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Technical Note

Project: Development of Proposed New Sports Hub, Clonmel, Co. Tipperary.

Technical Note: Engineering Services Design Note

FAO: Tipperary Planning Authority

Project Ref:	191020	Doc Ref:	191020/TN01/01	Date:	30/11/2021

1.0 INTRODUCTION

1.1 Background

1.1.1 This technical note contains information on the design of the proposed alterations and modifications to the storm water management system as previously approved through the Part 8 planning application for the proposed New Sports Hub, at LIT Campus, Frank Drohan Road, Clonmel.

1.2 Site

1.2.1 The site is located within the existing LIT Clonmel Campus, Cashel Rd, Clonmel, Co. Tipperary. The overall site area is approximately 68,300m² (6.83 hectares).

1.2.2 The site is bounded to the south by N24, to the East and West by existing residential developments and to the North by agricultural lands.

1.2.3 The site is served by existing connections to the local storm, foul and watermain systems which run through the site and along the adjacent road, N24.

1.2.4 The existing site levels fall from the North to South. Generally, the falls remain constant throughout, falling from 37.5m to 26.5m above ordnance datum.

1.2.5 The existing car park to the front (south) of the site is adequately drained through an existing system and it is proposed to be maintained as the existing road gullies discharge to an existing surface water systems located within the site.

2.0 STORM WATER MANAGEMENT SYSTEM

2.1 Storm Drainage System – Soakaway

2.1.1 It had been previously proposed to provide a storm water management system on site based largely on direct infiltration to the ground via infiltration devices (soakaways), for the roofs, running track, roads and car parking areas of the site at source.

2.1.2 Following site infiltration testing (BRE 365), completed by IGSL as included within Appendix A, Infiltration rates to the Northern portion of the site were found to be poor with infiltration rates found to be $0.0x10^{-6}$ m/sec (or 0.0000m/min) and $2.2x10^{-6}$ m/sec (or 0.00013m/min) respectively.

2.1.3 In contrast, infiltration rates to the Southern portion of the site were found to be suited for large scale infiltration systems with infiltration rates, of $6.3x10^{5}$ m/sec (or 0.00378m/min) and $4.7x10^{-5}$ m/sec (or 0.00286m/min) recorded.

2.1.4 Due to these aforementioned rates, the storm water generated from the hardstanding areas from the Northern portion of the site are to be conveyed to an amalgamated centralised soakaway which is to be provided to the Southern end of the site as set out within the enclosed drawings as opposed to the previously proposed localised soakaways dispersed throughout the site.

2.1.5 A formal piped gravity system from the new roof areas is to be provided. All storm water generated from roof and hard standing areas is to be directed to geo-cellular surface water soakaway as indicated on the layout drawings. All soakaway systems are to be designed in accordance with BRE Digest 365 based on the completed onsite infiltration testing.

2.2 Storm Drainage System – Attenuation Tank

2.2.1 Due to the extent of hardstanding associated with the IAAF running track, hardstanding and access routes, layout of the existing and proposed site, and the established infiltration rates to the North of the site hamper the incorporation of further large scale infiltration systems due to site spatial constraints.

2.2.2 Based on the preceding, it is proposed to supplement the previously proposed storm water management system with an attenuation system and Hydrobrake to restrict outflow to the Greenfield Run off rate prior to discharge to the existing storm system.

2.2.3 The attenuation system is proposed to attenuate stormwater generated from the IAAF Running Track and the associated hardstanding area only, with the stormwater management system for the remainder of the site utilising infiltration systems as previously proposed and set out above.

Greenfield Run-Off (Qbar)

2.2.4 In order to comply with the requirements of Tipperary County Council, the maximum level of outfall from the attenuation system will be restricted to replicate the existing green field runoff rate from the site.

2.2.5 Water exiting the system is controlled by means of a flow-control Hydrobrake with the maximum outflow determined by the allowable discharge from the site. The Hydrobrake will be located in the downstream manhole of the attenuation system.

2.2.6 The level of outfall from the attenuation system has been calculated in accordance with the Institute of Hydrology Report 124: Flood Estimation for Small Catchments as follows:

$$Q_{bar} = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$$

Where

Q_{bar} = mean annual peak flood (m^3/s)

Area = area of catchment (km^2)

SAAR = Standard Annual Average Rainfall (mm)

Soil = Soil index based on Winter Rain Acceptance Potential (WRAP)

2.2.7 From information provided by MET Eireann, SAAR for Tipperary has been taken to be 900mm and the Soil index for the site has been taken to be Soil Class 2. From the Flood Studies Report the value for Soil Class 2 is taken as 0.30.

2.2.8 The design value of $Q_{bar,}$ for the site based on the above is 14.4 l/s (i.e. 2.4 l/s/hectare). This is based on the site area of 5.9 ha which represents the northern portion of the site containing the IAAF Running track, and buildings which has been previously undeveloped. Please refer to Appendix B for calculations.

Attenuation Systems

2.2.9 As set out above, onsite storm water storage is required as part of the proposed new storm water management system for the 100-year storm event.

2.2.10 For the 100-year storm event 334m^3 of attenuation storage is required as shown in Appendix C. The storage is proposed to be provided in the form of a 15.5mx25mx0.9m deep Geocellular attenuation tank with a 95% voids ratio or equivalent. Additionally it is proposed to provide a permeable geotextile membrane to the attenuation system to promote infiltration to ground also.

3.0 SUMMARY & CONCLUSION

3.1 Summary

3.1.1 This Technical note which has been prepared by MPA Consulting Engineers and it contains information on the revised storm water management system to be constructed for the proposed New Sports Hub, at LIT Campus, Frank Drohan Road, Clonmel.

3.1.2 The storm water management system has been designed to best practice principles for SuDS and the requirements of the Greater Dublin Strategic Drainage Study (GDSDS).

3.1.3 The storm water management system proposed for the development consists of:

1) Centralised Infiltration system (Soakaway) to be provided to the Southern portion of the site as opposed to the previously proposed localised soakaways distributed throughout the site serving the proposed buildings and circulation routes.

2) An attenuation system, which will discharge through a flow control device to existing storm water system on site serving the IAAF Running tack and associated Hardstanding.

3.1.4 The design value of Qbar for the site is 14.4l/s (i.e. 2.4 l/s/hectare), this is based on the site area of 5.9ha which represents the norther portion of the site only which has been previously undeveloped and has been calculated in accordance with the Institute of Hydrology Report 124: Flood Estimation for Small Catchments.

3.1.5 Based on the above the attenuation volume required for the 100year return period is 334m^3.

3.2 Conclusions

3.2.1 In conclusion the proposed storm water management system has been shown to have sufficient capacity and a connection to the existing on site system with outflow restricted to the Greenfield run off rate, thus ensuring adequate drainage for the proposed development.

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APPENDIX A

BRE 365 Infiltration Testing

SPORTS HUB
DEVELOPMENT
L.I.T. CLONMEL

MPA
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.

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 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).

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
AT
PROPOSED SPORTS HUB
CLONMEL

FOR

L.I.T.

MPA
CONSULTING ENGINEERS

Report No. 21950 **September 2019**

I Introduction

A new sports hub development is proposed for L.I.T. on a site located at Clonmel, County Tipperary.

