Chapter 7:

Land and Soils

7.0 LAND AND SOILS

7.1 INTRODUCTION

This section will focus on the environmental impact of the proposed development relating to both land and soil. This chapter has been prepared by Hydrocare Environmental Ltd. The chapter was written by Daniel Nolan, BA BAI, MSc, MIEI and reviewed by Sean O'Connor, M. Appd Sc., Dip. Public Health, PG dip. Env. Engr.

The proposed development consists of a residential development comprising of 913 no. residential units, a neighbourhood centre, including 2 no. retail units, a café / restaurant unit, a primary healthcare / gym, a community facility and a childcare facility, all associated open space, a section of the Dunshaughlin Outer Relief Road, internal roads, cycle and pedestrian infrastructure, services and all other associated development on a site of c. 28.3 hectares.

The 913 no. residential units proposed consist of 505 no. houses (single, two, and three storey), 186 no. duplex units (three storey), and 222 no. apartments (four and five storey).

The 505 no. houses proposed consist of the following:

- 45 no. 2-bedroom houses
- 382 no. 3-bedroom houses (including 4 no. bungalows)
- 50 no. 4-bedroom houses (including 5 no. bungalows)
- 28 no. 4/5-bedroom houses (three storey)

The 186 no. duplex units consist of the following:

- 20 no. 1-bedroom duplex units
- 84 no. 2-bedroom duplex units
- 73 no. 3-bedroom duplex units
- 9 no. 4-bedroom duplex units

The 222 no. apartments consist of the following:

- 50 no. 1-bedroom apartments
- 151 no. 2-bedroom apartments
- 21 no. 3-bedroom apartments

The development includes the delivery of a section of the Dunshaughlin Outer Relief Road from the Phase 1 site boundary to the northern site boundary, including connections to adjacent lands, improvements to a section of the Outer Relief Road delivered with the Phase 1 development to the south, a bus bay and toucan crossing on the Dublin Road, all associated open space, boundary treatment, internal roads, cycle and pedestrian infrastructure, foul and surface water drainage, a pumping station, attenuation tanks, car and cycle parking, ESB substations, other services and all other associated development.

A Site Specific Flood Risk Assessment has been completed by Hydrocare Environmental Ltd and is included with the planning application submission. Relevant details of the Site Specific Flood Risk Assessment and Stormwater Assessment prepared by JBA Consulting contribute to this chapter of the EIAR.

7.2 STUDY METHODOLOGY

The potential impact of this development in relation to water bodies was assessed as per EPA methodology and criteria outlined in the following documents.

- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002 & Draft 2017)
- EIA Directive 2014/EU/52
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).
- Advice notes on current practice in the preparation of Environmental Impact Statements, (EPA, 2003)
- Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003).
- Development Management Guidelines (DoEHLG, 2007).

Baseline description data used to describe the receiving environment has been sourced from the following resources:

- Environmental Protection Agency Mapping Viewers and Online Data Sources.
- Geological Survey of Ireland Mapping Viewers and Online Data Sources.
- Trial Pit Site Investigation Data carried out by Hydrocare Environmental Ltd.
- Site Specific Flood Risk Assessment Report by Hydrocare Environmental Ltd.
- Site Investigation Report by IGSL Ltd.
- OPW and Meath County Council Flood Mapping Databases.
- Site Walkover and Inspection.
- Irish Water in relation to Watermain and Wastewater Treatment.
- Topographical Survey.
- OSI historical mapping archive.

Data for the development was collected from EPA, GSI, Teagasc, OSI sources. Verification of the relevant data relating to the Land & Soils profile further assessed through Site Investigation.

Trial Hole logs were carried out by Hydrocare Environmental Ltd for the proposed development. Data from this report is used to describe the baseline data.

A pre-construction Site Investigation Report by IGSL Ltd carried out for the 'The Willows' development on adjoining lands is also used to describe the baseline data.

