ABBVIE
NEW DEVELOPMENT
SLIGO

JACOBS
Consulting Engineers

CONTENTS

APPENDICES

FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Boring Procedures.

Unless otherwise stated, the 'Shell and Auger' technique of soft ground boring has been employed. All boring operations sampling and/or logging of soils and in-situ testing complies with the recommendations of the British Standard Code of Practice BS 5930 (1981), 'Site Investigation' and BS 1377:1990, 'Methods of test for soils for civil engineering purposes'.

Whilst the technique allows the maximum data to be obtained in soft ground, some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Where peat has been encountered during siteworks, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing.

Standard penetration tests, utilising either the standard split spoon sampler or solid cone and automatic trip-hammer are conducted unless otherwise where required by instruction. Subsequent to a seating drive of 150mm, a summation for the number of blows for 300mm penetration is recorded on the boring records together with the blow count for each 75mm penetration. In cases where incomplete penetration is obtained, the number of blows for the recorded value of penetration are noted. In coarse granular soils, a cone end is fitted to the sampler and a similar procedure adopted.

Groundwater.

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level.

Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage condition, tidal variation or other causes.

Retention of Samples.

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

REPORT ON A SITE INVESTIGATION FOR A DEVELOPMENT AT ABBVIE BALLYTIVNAN SLIGO

JACOBS
CONSULTING ENGINEERS

Report No 20974 **JULY 2018**

I Introduction

A new development is proposed at the ABBVIE Complex located on the Old Bundoran Road at Ballytivnan in Sligo.

The consulting engineers for the project, JACOBS acting for ABBVIE, have ordered an investigation of ground conditions at the site to provide data on which to base foundation and infrastructural design.

The programme of the investigation included the construction of four cable percussion boreholes and three machine excavated trial pits in accessible locations outside the existing plant. One soakaway test was carried out at TP01 while a plate bearing test was also completed in this area.

Works were also carried out within the existing warehouse with dynamic probing to establish soil strength below the floor concrete.

All field-work was carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999) and Euro-code 7.

A programme of laboratory testing to confirm geotechnical, chemical and environmental soil parameters was scheduled. Geotechnical laboratory testing was carried out at IGSL's Accredited Laboratory and chemical and environmental testing was carried out by Chemtest in the U.K.

This report presents all factual data pertaining to the project and comments on the findings relative to future development.

II Fieldwork

The site is located at the ABBVIE facility in Sligo. A site location map and a borehole, trial pit and probe layout is enclosed in Appendix VII to this report. All exploratory locations were determined by Jacobs and marked out by site personnel for IGSL.

The original scope of the investigation was amended and scheduled Geophysical Surveying and Rotary Core Drilling was not required.

Scheduled plate bearing tests within the existing building were also cancelled to avoid damage to the existing floor slab. These were replaced by Dynamic Probes taken through the pre-cored concrete floor.

Field operations were supervised by an IGSL geotechnical engineer under the direction of Jacobs.

Boreholes

The four exploratory holes were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig. Hand digging and electronic scanning was carried out at each borehole location to ensure that underground services were not damaged. Shallow refusal was recorded on an obstruction in BH01 at 1.70 metres. A re-bore (BH01A) was scheduled close to the original location

Detailed geotechnical boring records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement.

Boreholes commenced on Tarmac or Concrete surface with granular fill below the surfacing to 0.70 metres BGL in each instance.

Soft to firm mottled grey brown gravelly silty CLAY was noted below he upper fill at BH01, BH03 and BH04. This stratum shows an increasing strength / depth pattern.

In the above three locations a dense sandy GRAVEL stratum was encountered below the gravelly CLAY at depths between 3.00 and 3.50 metres. These boreholes were terminated at depths between 4.60 and 5.50 metres, probably on cobble or boulder obstruction. Proof core drilling to determine the possible presence of rock was not scheduled.

The stratification at BH02 is markedly different. Here stiff brown gravelly CLAY is noted below the fill at 0.70 metres and the stratum continues to borehole completion at 5.00 metres.

Ground water was noted only in BH03 in the gravel stratum at 4.70 metres BGL. No free water was observed in the other boreholes.

Trial Pits

Trial Pits were opened under engineering supervision at three specified locations, north of the existing building. Detailed geotechnical records are presented in Appendix II.