An investigation of sub soil conditions in the area of the new development has been carried out by IGSL under the direction of MPA Consulting Engineers, on behalf of the Limerick Institute of Technology.

The scope of works scheduled and completed is detailed below:

*	Cable Percussion Boreholes	3 nr.
•	Trial Pits	7 nr.
•	Dynamic Cone Penetrometer	7 nr.
•	BRE 365 Percolation Tests	4 nr.
•	Geotechnical Laboratory Tests	IGSL
•	Sulphate and pH Tests	CHEMTEST
•	RILTA Environmental Tests	CHEMTEST

The investigation has been carried out in accordance with the various standards outlined in the foreword to this document. Field operations were completed in July – August 2019.

This report includes all factual data from field operations and laboratories including detailed geotechnical logs, laboratory data and supporting photographs. Interpretation of all data and recommendations for foundation construction is also included in this report.

II Fieldwork

The site and the exploratory locations are noted on the drawings and Google Maps enclosed in Appendix VI.

The site is located north of the existing Clonmel LIT. The area was green-field and accessible to the investigation equipment. All locations were referenced to National Grid and OD levels were 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, recovered samples as required and prepared detailed records.

Each location was scanned electronically (CAT) to ensure that existing services were not damaged. Hand excavation was also carried out to a depth of 1.00 metres at borehole locations to ensure that underground services were not damaged.

Boreholes

The exploratory holes were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig. Holes are referenced BH01 to BH03. One re-bore was taken at BH01 when shallow obstruction prevented advancement past 2.70 metres.

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 high stone/cobble content of the strata encountered.

A high degree of consistency was confirmed in the boreholes. Topsoil overlies some soft to firm brown sandy CLAY / SILT which extends to about 0.50 metres BGL. Firm slightly mottled grey brown gravelly CLAY / SILT continues from about 0.50 to an average depth of 2.60 metres.

Stiff to very stiff light brown gravelly CLAY/SILT forms the base stratum with boreholes terminated generally 5.50 metres BGL (other than at BH01 which encountered a boulder obstruction at 2.80 metres BGL.

No ground water ingress was recorded during the course of the investigation. Long term ground water monitoring was not required.

The sub soils encountered represent glacial till deposition, locally referred to as Boulder Clay.

Trial Pits

Trial pits were scheduled at seven locations and opened using an 8 tonne tracked excavator under geotechnical engineering supervision. As-constructed co-ordinates are noted on the trial pit records.

Each location was electronically scanned to ensure that underground services were not damaged.

The IGSL geotechnical engineer recorded and logged the findings, directed soil sampling and noted ground water and stability. Photographs were taken at each trial pit.

Detailed trial pit logs and photographs are enclosed in Appendix II. Samples were recovered at intervals in all strata for detailed geotechnical laboratory analysis.

The trial pits confirm the borehole findings with very stiff to hard boulder clay noted at depths between 2.00 and 2.90 metres. The soils overlying this base stratum consist of generally firm mottled grey brown gravelly SILT / CLAY. Bands of GRAVEL were noted within the gravelly clay in Trial Pits TP04, TP05 and TP07.

As in the case of the boreholes there was no ground water observed during the course of trial pit excavation.

All excavations were backfilled with compacted excavated material and each location was carefully reinstated.

Dynamic Cone Penetrometer

In situ CBR values were established at each of the seven trial pit locations using The Dynamic Cone Penetrometer. Test data is presented in Appendix III and results are summarised as follows:

Test No.	Depth of Test	CBR value
CBR 1	0.50	19.1
CBR 2	0.50	5.8
CBR 3	0.60	4.8
CBR 4	0.50	5.3
CBR 5	0.50	5.1
CBR 6	0.60	8.2
CBR 7	0.50	6.8

BRE Digest 365

Infiltration testing was performed at four location (SA01 to SA04) in accordance with BRE Digest 365 'Soakaway Design'. The test pits were excavated and logged. The soils consisted of gravelly SILT / CLAY at two locations and sandy GRAVEL at two locations

To obtain a measure of the infiltration rate of the sub-soils, water is poured into the test pit, and records taken of the fall in water level against time. The test is carried out over two cycles following initial soakage.

The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second. In these calculations the exposed area is the sum of the base area and the average internal area of the permeable stratum over the test duration. Designs are based on the slowest infiltration rate, which has been calculated from the final cycle.

In the tests carried out in CLAY matrix material the water level dropped slowly over the test period. Where GRAVEL is present significant percolation was observed.

The design calculations are presented in Appendix IV, with the infiltration rates as follows:

SA 01	**Infiltration Rate (f)**	**0.0000 m/min**	**(Failure)**
SA 02	**Infiltration Rate (f)**	**0.00013 m/min**	**(Low)**
SA03	**Infiltration Rate (f)**	**0.00378 m/ min**	**(High)**
SA 04	**Infiltration Rate (f)**	**0.00286 m/ min**	**(High)**

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 SPT findings are summarised in the following Table with results at each 1.00 metre increment of penetration shown.

Stratum / Depth	N Value Range	Comment
Upper Mottled Silt / Clay		
1.00 metres BGL	11 to 14	Firm
Brown gravelly CLAY		
2.00 metres BGL	17 to 27	Stiff
3.00 metres BGL	41 to 52	Very Stiff to Hard
4.00 metres BGL	45 to 50	Very Stiff to Hard
5.00 metres BGL	+ 50	Hard

Refusal of SPT apparatus after limited penetration was recorded on some boulders and at the base of the respective boreholes.

(b) Laboratory :

A programme of laboratory testing was scheduled following completion of site operations.

Geotechnical soil testing was carried out by IGSL in its INAB-Accredited laboratory.

Chemical and environmental testing was carried out in the UK by CHEMTEST Ltd.

The overall test programme included the following elements:

*	Moisture Content	IGSL
•	Liquid and Plastic Limits	IGSL
•	PSD Grading by wet sieve	IGSL
•	PSD Grading by Hydrometer	IGSL
•	Compaction	IGSL
•	CBR at Natural MC	IGSL
•	MCV at Natural MC	IGSL
•	CBR with added Lime and Cement	IGSL
•	MCV with added Lime and Cement	IGSL
•	Sulphate, Chloride and pH	CHEMTEST
•	RILTA Suite	CHEMTEST

All laboratory data is presented in Appendices Va and Vb.

IV Discussion

The investigation has confirmed the presence of glacial till or boulder clay on this site extending to a depth of about 5.50 metres. Borehole refusal at this depth may be indicative of bedrock, however proof core drilling would be required to confirm this.

Below surface topsoil gravelly CLAY of firm consistency is encountered, this stratum becomes stiff below about 2.00 metres and very stiff to hard boulder clay is noted below about 2.50 metres. Some gravel bands were noted in the trial pits, these would be typical of the glacial till deposition of the region.

Foundations

The SPT data from the boreholes and the geotechnical assessment of the trial pits has formed the basis for foundation recommendations.

The use of conventional reinforced strip or pad foundations is recommended with allowable bearing pressures at varying depths below ground as follows:

Depth	Stratum	N Value	Allowable Bearing Pressure (KPa)
1.00	Firm Gravelly CLAY	12	125
2.00	Stiff gravelly CLAY	20	200
3.00	Very Stiff gravelly CLAY	40	350

Very careful visual inspection of excavated formation is advised to ensure uniformity and suitability of the founding medium. All soft or suspect material should be removed and replaced with low-grade concrete.