7.3 THE EXISTING RECEIVING ENVIRONMENT

7.3.1 Land

The subject lands on which development is sought, is currently used as agricultural farm land. The subject lands extend to 28.3 hectares of agricultural land.

The subject land topography can be described as mildly undulating rising from South to North. The crown of the site is located ca. 700m from the southern boundary and 175m from the northern boundary. The elevation across the site varies from ca. 99mAOD to 105mAOD. A gently cross fall sloping downward from the west to east also exists.

Visual inspection of the site on 3 occasions in January 2018 determined the tillage land to be very soft underfoot following the recent harvest and extensive wet weather period. Water logging is evident within the machine tracks from the harvest. Lands used for pasture purposes, with grass cover, were less impacted with standing water and were soft to firm underfoot, with minimal pockets of ponding evident.

The lands are drained via a network of ditch drains and natural watercourses. Runoff waters from lands south of the crown of the site are drained to the south east of the site via ditch drains. Runoff waters from lands north of the crown of the site are drained via ditch drains to a stream at the northern boundary of the site. The entire subject lands are within the catchment of the Broadmeadow River which rises 750m distant north of the proposed development lands.

7.3.2 Site Investigation

A Site Investigation consisting of Trial Hole log data was undertaken across the site by Hydrocare Environmental Ltd. The investigation determined the soil and subsoil to be of a CLAY soil type down to 3m below ground level across the site. WTL in the Trial Hole logs varied across the site, ranging from 0.6m BGL to 1.5m BGL. The report is included in Appendix 7.1 of this chapter.

Previously permitted phases of 'The Willows' development on lands immediately adjacent to the proposed development site, had a detailed site investigation carried out prior to construction in 2017 by IGSL Ltd. The Site Investigation is in accordance with BS5930, Code of Practice for Site Investigation (1999) and appropriate Eurocodes. This site investigation also determined the soil to be of a CLAY soil type down to 3m below ground level across the site. The report is included in Appendix 7.2 of this chapter.

EPA, GSI mapping data of the proposed development site along with Trial Hole data carried out across the site confirm the underlying soil and subsoil to be of a CLAY type soil with low-permeability. No bedrock has been recorded to within 3m of the ground surface in the SI reports.

7.3.3 Soils

The soil is described on the EPA Envision mapping portal as a poorly drained mineral (basic) soil and is classed in gley soil group. The trial pit investigation also determined a predominantly CLAY type upper soil evident across most of proposed development lands. Trial pit investigation at the highest point of the site determined a deep SILT/CLAY upper soil horizon to be present overlying a CLAY subsoil.

The subject site is currently used for agricultural purposes and is a greenfield site. There is no evidence of previous dumping or industrial use on the lands subjected for development. Soils removed from site will be required to be classified by WAC analysis testing during construction, however SI, EPA and GSI data for the site location indicate soils and subsoils to be inert.

