Parks & Landscape Services Section, Municipal Services Department

Proposed Development of a Running Track & Associated Facilities at St. Thomas Estate, Tibradden Road, Rathfarnam, Dublin 16 in Proximity to a Protected Structure (St. Thomas House)
PC/PKS/01/19

Appendix 5 – Engineering Reports

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DUNDRUM SOUTH DUBLIN ATHLETICS CLUB

Proposed Development at St. Thomas's, Tibradden Road

April 2019

ROD
ROUGHAN & O'DONOVAN

Dundrum South Dublin Athletics Club

Proposed Development at St. Thomas's, Tibradden Road

Document No: 14.110.101.10T

Author:..... Eoin Ó Catháin

Checker: ..... Deirdre Neff

Approver:..... Eoin Ó Catháin

Document No	Revision	Description	Made	Checked	Approved	Date
14.110.101.10T	**-**	TIA	EOC	DN	EOC	April 2019
14.110.101.10T	**1**	Client Comments	EOC	EOC	EOC	April 2019

Dundrum South Dublin Athletics Club

Proposed development at St. Thomas's, Tibradden Road

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1. INTRODUCTION

Roughan & O'Donovan has been requested by Dún Laoghaire – Rathdown County Council to review the traffic and transport implications of the proposed relocation of Dundrum South Dublin Athletics Club and other clubs to a consolidated sports facility at a site known as St. Thomas's on Tibradden Road, Dún Laoghaire – Rathdown. This follows an earlier application in 2014 that resulted in a grant of planning permission for a smaller scale development for the Athletics Club only. A pre-planning consultation meeting was held with Mr. Michael Mangan of the Transportation Department on March 20th 2019. The principal issues arising were as per the earlier planning application, and have been addressed in this report.

2. ACCESS

2.1 Visibility at proposed site access

Sightlines at the access are a less acute problem than in the case of the earlier planning application, since a new access is to be provided at a more convenient location west along Tibradden Road. 70m sightlines can be achieved to oncoming traffic in both directions from a 2.4m setback, in line with the requirements of the DMRB. Refer to Drawing 14.112.101.TR01 in the Appendix.

2.2 Coach Access

A 15m coach can manoeuvre into and around the car park. Drop off will be accommodated within the car park. Refer to Drawing 14.112.101.TR02 in the Appendix.

2.3 Pedestrian and Cycle Access

Following discussions with the Transportation Department of Dún Laoghaire Rathdown County Council, it is considered that it would be excessive to provide cycle facilities on Tibradden Road to serve the proposed development. However, it is important to provide high quality, safe pedestrian and cycle access to the proposed sports facilities with provision for possible onward future connection along Tibradden Road. It is proposed to adjust the boundary wall of St. Thomas's Estate to accommodate an elevated pedestrian / cycle route adjacent to the roadway from the existing access to St. Thomas's House to the proposed vehicular access location. The route is elevated so as to allow the retention of existing trees. A new boundary will be provided inside, and vegetation (other than the trees) and walls will be cleared between the existing roadway and the proposed elevated walkway. A transparent safety fence will be installed as required to prevent pedestrians or cyclists falling onto the roadway, which is of the order of 0.5m below the propose separate walkway / cycleway. A pedestrian crossing and dropped kerb for cycle access will be provided at the existing roundabout at the junction of Tibradden Road and Kilmashogue Lane. Refer to Drawing 14.112.101.TR03 in the Appendix.

3. PARKING AND CIRCULATION

3.1 Car Park Layout

Roughan & O'Donovan has worked with the architects to identify an appropriate parking and circulation regime that respects the historic context of the house. The proposal includes a car park between the proposed access and the proposed sports facility building:

- The car park layout has been adjusted to permit a 15m coach to circulate around it without requiring 3 point turn manoeuvres. It is not proposed to provide a dedicated parking space for occasional coaches, as per discussions with DLRCC transportation.
- Drop-off will be accommodated adjacent to the main Sports Facility Building.
- Disabled parking will be accommodated in the main car park.
- Sheltered bicycle parking will be accommodated adjacent to the main Sports Facility Building.

3.2 Quantum of Parking to be Provided

Roughan & O'Donovan raised a concern with the architects about the quantum of parking to be provided. On foot of these concerns, the overall quantum was increased to 143 spaces. This reflects the anticipated maximum cumulative concurrent demand based on information provided from the various sports clubs to be housed at the new facility. The provision of adequate on-site car parking will prevent over-spill parking occurring on the surrounding road network, particularly where the roadway is to be widened for pedestrian / cycle ways and visibility splays. ROD has recommended that for any major events, the on-site car park is closed and parking is provided remotely with coach transfers to the site.

4. MOBILITY MANAGEMENT

Mobility Management is not a particular concern at a sports and athletics club. One would expect many of the patrons to choose to walk, jog or cycle to the facility in any event. The provision of enhanced walking and cycling connections along Tibradden Road will support this. The sports clubs will avail of the new facilities to promote car sharing and walking and cycling modes. Information about car sharing opportunities and sustainable transport options will be posted on the noticeboards. Information on walking and cycling routes, distances and time to/from common destinations will also be posted on the noticeboards.

The club will provide the following facilities that would be provided to encourage use of sustainable transport modes, inter alia:

- Sheltered bicycle parking as indicated on the site plans;
- Showers within the main sports building;
- Changing rooms within the main sports building; and
- tool kit and spare parts for cyclists to use at reception and at bike storage areas.

5. CONCLUSION

Based on the foregoing assessment, Roughan & O'Donovan considers that the proposed development will not give rise to any appreciable adverse impacts on the receiving transportation network and recommends that Dún Laoghaire – Rathdown County Council grants permission for the proposed development.

Appendix:

Drawings

St. Thomas's
Running Track & Associated Facilities

Engineering Report – For Planning

Made: ..... Barbara Padel (BP)

Checked:..... John Paul Rooney (JPR)

Approved:..... Eoin OCatháin (EOC)

Revision	Description	Made	Checked	Approved	Date
0.1	PLANNING	BP	JPR	EOC	11/04/2018

St. Thomas's
Running Track & Associated Facilities

Engineering Report – For Planning

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

This report has been prepared by Roughan & O'Donovan to supplement a planning application for a proposed athletic development with a running track and associated facilities as well as access roads and car parking at St. Thomas Estate, Whitechurch, Dublin 16. This engineering report sets out the basis for the planning submission in terms of surface and foul drainage and water supply.

1.2 Consultation with Local Authority

This Engineering report was created as part of the planning package following consultations with Dún Laoghaire Rathdown County Council (DLRCC), O'Brien Finucane ARCHITECTS (OBFA), and Dundrum South Dublin Athletics Club on 20th April 2019.

2. PROPOSED DEVELOPMENT

The proposed development will consist of a 400m running track with a hammer and discus throwing area, a multi-use sports building, an archery field and a car park with approximately 150 spaces.

3. SITE INFORMATION

3.1 Site Location

The proposed development is located adjacent to St. Thomas's House, Tibradden Road, Co. Dublin, just south of the M50 motorway. The site is bounded by Tibradden Road to the north, Kilmashogue Lane to the east, Ballinascorney Golf Club to the south, and agricultural lands to the west.

The site is situated within the catchment of the Whitechurch Stream which flows in a south- north direction at the south-eastern boundary of the site.

3.2 Planning History

In June 2015, planning permission was granted by Dun Laoghaire Rathdown County Council under planning reference D15A/0255 for the following development: use of St. Thomas Estate for sports and recreation; change of use of St. Thomas House (a protected structure) to a sports clubhouse; provision of surface car parking for a total of 61 cars in two locations within the boundaries of the estate; widening of the primary existing vehicular access point to Tibradden Road by 1.3m with associated road lighting and landscaping works along the Tibradden Road; provision of new pedestrian entrance adjacent to existing vehicular access at Kilmashogue Lane with associated landscape works, pavement and road lighting; provision of new un-signalled road crossing point adjacent to existing Kilmashogue Lane entrance point; construction of two new gateways within the estate boundaries; provision of new tertiary waste treatment system and percolation area.

3.3 Site Topography

The Site falls from south-west to north-east from approximately 139mOD to 130mOD. The current site entrances are located on the Tibradden Road at approximately 133mOD and 125mOD.

3.4 Site Hydrology and Geology

The site is located in the catchment of the Whitechurch Stream which rises between Two Rock Mountain and Tibradden Mountain and outfalls to the Owenadoher River at Ballyboden/Willbrook Road, approximately 3km north of the site.

GSI mapping indicates that the vulnerability of the groundwater at the site is classed as moderate. Groundwater recharge is within 101-150mm/year. The bedrock aquifer in the area is classified as poor which is generally unproductive except for local zones. Quaternary sediments are gravels derived from limestones (GLs). Groundwater rock consist of granites and other igneous intrusive rocks.

Teagasc soils indicate to be AminDW - deep well drained mineral (mainly acidic). It is indicated that the site is underlain by pale grey fine to coarse-grained granite.

10 no Trial Pits were excavated on site in April 2017 to a maximum depth of 3.60m bgl. Bedrock was not encountered in the trial pits undertaken on site. Groundwater was observed at 3.2m bgl in TP01.

Refer to Appendix A for details of the GSI Maps.

Refer to Appendix B for the Ground Investigation Report.

4. WATER SUPPLY

4.1 Existing Water Supply

According to Irish Water drainage records, the site is currently served by 4 inch uPVC (1958) watermain located on Kilmashogue Lane. It is then continued by a 4 inch uPVC (2000) watermain along the roundabout Tibradden Road / Kilmashogue Lane / Whitechurch Road into Whitechurch Road and connects with a 450mm Asbestos concrete (1970) main.

4.2 Proposed Water Supply

The development shall be served by a future connection to the existing 4 inch uPVC (2000) pipe at the roundabout Tibradden Road/Kilmashogue Lane/Whitechurch Road which is approximately 280m north-east of the site. The water supply connection shall be subject to the requirements of Irish Water.

Refer to Appendix C for Watermain and Drainage Records.

5. FOUL DRAINAGE

It is proposed to provide new separate surface and foul drainage systems to serve the proposed development. This section describes the existing foul drainage services on or near the site and summarises the additional foul drainage infrastructure required to serve the proposed development.

5.1 Existing Foul Drainage

The site is not currently served by public foul drainage infrastructure. St. Thomas's House is served by a septic tank and percolation area. There will be a new wastewater treatment system on site to cater for the proposed multi-use sports building.

5.2 Proposed Foul Drainage

In August 2014, a site suitability assessment was undertaken in support of the planning application as described in section 3.2. A copy of this report is included in Appendix D.

The analysis undertaken in 2014 at the north-eastern boundary of the site confirmed that the soil is suitable for infiltration to ground.

A series of trial hole excavations and geotechnical analysis was undertaken on the subject site in 2017. This comprised 10 trial pits and soil classification (see Appendix B). The findings of the investigation confirmed that the overburden is relatively homogenous and consistent with the findings of the site suitability assessment undertaken in 2014.

In particular, the analysis of trial pits TP01, TP02 and TP03 were closely examined as these trial pits are adjacent to the location of the proposed treatment system. Refer to Trial Pit Locations drawing in Appendix B and proposed treatment system in Appendix E. See table 5.1 below for a comparison between the soil characteristics from the former percolation test and the more recent ground investigation.

Table 5.1 Comparison of soils regarding previous percolation test and more recent ground investigation (meters refer to below ground level)

Description	Trial Hole for percolation test from 01/09/2014 in previous planning application	Trial Pit TP01 from Ground Investigation from 28/04/2017 for new proposed location	Trial Pit TP02 from Ground Investigation from 28/04/2017 for new proposed location	Trial Pit TP03 from Ground Investigation from 28/04/2017 for new proposed location
Base of Trench	2.40m	3.20m	3.30m	3.10m
Soil Classification	0-0.3m (top soil): clayey loam → firm 0.3-1.5m: gravelly CLAY (few cobbles) → firm 1.5-2.4m: gravelly SILT/CLAY (cobbles and few small boulders) → firm	0-0.1m: topsoil 0.1-1.3m: gravelly CLAY (rare cobbles) → firm 1.3-3.2m: gravelly CLAY (occasional cobbles and rare boulders) → firm to stiff	0-0.1m: topsoil 0.1-1.2m: gravelly CLAY (rare cobbles) → soft to firm 1.2-3.3m: gravelly CLAY (occasional cobbles) → firm to stiff	0-0.1m: topsoil 0.1-2.1m: gravelly CLAY (rare cobbles) →soft to firm 2.2-3.1m: gravelly CLAY (occasional cobbles) →firm to stiff
Groundwater	1.80m	3.20m (as slow seepage)	Not encountered	Not encountered

It is therefore expected that the subsoil characteristics for the new proposed location have a similar T-value of 21 and P-value of 27 compared to the previously conducted percolation test as ground investigations show similar soil characteristics. However, it will be necessary to conduct a new site suitability assessment in accordance with the EPA Code of Practice to confirm this assumption, and given that the maximum daily discharge is expected to exceed 5m^3/day, a Tier 2 Hydrogeological Impact Assessment (as defined in EPA Guidance on the Authorisation for Discharge to Ground) will be necessary. This additional ground investigation will be undertaken in parallel with the Part VIII public display period so that any amendments that may be required can be incorporated prior to the planning approval stage.