Trial Pit 01 penetrated surface topsoil to underlying firm brown silty CLAY with root fibres. Firm gravelly silty CLAY was then noted and continues to the final depth of 2.00 metres. This excavation was dry and stable.

At TP02, topsoil overlies a stratum of granular FILL with some plastic, wire and roots. Firm silty CLAY extends from 0.80 to 1.50 metres with stiff grey brown sandy gravelly CLAY noted from 1.50 to the final depth of 2.10 metres. This trial pit was also dry and stable.

TP03 was located close to the existing building and MADE GROUND extends to 0.80 metres overlying firm organic silty CLAY from 0.80 to 1.50 metres. Firm gravelly CLAY with a thin gravel band extends from 1.50 to the final depth of 2.10 metres. Ground water ingress was noted in the thin gravel layer at 2.05 metres BGL.

Samples were taken at intervals for inspection and detailed geotechnical analysis.

Trial Pits were carefully backfilled with excavated material and the affected areas were reinstated.

Dynamic Probes

Heavy-duty dynamic probes were carried out at three locations within the existing facility. The concrete floor was pre-cored to facilitate the probing.

A tracked Competitor Probe Rig was used to establish a strength/depth pattern for the sub-soils. A 50kg hammer falling through 500mm is used to drive a 43.7mm diameter cone into the soil.

Probing is in accordance with the DPH specification of BS 1377: Part 9: 1990. In these tests, the soil resistance is measured in terms of the number of drop-hammer blows required to drive the test probe through each 100 mm increment of penetration. The results are presented in both graphical and tabular form in Appendix III. Probing is generally terminated following successive blow counts in excess of 25, to avoid damage to the apparatus.

Where very soft soils are encountered, the probe may penetrate the soil under self-weight and blow counts of zero may be entered where this happens. Blow counts of zero do not signify a void, unless specifically mentioned.

The concrete floor was pre-cored to 0.20 metres. Densely compacted granular FILL was noted below the floor concrete and probing continued to refusal at depths between 0.70 and 1.00 metres. The probes did not penetrate to any natural underlying stratum.

Percolation Test

A soakaway test was carried out in one trial pit location in accordance with BRE Digest 365.

The trial pit was excavated to 2.00 metres and carefully logged. The pit was then part filled with water and the dispersion of the water over time was recorded. The test was carried out over two cycles of filling and dispersion, the infiltration rate is calculated from the final cycle.

The test record is presented in Appendix IV with the infiltration rate as follows:

Infiltration Rate "f" = 0.00627 m/min

Plate Bearing Test

One plate bearing test was carried out at a depth of 0.50 metres in the vicinity of TP01.

A 450mm diameter steel plate is loaded and offloaded incrementally and the deflection or settlement is recorded by dial gauges. The test is carried out over two stages, load cycle and reload cycle.

The data is plotted and Modulus of Subgrade Reaction and equivalent CBR values are calculated. Data is presented in Appendix V and results summarised as follows:

	Modulus of Subgrade Reaction MPa /m	**CBR %**
Initial Load Cycle	17	1.3
Re -Load Cycle	29	1.6

III Testing

(a) In-Situ :

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes to measure relative in-situ soil strength. N values are noted in the right hand column of the boring records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate.

The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	COMMENT
BH01/03/04		
1.00 m BGL in Clay	3 to 7	Soft
2.00 m BGL in Clay	9 to 12	Firm
3.00 m BGL in Clay	15 to 17	Firm / Stiff
4.00 m BGL in Gravel	18 to 50	Medium Dense /Dense
5.00 m BGL in Gravel	22 to > 50	Medium Dense / Dense
BH02		
Gravelly CLAY	20 to 53	Stiff to Very Stiff

Refusal of SPT apparatus was recorded on boulder obstructions in the GRAVEL at the base of the boreholes.

(b) Laboratory :

All geotechnical samples from the boreholes have been returned to the IGSL laboratory for initial visual inspection, a schedule of testing was prepared and tests as appropriate carried out. Chemical and environmental testing was carried out by CHEMTEST in the UK. Laboratory data is presented in Appendix VI.