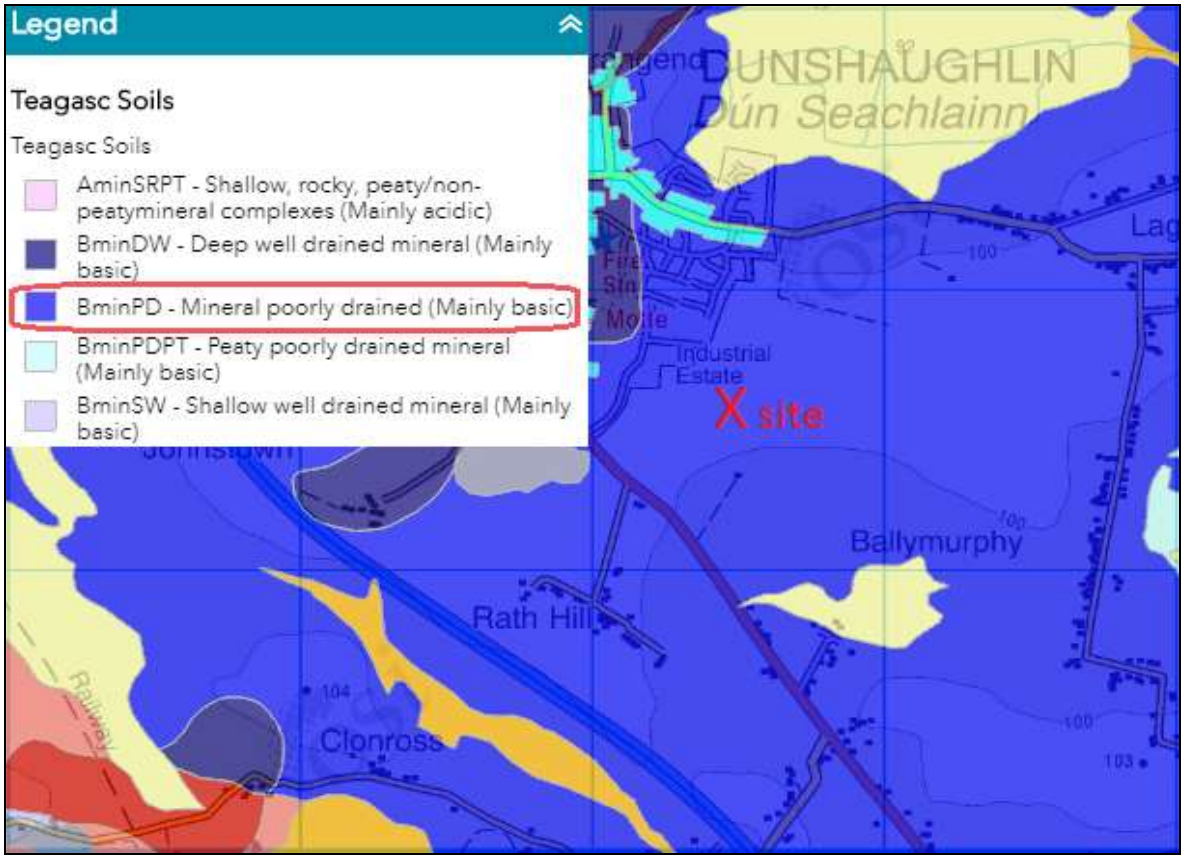

Figure 7.1 – EPA Soils Map (Nov 2018)

7.3.4 Quaternary (Subsoil)

The subsoil is described on the EPA Envision mapping portal as Limestone Till. The trial pit investigations confirm a Limestone Till is present. The subsoil is determined from the site investigation to be predominantly CLAY mineral across the entire site, with frequent quantities of angular, non-rounded, pebbles, cobbles and boulders present.

Pebbles, cobbles and boulders are of a limestone rock type. The subsoil is a blue grey colour in general across the entire site. In the lower grounds to the south less frequent pebbles, cobbles and boulders are present, and the CLAY subsoil mineral is well sorted, compacted to form large massive soil structure with orange mottling also present.