It is recommended that foul effluent should be treated using a sequential batch reactor system (SBR) followed by a sand polishing filter. Details of a proposed wastewater treatment system can be found in Appendix F.

It is important to note that the wastewater treatment system needs to be a minimum of 34m from the proposed buildings to ensure avoidance of odour and noise nuisances from the wastewater treatment systems. This number is taken from the EPA Waste Water Treatment Manual for Small Systems, Communities, Business, Leisure Centres and Hotels.

Refer to Appendix D for Previous Report from Dr. Eugene Bolton on On-site Waste Water Treatment System

Refer to Appendix E for the proposed Foul and Surface Water Drainage Layout.

Refer to Appendix F for Exemplary SBR System from Molloy Environmental Systems

5.2.1 Hydraulic & Organic Loading

Daily foul discharge has been estimated based on data provided by DLRCC and OBFA Architects, and in accordance with EPA and Irish Water guidelines. The maximum site occupancy is envisaged to be 173 persons, so the system has been sized for 200 persons. Occasional larger sporting events will need supplementary portable toilet facilities to be brought to site.

According to the EPA Waste Water Treatment Manual for Small Systems, Communities, Business, Leisure Centres and Hotels and treating the development as a football club, an allowance of *30 litres/day per person* and a *BOD_5 of 20 grams /day per person* is made. This results in *6,000 litres* of waste water and *4,000 grams* of BOD_5.

A hydraulic loading of 6,000 litres equates to a hydraulic population equivalent (PE) of *40* (at 150 litres/person) and an organic loading of 4,000 grams/day equates to an PE of *67* (at 60 grams/person). Thus, the system needs to be sized for a PE of 67.

Based on on-site wastewater treatment minimum performance standards with a BOD_5 of 20mg/l, Suspended Solids of 30mg/l and Ammonia of 20mg/l, a sand polishing filter can be loaded at 60litres/m^2 which requires a 100m^2 sand filter.

However, the minimum area needed for disposing the treated effluent is dependent on the hydraulic capacity of the soil. In sizing the infiltration area, the EPA guidance gives the following formula:

$$A = 0.125 * T * PE$$

Where A stands for the percolation area, T stands for the T-Value from the percolation test and PE for the hydraulic population equivalent.

This gives a percolation area of $A = 0.125 * 21 * 40 = 105m^2$ where the relevant estimate of the PE is based on the hydraulic loading. It is recommended that the area be increased to about *200m²* to allow a further buffer.

The proposed treatment standards and specific details of the sand polishing filter shall be confirmed following completion of a Tier 2 Hydrogeological Impact Assessment which shall be undertaken in parallel with the Part VIII public display period.

6. SURFACE WATER DRAINAGE

It is proposed to provide new separate surface and foul drainage systems to serve the proposed development.

This section outlines the existing surface water drainage services onsite and gives our proposals for the additional surface water drainage requirements as part of the development.

6.1 Existing Surface Water Drainage

The site drains north-east towards Tibradden Road and lies within the catchment of the Whitechurch Stream. Runoff either percolates through the subsoil to groundwater or discharges to the existing surface water drainage network on site and on Ferndale Road via 225mm Concrete pipes. The collected runoff ultimately outfalls into the Whitechurch Stream through a 300mm Concrete pipe a few meters north-east of the roundabout Tibradden Road/Kilmashogue Lane/Whitechurch Road.

Refer to Appendix C for Watermain and Drainage Records

6.2 Proposed Surface Water Drainage

It is proposed to construct a new surface water drainage system for the development to collect run-off from roofs and paved areas and any additional run-off from landscaped areas which doesn't percolate to ground.

In particular, there will be additional surface water run-off from:

- Proposed car park with approximately 150 spaces
- 400m running track
- Multi-use sports building

It is proposed that runoff from the car park will be dealt with via permeable paving that allows infiltration into the ground. Any excess water will be conveyed through a pipe into a new surface water system along Tibradden Road, see Appendix E.

Surface water from the running track will be drained by infiltration trenches, overflows by the proposed site drainage system on occasion when the subsoil is saturated. Usually, and according to the International Association of Athletics Federations (IAAF), running tracks have a slight slope of up to 2% to the inside which means that water moves to the most inside lane. Run-off flows slowly through the granular material next to the track, trapping sediments and providing attenuation. The water will then slowly infiltrate into the ground from the filter drain. Possible excess run-off will be conveyed

through a piped connection to the detention basin on site which is located between the car park and the multi-use sports building, see Appendix E.

The multi-use sports building is planned to have a 55% green roof and blue roof which will reduce the amount of surface water run-off. Excess water will be conveyed to the detention basin on site (Appendix E).

From the detention basin there will be a piped connection and outfall along Tibradden Road which connects into the existing surface water pipe at the entrance to St. Thomas's House and eventually outfalls to the Whitechurch Stream.

However, subject to the findings of detailed geotechnical investigations, including infiltration tests in boreholes (to be undertaken as part of the Tier 2 Assessment described in section 5.2) and infiltration tests to BRE Digest 365 and Ciria C753 it may be confirmed that the site can be served solely by infiltration systems. Therefore, the outfall along Tibradden Road may be found to be unnecessary.

Refer to Appendix E for the proposed Foul and Surface Water Drainage Layout.

All surface water drainage shall be constructed in accordance with Greater Dublin Region Code of Practice for Drainage Works

6.3 SUDS Approach

As part of the development, a number of different SuDS measures are proposed to minimise the impact on water quality and water quantity of the runoff and maximise the amenity and biodiversity opportunities within the site.

The proposed SuDS measures will include a combination of Source Control and Site Control measures as part of a Management Train whereby the surface water is managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment. The combination of the SuDS measures listed below will maximise the potential for surface water infiltration to the subsoil, reducing the impact on the existing surface water drainage network downstream. The proposed techniques will offer high level of treatment processes and nutrient removal of the runoff, particularly during the 'first flush'. Finally, the various measures will offer significant amenity and biodiversity opportunities compared to other drainage systems.

It is proposed to provide the following SuDS measures:

- Permeable Paving
- Green / Blue Roofs
- Detention Basin
- Infiltration Trench

Approximately 362m^3 of storage will be provided for the 1 in 100 year event (including 10% for climate change). This storage will be provided within the detention basin, with additional storage available within the permeable paving, green / blue roof and infiltration trench. The rate of surface water discharge shall be restricted to 2 litres per second per hectare for the 1 in 100 year rainfall event with an allowance of 10% increase in rainfall intensity for Climate Change, in accordance with regional drainage policy and DLRCC requirements. The provision of SuDS measures to convey, store and manage the discharge of surface water to the receiving watercourses will aid in managing flood risk.

Refer to Appendix G for Surface Water Calculations.

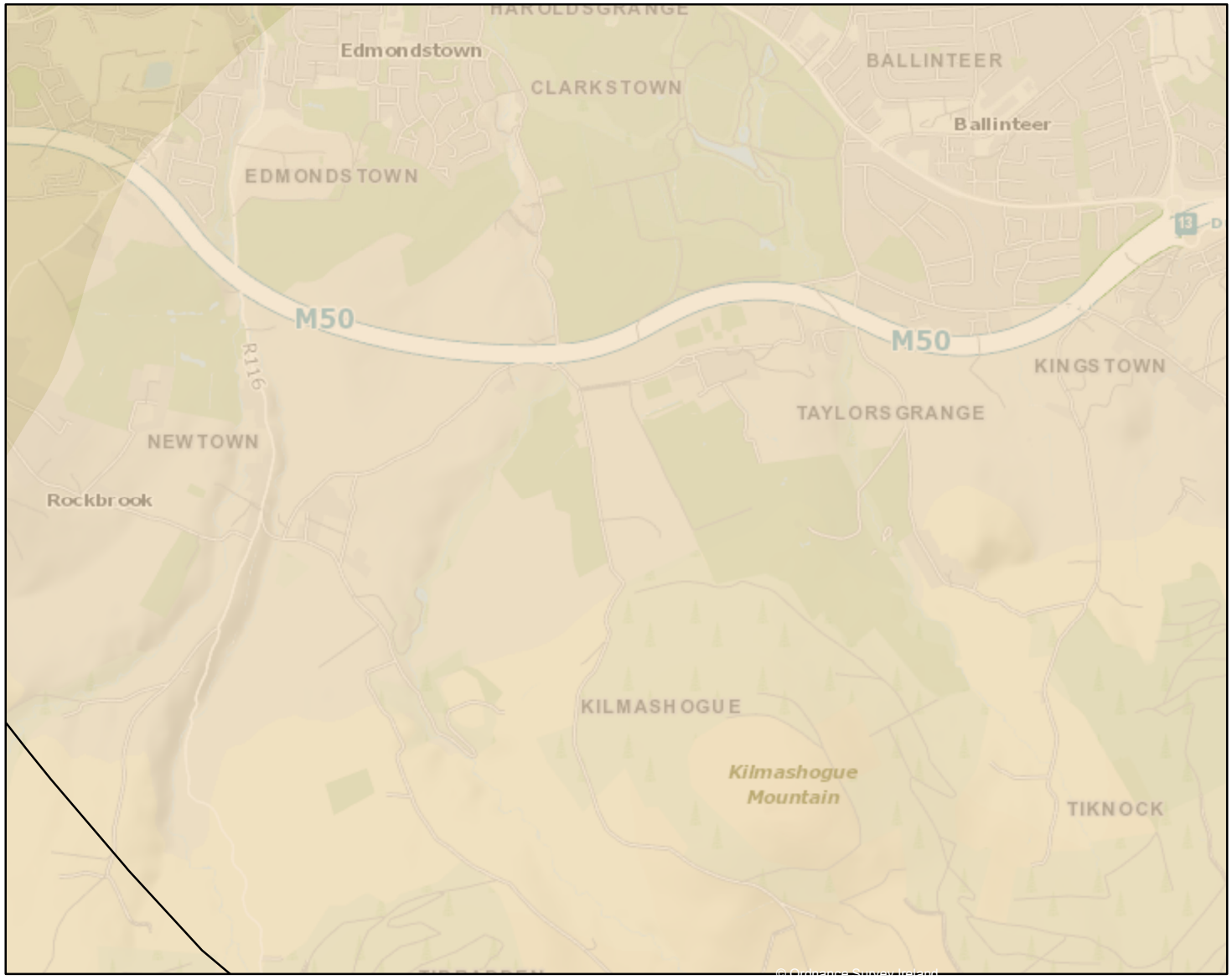
7. SUMMARY

- It is proposed that water will be supplied from the existing watermain at the roundabout Tibradden Road/Kilmashogue Lane/Whitechurch Road which is subject to the requirements of Irish Water.
- Separate foul and surface water drainage systems will be constructed to serve the site.
- Foul water will be treated on site via a sequential batch reactor followed by a sand polishing filter, where the treated effluent will discharge to ground.
- A Tier 2 Hydrogeological Assessment will be necessary to confirm soil/subsoil characteristics on site which shall be undertaken in parallel with the Part VIII public display period.
- A proposed detention basin on site and new surface water pipes will be constructed to serve excess run-off from the car park, running track and multi-use sports building.
- Following the findings from detailed geotechnical investigations, including infiltration tests in boreholes (to be undertaken as part of the Tier 2 Assessment described in section 5.2) and infiltration tests to BRE Digest 365 and Ciria C753, it may be confirmed that the site can be served solely by infiltration systems.
- The site will incorporate several soft SuDS measures promoting infiltration of surface water to underlying subsoil.
- Any excess surface water from the site which does not infiltrate to subsoil will be collected and attenuated on site, with a peak discharge rate of 2 litres per second per hectare for the 1 in 100 year rainfall event including 10% increase of rainfall intensity due to Climate Change.