The various tests comprised the following.

a. Classification (Liquid and Plastic Limits)
b. Grading Analysis (Wet sieve/ Hydrometer)
c. MCV
d. Sulphate and pH determination
d. RILTA Environmental Suite

Classification / Moisture Content

The liquid and plastic limits for samples from both trial pits and boreholes were established in accordance with BS1377 Part 2.

Tests on the upper cohesive soils indicate both clay matrix and silt matrix material with clay plotted in the CL/CI Zones and silt in ML/MI Zones.

Moisture contents for these samples range from about 17 to 40% with a reducing pattern of moisture content with depth. A moisture content of 10% was noted in the stiff clay sample from BH02.

Four samples from the lower granular stratum established that the material is a slightly silty or clayey sandy GRAVEL.

Grading

PSD curves were established for samples of both the upper cohesive soils and the lower granular stratum using both wet sieve and hydrometer methods as appropriate.

The graphs for the cohesive soils reflect fairly uniform characteristics with soils graded from the fine clay to coarse gravel fraction. The material is generally described as brown slightly sandy slightly gravelly CLAY, occasionally grading to slightly sandy slightly gravelly SILT.

PSD tests on the lower granular stratum confirm that this is typically brown silty sandy GRAVEL with some 80% of the sample passing to the gravel fraction.

MCV

Two samples of soil from TP01 and TP02 had MCV values established as follows:

TP01	0.50 m BGL	MCV 5.40	Moisture Content	32
TP02	1.20 m BGL	MCV 14.3	Moisture Content	19

Sulphate / pH

Four soil samples had sulphate content and PH established. Sulphate concentrations (SO_4 2:1 extract) ranging from < 0.010 to 0.045 g/l were established with pH values ranging from 5.4 to 8.6.

No special precautions are necessary to protect foundation concrete from sulphate aggression. A sulphate design class of DS-1 (ACEC Classification for Concrete) is indicated for concentrations less than 0.5 g/l.

RILTA Environmental

One sample was analysed in detail to RILTA Suite parameters. Detailed test data has been provided by CHEMTEST and is presented in Appendix VI. Results indicate very low or negligible concentrations of the various contaminants, all falling within the parameters for INERT waste material. The results indicate that material excavated from this site can be disposed of to a licensed landfill facility.

No traces of asbestos were identified during routine screening.

IV: Discussion

The investigation has been carried out at a proposed extension to the Abbvie Plant at Sligo. Work was carried out both in the area of a proposed extension and within the existing buildings.

A new extension to the existing warehouse is proposed and four boreholes were constructed under the new building footprint.

The existing warehouse floor is also to be upgraded to facilitate the installation of new machinery.

New Extension

Three of the four boreholes confirmed similar stratification with surface FILL overlying soft to firm gravelly CLAY / SILT with medium dense to dense silty sandy GRAVEL noted at about 3.00 metres. Laboratory tests indicate quite high moisture contents in the clay stratum, consistent with the "soft to firm" designation based on SPT data.

At BH02 however stiff gravelly CLAY extends from about 1.50 to 5.00 metres.

The findings at the three consistent boreholes have been used to assess an allowable bearing pressure for structural foundations.

SPT tests from 1.00 to 2.00 metres BGL were low (N values from 3 to 11) and these soils are deemed unsuited for support of structural loads.

To achieve an allowable bearing pressure of 150 KPa, foundations would have to be placed on the stiff gravelly CLAY at an approximate depth of 3.00 metres BGL.

At 4.00 metres BGL in the GRAVEL soils, an allowable bearing pressure of 200 KPa is indicated by the in situ tests.

The required excavation depth to achieve an adequate allowable bearing pressure may economically preclude direct excavation and the use of piles to support structural loads should be considered. It is understood that at least part of the existing building may have been piled.

Specialist piling contractors should be consulted to determine the most suitable pile type for this project. In this regard we would note that pile lengths may well exceed the depths specified and achieved in this investigation. Rotary core drilling should be considered to establish bedrock conditions in the area and confirm final design parameters for any proposed piling.

Ground Floor Slabs

a. Existing Plant

Three dynamic probes confirmed the make up of floors in the existing warehouse. 200mm of concrete overlies at least 1.00 metre of very dense granular fill.

b. New Extension

The boreholes have noted soft to firm gravelly clay/silt below surface fill. The trial pits indicate firm gravelly CLAY between 1.00 and 1.50 metres BGL. This stratum will be suitable for support of ground floor slabs.

