

Calculation of Attenuation Volume

Length, l = 18 m
 Width, w = 10 m
 Depth, d = 2 m
 Free Volume, V_{free} = 95%
 M5-60min from Met Éireann Data = 16.1 mm
 M5-60m/M5-2d from Met Éireann Data, r = 0.271

Area: 180.0 m²

Return Period, years = 100 year + 20%
 Contributory Area, A = 5193 m²
 Outflow Factor, AF = 7.92 l/s (0.00792 m³/s)
 Max. Inflow (from RWHT) = 0.0 l/s = 0 m³/s

Duration	M5 Rainfalls	100 year Rainfall	100 year Rainfall + 20%	Inflow (m ³)	Additional Inflow (m ³)	Outflow (m ³)	Storage Required (m ³)
5 mins	6.0 mm	14.5 mm	17.4 mm	90.4	0	2.4	88.0
10 mins	8.4 mm	20.2 mm	24.2 mm	125.9	0	4.8	121.1
15 mins	9.9 mm	23.8 mm	28.6 mm	148.3	0	7.1	141.2
30 mins	12.6 mm	29.4 mm	35.3 mm	183.2	0	14.3	169.0
1 hour	16.1 mm	36.4 mm	43.7 mm	226.8	0	28.5	198.3
2 hours	20.6 mm	44.9 mm	53.9 mm	279.8	0	57.0	222.8
3 hours	23.8 mm	50.9 mm	61.1 mm	317.2	0	85.5	231.7
4 hours	26.4 mm	55.6 mm	66.7 mm	346.5	0	114.0	232.4
6 hours	30.4 mm	62.9 mm	75.5 mm	392.0	0	171.1	220.9
9 hours	35.1 mm	71.2 mm	85.4 mm	443.7	0	256.6	187.1
12 hours	38.9 mm	77.8 mm	93.4 mm	484.8	0	342.1	142.7
18 hours	44.9 mm	88.0 mm	105.6 mm	548.4	0	513.2	35.2
24 hours	49.7 mm	96.2 mm	115.4 mm	599.5	0	684.3	-84.8

Rainfall Values are taken from Met Éireann Data for the site (see separate data sheet)

Required Storage, S_{reqd} = 232.4 m³
 Actual Storage, S_{act} = 342.0 m³ (0.68)

Storage Volume is OK

ADDITIONAL STORAGE FOR OVERFLOWS FROM OTHER AREAS

Calculation of Storage Volume & Infiltration

Length, l = 5.5 m
 Width, w = 3 m
 Depth, d = 800 mm
 Free Volume, V_{free} = 95%
 M5-60min from Met Éireann Data = 16.1 mm
 M5-60m/M5-2d from Met Éireann Data, r = 0.271

Area: 16.5 m²

Return Period, years = 100 year + 20%
 Impermeable Area, A = 239 m²
 Soil Infiltration Rate, f = 0.0000427 m/s
 Surface Area to 50% storage depth, A_{s50} = 6.8 m²
 Outflow Factor, AF = 0.00029036 m³/s
 Max. Inflow = 0.0 l/s = 0 m³/s

Duration	M5 Rainfalls	100 year Rainfall	100 year Rainfall + 20%	Inflow (m ³)	Additional Inflow (m ³)	Outflow (m ³)	Storage Required (m ³)
5 mins	6.0 mm	14.5 mm	17.4 mm	4.2	0	0.1	4.1
10 mins	8.4 mm	20.2 mm	24.2 mm	5.8	0	0.2	5.6
15 mins	9.9 mm	23.8 mm	28.6 mm	6.8	0	0.3	6.6
30 mins	12.6 mm	29.4 mm	35.3 mm	8.4	0	0.5	7.9
1 hour	16.1 mm	36.4 mm	43.7 mm	10.4	0	1.0	9.4
2 hours	20.6 mm	44.9 mm	53.9 mm	12.9	0	2.1	10.8
3 hours	23.8 mm	50.9 mm	61.1 mm	14.6	0	3.1	11.5
4 hours	26.4 mm	55.6 mm	66.7 mm	15.9	0	4.2	11.8
6 hours	30.4 mm	62.9 mm	75.5 mm	18.0	0	6.3	11.8
9 hours	35.1 mm	71.2 mm	85.4 mm	20.4	0	9.4	11.0
12 hours	38.9 mm	77.8 mm	93.4 mm	22.3	0	12.5	9.8
18 hours	44.9 mm	88.0 mm	105.6 mm	25.2	0	18.8	6.4
24 hours	49.7 mm	96.2 mm	115.4 mm	27.6	0	25.1	2.5

Rainfall Values are taken from Met Éireann Data for the site (see separate data sheet)

Required Storage, S_{reqd} = 11.8 m³
 Actual Storage, S_{act} = 12.54 m³ (0.94)

Storage Volume is OK

Time for emptying half volume:

T_{s50} = 00 days 05 hr 37 min 44 s

Discharge Time is OK

Appendix C – Soil Tests

**PROPOSED DEVELOPMENT
NEW CIVIC CENTRE
MONAGHAN
MONAGHAN CO. COUNCIL**

**CORA
CONSULTING ENGINEERS**

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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.

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). The following Irish (IS) and European Standards or Norms are referenced:

- IS EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- IS EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- IS EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- IS EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles

Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler or Piston 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 were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 to obtain the Energy Ratio (E_r) of each hammer. A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The recorded number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

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 conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004.

Where peat has been encountered during site works, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittills 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).

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.

Reporting

Recommendations made and opinions expressed in this 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 by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for the project client and the information should not be used without prior written permission. Any recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

REPORT ON A SITE INVESTIGATION

NEW CIVIC OFFICES FOR MONAGHAN COUNTY COUNCIL

CORA CONSULTING ENGINEERS

Report No. 24665

July 2023

I Introduction

A major new development is proposed for a site in Monaghan where new Civic Offices are to be located.

