (MADE GROUND)                                                                                                                          |                                                                                          | -0.34               | 1.00      |                  |                       |             |             |                   |
| End of Trial Pit at 1.00 m bgl.                                                                                                                                                                  |                                                                                          |                     |           |                  |                       |             |             |                   |
| <b>Observations / Remarks</b><br>1. Backfilled with arisings.<br>2. Water seeping in from wall at 0.6m bgl.<br>3. Base of wall encountered at 0.93m bgl. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |           |                  | Groundwater           |             |             |                   |
|                                                                                                                                                                                                  | Length : 0.40m<br>Width : 0.40m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |           |                  | Struck                | Rising to   | Time (mins) | Remarks           |
|                                                                                                                                                                                                  |                                                                                          |                     |           |                  | 0.60                  | -           | -mins       | Seepage from wall |

TT3



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Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
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Exploratory Hole Number

**TT4A****Preliminary**

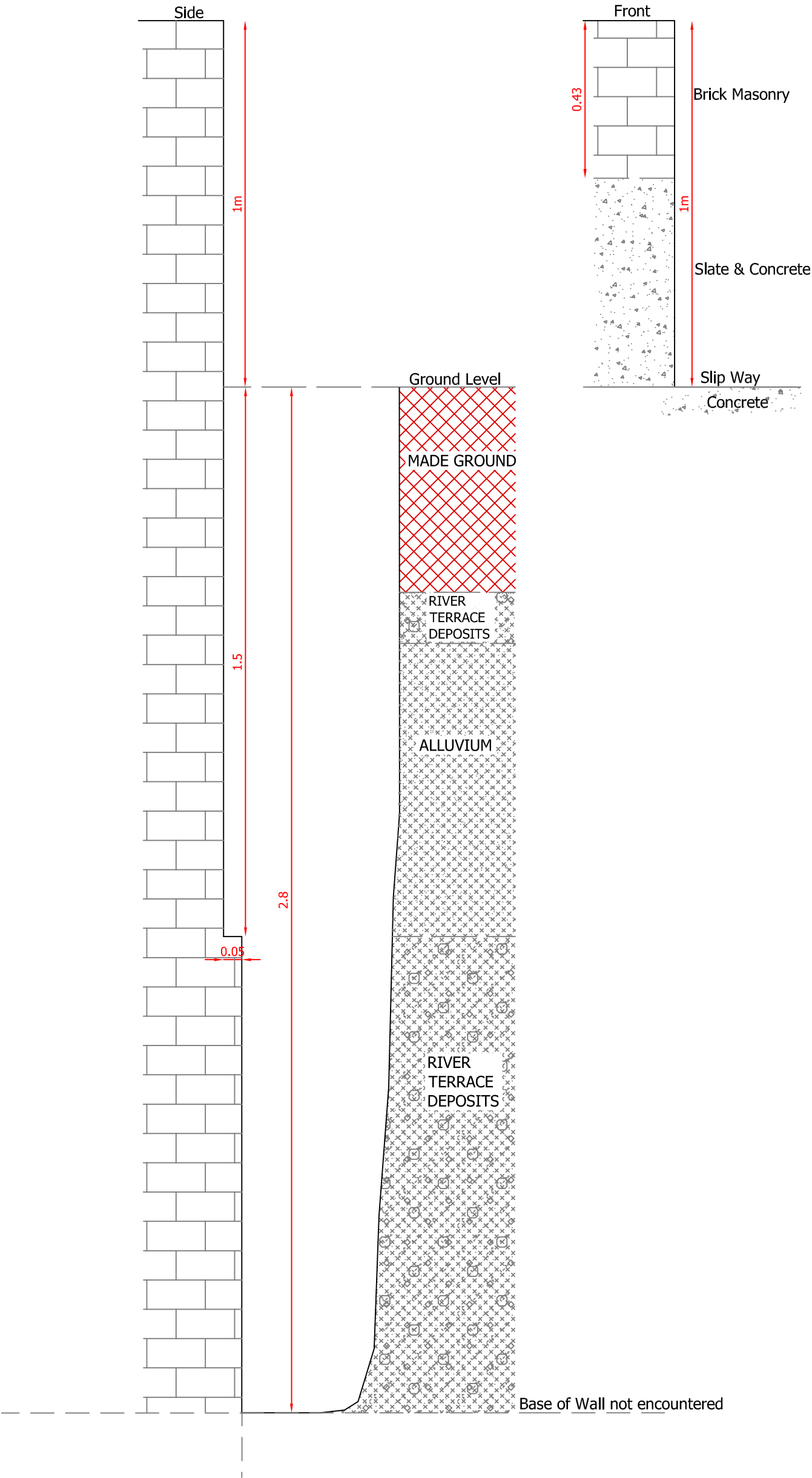
**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : 3.5t tracked excavator  
**Co-ordinates** : 217913E - 245934N  
**Level** : 2.02 mAOD

Scale 1:15 Sheet 1 of 1

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 05/03/15  
**Finish Date** : 05/03/15

| Strata Description                                                                                                                                                                                                                                      | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m)                                                                                                                                                                                  | Installation/ Backfill                                                               | Sample Test  |           | Notes / Remarks |         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------|-----------|-----------------|---------|
|                                                                                                                                                                                                                                                         |                                                                                          |                     |           |                                                                                                                                                                                                   |                                                                                      | Depth        | Type      |                 |         |
| Brown gravelly SAND with high cobble and boulder content of bricks, concrete, mudstone and metal sheet (20cm x 20cm). Gravel is fine to coarse sub-angular to sub-rounded slate, brick and concrete (MADE GROUND)                                       |         | 1.46                | 0.56      | <br>1.25<br><br><br>2.00 |  | 0.50-0.60    | ES1       |                 |         |
| Dark grey mottled orange mottled black silty gravelly SAND with mudstone cobbles. (ALLUVIAL DEPOSITS)                                                                                                                                                   |         | 1.32                | 0.70      |                                                                                                                                                                                                   |                                                                                      |              |           |                 |         |
| Grey silty SAND. (ALLUVIAL DEPOSITS)                                                                                                                                                                                                                    |        | 0.52                | 1.50      |                                                                                                                                                                                                   |                                                                                      |              |           |                 |         |
| Dark grey silty sandy gravelly angular mudstone COBBLES. (ALLUVIAL DEPOSITS)<br><br>... large boulder at western end of pit at 1.95m bgl.                                                                                                               |       | -0.78               | 2.80      |                                                                                                                                                                                                   |                                                                                      |              |           |                 |         |
| End of Trial Pit at 2.80 m bgl.                                                                                                                                                                                                                         |                                                                                          |                     |           |                                                                                                                                                                                                   |                                                                                      |              |           |                 |         |
| Observations / Remarks<br>1. Backfilled with arisings.<br>2. Groundwater encountered at 1.25m bgl seeping in slowly (13:05) and struck at 2.0m bgl fast inflow (13:15).<br>3. Base of wall was not encountered. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |           |                                                                                                                                                                                                   |                                                                                      | Groundwater  |           |                 |         |
|                                                                                                                                                                                                                                                         | Length : 3.00m<br>Width : 0.60m<br>Orientation : -<br>Shoring : None<br>Stability : Poor |                     |           |                                                                                                                                                                                                   |                                                                                      | Struck       | Rising to | Time (mins)     | Remarks |
|                                                                                                                                                                                                                                                         |                                                                                          |                     |           |                                                                                                                                                                                                   |                                                                                      | 1.25<br>2.00 | -<br>-    | -mins<br>-mins  | Seepage |

TT4  
Northern Side TT4A



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Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: admin.cardiff@wyg.com