We would suggest that the upper soft / organic material be removed and replaced with suitable granular fill. The composition of the floor in the existing warehouse would be appropriate for the new extension (0.80 to 1.00 metres of compacted fill below floor concrete).

Very careful visual inspection of ground floor excavation is recommended to ensure that all unsuitable organic soils are removed.

New Pavements

A CBR value of 1.6% was determined in the area of TP01 at a depth of 0.50 metres. The low CBR suggests that the use of a geo-grid or geo-textile would be appropriate for new pavement construction.

Percolation

An infiltration rate "f" of 0.00627 metres/minute was established in the soak-away test, carried out in firm gravelly CLAY soil. The gravelly clay soils are relatively impermeable and consideration should be given to the use of the local authority drainage system for disposal of surface and storm water.

IGSL Ltd/JC
JULY 2018

Appendix I Boring Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	BOREHOLE NO.	BH01
		SHEET	Sheet 1 of 1
CO-ORDINATES		RIG TYPE	Dando 2000
		BOREHOLE DIAMETER (mm)	
GROUND LEVEL (m AOD)		BOREHOLE DEPTH (m)	1.70
		DATE COMMENCED	14/06/2018
		DATE COMPLETED	14/06/2018
CLIENT	Abbvie	SPT HAMMER REF. NO.	
ENGINEER	Jacobs	ENERGY RATIO (%)	
		BORED BY	F.C
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TARMACADAM			0.10						
	MADE GROUND (Comprised of granular road fill)			0.70						
1	Soft to firm brown slightly silty gravelly (fine to coarse,sub rounded to angular) very sandy (medium to coarse) CLAY			1.70	AA01709	B	1.00		N = 10 (2, 3, 2, 2, 3, 3)	
2	Obstruction End of Borehole at 1.70 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.50	1.70	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m . Obstruction encountered at 1.70m . Relocated to BH01A and attempted rebore.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 20974.GPJ IGSL.GDT 25/6/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	**BOREHOLE NO.**	**BH01**
		SHEET	Sheet 1 of 1
CO-ORDINATES	569,762.00 E 837,629.53 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	
GROUND LEVEL (m AOD)	11.00	**BOREHOLE DEPTH (m)**	1.70
		DATE COMMENCED	14/06/2018
		DATE COMPLETED	14/06/2018
CLIENT	Abbvie	**SPT HAMMER REF. NO.**	
ENGINEER	Jacobs	**ENERGY RATIO (%)**	
		BORED BY	F.C
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND: Tarmacadam		10.90	0.10						
	MADE GROUND (Comprised of granular road fill)		10.30	0.70						
1	Soft to firm brown slightly silty gravelly (fine to coarse,sub rounded to angular) very sandy (medium to coarse) CLAY				AA01709	B	1.00		N = 10 (2, 3, 2, 2, 3, 3)	
			9.30	1.70						
2	Obstruction End of Borehole at 1.70 m									
3										
4										
5										
6										
7										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.5	1.7	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m . Obstruction encountered at 1.70m . Relocated to BH01A and attempted rebore.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 11M 20974.GPJ IGSL.GDT 24/7/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	**BOREHOLE NO.**	**BH01A**
		SHEET	Sheet 1 of 1
CO-ORDINATES	569,763.57 E 837,629.33 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	
GROUND LEVEL (m AOD)	11.03	**BOREHOLE DEPTH (m)**	5.50
		DATE COMMENCED	14/06/2018
		DATE COMPLETED	14/06/2018
CLIENT	Abbvie	**SPT HAMMER REF. NO.**	
ENGINEER	Jacobs	**ENERGY RATIO (%)**	
		BORED BY	F.C
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	MADE GROUND: Tarmacadam		10.93	0.10						
	MADE GROUND (Comprised of granular road fill)		10.33	0.70						
1	Firm brown slightly silty gravelly (fine to coarse,sub rounded to angular) very sandy (medium to coarse) CLAY				AA01710	B	1.00		N = 7 (1, 1, 2, 1, 2, 2)	
2					AA96081	B	2.00		N = 11 (1, 2, 2, 2, 3, 4)	
3					AA96082	B	3.00		N = 15 (2, 3, 3, 4, 3, 5)	
			7.53	3.50						
4	Medium dense to dense dark brown GRAVEL (fine to coarse,subrounded to angular) and medium cobble content				AA96083	B	4.00		N = 48 (6, 8, 10, 10, 14, 14)	
5									N = 50/225 mm (10, 10, 15, 15, 20)	
			5.53	5.50						
6	End of Borehole at 5.50 m									
7										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
5.3	5.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
15-06-18	5.00	1.00	5.00	50mm SP