APPENDIX A
GSI Maps

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



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Geological Survey Ireland

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Legend

Bedrock Aquifer Faults

— Bedrock Aquifer Faults

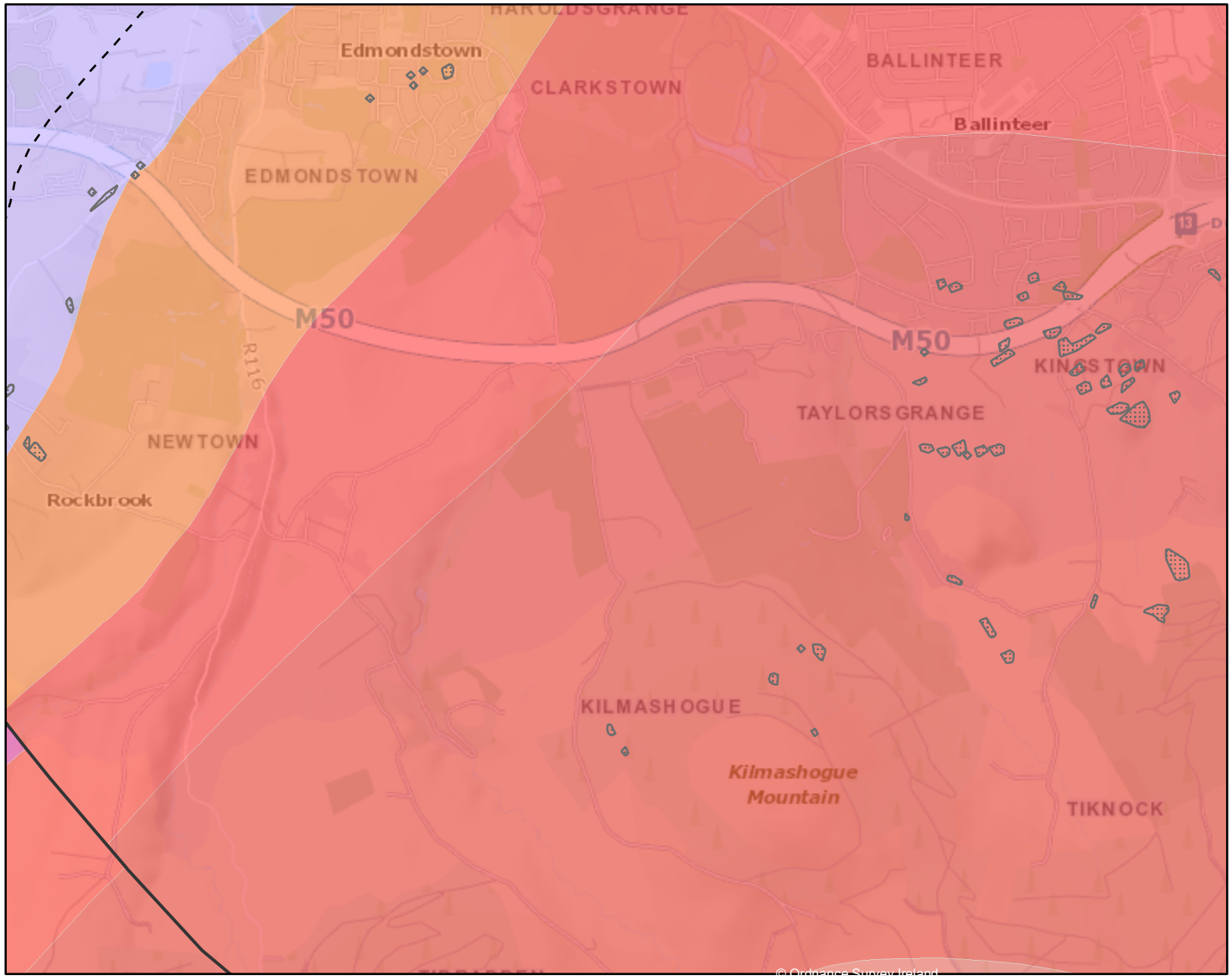
Bedrock Aquifer

LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

PI - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



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Bedrock Stratigraphic and Structural lines

- Area
- Fault

Bedrock Outcrop

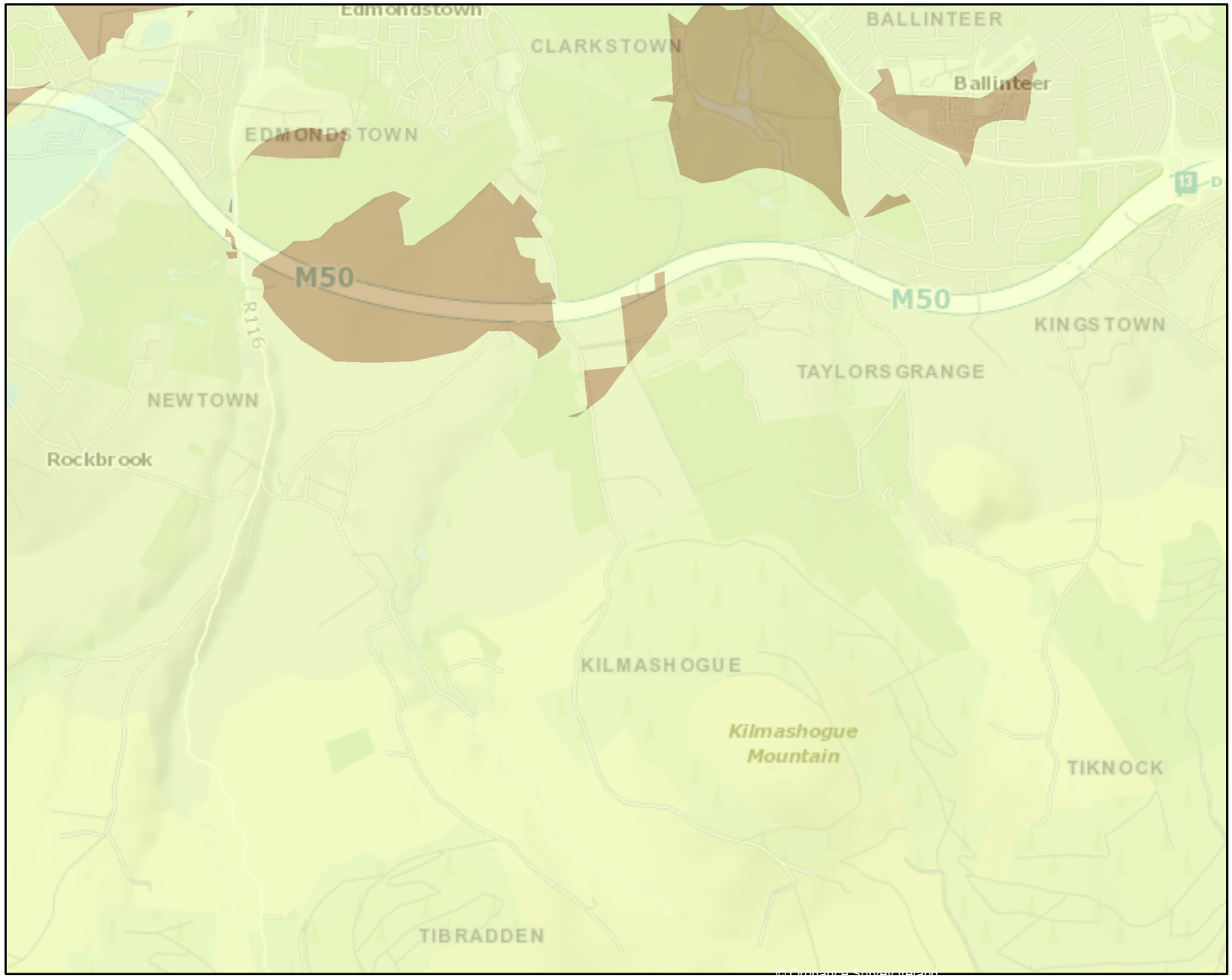
- Bedrock Outcrop

Bedrock Rock Units

- Type 1 Granodioite (Northern and Upper Liffey Valley Plutons)
- Type 3 muscovite porphyritic (Northern and Upper Liffey Valley Plutons)
- Type 4 muscovite/microcline porphyritic (Northern and Upper Liffey Valley Plutons)
- Type 2e equigranular (Northern and Upper Liffey Valley Plutons)
- Type 2p microcline porphyritic (Northern and Upper Liffey Valley Plutons)
- Butter Mountain Formation

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



Legend

Groundwater Recharge (mm/yr)

- 1-50 mm
- 51-100 mm
- 101-150 mm
- 151-200 mm

Scale: 1:25,000

Geological Survey Ireland

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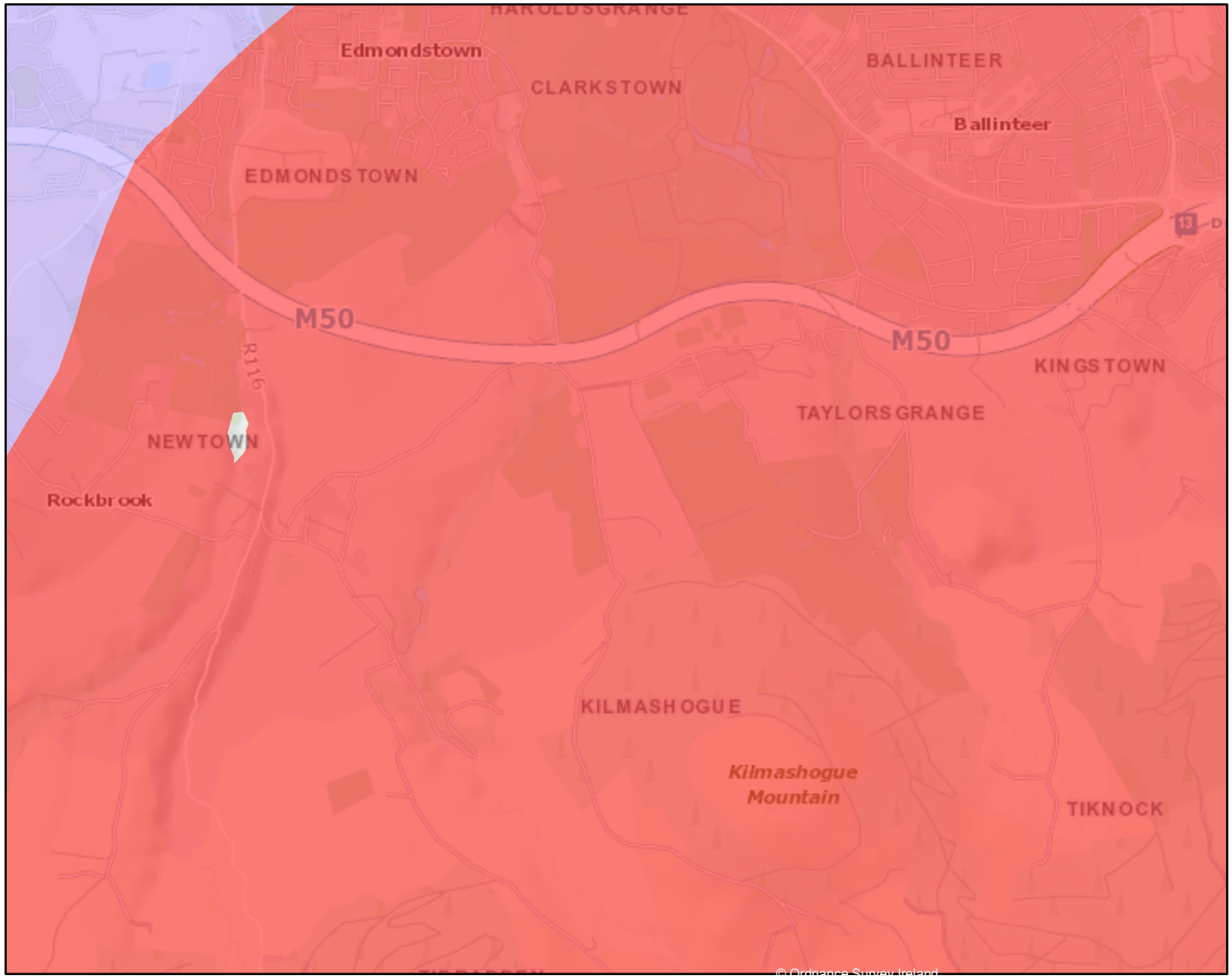
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



Legend

Groundwater Rock Units

- Granites & other Igneous Intrusive rocks
- Ordovician Metasediments

Scale: 1:25,000

Geological Survey Ireland

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Ireland | Éireann

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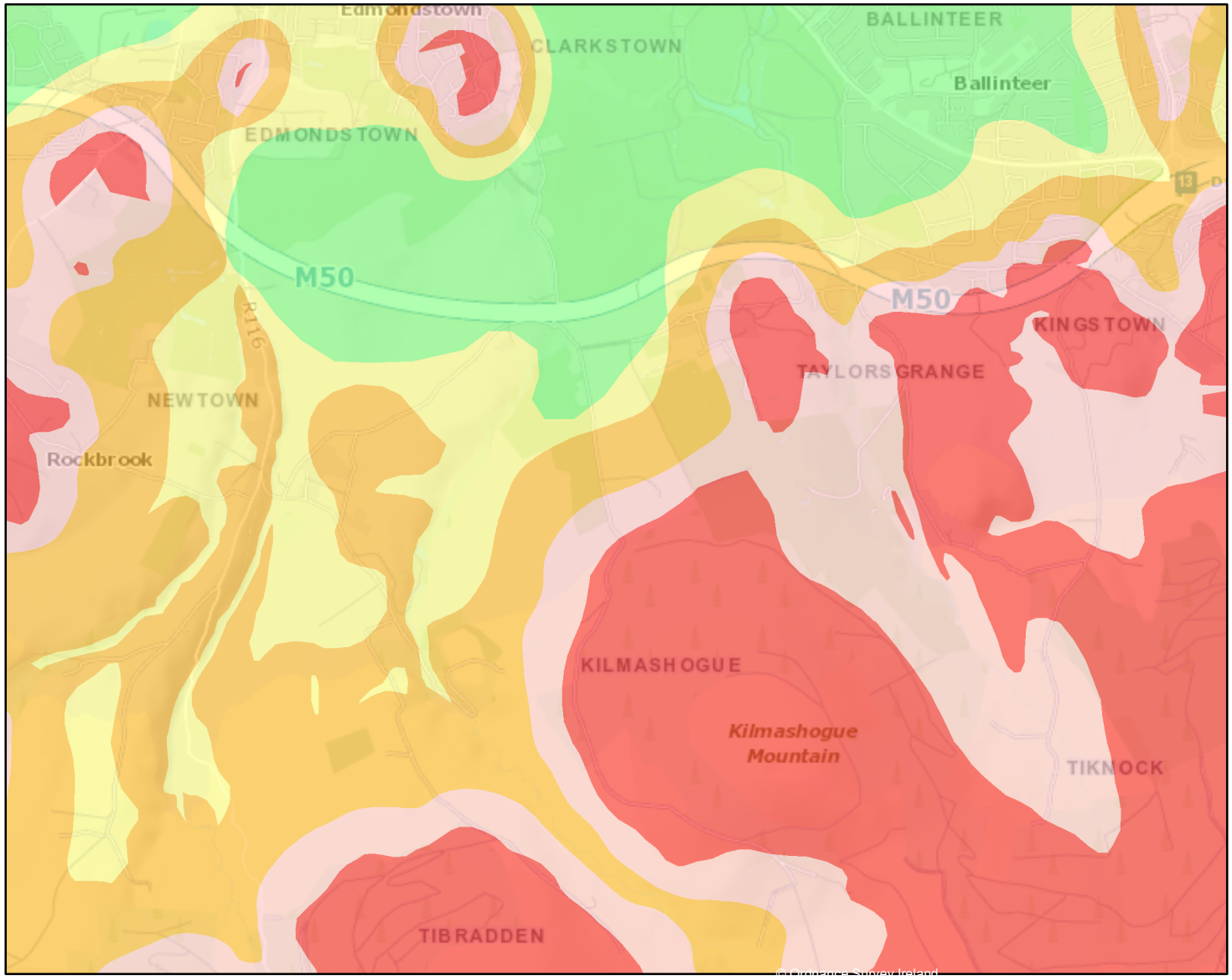