Exploratory Hole Number

**TT4B****Preliminary**

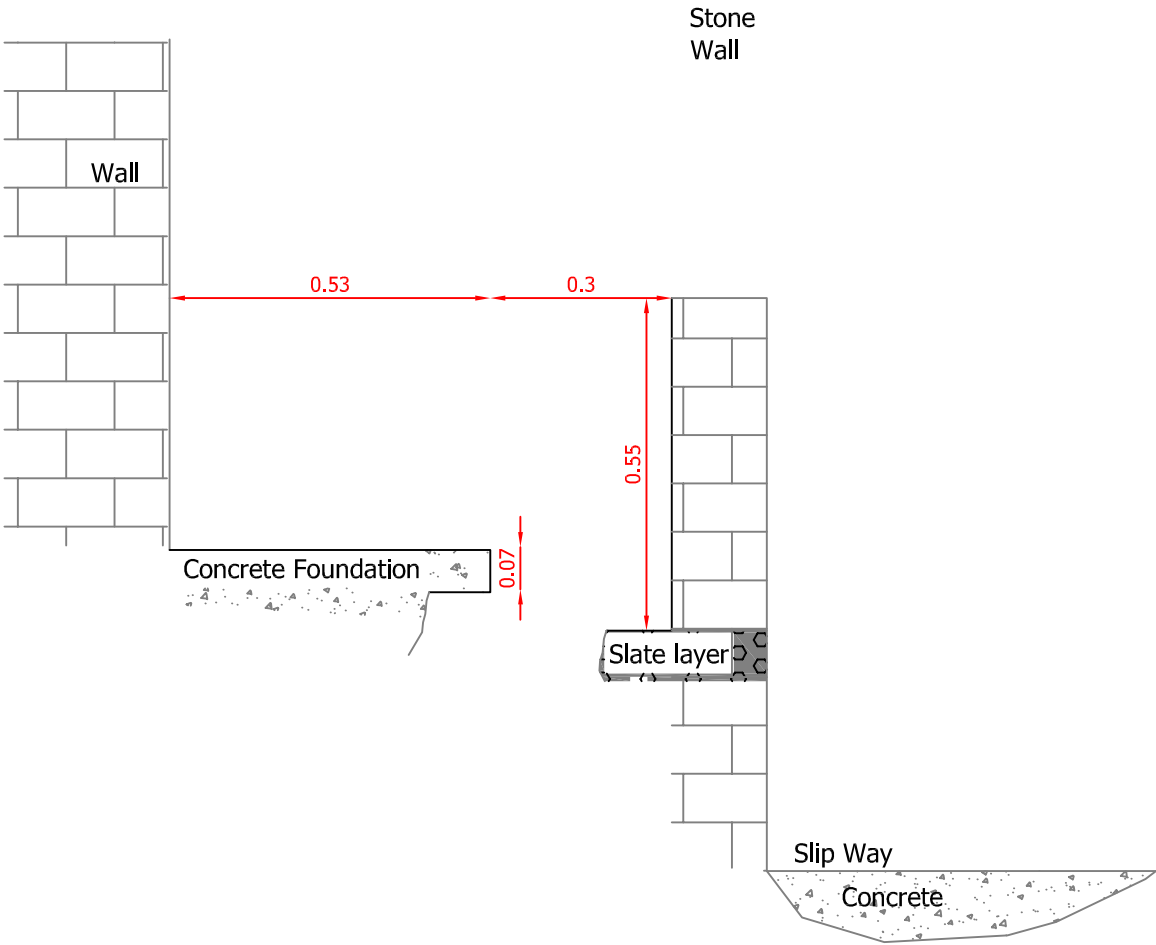
**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : Hand dug trial pit  
**Co-ordinates** : 217913E - 245936N  
**Level** : 2.81 mAOD

**Scale 1:15 Sheet 1 of 1**

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 03/03/15  
**Finish Date** : 03/03/15

| Strata Description                                                                                                                                                                                                                                                   | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m)                                                                   | Installation/ Backfill                                                              | Sample Test |           | Notes / Remarks |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|-----------|-----------------|---------|
|                                                                                                                                                                                                                                                                      |                                                                                          |                     |           |                                                                                    |                                                                                     | Depth       | Type      |                 |         |
| TOPSOIL                                                                                                                                                                                                                                                              |         | 2.69                | 0.12      |  |  |             |           |                 |         |
| Grey brown slightly sandy gravelly angular mudstone, brick and concrete COBBLES (MADE GROUND)                                                                                                                                                                        |         |                     |           |                                                                                    |                                                                                     |             |           |                 |         |
|                                                                                                                                                                                                                                                                      |                                                                                          | 2.26                | 0.55      |                                                                                    |                                                                                     |             |           |                 |         |
| End of Trial Pit at 0.55 m bgl.                                                                                                                                                                                                                                      |                                                                                          |                     |           |                                                                                    |                                                                                     |             |           |                 |         |
| <b>Observations / Remarks</b><br>1. Backfilled with arisings.<br>2. No groundwater encountered.<br>3. Unable to excavate deeper due to wall extending to the back and no room between concrete slab extending from building. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |           |                                                                                    |                                                                                     | Groundwater |           |                 |         |
|                                                                                                                                                                                                                                                                      | Length : 0.30m<br>Width : 0.30m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |           |                                                                                    |                                                                                     | Struck      | Rising to | Time (mins)     | Remarks |
|                                                                                                                                                                                                                                                                      |                                                                                          |                     |           |                                                                                    |                                                                                     |             |           |                 |         |

TT4  
Eastern Side TT4B



DRAFT ISSUE



| REV         |        | DESCRIPTION |             |          |          | BY       | CHK      | APP | DATE |
|-------------|--------|-------------|-------------|----------|----------|----------|----------|-----|------|
| Scale @     | A4     | Drawn       | Date        | Checked  | Date     | Approved | Date     |     |      |
| 1:12.5      |        | PP          | 26.03.15    | UK       | 30.03.15 | PV       | 22.04.15 |     |      |
| Project No. | Office | Type        | Drawing No. | Revision |          |          |          |     |      |
| A088137     | CD     | FGEQ        | TT4B        | 00       |          |          |          |     |      |

**Ground Engineering Services**  
Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
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# TT5



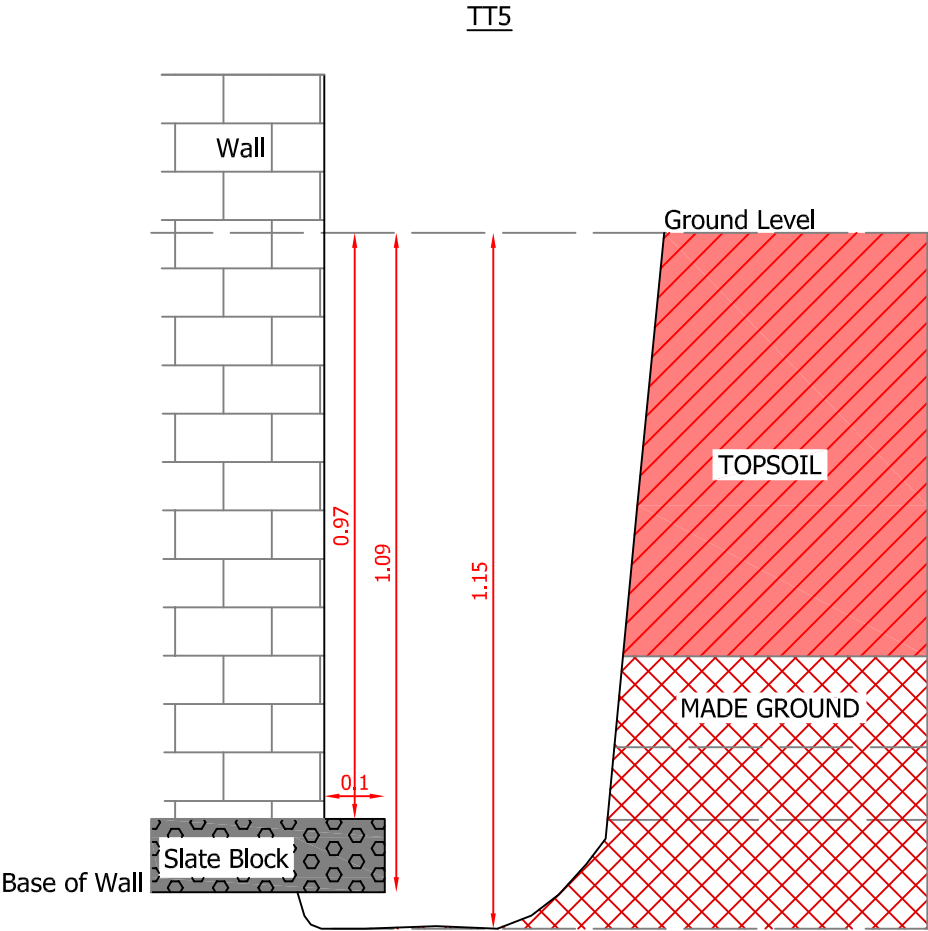
## Preliminary

**Scale 1:15    Sheet 1 of 1**

**Logged By : LK**  
**Checked By: PV**  
**Start Date : 04/03/15**  
**Finish Date : 04/03/15**

**Project : Cardigan FAS**  
**Project Number : A088137**  
**Client : Natural Resources Wales**  
**Method : Hand dug trial pit**  
**Co-ordinates : 217948E - 245970N**  
**Level : 3.49 mAOD**

| Strata Description                                                                                                                                                                   | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m) | Installation/ Backfill | Sample Test |             | Notes / Remarks |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|------------------|------------------------|-------------|-------------|-----------------|
|                                                                                                                                                                                      |                                                                                          |                     |           |                  |                        | Depth       | Type        |                 |
| Dark brown silty slightly gravelly SAND (TOPSOIL)                                                                                                                                    |                                                                                          | 2.79                | 0.70      |                  |                        |             |             |                 |
| Grey mottled orange sandy slightly gravelly CLAY with organic inclusions. Gravel is fine sub-angular slate. (MADE GROUND)                                                            |                                                                                          | 2.64                | 0.85      |                  |                        |             |             |                 |
| Grey mottled brown slightly sandy slightly gravelly slate COBBLES. Gravel is fine sub-angular slate. (MADE GROUND)                                                                   |                                                                                          | 2.34                | 1.15      |                  |                        |             |             |                 |
| End of Trial Pit at 1.15 m bgl.                                                                                                                                                      |                                                                                          |                     |           |                  |                        |             |             |                 |
| <b>Observations / Remarks</b><br>1. Backfilled with arisings.<br>2. No groundwater encountered.<br>3. Base of wall encountered at 1.09m bgl. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |           |                  | Groundwater            |             |             |                 |
|                                                                                                                                                                                      | Length : 0.40m<br>Width : 0.30m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |           |                  | Struck                 | Rising to   | Time (mins) | Remarks         |
|                                                                                                                                                                                      |                                                                                          |                     |           |                  |                        |             |             |                 |