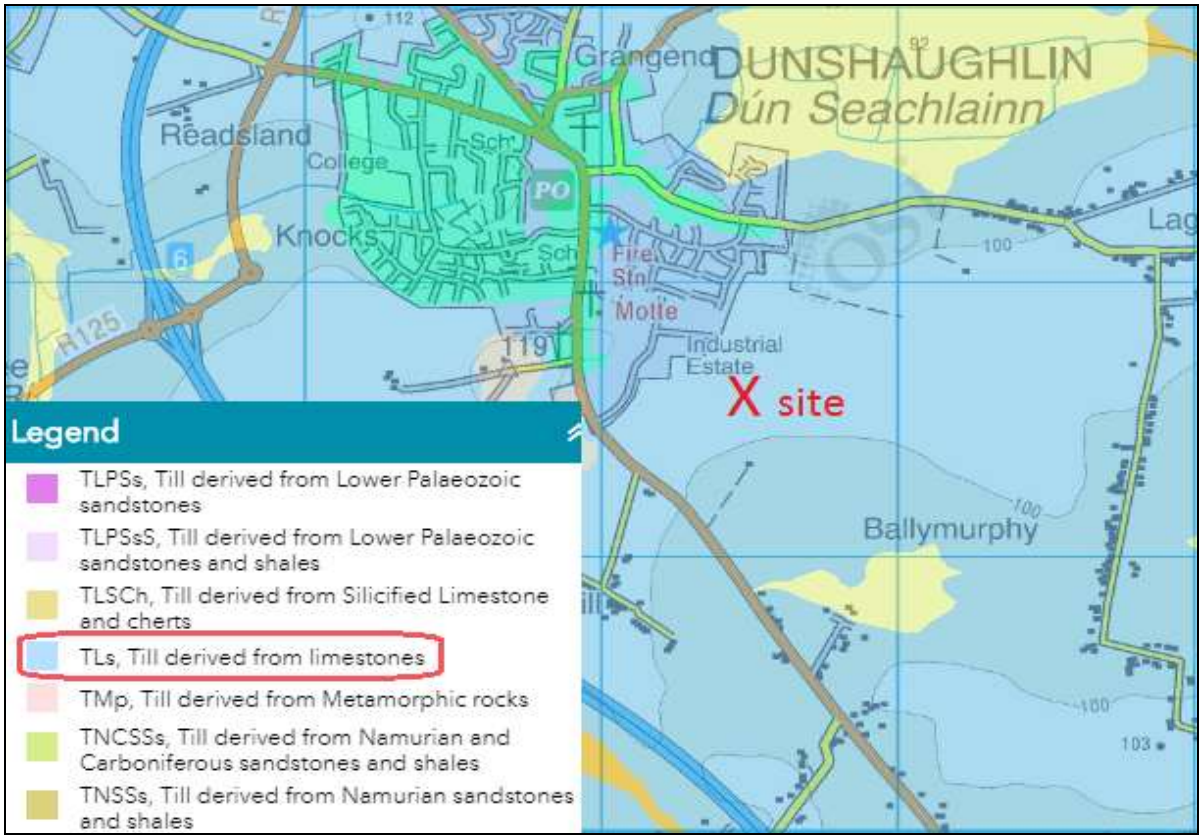

Figure 7.2 – EPA Subsoils/Quaternary Map (Nov 2018)

7.3.5 Hydrogeology

Groundwater is an important source of drinking water and it supports river flows, lake levels and ecosystems. It contains natural substances dissolved from the soils and rocks that it flows through and can also be contaminated by human actions on the land surface (extract from GSI.ie, Nov 2018).

The EU water Framework Directive (WFD, 2000/60/EC) defines an aquifer as a: “subsurface layer of…. Geological strata. [which allows] either a significant flow of groundwater or the abstraction of significant quantities of groundwater.” (extract from GSI.ie, Nov 2018)

There are two main types of aquifer in Ireland - bedrock aquifers and sand and gravel aquifers.

Aquifers are categorized based on their resource potential (Regionally, Locally Important, Poor) and groundwater flow type and attenuation potential (fissures, karst conduits, intergranular).

Groundwater vulnerability is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities.

Groundwater which readily and quickly receives water from the land surface is considered to be more vulnerable than groundwater that receives water more slowly.

The risk of contamination depends on the source of the polluting activity; the vulnerability of groundwater to contamination; the potential consequences of a contamination event.

Groundwater Quality

Groundwater quality is scored as having a good status. See EPA Envision Map data below, relating to Ground Waterbody Water Framework Directive 2010-2015.