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 11M 20974.GPJ IGSL.GDT 24/7/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	**BOREHOLE NO.**	**BH02**
		SHEET	Sheet 1 of 1
CO-ORDINATES	569,791.74 E 837,620.17 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	
GROUND LEVEL (m AOD)	10.77	**BOREHOLE DEPTH (m)**	5.00
		DATE COMMENCED	14/06/2018
		DATE COMPLETED	14/06/2018
CLIENT	Abbvie	**SPT HAMMER REF. NO.**	
ENGINEER	Jacobs	**ENERGY RATIO (%)**	
		BORED BY	PA
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	MADE GROUND: Tarmacadam		10.67	0.10						
	MADE GROUND: Granular fill		10.07	0.70	AA96074	B	0.50-1.00			
1	Stiff to very stiff light brown slightly silty gravelly (fine-coarse, subrounded-angular) very sandy (medium-coarse) CLAY with medium cobble (subangular) content				AA96075	U	1.20-1.70	40%rec 8 blows		
2					AA96076	B	2.00-2.50		N = 53 (4, 6, 8, 15, 15, 15)	
3					AA96077	B	3.00-3.50		N = 20 (6, 10, 6, 5, 4, 5)	
4					AA96078	B	4.00-4.50		N = 29 (8, 8, 8, 7, 7, 7)	
			5.77	5.00						
5	End of Borehole at 5.00 m									
6										
7										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 11M 20974.GPJ IGSL.GDT 24/7/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	BOREHOLE NO.	BH03
		SHEET	Sheet 1 of 1
CO-ORDINATES	569,879.91 E 837,610.38 N	RIG TYPE	Dando 2000
GROUND LEVEL (m AOD)	9.86	BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m)	5.00
		DATE COMMENCED	13/06/2018
		DATE COMPLETED	13/06/2018
CLIENT	Abbvie	SPT HAMMER REF. NO.	
ENGINEER	Jacobs	ENERGY RATIO (%)	
		BORED BY	PA
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	MADE GROUND: Tarmacadam		9.76	0.10						
	MADE GROUND: Granular fill		9.16	0.70	AA96069	B	0.50-1.00			
1	Soft mottled light-dark brown sandy (fine-medium) gravelly (fine-coarse, subangular-angular) SILT/CLAY with frequent soft dark brown organic material		7.86	2.00	AA96070	B	1.20-1.70		N = 3 (1, 0, 0, 1, 1, 1)	
2	Firm light brown slightly silty gravelly (fine, subrounded-angular) very sandy (medium) CLAY		6.76	3.10	AA96071	B	2.00-2.50		N = 9 (2, 2, 3, 2, 2, 2)	
3					AA96072	B	3.00-3.50		N = 17 (2, 3, 3, 6, 3, 5)	
4	Medium dense light brown/grey clayey very sandy (coarse) GRAVEL (fine-coarses, subrounded-angular) with mediun cobble (subangular) content		4.86	5.00	AA96073	B	4.00-4.50		N = 18 (2, 3, 4, 5, 6, 3)	
5	End of Borehole at 5.00 m								N = 22 (3, 5, 8, 5, 6, 3)	
6										
7										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4.7	4.9	0.75	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.70			4.90	45	

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
13-06-18	5.00	2.00	5.00	50mm SP

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 11M 20974.GPJ IGSL.GDT 24/7/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	BOREHOLE NO.	BH04
		SHEET	Sheet 1 of 1
CO-ORDINATES	569,821.19 E 837,564.72 N	RIG TYPE	Dando 2000
GROUND LEVEL (m AOD)	9.85	BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m)	4.60
		DATE COMMENCED	18/06/2018
		DATE COMPLETED	18/06/2018
CLIENT	Abbvie	SPT HAMMER REF. NO.	
ENGINEER	Jacobs	ENERGY RATIO (%)	
		BORED BY	F.C
		PROCESSED BY	DE