DRAFT ISSUE

| REV | DESCRIPTION         | BY         | CHK           | APP             | DATE          |
|-----|---------------------|------------|---------------|-----------------|---------------|
|     | Scale @ A4 1:12.5   | Drawn PP   | Date 26.03.15 | Checked LK      | Date 30.03.15 |
|     | Project No. A088137 | Office CDF | Type GEC      | Drawing No. TT5 | Revision 00   |

# WYG ENVIRONMENT

## Ground Engineering Services

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: admin.cardiff@wyg.com

Exploratory Hole Number

**TT6A**



**Preliminary**

**Project** : Cardigan FAS  
**Project Number** : A088137  
**Client** : Natural Resources Wales  
**Method** : Hand dug trial pit  
**Co-ordinates** : 218111E - 245963N  
**Level** : 1.77 mAOD

**Scale** 1:15 **Sheet** 1 of 1

**Logged By** : LK  
**Checked By** : PV  
**Start Date** : 04/03/15  
**Finish Date** : 04/03/15

| Strata Description                                                                                                                                                                                                                      | Legend                                                                                   | Reduced Level (mOD) | Depth (m) | Water Strike (m) | Installation/ Backfill | Sample Test |           | Notes / Remarks |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|-----------|------------------|------------------------|-------------|-----------|-----------------|
|                                                                                                                                                                                                                                         |                                                                                          |                     |           |                  |                        | Depth       | Type      |                 |
| Dark brown slightly sandy organic CLAY with many roots and rootlets and occasional mudstone cobbles (ALLUVIAL DEPOSITS)                                                                                                                 |                                                                                          | 1.27                | 0.50      |                  |                        |             |           |                 |
| Black slightly gravelly peaty CLAY (ALLUVIAL DEPOSITS)                                                                                                                                                                                  |                                                                                          | 1.17                | 0.60      |                  |                        |             |           |                 |
| End of Trial Pit at 0.60 m bgl.                                                                                                                                                                                                         |                                                                                          |                     |           |                  |                        |             |           |                 |
| <b>Observations / Remarks</b><br>1. Backfilled with arisings.<br>2. No groundwater encountered. But soil was wet throughout.<br>3. Base of wall was encountered at 0.6m bgl founded on bedrock. See pit sketch/photos for more details. | Excavation Information                                                                   |                     |           |                  |                        | Groundwater |           |                 |
|                                                                                                                                                                                                                                         | Length : 0.60m<br>Width : 0.30m<br>Orientation : -<br>Shoring : None<br>Stability : Good |                     |           |                  |                        | Struck      | Rising to | Time (mins)     |
|                                                                                                                                                                                                                                         |                                                                                          |                     |           |                  |                        |             |           |                 |

**Ground Engineering Services**  
Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: [admin.cardiff@wyg.com](mailto:admin.cardiff@wyg.com)

# TT6B



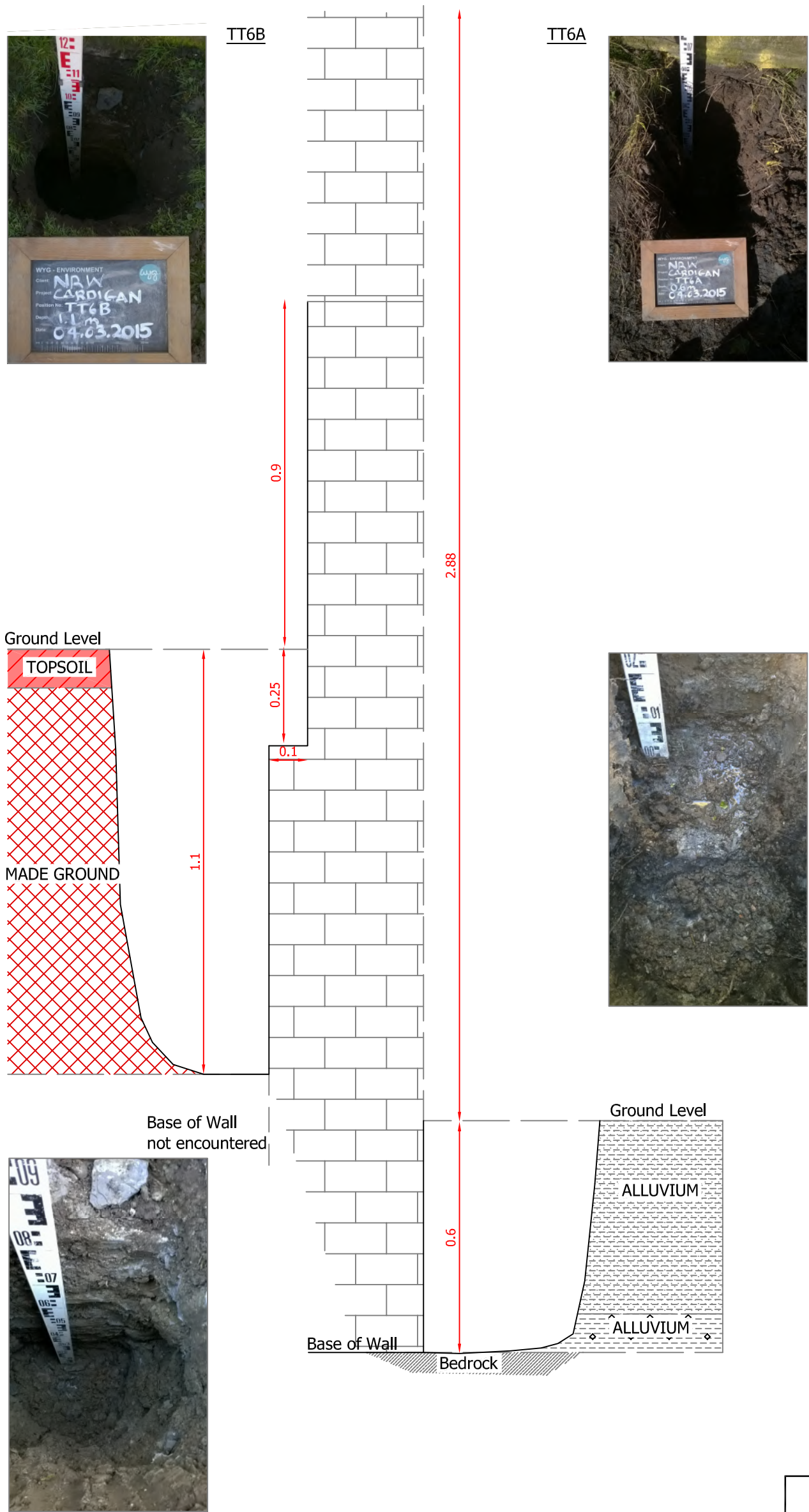
## Preliminary

Project : Cardigan FAS  
Project Number : A088137  
Client : Natural Resources Wales  
Method : Hand dug trial pit  
Co-ordinates : 218112E - 245964N  
Level : 3.65 mAOD

**Scale 1:15    Sheet 1 of 1**

**Logged By : LK**  
**Checked By: PV**  
**Start Date : 04/03/15**  
**Finish Date : 04/03/15**

[illegible]