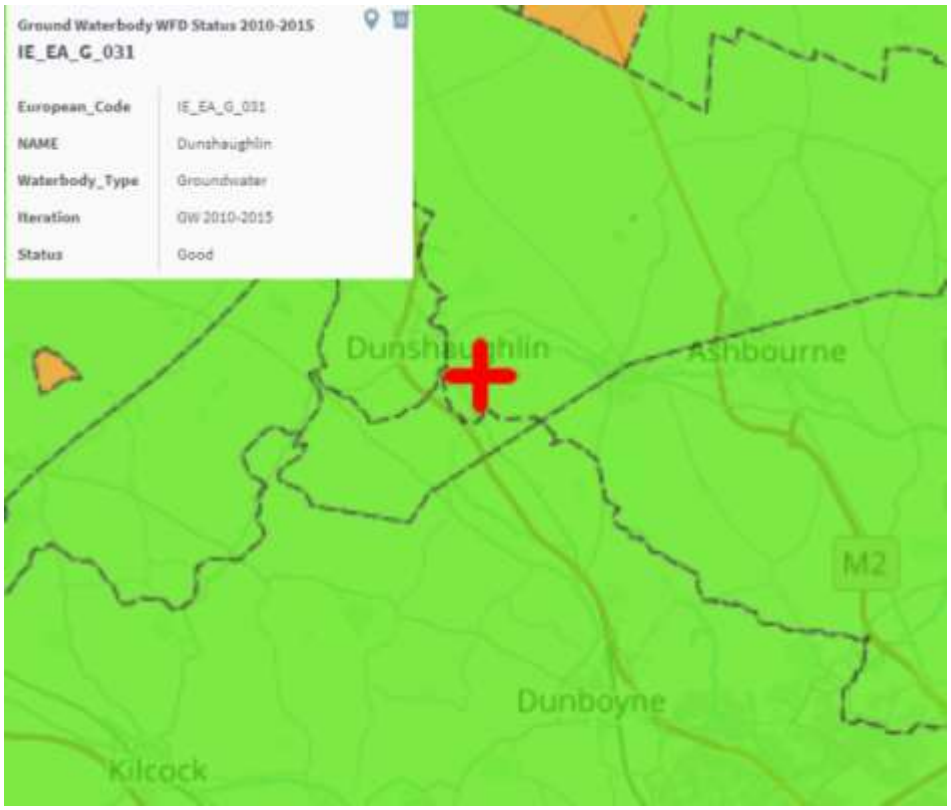

Figure 7.3 - Groundwater Quality (EPA, accessed Nov 2018)

Bedrock Type

The GSI identifies two bedrock units across the development site. The bedrock across the entire site can be generalised as a limestone bedrock which is not karstified.

On the NW section of the development site, the GSI defines the underlying bedrock unit as Loughshinny Formation, a dark micrite and calcarenite shale. The Lithology is described as laminated to thinly-bedded, argillaceous, pyritic, locally cherty limestone interbedded with dark-grey to black shale. The limestones include argillaceous micrites and graded calcarenites

On the SE section of the site the GSI defines the underlying bedrock as the Lucan Formation, a dark limestone and shale calp. The lithology is described as comprising dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcarenites.