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	MADE GROUND: Concrete		9.65	0.20						
	MADE GROUND (Comprised of granular road fill)		9.15	0.70	AA91003	B	0.50			
1	Soft to firm brown slightly silty gravelly (fine to coarse,sub rounded to angular) very sandy (medium to coarse) CLAY				AA91004	B	1.00		N = 5 (1, 0, 1, 1, 1, 2)	
2					AA91005	B	2.00		N = 12 (2, 2, 3, 4, 3, 2)	
3			6.85	3.00	AA91006	B	3.00		N = 34 (3, 6, 10, 7, 8, 9)	
	Dense dark brown GRAVEL (fine to coarse,subrounded to angular) and medium cobble content									
4					AA91007	B	4.00		N = 50/225 mm (6, 10, 15, 15, 20)	
	Obstruction End of Borehole at 4.60 m		5.25	4.60						
5									N = 50/75 mm (25, 50)	
6										
7										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.6	3.8	1	
4.3	4.6	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Location CAT scanned and inspection pit hand dug to 1.2m

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
U - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 11M 20974.GPJ IGSL.GDT 24/7/18

Appendix II Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo
TRIAL PIT NO.	TP01
SHEET	Sheet 1 of 1
LOGGED BY	DE
CO-ORDINATES	
DATE STARTED	24/05/2018
DATE COMPLETED	24/05/2018
GROUND LEVEL (m)	
CLIENT	Abbvie
ENGINEER	Jacobs
EXCAVATION METHOD	Hitachi Zaxis 80 SBLC

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.20							
Firm brown silty CLAY with occasional rootlets					AA81371	B	0.40-0.50		
1.0 Firm-stiffbrown mottled orange slightly sandy (medium) gravelly (fine-coarse, subrounded-angular) silty CLAY		1.00			AA81372	B	1.10-1.20		
Firm brown/grey slightly sandy (medium) silty very gravelly (fine-coarse, subrounded-angular) CLAY with low cobble (subrounded-angular) content		1.90			AA81373	B	1.80-1.90		
2.0 End of Trial Pit at 0.00m		2.00							
3.0									
4.0									

Groundwater Conditions
Pit remained dry

Stability
Pit remained stable

General Remarks
Soakaway pit

IGSL TP LOG 20974.GPJ IGSL.GDT 25/6/18

TRIAL PIT RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo
TRIAL PIT NO.	TP02
SHEET	Sheet 1 of 1
LOGGED BY	DE
CO-ORDINATES	
DATE STARTED	24/05/2018
DATE COMPLETED	24/05/2018
GROUND LEVEL (m)	
CLIENT	Abbvie
ENGINEER	Jacobs
EXCAVATION METHOD	Hitachi Zaxis 80 SBLC

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.10							
MADE GROUND: brown silty clay with grranular fill, wire and rootlets		0.30			AA81379	B	0.20-0.30		
MADE GROUND: Grey granular fill with occasional plastic pieces		0.80			AA81380	B	0.70-0.80		
1.0 Firm-stiff light brown mottled dark brown slightly sandy (medium) silty CLAY					AA81381	B	1.10-1.20		
Stiff grey/brown slightly gravelly (fine, subangular-angular) slightly silty CLAY		1.50			AA81382	B	1.80-1.90		
2.0 End of Trial Pit at 0.00m		2.10							
3.0									
4.0									

Groundwater Conditions
Pit remained dry

Stability
Pit remained stable

General Remarks

IGSL TP LOG 20974.GPJ IGSL.GDT 25/6/18

TRIAL PIT RECORD

REPORT NUMBER 20974

CONTRACT	Abbvie Sligo	TRIAL PIT NO.	TP03
		SHEET	Sheet 1 of 1
LOGGED BY	DE	CO-ORDINATES	
		DATE STARTED	24/05/2018
		DATE COMPLETED	24/05/2018
CLIENT	Abbvie	GROUND LEVEL (m)	
ENGINEER	Jacobs	EXCAVATION METHOD	Hitachi Zaxis 80 SBLC