The glacial soils will be sensitive to moisture content variation and should be protected from weather by blinding.

No difficulties are envisaged in stability of foundation excavations and ground water ingress is not expected.

Low sulphate concentrations and near neutral pH values confirm that no special precautions are necessary to protect foundation concrete.

Earthworks

The new development is to include construction of new playing pitches and extensive cut and fill operations are envisaged.

A detailed laboratory testing programme has therefore been undertaken to provide data relating to future earthworks.

An initial programme of testing was carried out to establish soil classification / CBR / MCV / Compaction.

These initial tests were carried out at Natural Moisture Content and results indicate that the soils as presently constituted should be suitable for re-use in sports field construction.

The initial results are summarised in Table 1 below:

Table 1

Summary Test Data for Brown Glacial Till (brown sandy gravelly CLAY/SILT)

Natural Moisture Content %	8.5 to 22	Average	15%
CBR (Field Tests) %	4.8 to 19.1	Average	7.8%
CBR (Laboratory) %	1.4 to 33	Average	16.5%
MCV	5.9 to 17	Average	13
Max. Dry Density (mg/cu.m.)	1.82 to 1.96		
Optimum Moisture Content %	9 to 14		

In order to provide information relating to possible soil stabilisation or soil improvement a programme of additional testing was scheduled. This included CBR and MCV testing with 1% and 2% Lime and 1% Cement added. Tests were carried out at 3, 7, 14 and 28 day intervals.

Bulk samples were taken from TP02, TP04, TP05 and TP07 for these additional tests. Detailed test data for each of these samples is enclosed in the appropriate appendices and is summarised in the following tables.

Table 2

TP02 SAMPLE 108310 DEPTH 0.50	
Natural Moisture Content %	13
Liquid Limit %	36
Plastic Limit %	N/P
Maximum Dry Density Mg/Cu.m.	1.85
Optimum Moisture Content %	9
CBR Unsoaked	
Top % / MC %	26
Base %/ MC %	22
MCV at Natural MC	16.4
CBR 1% Lime 28 day soaked	22
CBR 2% Lime 14 day soaked	36
CBR 2% Lime 28 day soaked	40
CBR 1% Lime 1% Cement 28 day soaked	32

Table 3

TP04 SAMPLE 108301 DEPTH 0.90	
Natural Moisture Content %	14
Liquid Limit %	30
Plastic Limit %	NP
Maximum Dry Density Mg/Cu.m.	1.82
Optimum Moisture Content %	14
CBR Unsoaked	
Top % / MC %	34
Base % / MC %	33
MCV at Natural MC	17
CBR 1% Lime 1% Cement 3 day soaked	27
CBR 1% Lime 1% Cement 7 day soaked	28
CBR 1% Lime 1% Cement 14 day soaked	38
CBR 1% Lime 1% Cement 28 day soaked	48

Table 4

TP05 SAMPLE 103343	DEPTH 1.00
Natural Moisture Content %	13
Liquid Limit %	31
Plastic Limit %	NP
Plasticity Index	-
Maximum Dry Density Mg/sq.m.	1.82
Optimum Moisture Content %	13
CBR Unsoaked	
Top / MC %	17
Base / MC %	27
MCV at Natural MC	13.4
CBR 1% Lime 7 day soaked	20
CBR 1% Lime 14 day soaked	22
CBR 1% Lime 28 day soaked	28
CBR 2% Lime 14 day soaked	22
CBR 2% Lime 28 day soaked	30
CBR 1% Lime 1% Cement 14 day soaked	26
CBR 1% Lime 1% Cement 28 day soaked	32

Table 5

TP07 SAMPLE 103323	DEPTH 0.60
Natural Moisture Content %	19
Liquid Limit %	39
Plastic Limit %	18
Plasticity Index	21
Maximum Dry Density Mg/sq.m.	1.82
Optimum Moisture Content %	14
CBR Unsoaked	
Top / MC %	2.6
Base / MC %	2.4
MCV at Natural MC	8.6
MCV 1% Lime	8.4
MCV 2% Lime	9
MCV 1% Lime – 1% Cement	11.4
CBR 1% Lime 3 day soaked	2.6
CBR 1% Lime 7 day soaked	24
CBR 1% Lime 14 day soaked	38
CBR 1% Lime 28 day soaked	42
CBR 2% Lime 7 day soaked	30
CBR 2% Lime 14 day soaked	36
CBR 2% Lime 28 day soaked	48
CBR 1% Lime 1% Cement 3 day soaked	15
CBR 1% Lime 1% Cement7 day soaked	23
CBR 1% Lime 1% Cement 14 day soaked	33
CBR 1% Lime 1% Cement 28 day soaked	40

The results confirm an improvement in CBR / MCV values with the addition of Lime or Lime /Cement at appropriate concentrations.

The detailed data should be assessed by the appointed civil contractor / soil stabilisation specialist, to determine the most suitable solution from both an engineering and economic viewpoint.

Sulphate and pH.

Four soil samples were selected for sulphate and pH analysis. Sulphate concentrations (SO4 2:1 extract) of < 0.010 g/l were established with pH values from 7.8 to 8.5 . 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.

Chloride

Water Soluble Chloride values were established for three samples, all results were less than 0.010 g/l. No issues arise relative to concrete protection.

RILTA Environmental

Three soil sample were submitted for detailed environmental analysis to RILTA (WAC) parameters. The results confirm that the material can be classified as INERT with no elevated contaminant levels recorded. Results indicate that material excavated from this site can be readily disposed of either on-site or to a licensed landfill facility.

No asbestos traces were found during routine screening.

IGSL/JC
SEPTEMBER 2019

Appendix IV BRE Digest 365

Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA01 (1st cycle)
Engineer MPA Consulting Engineers
Date: 24.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm light brown TOPSOIL with rootlets	No water
0.20	1.40	Firm to stiff brown/light brown sandy SILT with occasional gravel	
1.40	2.30	Firm to stiff brown sandy very gravelly cobbly SILT with rare subrounded to	
		rounded boulders up to 260mm	

Field Data

Depth to Water (m)	Elapsed Time (min)
1.970	0.00
1.970	1.00
1.970	2.00
1.970	3.00
1.970	4.00
1.970	5.00
1.970	6.00
1.970	7.00
1.970	8.00
1.970	9.00
1.970	10.00
1.970	12.00
1.970	14.00
1.980	16.00
1.980	18.00
1.980	20.00
1.980	25.00
1.980	30.00
1.980	45.00
1.980	60.00