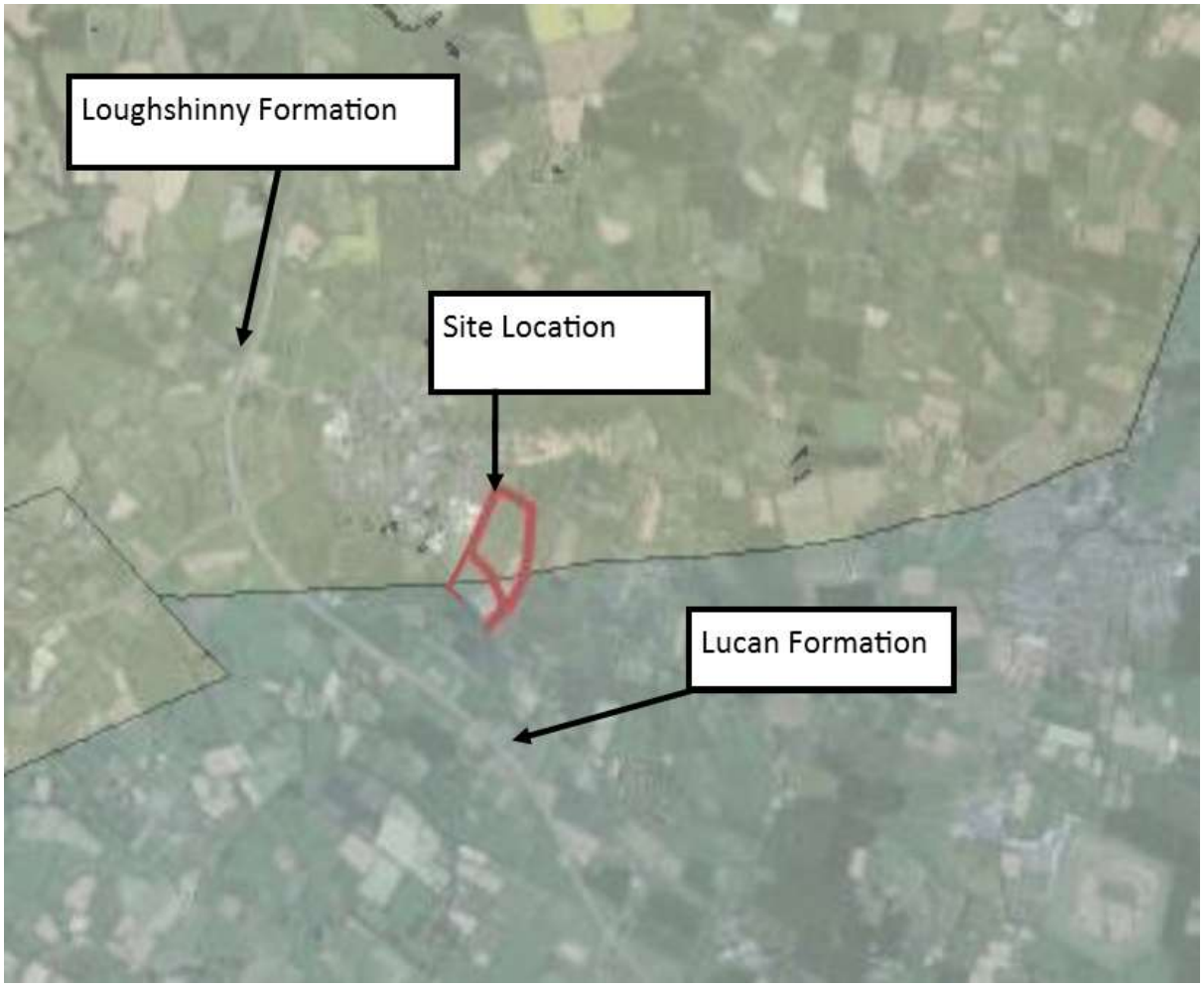

Figure 7.4- Bedrock Geology Map (GSI - Nov 2018)

Aquifer Classification

The aquifer is classified by the Geological Survey of Ireland to be moderately productive. The aquifer is also classified as locally important, indicating any contamination would have a local impact rather than a regional impact.

Locally important aquifers are described by the GSI to be a bedrock aquifer unit capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or 'good' yields (100-400 m 3 /d). Groundwater flow occurs predominantly through fractures, fissures and joints.

Locally Important Bedrock Aquifer which are Generally Moderately Productive is described by the GSI as an aquifer in which the network of fractures, fissures and joints, through which groundwater flows, is reasonably well connected and dispersed throughout the rock, giving a moderate permeability and groundwater throughput. Aquifer storage is moderate and groundwater flow paths can be up to several kilometres in length. There is likely to be a substantial groundwater contribution to surface waters ('baseflow') and large (>2,000 m 3 /d), dependable springs may be associated with these aquifers.