Legend

Groundwater Vulnerability

- X - Rock at or near surface or Karst
- E - Extreme
- H - High
- M - Moderate
- L - Low

Scale: 1:25,000

Geological Survey Ireland

N W E S

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Ireland | Éireann

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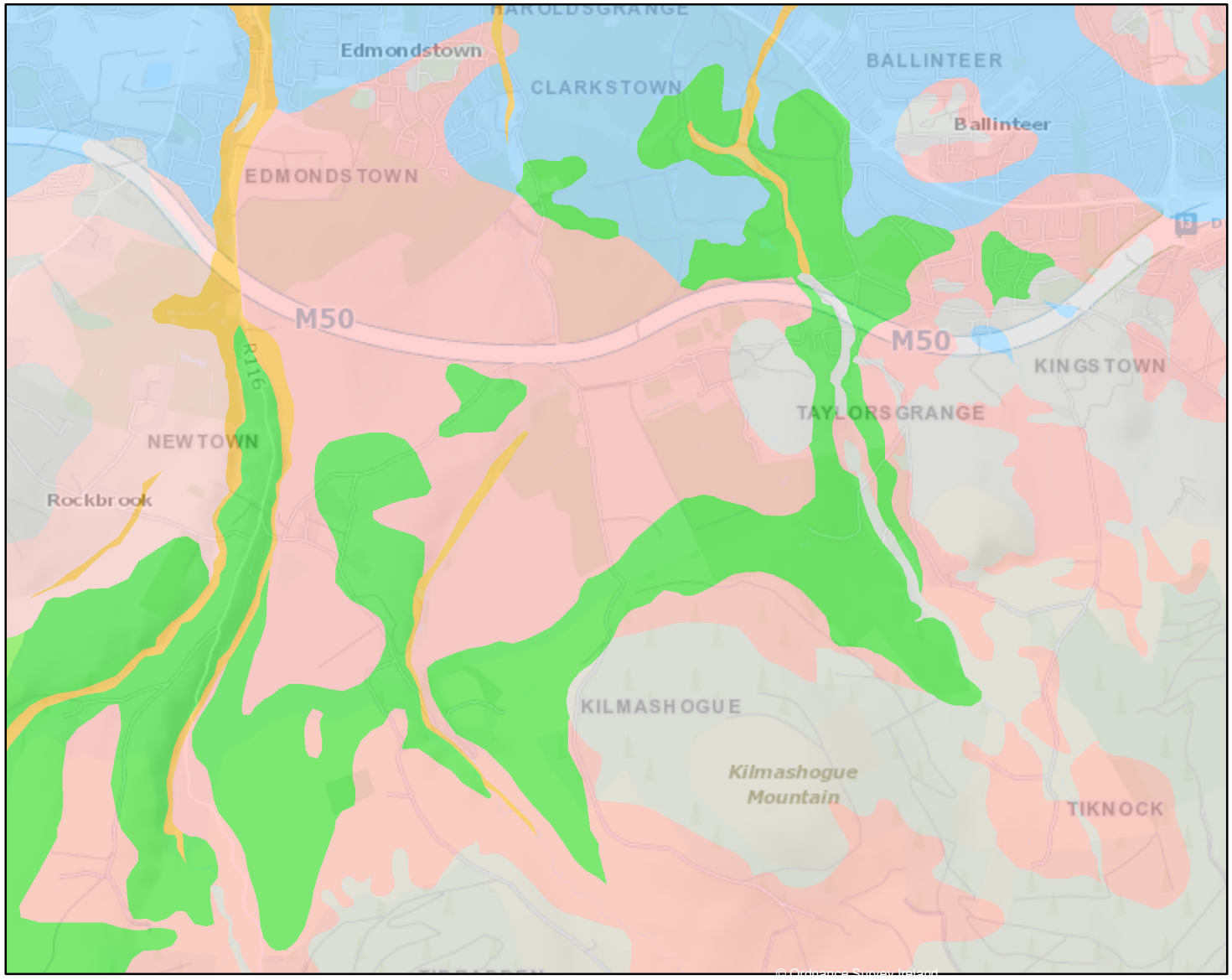

Legend

Quaternary Sediments

- A, Alluvium
- Ag, Alluvium (gravelly)
- GCh, Gravels derived from chert
- GGr, Gravels derived from granite
- GLs, Gravels derived from Limestones
- GMp, Gravels derived from Metamorphic rocks
- Rck, Bedrock outcrop or subcrop
- Scree, Scree
- TGr, Till derived from granites
- TLs, Till derived from limestones
- TMp, Till derived from Metamorphic rocks

Scale: 1:25,000

Geological Survey Ireland

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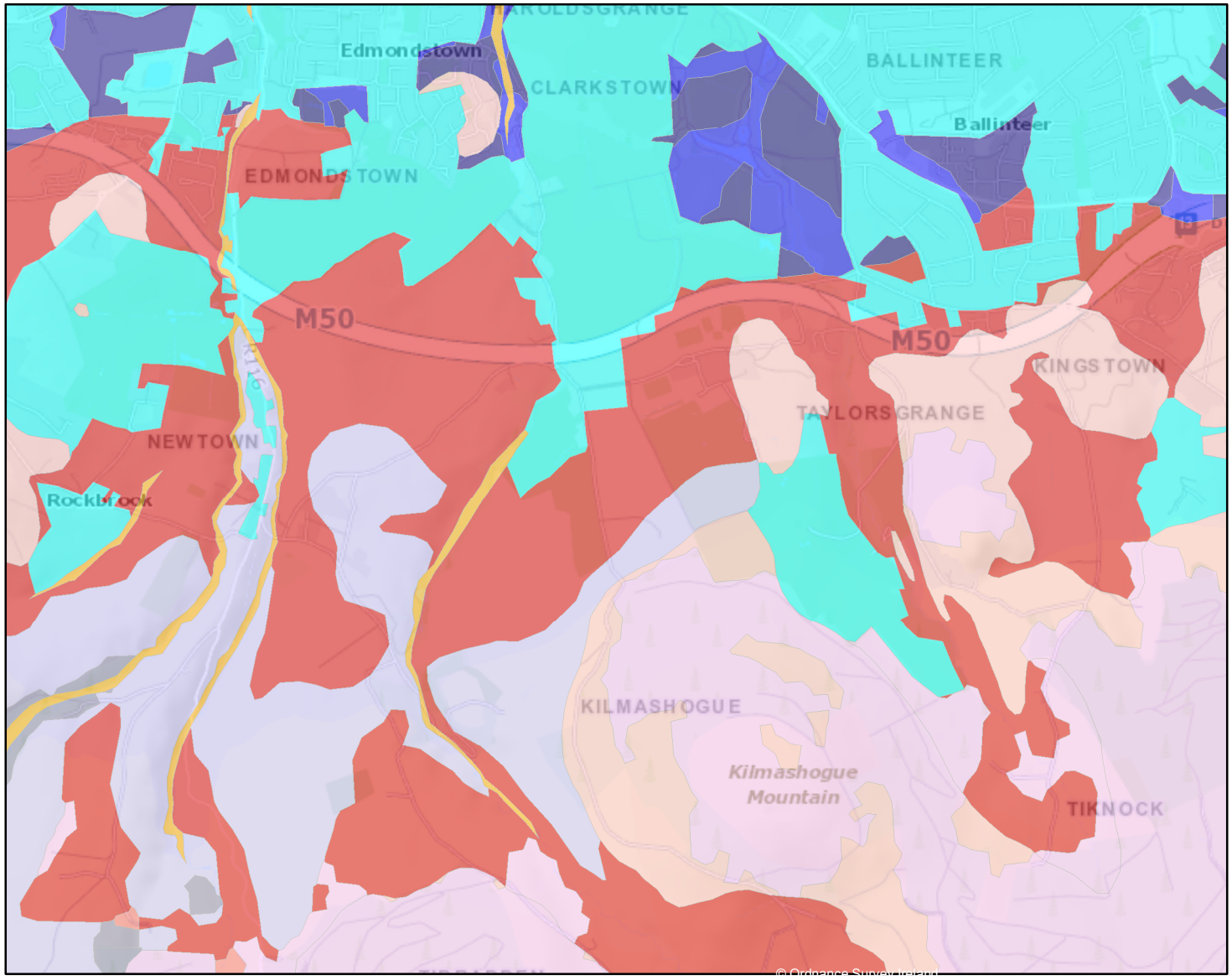
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



Legend

- AminDW - Deep well drained mineral (Mainly acidic)
- AminPD - Mineral poorly drained (Mainly acidic)
- AminSW - Shallow well drained mineral (Mainly acidic)
- AminSRPT - Shallow, rocky, peaty/non-peatymineral complexes (Mainly acidic)
- BminDW - Deep well drained mineral (Mainly basic)
- BminPD - Mineral poorly drained (Mainly basic)
- BminSW - Shallow well drained mineral (Mainly basic)
- BminSP - Shallow poorly drained mineral (Mainly basic)
- BminSPPT - Shallow peaty poorly drained mineral (Mainly basic)
- AlluvMIN - Alluvial (mineral)
- Made - Made ground

Scale: 1:25,000

Geological Survey Ireland

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APPENDIX B
GROUND INVESTIGATION REPORT

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Ground Investigations Ireland

St. Thomas Estate Geotech

Ground Investigation Report

DOCUMENT CONTROL SHEET

Project Title	St. Thomas Estate Geotech
Client	Dundrum South Athletic Club Ltd.
Project No	6702-04-17
Document Title	Ground Investigation Report

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GROUND INVESTIGATIONS IRELAND

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APPENDICES

1.0 Preamble

On the instructions of Dundrum South Athletic Club Ltd., a site investigation was carried out by Ground Investigations Ireland Ltd., on the 28th April 2017 at the site of the proposed athletic development on the Tibradden Road, Taylorsgrange, Co. Dublin.