An investigation of sub soil conditions in the area of the new development has been carried out by IGSL for CORA, Consulting Engineers, on behalf of Monaghan County Council.

The scheduled site investigation included the following elements.

*	Cable Percussion Boreholes	8 nr.
•	Rotary Core Holes	3 nr.
•	Standpipe Installations	1 nr.
•	Trial Pits	14 nr.
•	BRE Digest 365 Infiltration Tests	4 nr.
•	Geotechnical Laboratory Tests	
*	Chemical and Environmental Tests	

This report includes all factual data from field and laboratory operations and discusses these findings relative to foundation and infrastructural design for the proposed new development.

II Fieldwork

This development is to take place on an undulating greenfield site in Monaghan Town.

The exploratory locations are noted on the drawing enclosed in Appendix VI and were marked out by IGSL on site. All locations have been referenced to national grid and ground levels established.

The various elements of the investigation are detailed in the following paragraphs. All field works were supervised by an experienced geotechnical engineer who carefully recorded stratification, took photographs as necessary, recovered samples and prepared detailed records.

Close liaison was maintained throughout with CORA Consulting Engineers and Monaghan County Council personnel.

All appropriate documentation was submitted and approved prior to site commencement. Each location was scanned electronically (CAT) to ensure that existing services were not damaged. A shallow trial pit was also opened by hand at borehole / corehole locations to confirm this.

Drawings from the various utilities were also examined to ensure that major services were avoided.

Statutory HSE safety precautions relating to general safety and COVID 19 were strictly observed, with working areas restricted to IGSL personnel only, to ensure safety of the general public.

Boreholes

Boreholes were 200mm diameter and were constructed using conventional cable percussion equipment. Holes were referenced BH01 to BH08. A trial pit was opened at each borehole location to 1.00 metre deep to ensure that underground services were not damaged.

Shallow refusal was recorded on boulder obstructions at two locations (BH04 and BH06). Following a period of abortive chiselling, the equipment was moved by about 3 metres and re-bores were taken. These are referenced BH04A and BH06A.

Detailed geotechnical 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. It was not possible to recover undisturbed samples because of the hard and granular nature of the strata encountered.

The findings are fairly consistent, with topsoil generally overlying a 1.50 stratum of soft to firm brown sandy SILT /CLAY.

Stiff brown sandy gravelly CLAY, typically containing cobble and boulder material, is encountered at shallow depth (generally 0.50 to 1.00 metres). This stratum continues to about 2.50 metres where very stiff to hard dark grey gravelly CLAY is noted. This stratum also contains significant cobbles and boulder.

Boreholes were terminated on boulder obstructions in all locations at varying depths. Chiselling techniques were used in all locations in an attempt to advance borehole depths without success.

The stiff brown and grey gravelly CLAY encountered on this site is a GLACIAL TILL or BOULDER CLAY with the high percentage of coarse material typical of the stratum.

The increasing strength with depth pattern particularly in the base grey boulder clay is also noted. The final refusal depths are **NOT** indicative of rock horizon.

The borehole findings are summarised in the following **TABLE A**:

TABLE A

Ref	Sandy Clay	Stiff brown BC	Stiff grey BC	Refusal Depth
BH01	0.30 – 1.20	1.20 – 3.00		3.00
BH02	0.30 – 0.70	0.70 – 2.50	2.50 – 4.50	4.50
BH03	0.30 – 1.50	1.50 – 3.70		3.70
BH04	0.30 – 1.20			1.20
BH04A	0.30 – 0.50	0.50 – 2.50	2.50 – 4.50	4.50
BH05	0.30 – 1.50	1.50 – 2.00	2.00 – 4.50	4.50
BH06	0.30 – 0.50	0.50 – 1.00		1.00
BH06A	0.30 – 0.50	0.50 – 1.00		1.00
BH07	0.20 – 0.50	0.50 – 1.00		1.00
BH08	0.30 – 1.00	1.00 – 1.80	1.80 – 3.40	3.40

Ground water ingress was note in two locations, at 3.00 metre BGL in BH01 and at 4.50 metres BGL in BH05. The remaining boreholes were DRY.

Rotary Core Drilling

Rotary core drilling was employed at three of the borehole locations to advance investigation depth, establish bedrock horizon and recover representative rock core if practical.

A BT-44 drilling rig was used to drill in each location using triple tube core drilling technique and an air-mist coolant. Symmetrix open hole drilling (100mm diameter) was used through the overburden deposits.

Detailed drilling records are presented in Appendix II with accompanying core photographs. The records note Total and Solid Core Recovery (TCR / SCR) and provide a detailed geological description of the rock.

Drilling continued in each location to depths between 10.50 and 15.00 metres, penetrating very stiff to hard GLACIAL TILL consisting of brown or grey gravelly CLAY with extensive boulder presence.

Some core was recovered in the hard base till. The enclosed core photographs clearly indicate the significant boulder presence.

The strength of the boulder clay was established by standard penetration tests taken at 1.50 metre intervals during the drilling operation. Results are noted in the right hand column of the records. SPT values typically exceed N=40 with numerous test refusals recorded.

A slotted PVC standpipe was installed in RC02 to facilitate on-going monitoring of ground water level. The installation was sealed at surface and protected by a steel cover.

The rotary core findings are summarised in the following table.

TABLE B

Hole No.	Overburden	Core Recovered	Standpipe
RC02	0 – 10.50		0 – 10.50
RC03	0 – 10.50	8.10 – 10.50	
RC06	0 – 15.00	13.5 – 15.00	