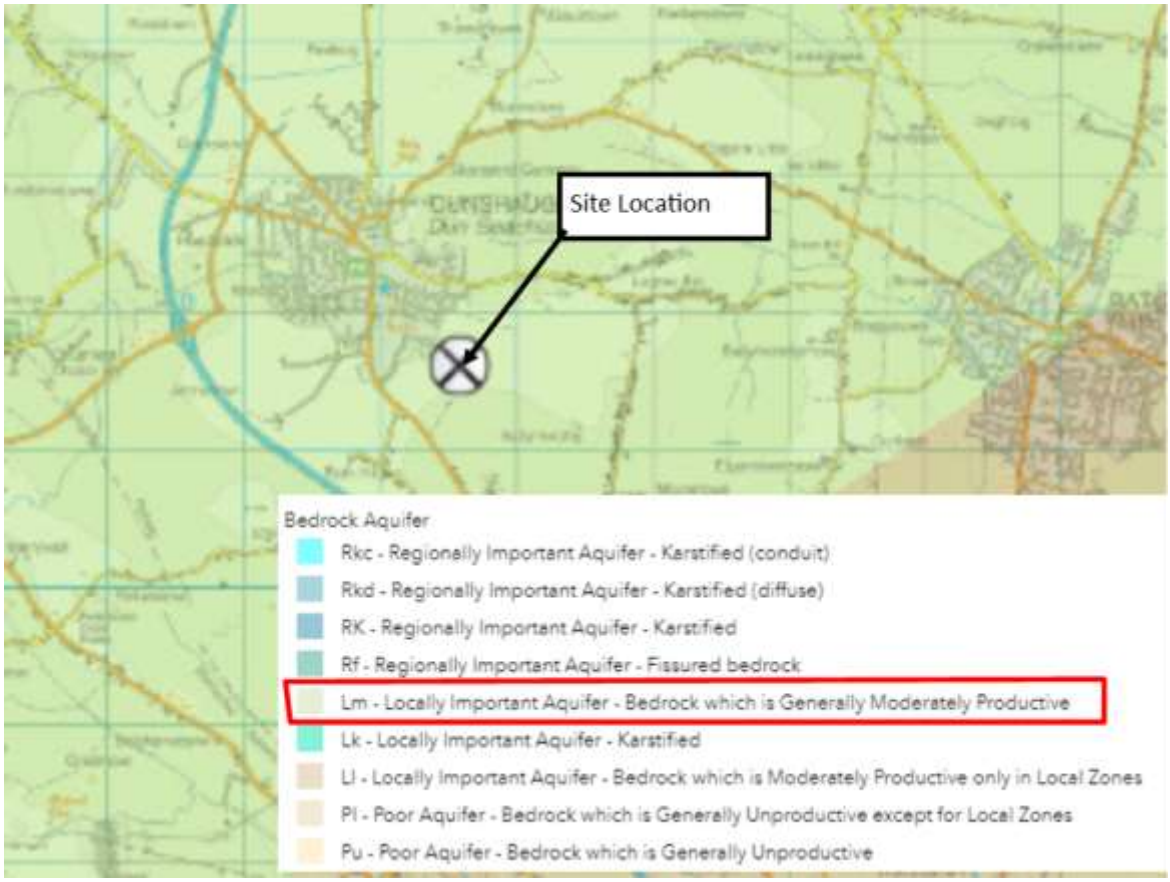

Figure 7.5 – GSI Aquifer Map (Nov 29, 2018)

Recharge Classification

The GSI identifies two estimated recharge quantities, across the development site.

On the NW section of the site recharge is estimated to be 73mm per annum. On the SE section of the site recharge is estimated to be 36mm per annum.

The recharge estimates are low. This condition is likely across the entire site as Site Investigation determined a CLAY subsoil is present and mapping does not indicate otherwise.