2.0 Overview

2.1. Background

It is proposed to construct a new athletic development with associated services, access roads and car parking at the proposed site. The site is currently greenfield and is situated on the Tibradden Road, behind Ballinascorney Golf Course in County Dublin. The proposed construction is envisaged to consist of a 400m running track with a hammer and discus throwing area.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 10 No. Trial Pits to a maximum depth of 3.60m BGL
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Surveying

The exploratory hole locations have been recorded using a handheld GPS which records the coordinates of the locations to ITM or Irish National Grid as required by the project specification. The coordinates are provided on the exploratory hole logs in the appendices of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Topsoil
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.20m BGL.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and were described typically as *light brown sandy slightly gravelly CLAY with occasiona/rarel cobbles* overlying a *brown slightly sandy gravelly CLAY with occasional cobbles and rare boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.00m BGL in the majority of the exploratory holes, however, in TP09, the deposits were firm to a depth of 3.60m BGL. These deposits had rare, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

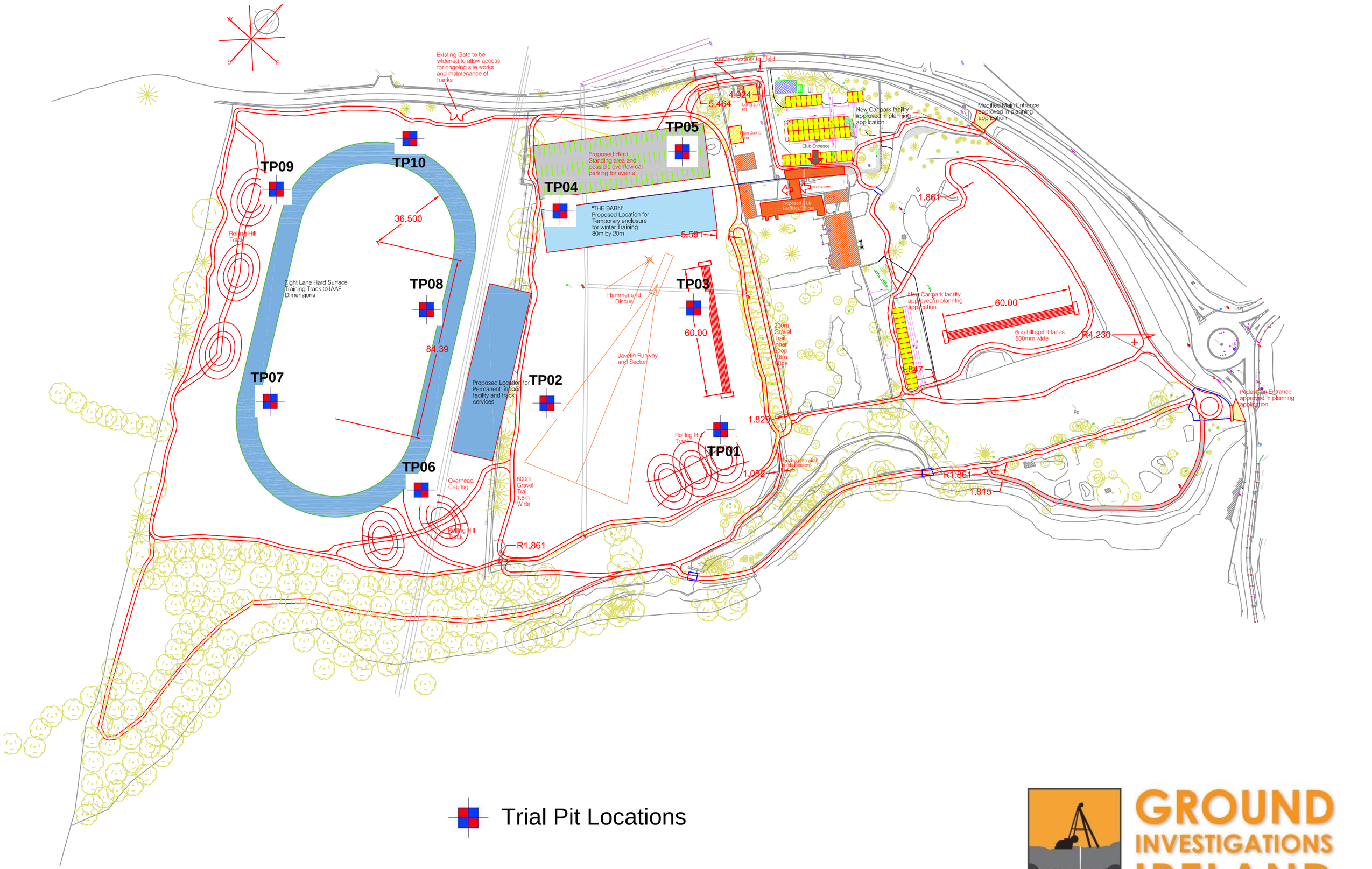
An allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the stiff cohesive deposits at a depth of 1.5m BGL.
A ground bearing floor slab is recommended to be based on the firm to stiff cohesive deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:214 and/or NRA SRW CL808 Type E granular stone fill.

5.3. Excavations

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.
The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations
Any material to be removed off site should be disposed of to a suitably licenced landfill.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan



Trial Pit Locations

GROUND INVESTIGATIONS IRELAND

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
St. Thomas Estate	TP01

Machine : JCB 3CX Method : Trial Pit	Dimensions L x W x D 3.30 x 0.40 x 3.20m	Ground Level (mOD)	Client Dundrum South Athletic Club Ltd	Job Number 6702-04-17
	Location (Handheld GPS) 714566 E 725208 N	Dates 28/04/2017	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	TOPSOIL		
						Firm light brown slightly sandy gravelly CLAY with rare cobbles		
					(1.20)			
0.80	B							
					1.30	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles and rare boulders		
					(1.90)			
						Stiff below 2.60mBGL		
3.20	B		Slow seepage(1) at 3.20m.		3.20	Complete at 3.20m		▽1

Plan

Remarks

Trial pit stable
Groundwater encountered at 3.20m BGL as slow seepage

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
St. Thomas Estate	TP02

Machine : JCB 3CX Method : Trial Pit	Dimensions L x W x D 2.90 x 0.40 x 3.30m	Ground Level (mOD)	Client Dundrum South Athletic Club Ltd	Job Number 6702-04-17
	Location (Handheld GPS) 714501 E 725173 N	Dates 28/04/2017	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	TOPSOIL		
						Soft to firm light brown/brown mottled black sandy slightly gravelly CLAY with rare cobbles		
					(1.10)			
1.00	B				1.20	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles		
					(2.10)			
2.50	B					Stiff below 2.70mBGL		
					3.30	Complete at 3.30m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.10 x 0.40 x 3.10m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714431 E 725219 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	TOPSOIL		
						Soft to firm light brown/brown mottled black sandy slightly gravelly CLAY with rare cobbles		
0.60	B				(2.10)			
					2.20	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles		
2.60	B				(0.90)	Stiff below 2.70mBGL		
					3.10	Complete at 3.10m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP04
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 0.40 x 3.00m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714442 E 725231 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.60) 0.80	Soft to firm light brown mottled black sandy slightly gravelly CLAY with rare cobbles		
1.10	B				(2.20)	Firm to stiff brown slightly sandy gravelly CLAY with frequent cobbles and occasional boulders Stiff below 2.60mBGL		
					3.00	Complete at 3.00m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP04

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP05
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 0.40 x 3.20m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714457 E 725284 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.50) 0.70	Soft to firm light brown sandy slightly gravelly CLAY with rare cobbles		
2.30	B				(2.50) 3.20	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles Stiff below 2.70mBGL		
						Complete at 3.20m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP05

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP06
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.30 x 0.40 x 3.10m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714474 E 725105 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.60) 0.80	Soft to firm light brown sandy slightly gravelly CLAY with rare cobbles		
3.00	B				(2.30) 3.10	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles Stiff below 2.50mBGL		
						Complete at 3.10m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP06

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP07
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 0.40 x 3.20m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714406 E 725090 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
					0.20	Soft to firm light brown slightly sandy slightly gravelly silty CLAY		
					(0.70)			
0.90	B				0.90	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles		
					(2.30)	Stiff below 2.80mBGL		
					3.20	Complete at 3.20m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP07

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP08
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.70 x 0.40 x 3.30m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714446 E 725160 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.60)	Soft to firm light brown slightly sandy slightly gravelly silty CLAY with rare cobbles		
					0.80	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles and rare boulders		
1.50	B				(2.50)	Stiff below 2.70mBGL		
					3.30	Complete at 3.30m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP08

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP09
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.10 x 0.40 x 3.60m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714354 E 725153 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(1.00) 1.20	Soft to firm light brown slightly sandy slightly gravelly silty CLAY with rare cobbles		
2.10	B				(2.40) 3.60	Firm brown sandy gravelly CLAY with occasional cobbles		
						Complete at 3.60m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP09

Ground Investigations Ireland Ltd
www.gii.ie

Site St. Thomas Estate			**Trial Pit Number** TP10
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.20 x 0.40 x 3.10m	**Ground Level (mOD)**	**Client** Dundrum South Athletic Club Ltd	**Job Number** 6702-04-17
	Location (Handheld GPS) 714372 E 725202 N	**Dates** 28/04/2017	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL		
					(0.80) 1.00	Soft to firm light brown/brown slightly sandy slightly gravelly silty CLAY with rare cobbles		
					(2.10) 3.10	Firm to stiff brown slightly sandy gravelly CLAY with occasional cobbles Stiff below 2.50mBGL		
3.00	B							
						Complete at 3.10m		

Plan

Remarks

Trial pit stable
No groundwater encountered

Scale (approx)	Logged By	Figure No.
1:25	S. Worth	6702-04-17.TP10

St. Thomas Estate – Trial Pit Photos

TP01

TP01

TP01

TP01

TP02

TP02

TP02

TP02

TP03

TP03

TP03

TP03

TP04

TP04

TP04

TP04

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TP08

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TP09

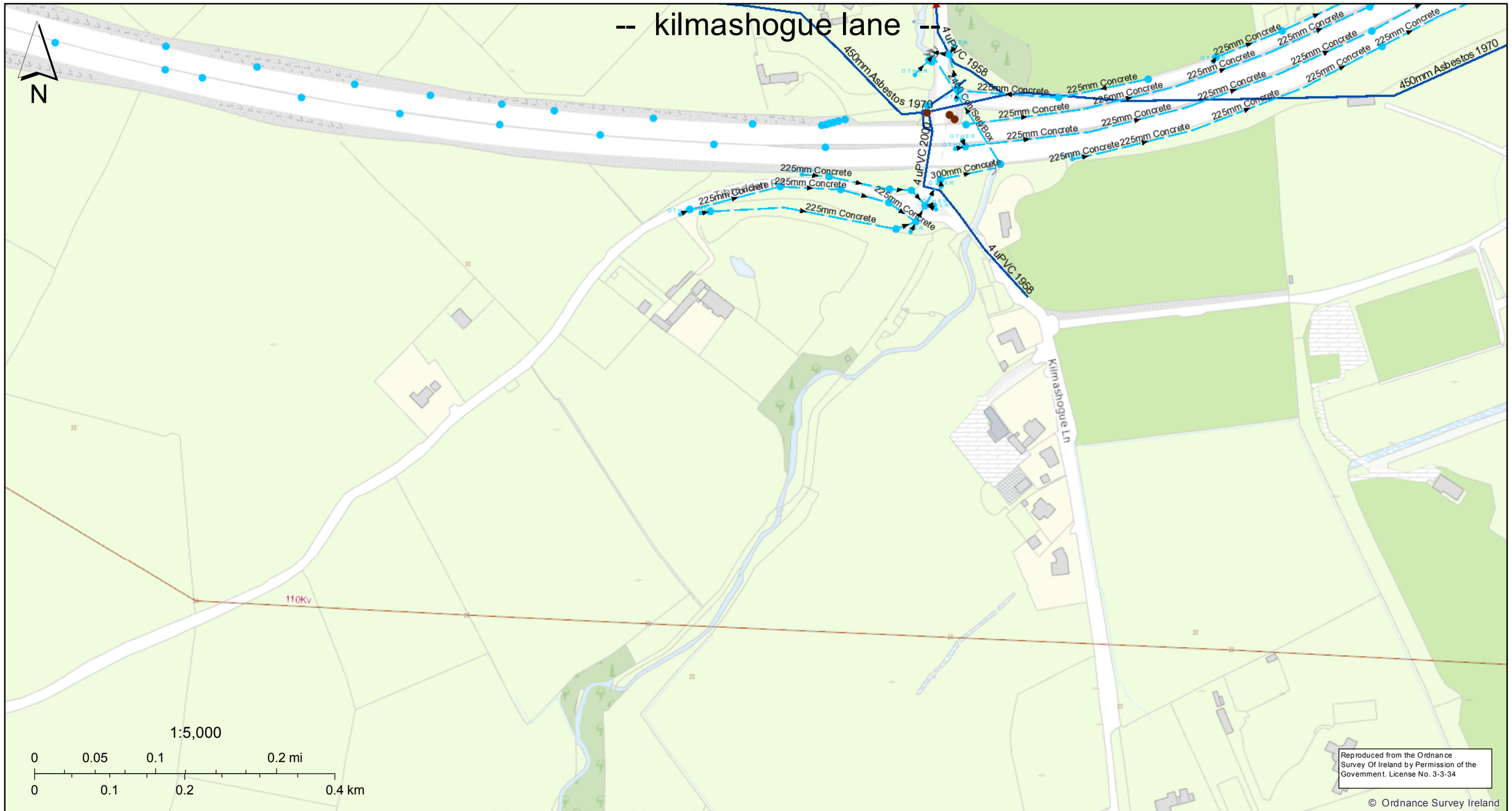
TP10

TP10

TP10

TP10

APPENDIX C
WATERMAIN AND DRAINAGE RECORDS



4/1/2019 12:14:21 PM

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

APPENDIX D
PREVIOUS REPORT FROM DR. EUGENE BOLTON ON ON-SITE WASTE WATER TREATMENT SYSTEM

Trinity Green
Environmental Consultants

Clonfert
Maynooth
Co. Kildare
t: 01-6290616
m: 086-2434828
Vat No. 3251411B

Report on On-Site Wastewater Treatment system

at

Thomas Estate

Dwelling: Facility to cater for up to 120 visitors

Location: Tibradden Road Dublin

Prepared by: *Dr. Eugene Bolton*
Senior Consultant
Trinity Green

1. Background

It is proposed to change the use of the existing building to a sports facility. As part of the planning application the existing on-site wastewater treatment and disposal system was assessed and if deemed insufficient then a site Characterisation report was to be produced to facilitate design of an upgraded system. Dr. Eugene Bolton of Trinity Green was commissioned to undertake the assessment.

2. Existing System

2.1 Treatment system

The dwelling supports 10 double bedrooms which can accommodate up to a maximum of 2 people per room or a total of 20 People. It is serviced by a septic tank and percolation area. The existing tank was 2.4m long 1.3m wide with a working depth of 1.4m thus giving a working volume of $4.3m^3$ Based on EPA guidelines this has capacity to cater for a Population Equivalent (PE) of up to 15 (Capicity $_{\text{in litres}}$ = 2000 + 150 x PE). Thus if the house were fully occupied the tank does not have sufficient capacity.