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND: Brown/black silty clay with granular fill									
MADE GROUND: Grey/brown gravelly silty clay with frequent redbrick, plastic, wood and wire pieces		0.30			AA81374	B	0.30-0.40		
Firm brown/grey SILT/CLAY with frequent rootlets and organic traces		0.80			AA81375	B	0.80-0.90		
1.0 Firm light brown/grey gravelly (fine-coarse, subangular-angular) silty very sandy (medium-coarse) CLAY with low cobble (subangular-angular) content		1.50			AA81376	B	1.60-1.70		
2.0 Light brown silty very clayey very sandy (medium-coarse) GRAVEL (medium-coarse, subangular-angular)		2.00		1 (Standing)	AA81377	B	1.90-2.00		
End of Trial Pit at 0.00m		2.10			AA81378	B	2.00-2.10		
3.0									
4.0									

Groundwater Conditions
Standing at 2.05m

Stability
Pit remained stable

General Remarks

IGSL TP LOG 20974.GPJ IGSL.GDT 25/6/18

Appendix III Dynamic Probes

DYNAMIC PROBE RECORD

REPORT NUMBER 20963

CONTRACT Abbvie , Sligo

PROBE NO. DP01

SHEET Sheet 1 of 1

CO-ORDINATES

GROUND LEVEL (mOD)

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 24/05/2018

DATE COMPLETED 24/05/2018

CLIENT

ENGINEER Jacobs

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	3
						0.30	13
						0.40	23
						0.50	25
						0.60	24
						0.70	35
						0.80	38
						0.90	25
1.0	End of Probe at 1.00 m						
2.0							
3.0							
4.0							

Graphic Probe Record

0 5 10 15 20 25

35

38

GROUNDWATER OBSERVATIONS

REMARKS

Cored to 0.20m

IGSL DP LOG 100MM INCREMENTS 20971.GPJ IGSL.GDT 28/5/18

DYNAMIC PROBE RECORD

REPORT NUMBER 20963

CONTRACT Abbvie , Sligo

PROBE NO. DP02

SHEET Sheet 1 of 1

CO-ORDINATES

GROUND LEVEL (mOD)

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 24/05/2018

DATE COMPLETED 24/05/2018

CLIENT

ENGINEER Jacobs

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	10
						0.30	13
						0.40	29
						0.50	34
						0.60	40
						0.70	33
	End of Probe at 0.80 m						
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record

0 5 10 15 20 25

29 34 40 33

GROUNDWATER OBSERVATIONS

REMARKS

Cored to 0.20m

IGSL DP LOG 100MM INCREMENTS 20971.GPJ IGSL.GDT 28/5/18

DYNAMIC PROBE RECORD

REPORT NUMBER 20963

CONTRACT Abbvie , Sligo

PROBE NO. DP04

SHEET Sheet 1 of 1

CO-ORDINATES

GROUND LEVEL (mOD)

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 24/05/2018

DATE COMPLETED 24/05/2018

CLIENT

ENGINEER Jacobs

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	10
						0.30	44
						0.40	49
						0.50	48
						0.60	50
	End of Probe at 0.70 m						
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record

0 5 10 15 20 25

44 49 48 50

GROUNDWATER OBSERVATIONS

REMARKS

Cored to 0.20m

IGSL DP LOG 100MM INCREMENTS 20971.GPJ IGSL.GDT 28/5/18

Appendix IV Percolation Test Data

Soakaway Design f -value from field tests (F2C) IGSL

Contract: Abbvie, Sligo Contract No. 20974
Test No. STP01
Client Abbvie / Jacobs
Date: 24/05/2018

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	Dry
0.20	1.00	Firm brown silty CLAY with occasional rootlets	
1.00	1.70	Firm-stiffbrown mottled orange slightly sandy gravelly silty CLAY	
1.70	2.00	Firm brown/grey slightly sandy silty very gravelly CLAY with cobbles	

Notes:

Field Data

Depth to Water (m)	Elapsed Time (min)
1.30	0.00
1.35	2.00
1.40	5.00
1.45	8.00
1.50	10.00
1.55	12.00
1.60	15.00
1.70	20.00
1.80	25.00
1.90	30.00
2.00	35.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.60	m
Initial depth to Water =	1.30	m
Final depth to water =	2.00	m
Elapsed time (mins)=	35.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.64	m2
*Av. side area of permeable stratum over test period	1.4	m2
Total Exposed area =	2.04	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00627 m/min or 0.0001046 m/sec