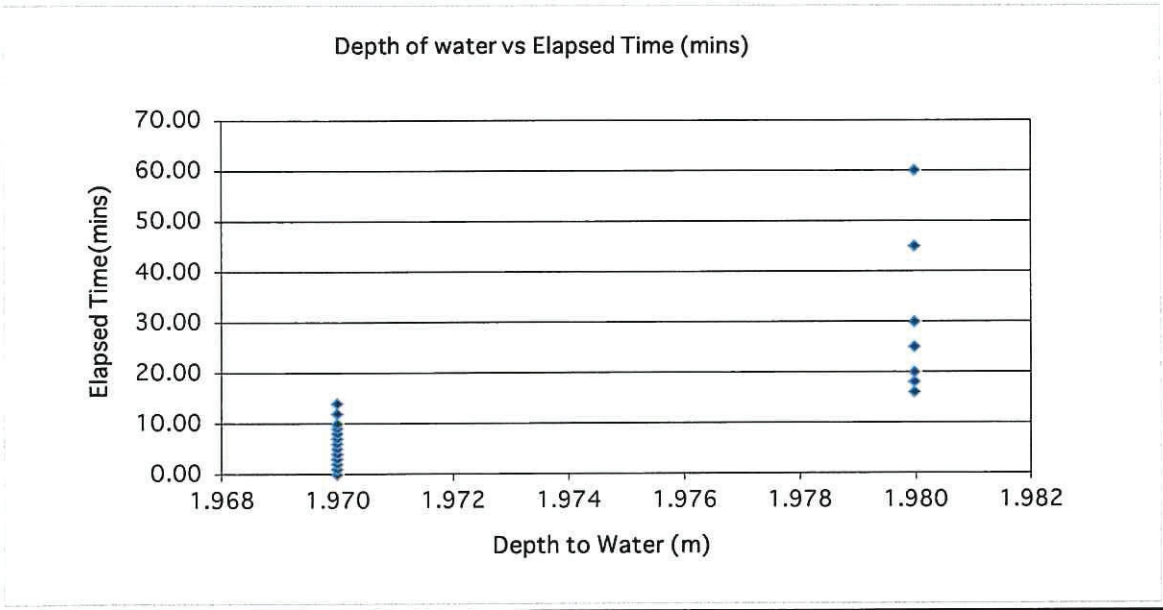
Field Test

Depth of Pit (D)	2.30	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.60	m
Initial depth to Water =	1.97	m
Final depth to water =	1.980	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test period	1.43	m2
Total Exposed area =	2.39	m2

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

f= 0 m/min or 0 m/sec

No fall in water after 16 minutes - test failed



Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA02 (1st cycle)
Engineer MPA Consulting Engineers
Date: 24.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm to stiff brown/light brown sandy SILT with occasional gravel	No water
1.00	1.70	Firm to stiff brown sandy gravelly slightly cobbly SILT	
1.70	2.15	Light brown very sandy GRAVEL, locally a very gravelly sand	
2.15	2.50	Brown sandy very gravelly SILT with occasional cobbles and rare boulders	

Field Data

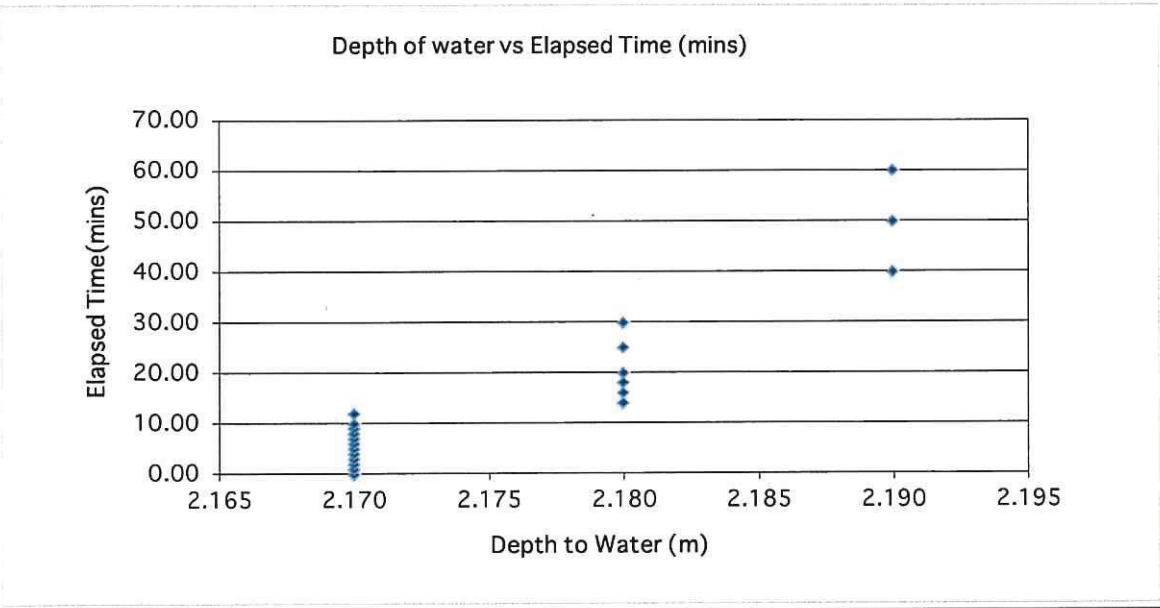
Depth to Water (m)	Elapsed Time (min)
2.170	0.00
2.170	1.00
2.170	2.00
2.170	3.00
2.170	4.00
2.170	5.00
2.170	6.00
2.170	7.00
2.170	8.00
2.170	9.00
2.170	10.00
2.170	12.00
2.180	14.00
2.180	16.00
2.180	18.00
2.180	20.00
2.180	25.00
2.180	30.00
2.190	40.00
2.190	50.00
2.190	60.00

Field Test

Depth of Pit (D)	2.50	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.50	m
Initial depth to Water =	2.17	m
Final depth to water =	2.190	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.9	m2
*Av. side area of permeable stratum over test period	1.344	m2
Total Exposed area =	2.244	m2

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

f= 0.00013 m/min or 2.22816E-06 m/sec



Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA03 (1st cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Firm light brown TOPSOIL with rootlets	No water
0.30	1.50	Firm to stiff brown sandy SILT with occasional gravel and rare cobbles	
1.50	2.40	Medium dense brown very silty sandy GRAVEL with rare cobbles up to 160mm	
		locally a sandy very gravelly SILT	