DRAFT ISSUE

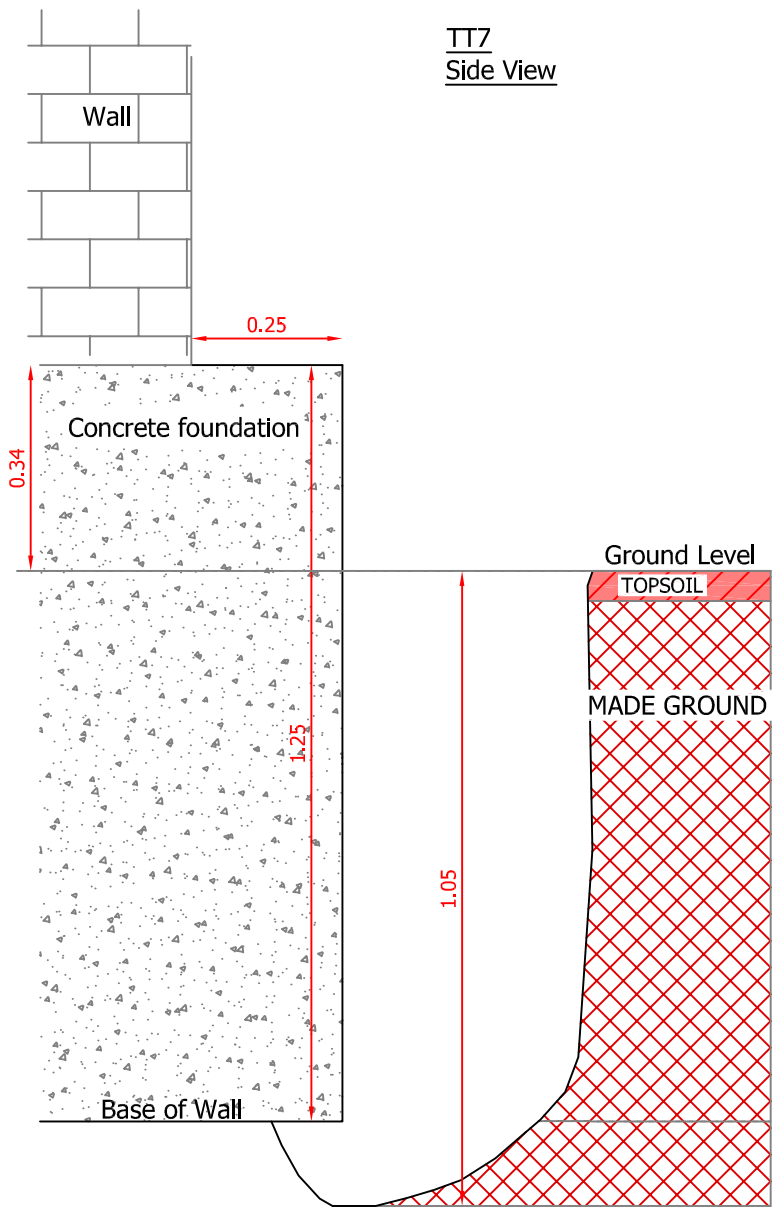


**Scale 1:15    Sheet 1 of 1**

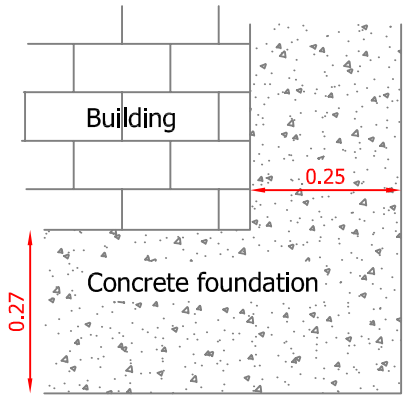
**Project : Cardigan FAS**  
**Project Number : A088137**  
**Client : Natural Resources Wales**  
**Method : Hand dug trial pit**  
**Co-ordinates : 217918E - 245818N**  
**Level : 3.18 mAOD**

**Logged By : LK**  
**Checked By: PV**  
**Start Date : 02/03/15**  
**Finish Date : 02/03/15**

[illegible]



TT7  
Plan View



DRAFT ISSUE

| REV | DESCRIPTION |        |          | BY          | CHK      | APP      | DATE     |
|-----|-------------|--------|----------|-------------|----------|----------|----------|
| TT7 | Scale @ A4  | Drawn  | Date     | Checked     | Date     | Approved | Date     |
|     | 1:12.5      | PP     | 26.03.15 | UK          | 30.03.15 | PV       | 22.04.15 |
|     | Project No. | Office | Type     | Drawing No. |          | Revision |          |
|     | A088137     | CDFGEO |          | TT7         |          | 00       |          |

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
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# TT8A

## Preliminary



**Project : Cardigan FAS**  
**Project Number : A088137**  
**Client : Natural Resources Wales**  
**Method : Hand Tools**  
**Co-ordinates : 217888E - 245805N**  
**Level : 2.77 mAOD**

**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 02/03/15**  
**Finish Date : 02/03/15**

| Strata Description                                                                                                                                                                                        | Legend                                                                            | Reduced Level (mOD) | Depth (m) | Water Strike (m) | Installation/Backfill | Sample Test                                                                                                          |      | Notes / Remarks |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------|-----------|------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------|------|-----------------|
|                                                                                                                                                                                                           |                                                                                   |                     |           |                  |                       | Depth                                                                                                                | Type |                 |
| Brown clayey silty sandy angular fine to coarse brick, concrete and mudstone GRAVEL with brick and mudstone cobbles (MADE GROUND)                                                                         |  | 2.45                | 0.32      |                  |                       |                                                                                                                      |      |                 |
| Grey angular slate COBBLES (MADE GROUND)                                                                                                                                                                  |                                                                                   | 2.37                | 0.40      |                  |                       |                                                                                                                      |      |                 |
| <div>End of Trial Pit at 0.40 m bgl.</div>                                                                                                                                                                |                                                                                   |                     |           |                  |                       |                                                                                                                      |      |                 |
| <div> <div>Observations / Remarks</div> <div>           1. Backfilled with arisings.<br/>           2. No groundwater encountered.         </div> </div>                                                  |                                                                                   |                     |           |                  |                       |                                                                                                                      |      |                 |
| <div>Excavation Information</div> <div>           Length : 0.40m<br/>           Width : 0.40m<br/>           Orientation : -<br/>           Shoring : None<br/>           Stability : Good         </div> |                                                                                   |                     |           |                  |                       | <div>Groundwater</div> <div> <div>Struck</div> <div>Rising to</div> <div>Time (mins)</div> <div>Remarks</div> </div> |      |                 |

**Ground Engineering Services**  
Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 829 200. Email: [admin.cardiff@wyg.com](mailto:admin.cardiff@wyg.com)

# TT8B

## Preliminary



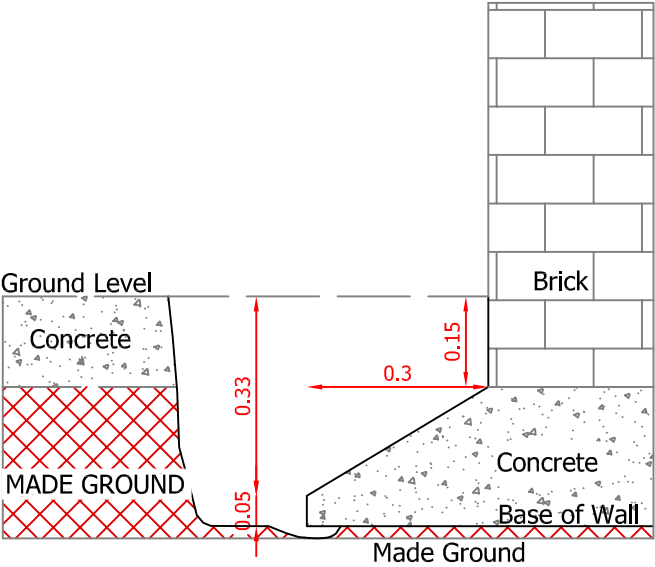
**Project : Cardigan FAS**  
**Project Number : A088137**  
**Client : Natural Resources Wales**  
**Method : Hand Tools**  
**Co-ordinates : 217883E - 245801N**  
**Level : 3.08 mAOD**

Scale 1:15 Sheet 1 of 1

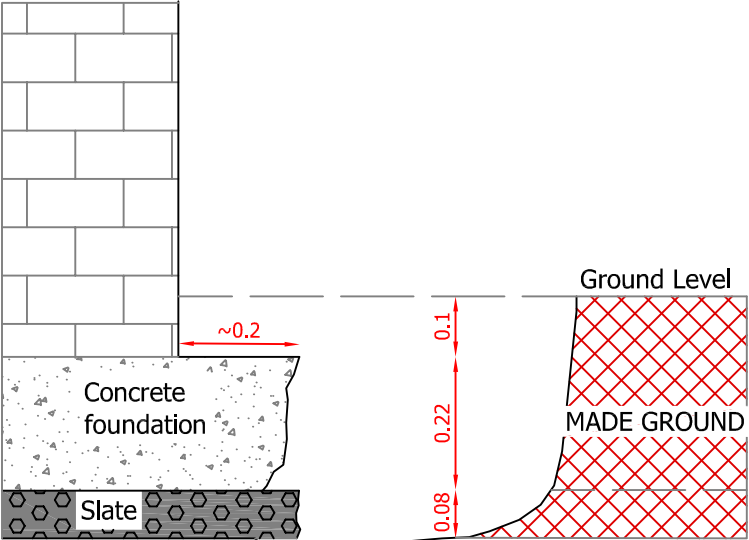
**Logged By : NEB**  
**Checked By: PV**  
**Start Date : 04/03/15**  
**Finish Date : 04/03/15**

[illegible]

TT8B  
Side View



TT8A  
Side View



DRAFT ISSUE

| REV | DESCRIPTION         | BY         | CHK           | APP                     | DATE          |
|-----|---------------------|------------|---------------|-------------------------|---------------|
| 1   | Scale @ A4 1:12.5   | Drawn PP   | Date 26.03.15 | Checked UK              | Date 30.03.15 |
| 2   | Project No. A088137 | Office CDF | Type GEC      | Drawing No. TT28 & TT8B | Revision 00   |

Longcross Court, 47 Newport Road, Cardiff, CF24 0AD.  
Tel: 02920 2082 9200, Fax: 02920 2045 5321.