In the redeveloped site it is proposed to develop the facility as a Sports and Leisure Club that will cater for up to 120 people. Using the recommendations on loadings contained in the EPA Manual (Wastewater Treatment Manuals: *Treatment Systems for Small Communities , Business, Leisure Centres and Hotels*) and treating the facility as a football club then an allowance of 30 litres/person and 20grams of BOD ismade. This results in 3,600 litres of wastewater and an organic loading of 2400 grams of BOD.
Using these figures the hydraulic loading of 3600 equates to a PE of 24(at 150 litres/person) and a PE of 40 based on the Organic loading
Based on these figures the existing system does not have sufficient capacity to treat the wastewater under full capacity. It will be necessary to install a new secondary treatment unit with a capacity to treat wastewater from a PE of 40.

2.2 Percolation

Effluent from the septic tank flows to a splitter box with 2 outlets each going to a separate distribution box . Box 1 has 3 outlets and it is estimated that the infiltration trench from each outlet is about 12m long – giving a total of 36 linear meters. The base of the distribution box is 1.2m bgl.
Distribution box no. 2 has water and solids in the base so that it was not possible to establish number of outlets. The base of this box was at 1.7m bgl.
It is likely this box is similar to box 1 thus giving an estimated 36 linear meters of distribution trench and a total trench length of 72 linear meters in the percolation area. Under the current EPA Code of Practice 72 linear meters will cater for a PE of 4.

However the main issue with the percolation area is the fact that there is water in one of the distribution boxes at 1.7m bgl and staining in the distribution box suggests this raises to about 1.2m bgl. If this reflects a high watertable then this site is not suitable for a standard septic tank and percolation area.

In order to establish this, a Site Characterisation report was generated. This showed there is acceptable soakage with a T-value of 21 and a P–value of 27. However the watertable was at 1.8m bgl – which is consistent with the observation, that there is water in the distribution box was at approximately the same level. This shows the existing system is not sufficient to treat and dispose of wastewater without causing a risk of pollution and a risk to public health. It will therefore be necessary to upgrade the system taking account of the depth of free draining soil.

It is recommended that the upgrade will consist of a secondary treatment system followed by polishing in a Tertiary treatment filter (Sand or Peat – Puraflo) with discharge to ground. If the secondary treatment system produces a wastewater with a BOD of 20mg/l, Suspended Solids at 30mg/l and Ammonia at 20mg/l then a Sand Polishing filter can be loaded at 60 litres/m2 thus requiring a 60m2 sand Filter. If a peat filter is used then each module can be loaded at 750 litres/module thus requiring a total of 5 modules.

The secondary treatment unit should cater for a PE of 40 based on the organic loading. This is based on 120 people at 20 grams of BOD/person and 60 grams of BOD gives the equivalent of 1PE.

The effluent from the secondary system is then polished in a tertiary polishing filter before discharge to ground. The size of the area required to dispose of the treated effluent is dependent only on the hydraulic capacity of the soil. This is based on the EPA guideline where the size of the infiltration pad is given as 0.125 x T x PE. In this case the relevant estimate of the PE is based on the hydraulic loading and may be taken as a PE of 24.

In sizing the infiltration pad the size is 0.125 x 21 x 24 = 63m2. It is recommended that this be increased to about 100m2 to cater for any peak loadings

Signed .....

Dr. Eugene Bolton
Senior Consultant
Trinity Green

21/08/2014

Photos

Septic Tank showing inlet T-Piece

Splitter Box

Distribution Box No. 1

Distribution Box No. 2

SITE CHARACTERISATION FORM
COMPLETING THE FORM

Step 1:

Goto Menu Item **File, Save As** and save the file under a reference relating to the client or the planning application reference if available.

Use the **Clear Form** button to clear all information fields.

Notes:

All calculations in this form are automatic.

Where possible information is presented in the form of drop down selection lists to eliminate potential errors.

Variable elements are recorded by tick boxes. In all cases only one tick box should be activated.

All time record fields must be entered in twenty hour format as follows: HH:MM

All date formats are DD/MM/YYYY.

All other data fields are in text entry format.

This form can be printed out fully populated for submission with related documents and for your files. It can also be submitted by email.

Section 3.2

In this section use an underline _____ across all six columns to indicate the depth at which changes in classification / characteristics occur.

Section 3.4

Lists supporting documentation required.

Section 4

Select the treatment systems suitable for this site and the discharge route.

Section 5

Indicate the system type that it is proposed to install.

Section 6

Provide details, as required, on the proposed treatment system.

SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Dundrum South Dublin Athletic Club Surname:

Address:

Site Location and Townland: Saint Thomas Estate, Tibradden Road Dublin

Telephone No: Fax No:

E-Mail:

Maximum no. of Residents: No. of Double Bedrooms: No. of Single Bedrooms:

Proposed Water Supply: Mains ✓ Private Well/Borehole Group Well/Borehole

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type): Till Derived from Granite

Aquifer Category: Regionally Important Locally Important Poor Pl

Vulnerability: Extreme High Moderate ✓ Low High to Low Unknown

Bedrock Type: Granites and other Igneous Intrusive Rock

Name of Public/Group Scheme Water Supply within 1 km: None

Groundwater Protection Scheme (Y/N): Yes Source Protection Area: SI SO

Groundwater Protection Response: R1

Presence of Significant Sites (Archaeological, Natural & Historical): None

Past experience in the area: Good soakage

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

The groundwater is likely to be at low risk because of the moderate vulnerability.
The development is a Sports complex catering for 120 people. Allow 30 litres/person and 20grams BOD equates to 36m3 of wastewater and 2,400 grams of BOD

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position: At base of Dublin hills - North facing slopes

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☐ Relatively Flat (<1:20) ✓

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses: No house bordering site or within 150m.

Existing Land Use: residential

Vegetation Indicators: Nothing to suggest poor soakage

Groundwater Flow Direction: North east

Ground Condition: Firm - no surface water

Site Boundaries: Walled garden Roads: Minor rd. to North

Outcrops (Bedrock And/Or Subsoil): None exposed

Surface Water Ponding: None Lakes: None within 500m

Beaches/Shellfish: None Areas/Wetlands: None

Karst Features: None Watercourse/Stream*: Stream to East of site at about 200m

Drainage Ditches*: None bordering site Springs / Wells*: Mains water

Comments:
(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

Ground conditions are dry and with no rushes there may be good soakage.
There is a pond to the front East of the building. This is man-made and may not reflect groundwater levels. Existing septic tank is in a paddock to North of the dwelling. There are a number of distribution boxes and while 2 are clean one has water at 1.8m bgl. As this is the deepest and may suggest there is a high watertable.

***Note and record** water level

3.2 **Trial Hole** (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m): 2.40

Depth from ground surface to bedrock (m) (if present):

Depth from ground surface to water table (m) (if present): 1.80

Depth of water ingress:

Rock type (if present): None Present

Date and time of excavation: 21/08/2014

Date and time of examination: 22/08/2014

	Depth of P/T Test*	Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m	P	Top soil - Clayey loam	dilatant	Crumb	Firm	Bl;ack	Rootlets
0.2 m	P						
0.3 m	P,	Gravely CLAY (Low gravel content) Few Cobbles	Slowly Dilatant Trds= 7, 9.9 Rib - 100, 100, 120	Blocky	Firm (Relatively uncomacted)	Dark Brown	
0.4 m	P, T3						None
0.5 m	T1-3						
0.6 m	T1-3						
0.7 m	T1-3						
0.8 m	T1-2						
0.9 m							
1.0 m							
1.1 m							
1.2 m							
1.3 m							
1.4 m							
1.5 m		Gravely SILT/ CLAY Cobbles and few small boulders	Slowly Dilatent Trds = 3,6,6 Ribs = 80, 70,70	Blocky	Firm	Brown	
1.6 m							
1.7 m							
1.8 m							
1.9 m							
2.0 m							
2.1 m							
2.2 m							
2.3 m							
2.4 m		Base of trench					
2.5 m							
2.6 m							
2.7 m							
2.8 m							
2.9 m							
3.0 m							

Evaluation:

Topsoil is likely to have good soakage. Subsoil is high in clay and silt but is not compacted and with some gravel present is likely to have soakage in the mid-range.
The water table is high and is likely to be higher in winter though no evidence of mottling was detected.

Likely T value: 30.00

Note: *Depth of percolation test holes should be indicated on log above. (Enter P or T at depts as appropriate).
** See Appendix E for BS 5930 classification.
*** 3 samples to be tested for each horizon and results should be entered above for each horizon.
**** All signs of mottling should be recorded.

3.3(a) Percolation ("T") Test for Deep Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	500	500	500
Depth from ground surface to base of hole (mm) (B)	900	900	900
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started	22/08/2014		22/08/2014		22/08/2014	

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	23/08/2014	23/08/2014	23/08/2014
Time filled to 400 mm	08:21	08:26	08:28
Time water level at 300 mm	09:22	09:21	09:38
Time to drop 100 mm (T_{100})	61.00	55.00	70.00
Average T_{100}			62.00

If T_{100} > 300 minutes then T-value >90 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	09:22	10:41	79.00	09:21	10:27	66.00	09:38	11:02	84.00
2	10:41	12:08	87.00	10:27	11:42	75.00	11:02	12:41	99.00
3	12:08	13:43	95.00	11:42	13:01	79.00	12:41	14:29	108.00
Average Δt Value			87.00			73.33			97.00
	Average Δt/4 = [Hole No.1]		21.75 (t_1)	Average Δt/4 = [Hole No.2]		18.33 (t_2)	Average Δt/4 = [Hole No.3]		24.25 (t_3)

Result of Test: T = 21.44 (min/25 mm)

Comments:

Soakage is acceptable.

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average T- Value	T- Value Hole 1= (t_1)			0.00	T- Value Hole 1= (t_2)			0.00	T- Value Hole 1= (t_3)			0.00

Result of Test: T = 0.00 (min/25 mm)

Comments:

3.3(b) Percolation ("P") Test for Shallow Soil / Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)	0	0	0
Depth from ground surface to base of hole (mm)	400	400.00	400
Depth of hole (mm)	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started	22/08/2014		22/08/2014		22/08/2014	

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring P_{100}

Percolation Test Hole No.	1	2	3
Date of test	23/08/2014	23/08/2014	23/08/2014
Time filled to 400 mm	08:31	08:33	08:36
Time water level at 300 mm	09:38	09:44	09:52
Time to drop 100 mm (P_{100})	67.00	71.00	76.00
Average P_{100}			71.33

If P_{100} > 300 minutes then T-value >90 – site unsuitable for discharge to ground
If $P_{100} \leq 210$ minutes then go to Step 4;
If P_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $P_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)
1	09:38	11:04	86.00	09:44	10:57	73.00	09:52	11:24	92.00
2	11:04	12:46	102.00	10:57	12:26	89.00	11:24	13:26	122.00
3	12:46	14:50	124.00	12:26	14:23	117.00	13:26	16:07	161.00
Average Δp Value			104.00			93.00			125.00
	Average Δp/4 = [Hole No.1]		26.00 (p_1)	Average Δp/4 = [Hole No.2]		23.25 (p_2)	Average Δp/4 = [Hole No.3]		31.25 (p_3)

Result of Test: P = 26.83 (min/25 mm)

Comments:

The P-value is within the acceptable range

Step 5: Modified Method (where $P_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average P- Value	P- Value Hole 1= (p_1)			0.00	P- Value Hole 1= (p_2)			0.00	P- Value Hole 1= (p_3)			0.00

Result of Test: P = 0.00 (min/25 mm)

Comments:

3.4 The following associated Maps, Drawings and Photographs should be appended to this site characterisation form.

1. Discovery Series 1:50,000 Map indicating overall drainage, groundwater flow direction and housing density in the area.
2. Supporting maps for vulnerability, aquifer classification, soil, bedrock.
3. North point should always be included.
4. (a) Sketch of site showing measurements to Trial Hole location and
   (b) Percolation Test Hole locations,
   (c) wells and
   (d) direction of groundwater flow (if known),
   (e) proposed house (incl. distances from boundaries)
   (f) adjacent houses,
   (g) watercourses,
   (h) significant sites
   (i) and other relevant features.
5. Cross sectional drawing of the site and the proposed layout[1] should be submitted.
6. Photographs of the trial hole, text holes and site (date and time referenced).

[1] The calculated percolation area or polishing filter area should be set out accurately on the site layout drawing in accordance with the code of practice's requirements.

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Not Suitable for Development ☐

Suitable for [1]		**Discharge Route**
1. Septic tank system (septic tank and percolation area)	No	Discharge to Ground Water
2. Secondary Treatment System		
a. septic tank and filter system constructed on-site and polishing filter; or	Yes	
b. packaged wastewater treatment system and polishing filter	Yes	

5.0 RECOMMENDATION

Propose to install: Packaged wastewater treatment system and polishing filter

and discharge to: Ground Water

Trench Invert level (m):

Site Specific Conditions (e.g. special works, site improvement works testing etc.