Field Data

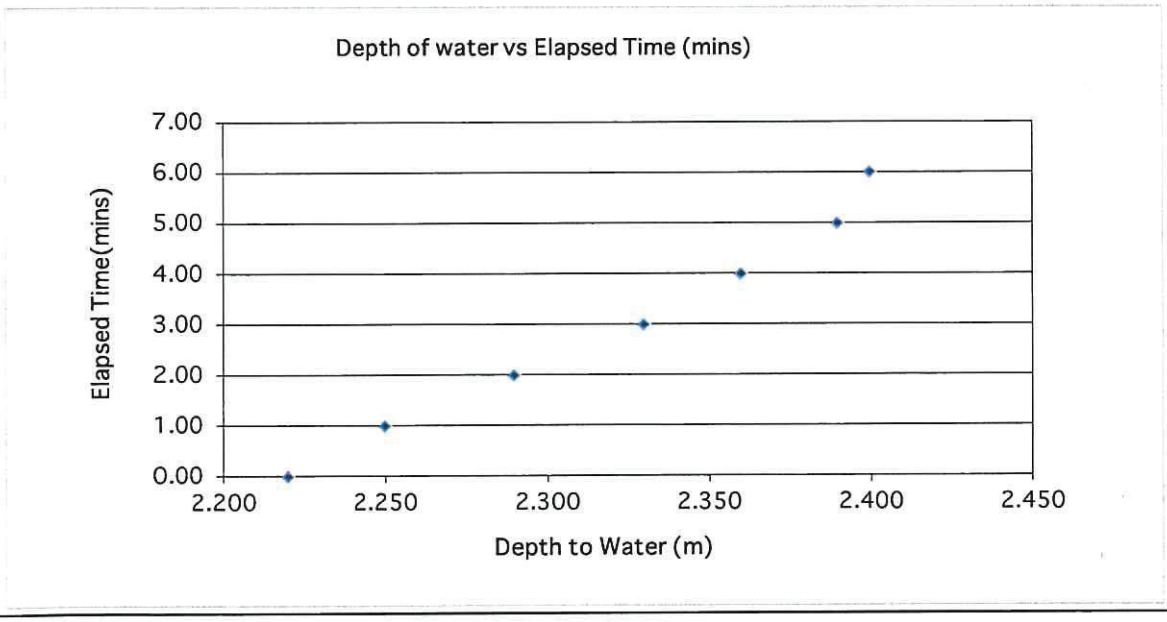
Depth to Water (m)	Elapsed Time (min)
2.220	0.00
2.250	1.00
2.290	2.00
2.330	3.00
2.360	4.00
2.390	5.00
2.400	6.00

Field Test

Depth of Pit (D)	2.40	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.30	m
Initial depth to Water =	2.22	m
Final depth to water =	2.400	m
Elapsed time (mins)=	6.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.78	m2
*Av. side area of permeable stratum over test period	0.342	m2
Total Exposed area =	1.122	m2

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

f= 0.02086 m/min or 0.000347594 m/sec



Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA03 (2nd cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Firm light brown TOPSOIL with rootlets	No water
0.30	1.50	Firm to stiff brown sandy SILT with occasional gravel and rare cobbles	
1.50	2.40	Medium dense brown very silty sandy GRAVEL with rare cobbles up to 160mr	
		locally a sandy very gravelly SILT	

Field Data

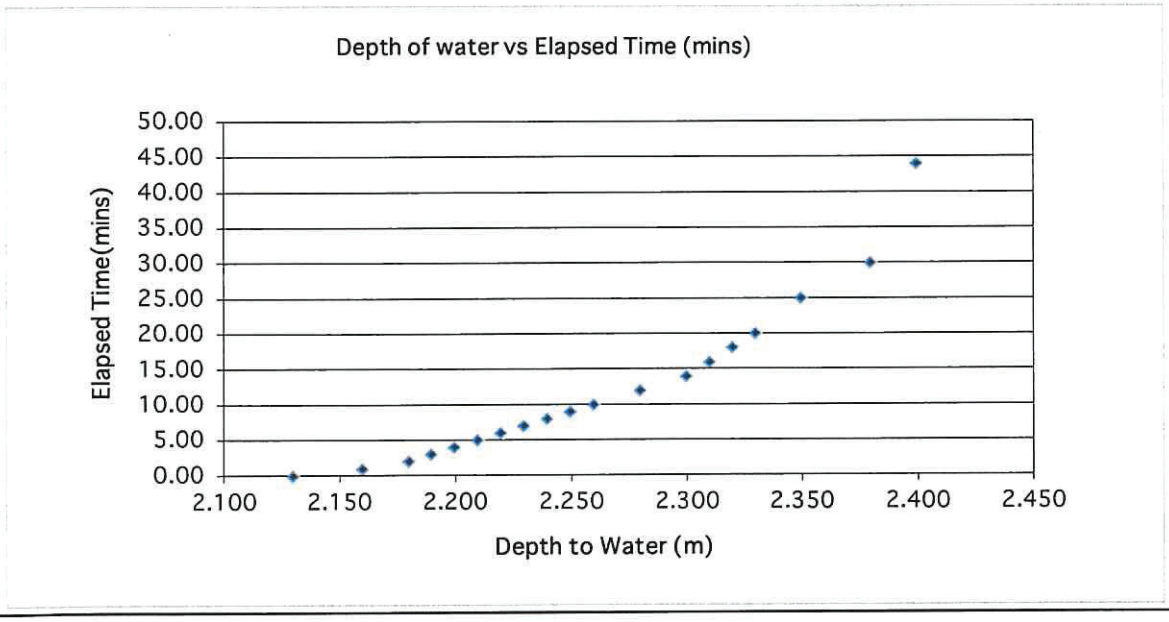
Depth to Water (m)	Elapsed Time (min)
2.130	0.00
2.160	1.00
2.180	2.00
2.190	3.00
2.200	4.00
2.210	5.00
2.220	6.00
2.230	7.00
2.240	8.00
2.250	9.00
2.260	10.00
2.280	12.00
2.300	14.00
2.310	16.00
2.320	18.00
2.330	20.00
2.350	25.00
2.380	30.00
2.400	44.00

Field Test

Depth of Pit (D)	2.40	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.30	m
Initial depth to Water =	2.13	m
Final depth to water =	2.400	m
Elapsed time (mins)=	44.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.78	m2
*Av. side area of permeable stratum over test period	0.513	m2
Total Exposed area =	1.293	m2

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

f= 0.0037 m/min or 6.16958E-05 m/sec



Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA03 (3rd cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Firm light brown TOPSOIL with rootlets	No water
0.30	1.50	Firm to stiff brown sandy SILT with occasional gravel and rare cobbles	
1.50	2.40	Medium dense brown very silty sandy GRAVEL with rare cobbles up to 160mm	
		locally a sandy very gravelly SILT	

Field Data

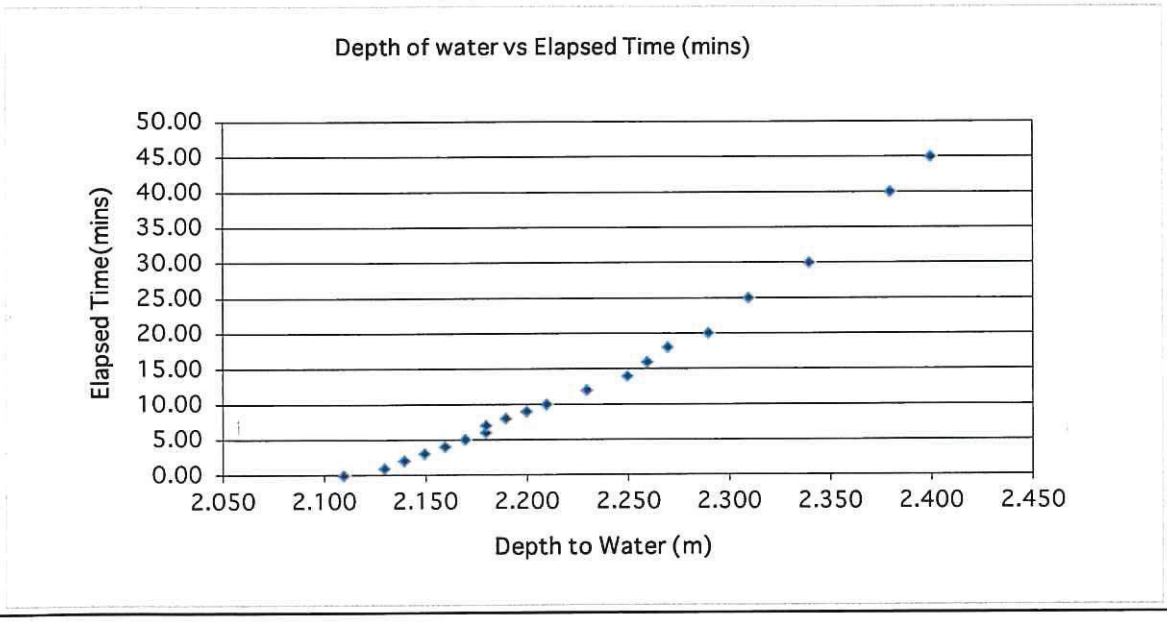
Depth to Water (m)	Elapsed Time (min)
2.110	0.00
2.130	1.00
2.140	2.00
2.150	3.00
2.160	4.00
2.170	5.00
2.180	6.00
2.180	7.00
2.190	8.00
2.200	9.00
2.210	10.00
2.230	12.00
2.250	14.00
2.260	16.00
2.270	18.00
2.290	20.00
2.310	25.00
2.340	30.00
2.380	40.00
2.400	45.00