# WS1



## Preliminary

Project : Cardigan FAS, Cardigan  
Project Number: A088137  
Client : Natural Resources Wales  
Method : Hand Held Window Sampler  
Co-ordinates : 217913.18E - 245935.44N  
Level :

**Scale 1:10    Sheet 1 of 1**

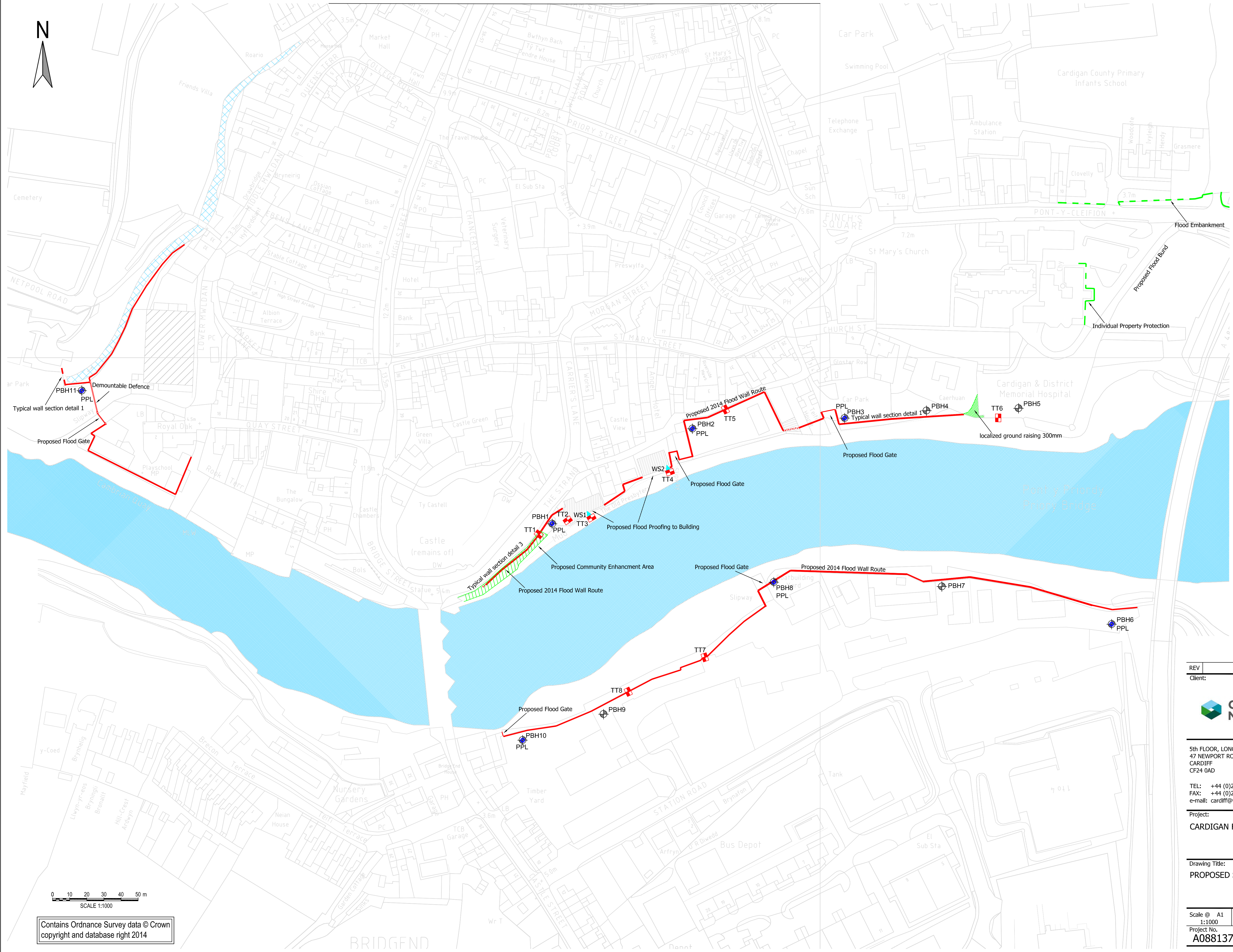
**Logged By : LK**  
**Checked By: PV**  
**Start Date : 04/03/15**  
**Finish Date : 04/03/15**

| Strata Description                                                                      | Legend                | Reduced Level (mOD) | Depth (m)    | Casing (m) | Water Strike (m) | Installation Backfill | Sample Test |             | Notes / Remarks |  |
|-----------------------------------------------------------------------------------------|-----------------------|---------------------|--------------|------------|------------------|-----------------------|-------------|-------------|-----------------|--|
|                                                                                         |                       |                     |              |            |                  |                       | Depth       | Type        |                 |  |
| No recovery                                                                             |                       |                     |              |            |                  |                       |             |             |                 |  |
|                                                                                         |                       |                     | 0.46<br>0.50 |            |                  |                       |             |             |                 |  |
| Mudstone COBBLE. (MADE GROUND)                                                          |                       |                     |              |            |                  |                       |             |             |                 |  |
| Brown silty gravelly SAND. (MADE GROUND)                                                |                       |                     |              |            |                  |                       |             |             |                 |  |
|                                                                                         |                       |                     | 0.90         |            |                  |                       |             |             |                 |  |
| Slate COBBLE broken into flat cobbles (MADE GROUND)                                     |                       |                     |              |            |                  |                       |             |             |                 |  |
|                                                                                         |                       |                     | 1.15         |            |                  |                       |             |             |                 |  |
| Brown grey sandy slightly gravelly SILT. Gravel is fine sub-angular slate (MADE GROUND) |                       |                     | 1.25         |            |                  |                       |             |             |                 |  |
|                                                                                         |                       |                     | 1.30         |            |                  |                       |             |             |                 |  |
| Slate COBBLE. (MADE GROUND)                                                             |                       |                     |              |            |                  |                       |             |             |                 |  |
| End of Window Sample at 1.30 m                                                          |                       |                     |              |            |                  |                       |             |             |                 |  |
| Observations / Remarks                                                                  | Dynamic Sampling Runs |                     |              |            |                  |                       | Groundwater |             |                 |  |
|                                                                                         | From                  | To                  | Diameter     | Recovery   | Remarks          | Struck                | Rising to   | Time (mins) | Remarks         |  |
|                                                                                         |                       |                     |              |            |                  |                       |             |             |                 |  |
| 1. Backfilled with arisings                                                             |                       |                     |              |            |                  |                       |             |             |                 |  |

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

- Key:
- Route of Flood Defence Wall
  - TT Proposed Location of Trial Trench
  - PBH Proposed location of Bore Hole
  - PPL Proposed location of Piezometers

Note:  
Drawing based on Natural Resources Wales  
Drawing IMWA001477/004 Rev C Preliminary  
Locations of GI Work.



| REV | DESCRIPTION | BY | CHK | APP | DATE |
|-----|-------------|----|-----|-----|------|
|-----|-------------|----|-----|-----|------|

Client:

**Cyfoeth Naturiol Cymru**  
**Natural Resources Wales**

5th FLOOR, LONGCROSS COURT  
47 NEWPORT ROAD  
CARDIFF  
CF24 0AD

TEL: +44 (0)29 2032 0769  
FAX: +44 (0)29 2045 5321  
e-mail: cardiff@wyg.com

Project:

CARDIGAN FLOOD ALLEVIATION SCHEME

Drawing Title:

PROPOSED SITE INVESTIGATION LAYOUT PLAN

| Scale @     | A1      | Drawn | Date        | Checked  | Date     | Approved | Date     |
|-------------|---------|-------|-------------|----------|----------|----------|----------|
| 1:1000      |         | PP    | 21.01.15    | PV       | 21.01.15 | CBP      | 21.01.15 |
| Project No. | Office  | Type  | Drawing No. | Revision |          |          |          |
| A088137     | CDF/GEO |       | 2           | 00       |          |          |          |

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## Appendix C – Geotechnical Laboratory Testing Results



# Laboratory Report



GEO Site & Testing Services Ltd

## Contract Number: 26216

Client's Reference: **A088137 C15-184**

Report Date: **10-04-2015**

Client **WYG Group**  
**5th Floor**  
**Longcross Court**  
**47 Newport Road**  
**Cardiff**  
**CF24 0AD**