Because of the high watertable the site is not suitable for a standard septic tank and percolation area.It is recommended to install a Package aeration system and to polish the effluent through a polishing filter. - See main report

[1] note: more than one option may be suitable for a site and this should be recorded

[2] A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.6.2.

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m^3)		Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System

Filter Systems

Media Type	Area (m^2)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Package Treatment Systems

Type	Platinum P 40
Capacity PE	40.00
Sizing of Primary Compartment	5.50 m^3

SYSTEM TYPE: Tertiary Treatment System

Polishing Filter: Surface Area (m^2)*		**Package Treatment System:** Capacity (pe)	40.00
or **Gravity Fed:**		**Constructed Wetland:** Surface Area (m^2)*	
No. of Trenches			
Length of Trenches (m)			
Invert Level (m)			

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate * ($l/m^2.d$)	60.00
Surface Water **		Discharge Rate (m^3/hr)	

TREATMENT STANDARDS:

Treatment System Performance Standard (mg/l)	BOD	SS	NH_3	Total N	Total P
	20.00	30.00	20.00		10.00

QUALITY ASSURANCE:

Installation & Commissioning	On-going Maintenance
Installation supervised and Certified by qualified assessor or a suitably qualified person familiar with the EPA Code of Practice 2009.	Annual maintenance contract - including desludging

* Hydrolic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

7.0 SITE ASSESSOR DETAILS

Company: Trinity Green

Prefix: Dr. First Name: Eugene Surname: Bolton

Address: Clonfert, Maynooth, Co. Kildare

Qualifications/Experience: PhD Microbiology, Site Suitability Assessment Course (FETAC)

Date of Report: 01/09/2014

Phone: 086 2434828 Fax: e-mail info@trinitygreen.ie

Indemnity Insurance Number: QQ002280f007

Signature: _____

APPENDIX E
FOUL AND SURFACE WATER DRAINAGE LAYOUT

PC/PKS/01/19

All surface water drainage works shall be constructed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works

Legend:

- Manhole
- Possible surface water drainage network subject to ground investigation
- Existing public drainage pipe
- Proposed permeable paving
- Proposed detention infiltration basin
- Proposed infiltration trench

No.	Revision	Date	By	Chk'd	App'd
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Stage	Date	App'd
PRELIMINARY	-	-
APPROVAL	-	-
TENDER	-	-
CONSTRUCTION	-	-

Roughan & O'Donovan
Consulting Engineers
Civil - Structural - Transportation - Environmental

Arena House, Arena Road,
Sandyford, Dublin 18.
Tel : +353 1 294 0800
Fax : +353 1 294 0820
e-mail : info@rod.ie
Website : www.rod.ie

Designed: BP | Checked: JPR | Approved: EOC | Status: PLANNING

Project Title: ST. THOMAS DEVELOPMENT, TIBRADDEN ROAD

Drawing Title: FOUL AND SURFACE WATER DRAINAGE LAYOUT

Drawn:	Job No:	Drawing No:	Rev:
AG	14.112	14.112.101-100	-
Scale: (A1) 1:1000	Date: APRIL 2019		

Apr 12, 2019 - 1:46pm Drawing Location: J:\2014\14112\14.112.101\14112101-02_WIP\08 MODELS\01 CAD\01 DWG\Landscape Masterplan - St.Thomas's 2 (2434)_ROD_BP AG.dwg

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

APPENDIX F
EXEMPLARY SBR SYSTEM FROM MOLLOY ENVIRONMENTAL SYSTEMS

MOLLOY
ENVIRONMENTAL SYSTEMS

MES1480 Dundrum AC

Wastewater treatment using SBR technology

Shane Fox BEng PhD MIEI

Proposal

Coleraine,
Clara Road,
Tullamore,
Co. Offaly.

Tel: +353 (0)57 93 26000
Fax: +353 (0)57 93 26060

E-mail: info@molloyprecast.com
Web: www.molloyprecast.com

Proposal for wastewater treatment using SBR technology for Dundrum AC

Date: 09/04/2019
File Reference: MES1480_Report_090419.docx
Project Name: Dundrum AC
Project address: Taylorsgrange
Co. Dublin

Contents

1. Introduction

This report details a proposal for the treatment of wastewater discharged from Dundrum AC, Taylorstown, Co. Dublin. The technology detailed in this report is Sequential Batch Reactor (SBR) technology followed by a sand polishing filter

2. Design Criteria

The wastewater treatment system is designed to handle the following loading:

Parameter	*Daily Loading*	*Equivalent PE*
Hydraulic load	6,000 litres	40 PE (@150 l/p/d)
Organic load	4,000 g BOD_5	67 PE (@60g BOD_5/d)

Design effluent concentrations from the wastewater treatment system:

Parameter	*Concentration*	*unit*
BOD_5	20	mg/l
TSS	30	mg/l
Ammonium-Nitrogen	20	mg/l

3. Proposed Treatment System

The proposed treatment unit is a Molloy Environmental M1 system. The system is capable of treating the design loading as described above. The proposed system in summary consists of the following components:

- 1 no. precast concrete primary tank (L tank - 10,000 litres)
- 1 no. precast concrete buffer tank (S+ tank - 7,000 litres)
- 1 no. precast concrete reactor tank (S+ tank - 7,000 litres)
- 120m^2 sand polishing filter

3.1. Primary settlement tank

The purpose of the primary tank is to allow for settlement of solids from the influent. This is achieved by creating quiescent conditions and large dwell times. A total of 5,800 litres of storage is achieved here. This tank is designed to store additional sludge returned from the reactor tank. The tank is capable of handling fats oils and greases (FOG) from general day to day activities, however, it should be noted that if the influent is likely to contain large quantities of FOG, grease traps should be employed to prevent negative effects to the treatment system. Separate grease traps should always be used where busy commercial kitchens discharge into the system. The frequency of desludging of the primary tank is dependent on actual sludge build-up, which varies from system to system. Maintenance technicians will indicate when desludging is required during onsite visits.

3.2. Buffer tanks

SBR technology treats wastewater in batches and hence buffer tanks are required to buffer flow as a batch is being treated. This is important in this application where the load can be concentrated over a short number of hours each day. A total of 5,300 litres of storage is employed here.

Flow into this chamber is by gravity from the primary settlement chamber. Flow to the Reaction tank is via standard submersible pumps. The buffer tank is equipped with:

- 1 no. submersible feed pumps
- 3 no. float switches

3.3. Reaction tank

The purpose of the reaction tank system is to remove biological and nutrient contaminants from the wastewater. This is achieved in a mechanically created aerobic and anoxic environments. See section on technology description for further details. A 7,000 litre reaction tank is employed to achieve this. The tank is equipped with:

- 1 no. air delivery system
- 2 no. submersible discharge pumps
- 1 no. submersible sludge return pump
- 3 no. float switches (shared between each tank)

3.4. Sand polishing filter

A 120m^2 sand polishing filter was specified for this project. The distribution network required for this should have a hole matrix of 0.6m by 0.6m. This network should be divided into 2 independent zones each serviced by an independent pump housed within the reaction chamber.

4. Control

Control of all equipment associated with this treatment system is housed within a control kiosk to be installed on top of the treatment unit. An alarm system will be provided with an external beacon. A single-phase power supply will be required to the control kiosk (by others).

5. Access

Appropriate vehicular access for maintenance purposes will be required to the system with emphases on the primary tank which requires rigid lorry access for desludgeing.

6. Treatment system technology details

- Electrical requirement is an independent 20 amp c-rated single phase supply
- Annual energy consumption is 2,400Kwh
- During light load periods the facility will revert to an economy mode, thus reducing energy requirements
- All tanks are installed underground with low noise operation
- When ventilated effectively no unacceptable odours will be noticed
- A local caretaker will be trained and instructed in the operation and checks of the system for efficient operation
- Delivery, installation and commissioning by Molloy Environmental System's employees
- Foul sewer system to be design and installed by others
- It is recommended this facility receives two services per year
- It is recommended that an auxiliary is connected to the main MCB and connected to an alarm in the building to alert the operator of a major trip (by others)

7. Technology Description

Sequential Batch Reactor (SBR) Wastewater Treatment

An SBR system treats wastewater in a cycle of four stages namely Fill, React, Settle and Discharge. In general this cycle is repeated 3 times a day, however, a cycle can be varied to last for 6, 8, 12 or 24 hours to handle varying wastewater and hydraulic conditions. The system consists of a primary settlement tank, a buffer tank and a reaction tank. The primary tank allows solids to settle under quiescent conditions. the purpose of the buffer tank is to collect and store wastewater while the treatment tank is in a cycle. The treatment tank treats the wastewater prior to discharge into the receiving disporsal system. The illustration below details a typical single stream commercial system.

1 Fill

Wastewater firstly enters the primary tank (On the right), This chamber acts like a septic tank, settling out solids and allowing grease to float to the top. The purpose of the second tank (buffer tank) is to store in coming wastewater while the last tank (SBR tank) is treating a batch of wastewater. During the fill period, wastewater is pumped from the buffer tank into the SBR tank where it is to be treated.

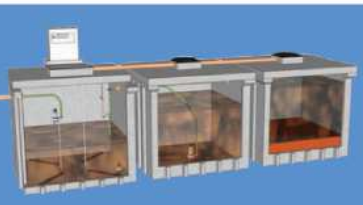
2 React

The SBR tank always has a large volume of liquid in it. This Liquid contains high concentrations of bacteria, it is this bacteria that breaks down the contaminents in the influent wastewater. During the aeration phase oxygen is introduced using a system of air diffusers. This supply of oxygen encourages the bacteria to breakdown the contaminents while also agitating the liquid contents of the tank. This phase is optimised by intermittently supplying oxygen. This reduces energy consumption without affecting the treatment performance.

3 Settle

After completion of the reaction phase all contaminents are removed from the wastewater. The settle phase is used to allow the bacteria to settle to the bottom of the tank. This leaves a clarified treated layer of liquid on top of the tank.

4 Discharge



The upper treated layer is pumped out to the receiving environment, leaving the lower bacteria layer to be used in the next treatment cycle. The receiving environment is generally a percolation area or sand filter. Once passed through a sand filter the liquid can potentially be discharged directly into a water course.

8. System Guarantee

Molloy Environmental Systems fully guarantees the Molloy Environmental Systems wastewater treatment technology as suitable for the development in question. The system must be installed as per the manufacturer's guidelines and commissioned by trained personnel. To ensure the efficient treatment of the wastewater the following is recommended:

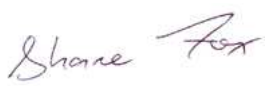
- No rainwater, surface water etc., should be discharged to the treatment system
- Only wastewater as listed in the design criteria should enter the system
- Excessive fats, oils and greases should be removed upstream of the system
- Care should be taken not to discharge large materials such as rags etc. into the system
- An adequate ventilation system should be installed by others (a 6m minimum high vent stack should be installed depending on site conditions. A taller vent stack should be installed where possible or necessary). Please refer to your site engineer for specification for
- Urinals and any other automatically flushing apparatus should be operated in a water conservative manner and only operate during the occupied time.
- Good practice would be to monitor all water usage, using a water meter. This would alert the caretaker of unusual excessive water usage and hence a leak

Molloy Environmental Systems provides a 2-year warranty to remedy any fault in products provided:

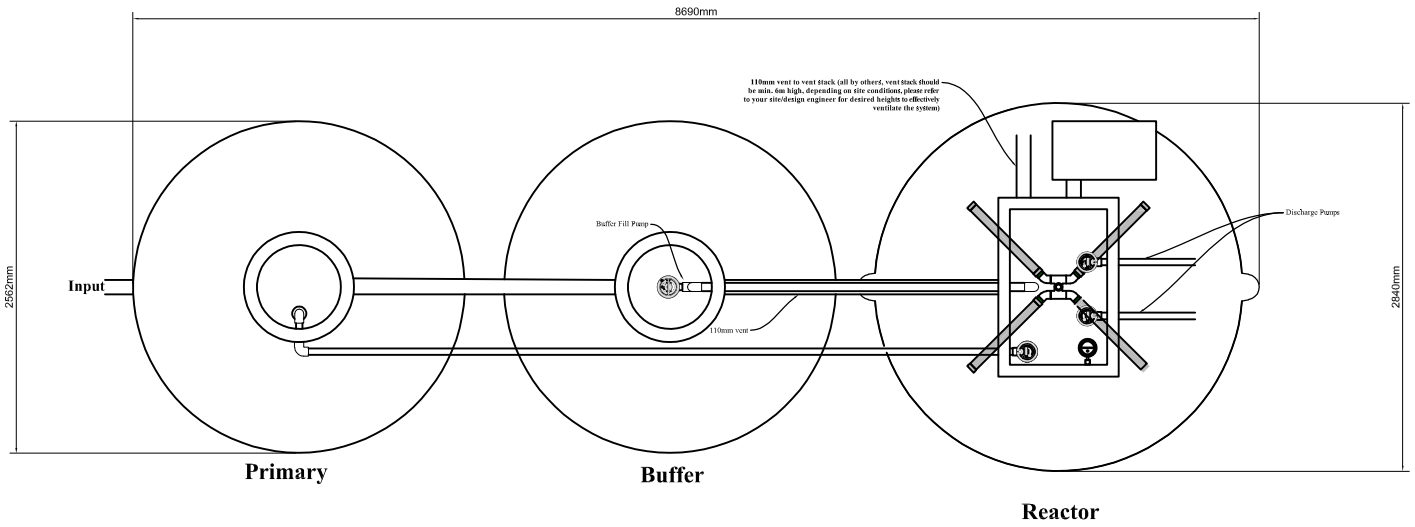
- That the fault is due to defects in design, materials or workmanship
- That the fault is reported to Molloy Environmental Systems during the guarantee period
- That the product has been used only under the conditions described in the care and maintenance instructions, and in applications for which it is intended
- That all service and repair is carried out by Molloy Environmental Systems personnel as per the maintenance requirements
- Therefore, this warrantee does not apply to faults resulting from lack of maintenance, inadequate civil works, repair works carried out improperly or normal wear and tear
- Furthermore, Molloy Environmental Systems disclaims any liability in case of physical injuries, material or economic damages for those mentioned above