Field Test

Depth of Pit (D)	2.40	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.30	m
Initial depth to Water =	2.11	m
Final depth to water =	2.400	m
Elapsed time (mins)=	45.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.78	m2
*Av. side area of permeable stratum over test period	0.551	m2
Total Exposed area =	1.331	m2

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

f= 0.00378 m/min or 6.29435E-05 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA04 (1st cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm light brown TOPSOIL with rootlets	No water
0.20	1.35	Stiff brown sandy SILT with rare gravel and cobbles up to 100mm	
1.35	2.50	Medium dense light brown/greyish brown very sandy cobbly GRAVEL with	
		occasional subrounded boulders up to 250mm	

Field Data

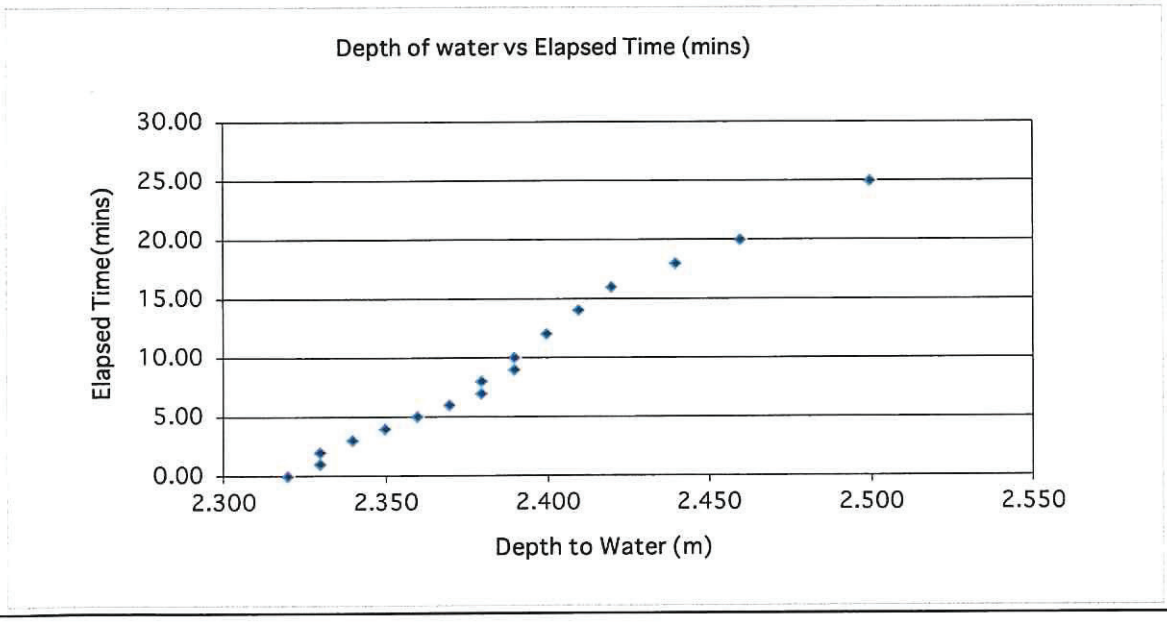
Depth to Water (m)	Elapsed Time (min)
2.320	0.00
2.330	1.00
2.330	2.00
2.340	3.00
2.350	4.00
2.360	5.00
2.370	6.00
2.380	7.00
2.380	8.00
2.390	9.00
2.390	10.00
2.400	12.00
2.410	14.00
2.420	16.00
2.440	18.00
2.460	20.00
2.500	25.00

Field Test

Depth of Pit (D)	2.50	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.40	m
Initial depth to Water =	2.32	m
Final depth to water =	2.500	m
Elapsed time (mins)=	25.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.84	m2
*Av. side area of permeable stratum over test period	0.36	m2
Total Exposed area =	1.2	m2

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

f= 0.00504 m/min or 8.4E-05 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA04 (2nd cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm light brown TOPSOIL with rootlets	No water
0.20	1.35	Stiff brown sandy SILT with rare gravel and cobbles up to 100mm	
1.35	2.50	Medium dense light brown/greyish brown very sandy cobbly GRAVEL with	
		occasional subrounded boulders up to 250mm	

Field Data

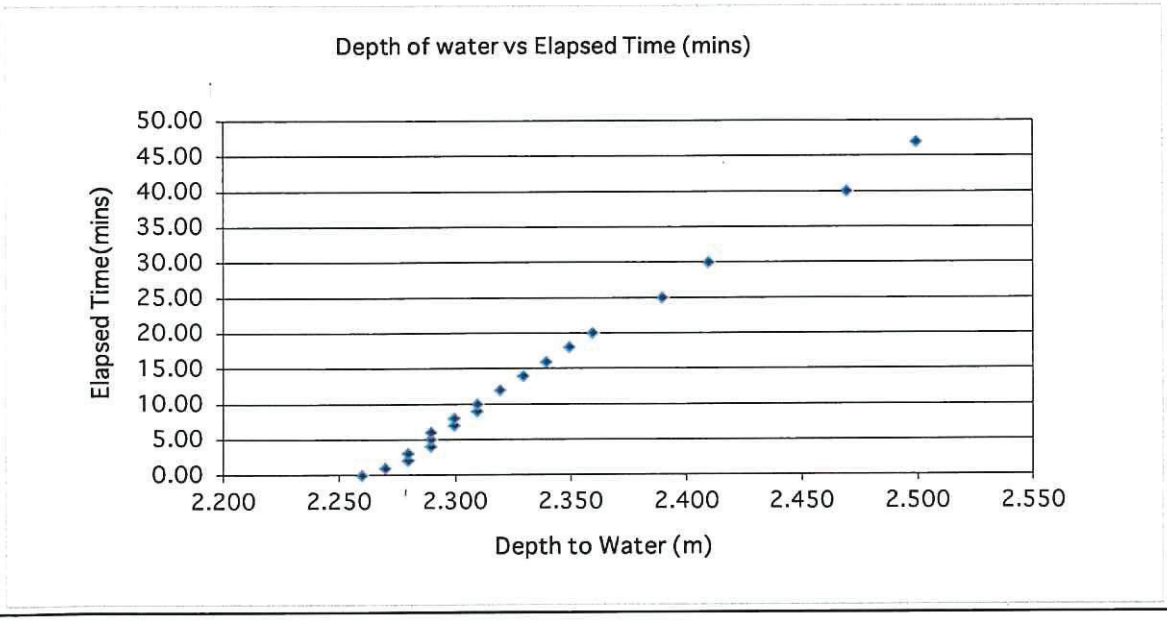
Depth to Water (m)	Elapsed Time (min)
2.260	0.00
2.270	1.00
2.280	2.00
2.280	3.00
2.290	4.00
2.290	5.00
2.290	6.00
2.300	7.00
2.300	8.00
2.310	9.00
2.310	10.00
2.320	12.00
2.330	14.00
2.340	16.00
2.350	18.00
2.360	20.00
2.390	25.00
2.410	30.00
2.470	40.00
2.500	47.00