Contract Title: **Cardigan FAS**  
For the attention of: **Nicholas Bool**

Date Received: **11-03-2015**  
Date Commenced: **11-03-2015**  
Date Completed: **10-04-2015**

| Test Description                                                                                     | Qty |
|------------------------------------------------------------------------------------------------------|-----|
| <b>Moisture Content</b><br>1377 : 1990 Part 2 : 3.2 - * UKAS                                         | 17  |
| <b>4 Point Liquid &amp; Plastic Limit (LL/PL)</b><br>1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS         | 17  |
| <b>PSD Wet Sieve method</b><br>1377 : 1990 Part 2 : 9.2 - * UKAS                                     | 30  |
| <b>PSD: Sedimentation by pipette carried out with Wet Sieve</b><br>1377 : 1990 Part 2 : 9.4 - * UKAS | 15  |
| <b>Acid Soluble Sulphate</b><br>1377 : 1990 Part 3 : 5 - @ Non Accredited Test                       | 27  |
| <b>Water Soluble Sulphate 2:1 extract</b><br>1377 : 1990 Part 3 : 5 - @ Non Accredited Test          | 27  |
| <b>pH Value of Soil</b><br>1377 : 1990 Part 3 : 9 - @ Non Accredited Test                            | 27  |

Notes: **Observations and Interpretations are outside the UKAS Accreditation**  
\* - denotes test included in laboratory scope of accreditation  
# - denotes test carried out by approved contractor  
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

#### Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)  
Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)



# Laboratory Report



GEO Site & Testing Services Ltd

## Contract Number: 26216

| Test Description                                                                                                                                | Qty |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>One-dimensional Consolidation 75mm or 50mm diameter specimens (5 days)</b><br>1377 : 1990 Part 5 : 3 - * UKAS                                | 3   |
| <b>Quick Undrained Triaxial Compression Test - Multi-stage Loading of a single specimen (100mm diameter)</b><br>1377 : 1990 Part 7 : 9 - * UKAS | 2   |
| <b>Disposal of Samples on Project</b>                                                                                                           | 1   |

**Notes:** Observations and Interpretations are outside the UKAS Accreditation

\* - denotes test included in laboratory scope of accreditation

# - denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

**Approved Signatories:**

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)

Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd

Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

**Test Report: Method of the Determination of the plastic limit and plasticity index**  
**BS 1377 : Part 2 : 1990 Method 5**

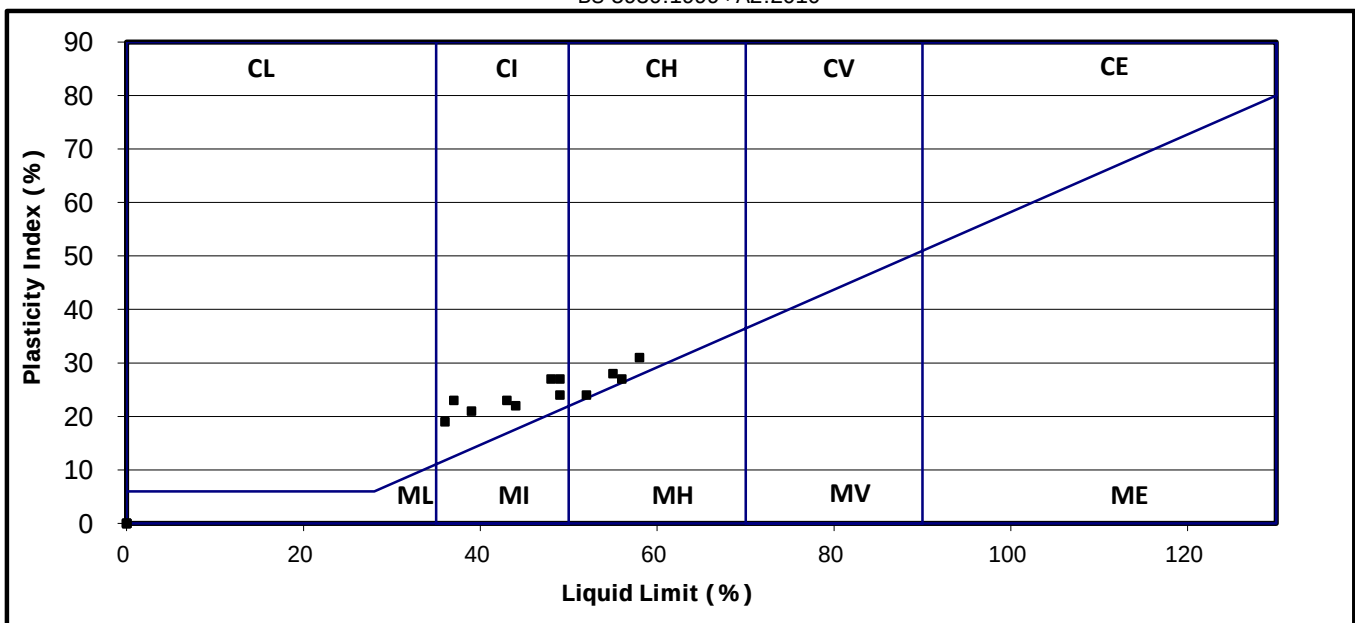
**Client ref:** A088137  
**Location:** Cardigan FAS  
**Contract Number:** 26216-240315

| Hole/<br>Sample<br>Number | Sample<br>Type | Depth<br>m  | Moisture<br>Content<br>%<br>Cl. 3.2 | Liquid<br>Limit<br>%<br>Cl. 4.3/4.4 | Plastic<br>Limit<br>%<br>Cl. 5. | Plasticity<br>Index<br>%<br>Cl. 6. | %<br>Passing<br>.425mm | Remarks                    |
|---------------------------|----------------|-------------|-------------------------------------|-------------------------------------|---------------------------------|------------------------------------|------------------------|----------------------------|
| PBH2/4                    |                | 3.30 - 4.00 | 22                                  |                                     | NP                              |                                    | 82                     |                            |
| PBH4/1                    |                | 1.70 - 2.00 | 13                                  | 36                                  | 17                              | 19                                 | 44                     | CI Intermediate Plasticity |
| PBH5/1                    |                | 1.20 - 1.70 | 22                                  | 44                                  | 22                              | 22                                 | 80                     | CI Intermediate Plasticity |
| PBH6/1                    |                | 1.40 - 1.80 | 24                                  | 49                                  | 22                              | 27                                 | 52                     | CI Intermediate Plasticity |
| PBH6/2                    |                | 2.00 - 2.60 | 25                                  | 48                                  | 21                              | 27                                 | 60                     | CI Intermediate Plasticity |
| PBH6/1                    |                | 4.00 - 4.65 | 12                                  |                                     | NP                              |                                    | 27                     |                            |
| PBH6/4                    |                | 5.00 - 5.50 | 46                                  | 56                                  | 29                              | 27                                 | 66                     | CH High Plasticity         |
| PBH7/1                    |                | 3.00 - 3.65 | 5.2                                 |                                     | NP                              |                                    | 30                     |                            |
| PBH7/2                    |                | 5.00 - 5.65 | 38                                  | 52                                  | 28                              | 24                                 | 79                     | CH High Plasticity         |
| PBH7/8                    |                | 6.50 - 7.00 | 13                                  |                                     | NP                              |                                    | 30                     |                            |
| PBH8/6                    |                | 4.00 - 5.00 | 15                                  | 43                                  | 20                              | 23                                 | 40                     | CI Intermediate Plasticity |
| PBH8/9                    |                | 6.00 - 7.00 | 14                                  | 39                                  | 18                              | 21                                 | 54                     | CI Intermediate Plasticity |
| PBH9/2                    |                | 1.60 - 2.00 | 30                                  | 49                                  | 25                              | 24                                 | 36                     | CI Intermediate Plasticity |
| PBH9/2                    |                | 4.10 - 4.65 | 33                                  | 58                                  | 27                              | 31                                 | 61                     | CH High Plasticity         |
| PBH9/3                    |                | 7.00 - 7.45 | 16                                  | 37                                  | 14                              | 23                                 | 81                     | CI Intermediate Plasticity |
| PBH10/6                   |                | 5.60 - 6.00 | 35                                  | 55                                  | 27                              | 28                                 | 82                     | CH High Plasticity         |
| PBH10/9                   |                | 8.00 - 9.00 | 23                                  | 42                                  | 16                              | 26                                 | 67                     | CI Intermediate Plasticity |

**Symbols:** NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

BS 5930:1999+A2:2010



Test Report:

# Particle Size Distribution Test

## BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

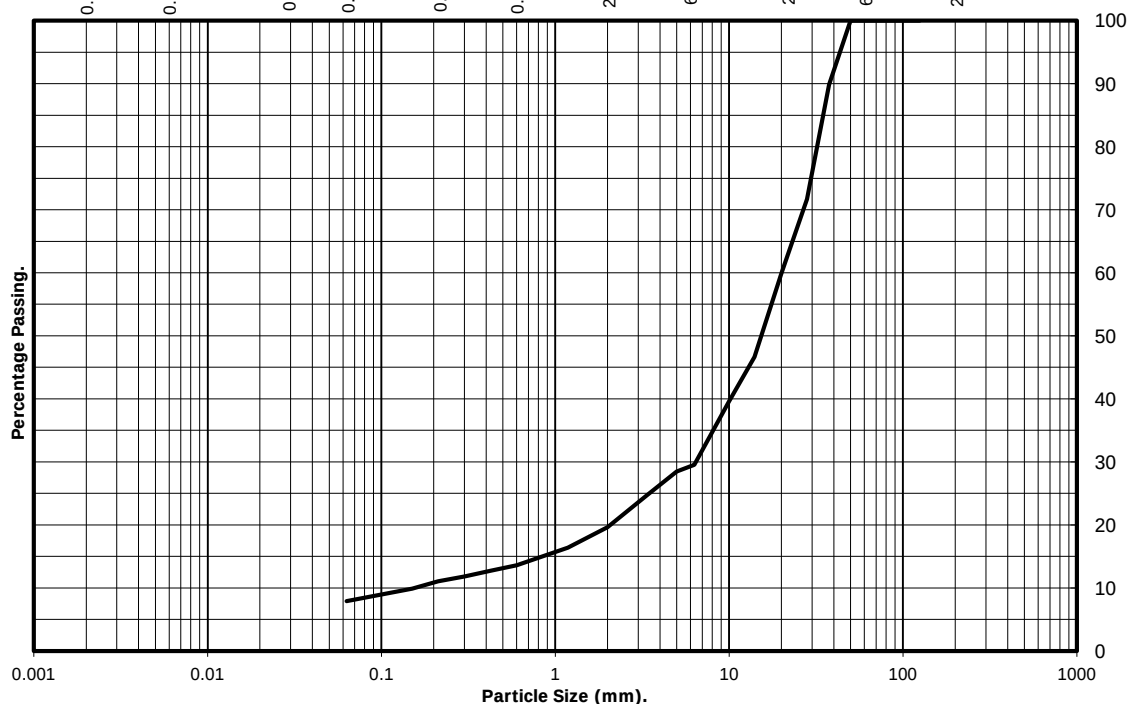
Client ref: A088137  
Contract Number: 26216-240315  
Hole Number: BH2

Sample Number: 1  
Depth from (m): 1.2  
Depth to (m): 1.5  
Sample Type: B

Location: Cardigan FAS  
Description: Brown silty clayey sandy fine to coarse GRAVEL.

|      | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse |         |
|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|
| CLAY | SILT |        |        | SAND |        |        | GRAVEL |        |        | COBBLES |

| BS Test Sieve | % Passing |
|---------------|-----------|
| 125           | 100       |
| 90            | 100       |
| 75            | 100       |
| 63            | 100       |
| 50            | 100       |
| 37.5          | 90        |
| 28            | 72        |
| 20            | 60        |
| 14            | 47        |
| 10            | 40        |
| 6.3           | 30        |
| 5.0           | 28        |
| 3.35          | 25        |
| 2.00          | 20        |
| 1.18          | 16        |
| 0.60          | 14        |
| 0.425         | 13        |
| 0.300         | 12        |
| 0.212         | 11        |
| 0.150         | 10        |
| 0.063         | 8         |



| Particle Diameter | % Passing |
|-------------------|-----------|
| 0.02              | #         |
| 0.006             | #         |
| 0.002             | #         |

|  | Silt and Clay | Sand | Gravel | Cobbles | Soil Fraction    |
|--|---------------|------|--------|---------|------------------|
|  | 8             | 12   | 80     | 0       | Total Percentage |

### Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:  
Emma Williams (Office Manager)

Date: 9.4.15



**Test Report:**

# **Particle Size Distribution Test** **BS 1377 Part 2:1990.**

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Client ref: **A088137**  
 Contract Number: **26216-240315**  
 Hole Number: **BH2**

Sample Number: **4**  
 Depth from (m): **3.3**  
 Depth to (m): **4**  
 Sample Type: **B**

Location: **Cardigan FAS**  
 Description: **Brown silty clayey gravelly fine to medium SAND.**

|      | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse |         |
|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|
| CLAY | SILT |        |        | SAND |        |        | GRAVEL |        |        | COBBLES |

| BS Test Sieve | % Passing |
|---------------|-----------|
| 125           | 100       |
| 90            | 100       |
| 75            | 100       |
| 63            | 100       |
| 50            | 100       |
| 37.5          | 100       |
| 28            | 100       |
| 20            | 90        |
| 14            | 90        |
| 10            | 88        |
| 6.3           | 86        |
| 5.0           | 86        |
| 3.35          | 85        |
| 2.00          | 84        |
| 1.18          | 83        |
| 0.60          | 83        |
| 0.425         | 82        |
| 0.300         | 81        |
| 0.212         | 80        |
| 0.150         | 41        |
| 0.063         | 16        |



| Particle Diameter | % Passing |
|-------------------|-----------|
| 0.02              | 13        |
| 0.006             | 11        |
| 0.002             | 9         |

| Clay | Silt | Sand | Gravel | Cobbles | Soil Fraction    |
|------|------|------|--------|---------|------------------|
| 9    | 7    | 68   | 16     | 0       | Total Percentage |

**Remarks:**

CI 9.4.8 - Sample has not been pretreated

**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
 Emma Williams (Office Manager)

Date: **9.4.15**

*Signature*



**Test Report:**

# **Particle Size Distribution Test** **BS 1377 Part 2:1990.**

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

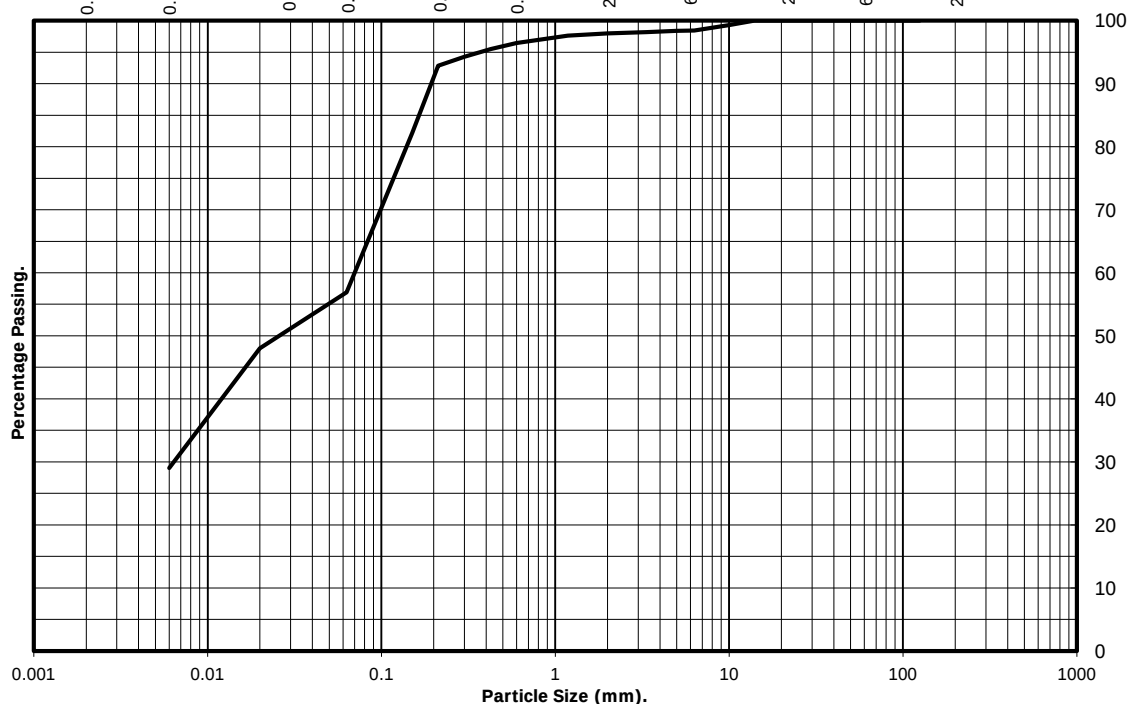
Client ref: **A088137**  
 Contract Number: **26216-240315**  
 Hole Number: **BH2**

Sample Number: **7**  
 Depth from (m): **6**  
 Depth to (m): **6.5**  
 Sample Type: **B**

Location: **Cardigan FAS**  
 Description: **Brown gravelly clayey silty fine to medium SAND.**

|      | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse |         |
|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|
| CLAY | SILT |        |        | SAND |        |        | GRAVEL |        |        | COBBLES |

| BS Test Sieve | % Passing |
|---------------|-----------|
| 125           | 100       |
| 90            | 100       |
| 75            | 100       |
| 63            | 100       |
| 50            | 100       |
| 37.5          | 100       |
| 28            | 100       |
| 20            | 100       |
| 14            | 100       |
| 10            | 99        |
| 6.3           | 98        |
| 5.0           | 98        |
| 3.35          | 98        |
| 2.00          | 98        |
| 1.18          | 98        |
| 0.60          | 96        |
| 0.425         | 96        |
| 0.300         | 94        |
| 0.212         | 93        |
| 0.150         | 82        |
| 0.063         | 57        |



| Particle Diameter | % Passing |
|-------------------|-----------|
| 0.02              | 48        |
| 0.006             | 29        |
| 0.002             | 24        |

| Clay | Silt | Sand | Gravel | Cobbles | Soil Fraction    |
|------|------|------|--------|---------|------------------|
| 24   | 33   | 41   | 2      | 0       | Total Percentage |