Please contact me if you require any additional information

Yours sincerely,

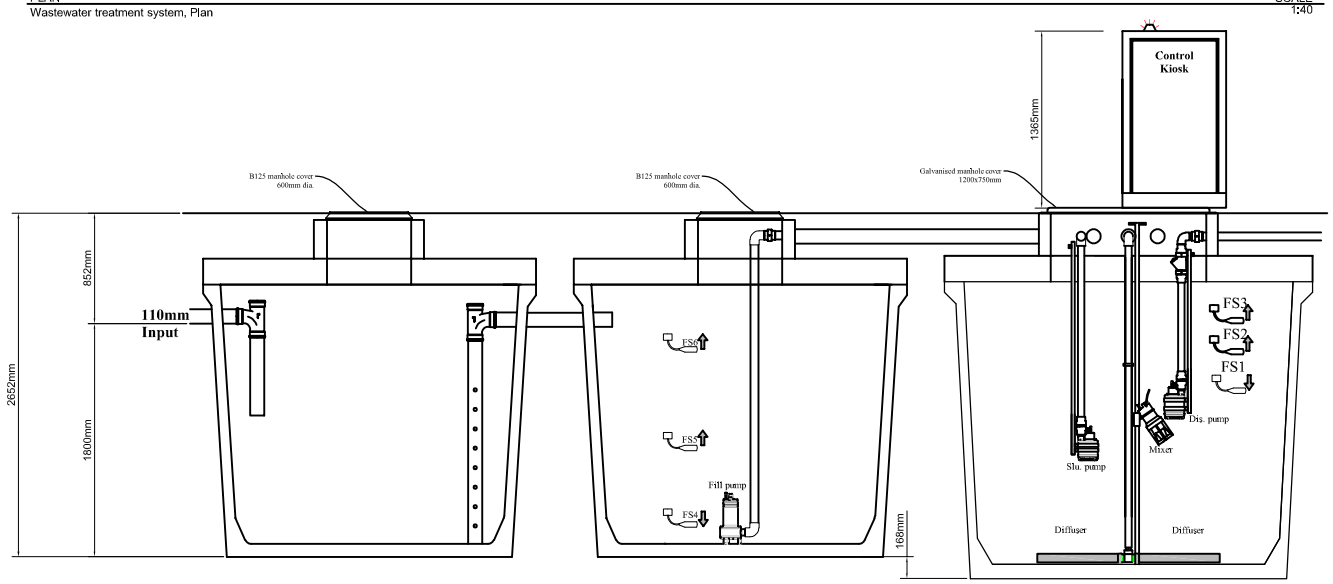


Shane Fox BEng PhD MIEI
Environmental Process Engineer
Molloy Environmental Systems



PLAN
Wastewater treatment system, Plan

SCALE
1:40



SECTION
Wastewater treatment system, Section

SCALE
1:40

For Tender only,
NOT CONSTRUCTION DRAWINGS

MOLLOY ENVIRONMENTAL SYSTEMS
Clara Road, Tullamore, Co. Offaly, Ireland
Tel: 057 9326000 Info@molloyprecast.com
Fax: 057 9326060 www.molloyprecast.com

Title: SBR WWTP

Date: 05/10/2017

Drg. No.: TS-L-008-051017

Drawn By: SF

Drg. Size: A3

APPENDIX G
SURFACE WATER CALCULATIONS

		INPUT	
Total Area to be Drained		57,359	Sq m
Impermeability Factor		0.14	
Storm Return Period	T	100	Yrs
Allowable Discharge **per hectare**		2.00	l/s
Time of Concentration	TC	8.00	min
2 Day M5 (mm) =		76.50	mm
Ratio 60 Minute M5/2 Day M5	r	0.25	
Impermeable Area		8030.26	Sq m
Allowable Discharge	P	0.69	Cu m/min
60 Minute M5		19.40	mm
Storage Event		Maximum Event	

ROUGHAN & O'DONOVAN
Consulting Engineers

SURFACE WATER ATTENUATION & STORAGE

Version 1.04

Storage C = Q*TS - P*(TS + TC) + P^2*TC/Q

W = LN(1.06 * M5-60/(48*r))
X = LN(721/(1 + 15 * D))
Y = LN(48 * r/1.06)
Z = LN(721/16)
LN(M5-D) = LN(D) + W + (X * Y)/Z

Cr = J0 + J1 * (M5-D) + J2 * (M5-D)^2

LN((MT-D)/M5-D)) = Cr * (LN(T) - 1.5)

Project No.:	**14.112.101**
Project:	**St. Thomas's Running Track**
Date:	**8-Apr-2019**
Designer:	**BP**

Time of Storm TS	Time of Storm D	Time of Concentration TC	W	X	Y	Z	LN(D)	LN(M5-D)	M5-D	Rainfall Intensity	J0	J1	J2	Cr	M100-D	Rainfall Intensity +10%	Discharge to Storage	Discharge to Storage Q	Storage Required C
Minutes	Hours	Minutes							mm	mm/hr					mm	mm/hr	l/s	Cu.m/min	Cu. m
3	0.050	8.0	0.524	6.021	2.441	3.808	-2.996	1.388	4.007	80.139	0.165	0.008	-0.000305	0.193	7.302	160.655	358.361	21.502	57.11
5	0.083	8.0	0.524	5.770	2.441	3.808	-2.485	1.738	5.685	68.216	0.165	0.008	-0.000305	0.202	10.654	140.637	313.708	18.822	85.37
7	0.117	8.0	0.524	5.569	2.441	3.808	-2.148	1.946	6.998	59.982	0.165	0.008	-0.000305	0.208	13.357	125.935	280.913	16.855	107.88
10	0.167	8.0	0.524	5.328	2.441	3.808	-1.792	2.148	8.565	51.391	0.165	0.008	-0.000305	0.214	16.636	109.798	244.918	14.695	134.82
13	0.217	8.0	0.524	5.134	2.441	3.808	-1.529	2.286	9.832	45.377	0.165	0.008	-0.000305	0.217	19.302	97.994	218.588	13.115	156.33
16	0.267	8.0	0.524	4.971	2.441	3.808	-1.322	2.389	10.903	40.888	0.165	0.008	-0.000305	0.219	21.550	88.893	198.286	11.897	174.15
20	0.333	8.0	0.524	4.789	2.441	3.808	-1.099	2.495	12.126	36.378	0.165	0.008	-0.000305	0.221	24.086	79.483	177.298	10.638	193.84
25	0.417	8.0	0.524	4.600	2.441	3.808	-0.875	2.597	13.426	32.223	0.235	-0.001	-0.000017	0.221	26.704	70.498	157.255	9.435	213.57
30	0.500	8.0	0.524	4.441	2.441	3.808	-0.693	2.678	14.550	29.099	0.235	-0.001	-0.000017	0.220	28.812	63.387	141.392	8.484	228.80
45	0.750	8.0	0.524	4.075	2.441	3.808	-0.288	2.849	17.267	23.022	0.235	-0.001	-0.000017	0.216	33.814	49.594	110.625	6.638	262.78
60	1.000	8.0	0.524	3.808	2.441	3.808	0.000	2.965	19.400	19.400	0.235	-0.001	-0.000017	0.213	37.640	41.404	92.357	5.541	286.37
75	1.250	8.0	0.524	3.597	2.441	3.808	0.223	3.053	21.188	16.951	0.235	-0.001	-0.000017	0.211	40.775	35.882	80.040	4.802	303.84
90	1.500	8.0	0.524	3.424	2.441	3.808	0.405	3.124	22.745	15.163	0.235	-0.001	-0.000017	0.208	43.449	31.862	71.073	4.264	317.23
105	1.750	8.0	0.524	3.276	2.441	3.808	0.560	3.184	24.133	13.790	0.235	-0.001	-0.000017	0.206	45.788	28.781	64.199	3.852	327.66
120	2.000	8.0	0.524	3.147	2.441	3.808	0.693	3.234	25.393	12.696	0.250	-0.002	0.000012	0.204	47.913	26.352	58.781	3.527	336.20
135	2.250	8.0	0.524	3.032	2.441	3.808	0.811	3.279	26.551	11.800	0.250	-0.002	0.000012	0.203	49.832	24.362	54.343	3.261	342.91
150	2.500	8.0	0.524	2.930	2.441	3.808	0.916	3.319	27.625	11.050	0.250	-0.002	0.000012	0.201	51.598	22.703	50.642	3.039	348.27
165	2.750	8.0	0.524	2.837	2.441	3.808	1.012	3.354	28.630	10.411	0.250	-0.002	0.000012	0.200	53.237	21.295	47.501	2.850	352.51
180	3.000	8.0	0.524	2.752	2.441	3.808	1.099	3.387	29.576	9.859	0.250	-0.002	0.000012	0.198	54.770	20.082	44.796	2.688	355.81
240	4.000	8.0	0.524	2.470	2.441	3.808	1.386	3.494	32.909	8.227	0.250	-0.002	0.000012	0.194	60.095	16.526	36.864	2.212	361.85
300	5.000	8.0	0.524	2.250	2.441	3.808	1.609	3.576	35.729	7.146	0.250	-0.002	0.000012	0.190	64.520	14.194	31.662	1.900	359.92
360	6.000	8.0	0.524	2.070	2.441	3.808	1.792	3.643	38.199	6.367	0.250	-0.002	0.000012	0.187	68.343	12.530	27.949	1.677	352.65
420	7.000	8.0	0.524	1.917	2.441	3.808	1.946	3.699	40.414	5.773	0.250	-0.002	0.000012	0.185	71.732	11.272	25.144	1.509	341.55
480	8.000	8.0	0.524	1.785	2.441	3.808	2.079	3.748	42.430	5.304	0.250	-0.002	0.000012	0.183	74.793	10.284	22.940	1.376	327.53
540	9.000	8.0	0.524	1.668	2.441	3.808	2.197	3.791	44.289	4.921	0.250	-0.002	0.000012	0.181	77.594	9.484	21.155	1.269	311.21
600	10.000	8.0	0.524	1.563	2.441	3.808	2.303	3.829	46.018	4.602	0.250	-0.002	0.000012	0.179	80.186	8.820	19.675	1.181	293.03
660	11.000	8.0	0.524	1.469	2.441	3.808	2.398	3.864	47.639	4.331	0.250	-0.002	0.000012	0.177	82.604	8.260	18.426	1.106	273.30
720	12.000	8.0	0.524	1.382	2.441	3.808	2.485	3.895	49.166	4.097	0.250	-0.002	0.000012	0.176	84.876	7.780	17.355	1.041	252.28
780	13.000	8.0	0.524	1.303	2.441	3.808	2.565	3.924	50.613	3.893	0.227	-0.001	0.000003	0.175	87.016	7.363	16.424	0.985	230.09
840	14.000	8.0	0.524	1.229	2.441	3.808	2.639	3.951	51.990	3.714	0.227	-0.001	0.000003	0.173	89.048	6.997	15.607	0.936	206.95
900	15.000	8.0	0.524	1.160	2.441	3.808	2.708	3.976	53.305	3.554	0.227	-0.001	0.000003	0.172	90.976	6.672	14.882	0.893	182.88
960	16.000	8.0	0.524	1.096	2.441	3.808	2.773	3.999	54.564	3.410	0.227	-0.001	0.000003	0.171	92.813	6.381	14.233	0.854	158.00
1020	17.000	8.0	0.524	1.035	2.441	3.808	2.833	4.021	55.773	3.281	0.227	-0.001	0.000003	0.170	94.566	6.119	13.649	0.819	132.38
1080	18.000	8.0	0.524	0.979	2.441	3.808	2.890	4.042	56.937	3.163	0.227	-0.001	0.000003	0.169	96.246	5.882	13.120	0.787	106.10
1140	19.000	8.0	0.524	0.925	2.441	3.808	2.944	4.061	58.060	3.056	0.227	-0.001	0.000003	0.168	97.858	5.665	12.638	0.758	79.23
1400	23.333	8.0	0.524	0.720	2.441	3.808	3.150	4.136	62.531	2.680	0.227	-0.001	0.000003	0.164	104.200	4.912	10.958	0.657	0.00
1700	28.333	8.0	0.524	0.526	2.441	3.808	3.344	4.206	67.067	2.367	0.227	-0.001	0.000003	0.161	110.521	4.291	9.571	0.574	0.00

MAXIMUM STORAGE REQUIRED (Cu. M) = 361.85