Field Test

Depth of Pit (D)	2.50	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.40	m
Initial depth to Water =	2.26	m
Final depth to water =	2.500	m
Elapsed time (mins)=	47.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.84	m2
*Av. side area of permeable stratum over test period	0.48	m2
Total Exposed area =	1.32	m2

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

f= 0.00325 m/min or 5.41586E-05 m/sec



Soakaway Design f -value from field tests IGSL

Contract: L.I.T Clonmel (Regional Sports Hub) Contract No. 21950
Test No. SA04 (3rd cycle)
Engineer MPA Consulting Engineers
Date: 23.07.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm light brown TOPSOIL with rootlets	No water
0.20	1.35	Stiff brown sandy SILT with rare gravel and cobbles up to 100mm	
1.35	2.50	Medium dense light brown/greyish brown very sandy cobbly GRAVEL with	
		occasional subrounded boulders up to 250mm	

Field Data

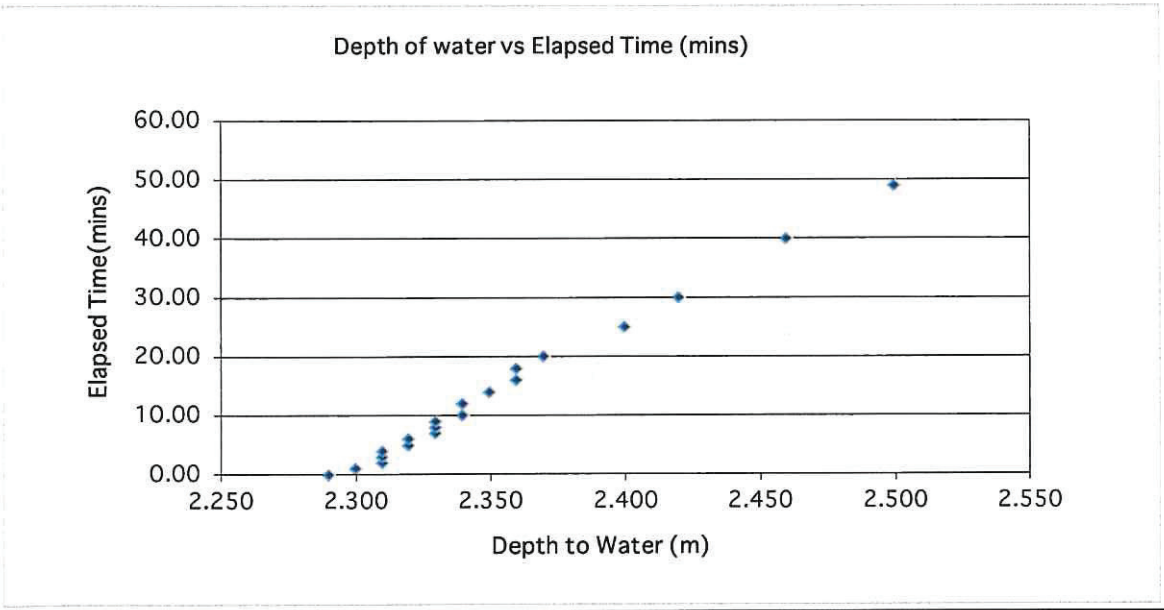
Depth to Water (m)	Elapsed Time (min)
2.290	0.00
2.300	1.00
2.310	2.00
2.310	3.00
2.310	4.00
2.320	5.00
2.320	6.00
2.330	7.00
2.330	8.00
2.330	9.00
2.340	10.00
2.340	12.00
2.350	14.00
2.360	16.00
2.360	18.00
2.370	20.00
2.400	25.00
2.420	30.00
2.460	40.00
2.500	49.00

Field Test

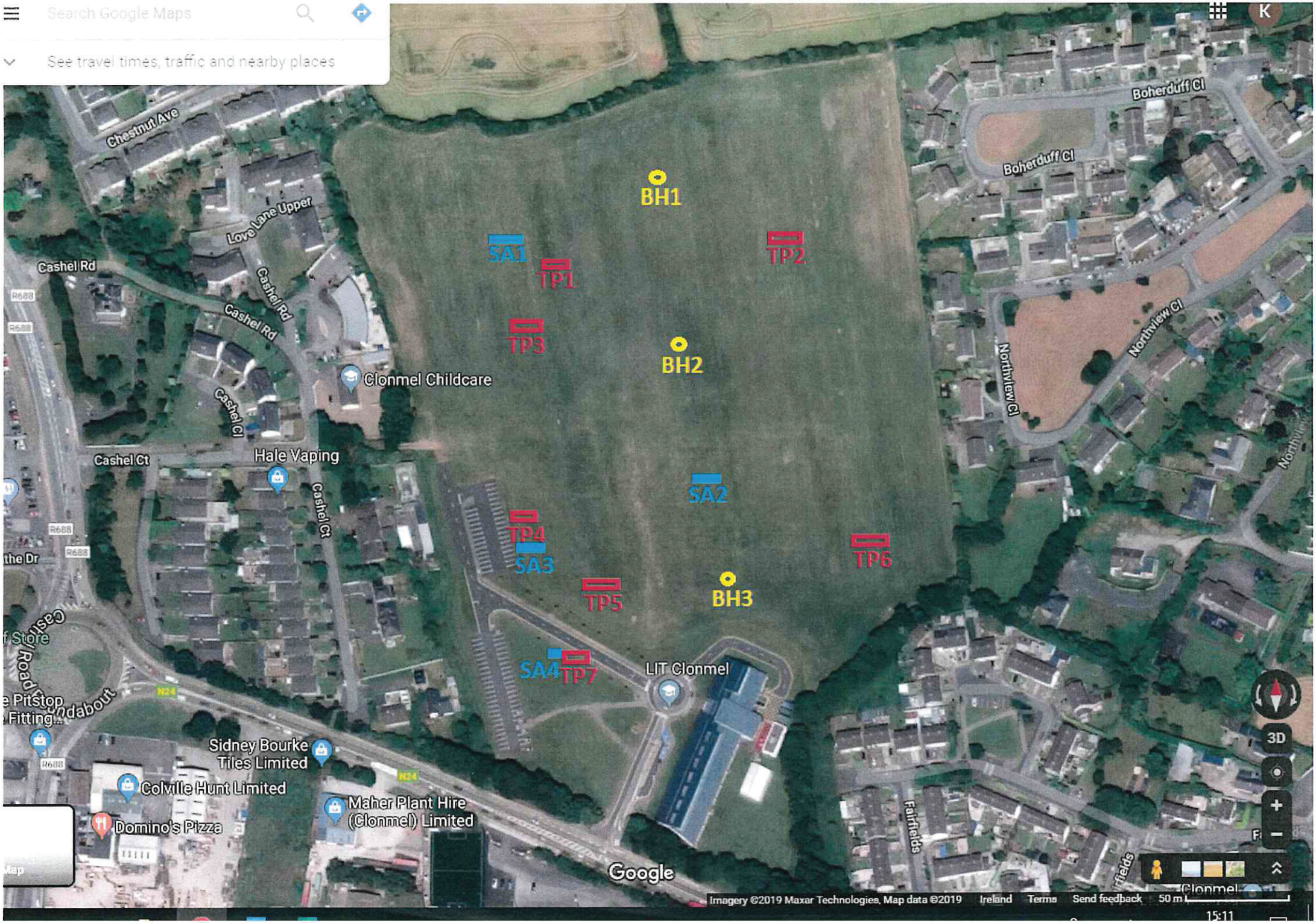
Depth of Pit (D)	2.50	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.40	m
Initial depth to Water =	2.29	m
Final depth to water =	2.500	m
Elapsed time (mins)=	49.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.84	m2
*Av. side area of permeable stratum over test period	0.42	m2
Total Exposed area =	1.26	m2