**Remarks:**

CI 9.4.8 - Sample has not been pretreated

**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
 Emma Williams (Office Manager)

Date: **9.4.15**



**Test Report:**

# **Particle Size Distribution Test** **BS 1377 Part 2:1990.**

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

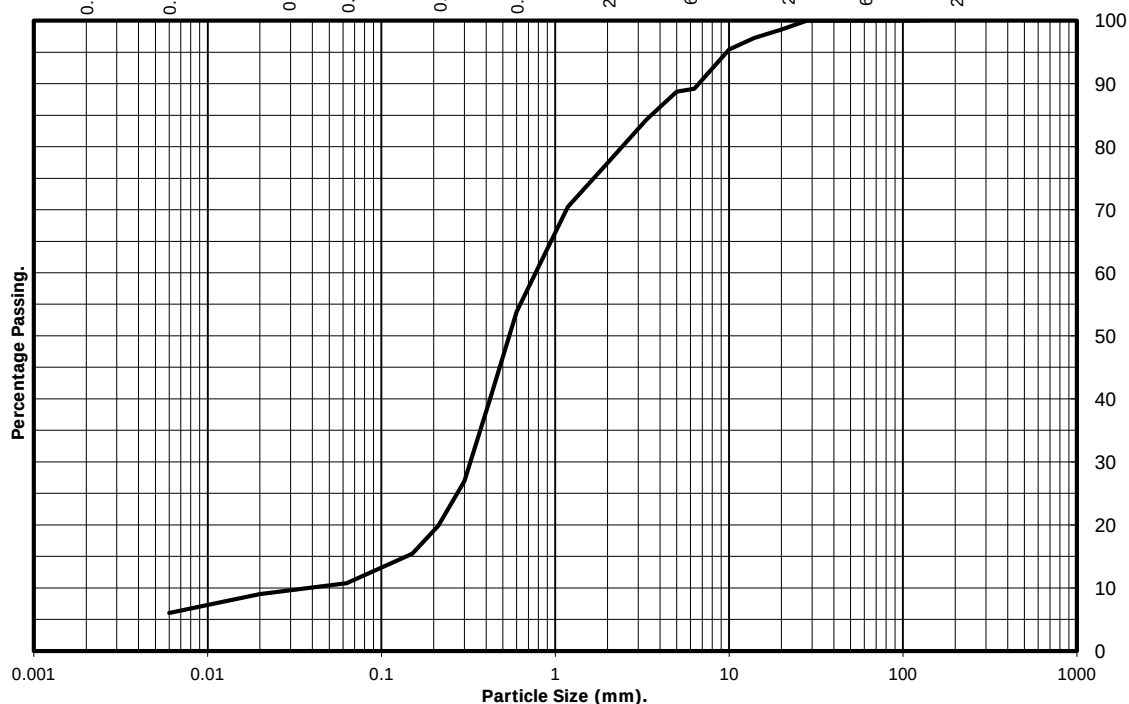
Client ref: **A088137**  
 Contract Number: **26216-240315**  
 Hole Number: **BH2**

Sample Number: **10**  
 Depth from (m): **8**  
 Depth to (m): **9**  
 Sample Type: **B**

Location: **Cardigan FAS**  
 Description: **Brown silty clayey gravelly fine to medium SAND.**

|      | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse |         |
|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|
| CLAY | SILT |        |        | SAND |        |        | GRAVEL |        |        | COBBLES |

| BS Test Sieve | % Passing |
|---------------|-----------|
| 125           | 100       |
| 90            | 100       |
| 75            | 100       |
| 63            | 100       |
| 50            | 100       |
| 37.5          | 100       |
| 28            | 100       |
| 20            | 99        |
| 14            | 97        |
| 10            | 95        |
| 6.3           | 89        |
| 5.0           | 89        |
| 3.35          | 84        |
| 2.00          | 77        |
| 1.18          | 70        |
| 0.60          | 54        |
| 0.425         | 40        |
| 0.300         | 27        |
| 0.212         | 20        |
| 0.150         | 15        |
| 0.063         | 11        |



| Particle Diameter | % Passing |
|-------------------|-----------|
| 0.02              | 9         |
| 0.006             | 6         |
| 0.002             | 5         |

| Clay | Silt | Sand | Gravel | Cobbles | Soil Fraction    |
|------|------|------|--------|---------|------------------|
| 5    | 6    | 66   | 23     | 0       | Total Percentage |

**Remarks:**

CI 9.4.8 - Sample has not been pretreated

**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
 Emma Williams (Office Manager)

Date: **9.4.15**



Test Report:

# Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

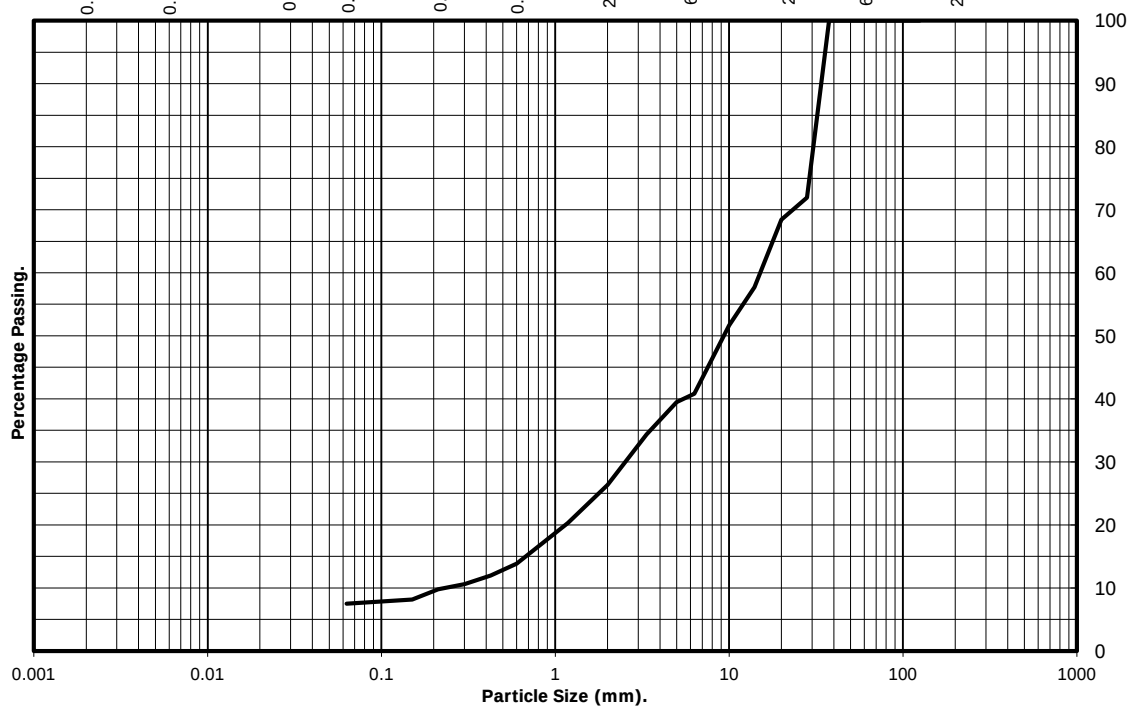
Client ref: A088137  
Contract Number: 26216-240315  
Hole Number: BH2

Sample Number: 13  
Depth from (m): 11  
Depth to (m): 11  
Sample Type: B

Location: Cardigan FAS  
Description: Brown silty clayey sandy fine to coarse GRAVEL.

|      | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse |         |
|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|
| CLAY | SILT |        |        | SAND |        |        | GRAVEL |        |        | COBBLES |

| BS Test Sieve | % Passing |
|---------------|-----------|
| 125           | 100       |
| 90            | 100       |
| 75            | 100       |
| 63            | 100       |
| 50            | 100       |
| 37.5          | 100       |
| 28            | 72        |
| 20            | 68        |
| 14            | 58        |
| 10            | 52        |
| 6.3           | 41        |
| 5.0           | 39        |
| 3.35          | 34        |
| 2.00          | 26        |
| 1.18          | 20        |
| 0.60          | 14        |
| 0.425         | 12        |
| 0.300         | 11        |
| 0.212         | 10        |
| 0.150         | 8         |
| 0.063         | 7         |



| Particle Diameter | % Passing |
|-------------------|-----------|
| 0.02              | #         |
| 0.006             | #         |
| 0.002             | #         |

|  | Silt and Clay | Sand | Gravel | Cobbles | Soil Fraction    |
|--|---------------|------|--------|---------|------------------|
|  | 7             | 19   | 74     | 0       | Total Percentage |

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:  
Emma Williams (Office Manager)

Date: 9.4.15