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

f= 0.00286 m/min or 4.7619E-05 m/sec



Appendix VI Site Plans


Search Google Maps
See travel times, traffic and nearby places
Chestnut Ave
Love Lane Upper
Cashel Rd
Cashel Rd
Cashel Rd
Cashel Cl
Cashel Ct
Cashel Ct
Clonmel Childcare
Hale Vaping
Boherduff Cl
Boherduff Cl
Northview Cl
Northview Cl
BH1
BH2
BH3
SA1
SA2
SA3
SA4
TP1
TP2
TP3
TP4
TP5
TP6
TP7
LIT Clonmel
Sidney Bourke Tiles Limited
Colville Hunt Limited
Maher Plant Hire (Clonmel) Limited
Domino's Pizza
Fairfields
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Imagery ©2019 Maxar Technologies, Map data ©2019
Ireland
Terms
Send feedback
50 m
3D

APPENDIX B

Greenfield Run-Off (Qbar

	Project: LIT, Clonmel Sports Hub	**Calc. Sheet No.** Page 1 of 1	**Martin Peters Associates** **Consulting Engineers** **Ormonde Road** **Kilkenny** **R95 AHX8** **T: + 353 56 77 02761** **E: info@mpa.ie** **W: www.mpa.ie**
	Project No: 191020	**Calculations by** DCH	
		Checked by EJQ	
	Drawing ref. 191020/C/004	**Date** 03/03/2020	

QBAR $_{RURAL}$

Design Data:

Station Name: **Tipperary**

Standard Average Annual Rainfall (SAAR): **900** mm

Catchment Details:

Catchment Data:		
	58,698	**m^2**
	5.8698	**Ha**
	0.058698	**km^2**

Catchment Area: **0.5** **km^2**

Note: 50 hectares to be used for small catchments < 50Ha

Soil Index (G):

Soil Type

Refer to Winter Rain Acceptance Potential Map

Proposed Area Under Soil Type 1,	g_1 =	**0.0**
Proposed Area Under Soil Type 2,	g_2 =	**1.0**
Proposed Area Under Soil Type 3,	g_3 =	**0.0**
Proposed Area Under Soil Type 4,	g_4 =	**0.0**
Proposed Area Under Soil Type 5,	g_5 =	**0.0**
Classified Area (g)		1.0

Soil Index (G) = $\dfrac{0.15g_1 + 0.30g_2 + 0.40g_3 + 0.45g_4 + 0.50g_5}{\text{Classified Area (g)}}$

Soil Index (G) = **0.30**

QBAR rural:

Mean annual flood QBAR from catchment characteristics for small rural catchments (< 25 km2) from the "Flood estimation for small catchments - Report No. 124", published by the Institute of Hydrology

$QBAR_{rural}$ = 0.00108 ($AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$)

Site Specific Data:

$QBAR_{rural}$ **2.4** L/sec/Ha (Based on 50 Ha)

OR

$QBAR_{rural}$ **2.0** L/sec/Ha

whichever is greater, as per GDSDS Table 6.3, Criterion 4.3 where maximum discharge rate of QBAR or 2l/s/ha for all attenuation storage where separate "long term" storage cannot be provided.

Summary:

$QBAR_{rural}$ **2.4** L/sec/Ha

$QBAR_{site}$ **14.4** L/sec

APPENDIX C

Surface Water Storage Design Sheet

Project: LIT, Clonmel Sports Hub	**Calc. Sheet No.** 1 Page 1 of 1	**Martin Peters Associates**
	Calculations by	**Consulting Engineers**
Project No: 191020	DCH	**Ormonde Road**
	Checked by	**Kilkenny**
	EJQ	**R95 AHX8**
Drawing ref. 191020/C/001	**Date** 03/03/2020	**T: + 353 56 77 02761**
		E: info@mpa.ie
		W: www.mpa.ie

ATTENUATION DESIGN -

Design Data:

Station Name: **Tipperary**
Annual Rainfall: 900 mm

Allowable Outflow:

Outflow (O) = **14.4** Litres / sec

Refer to Enclosed Qbar Calculations
Discharge rate is in accordance with GDSDS Criterion 2.1 River Regime Protection

Catchment Details :

Total Area =	**16285**	(m^2) @	
Track =	**7150**	(m^2) @	90%
Road/Hardstanding =	**960**	(m^2) @	80%
Permeable Paving =	**0**	(m^2) @	20%
Infield =	**8175**	(m^2) @	25%

Effective Area of Catchment (A)	**9247**	**m^2**
	0.9247	**ha**

Rainfall Data :

Return Period (Yrs)	**100 year**

Storm Duration (D) (min)	Rainfall (R) (mm)
15	21.0
30	27.0
60	35.0
120	43.0
240	51.0
360	60.0
720	74.0
1440	89.0
2880	105.0

Inflow Volume Equation :

Storm Duration (D) (min)	Rainfall (R) (m^3/ha)	Intensity (mm/hr)	Inflow (I) (m^3)	Outflow (O) (m^3)	Storage Req'd (S) (m^3)
15	231	92.40	214	13	201
30	297	59.40	275	26	249
60	385	38.50	356	52	304
120	473	23.65	437	104	334
240	561	14.03	519	207	311
360	660	11.00	610	311	299
720	814	6.78	753	622	131
1440	979	4.08	905	1244	-339
2880	1155	2.41	1068	2488	-1420

Rainfall (R) inclues a 10% provision for climate change as per GDSDS
GDSDS; Site critical duration storm to be used to assess attenuation storage volume, which satisfies Criterion 2.1 for River Regime Protection

Attenuation Volume Required	**334**	**m^3**