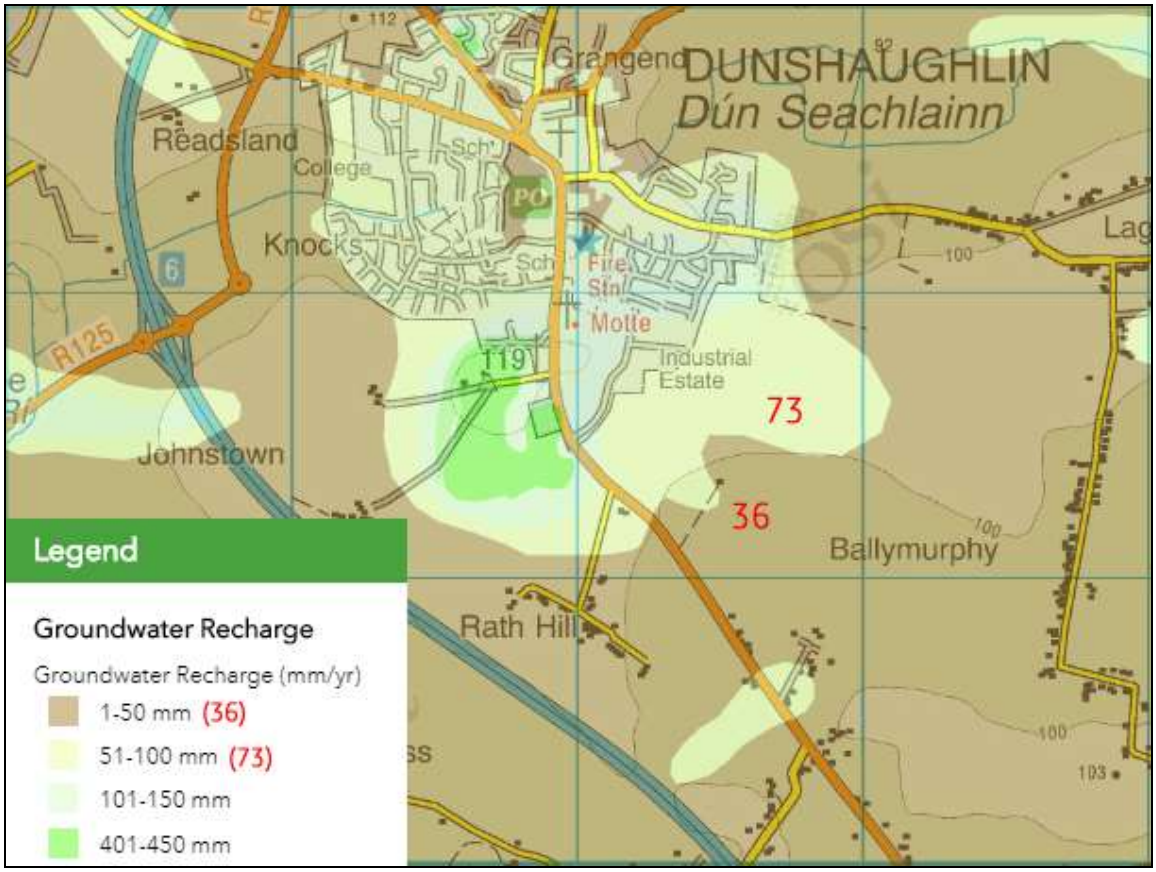

Figure 7.6 – GSI Recharge Map (Nov 29, 2018)

Vulnerability

The Geological Survey of Ireland classifies the aquifer to be of moderate vulnerability for most of the North Western portion of the site which is ca. 70% of the entire development site. This indicates that a subsoil depth of 5m to 10m is likely to be overlying the limestone bedrock.

The North Western most corner of the proposed development is classified as high and extreme vulnerability which is ca. 5% of the entire development site. Refer to map below. This indicates that an elevated bedrock is likely to be encountered between ground level and 5m below ground surface in this area. The aquifer in this location is more vulnerable to contamination and measures to prevent contamination during the proposed development, especially at construction stage is necessary. Developed lands to the west of the proposed development site are located within high and extreme vulnerability classified aquifers.

The Geological Survey of Ireland classifies the aquifer to be of low vulnerability in the South Eastern half of the site which is ca. 25% of the development site. This indicates that a subsoil depth of greater than 10m is likely to overlie the limestone bedrock. The aquifer is less vulnerable to contamination in the SE portion of the site. Agricultural lands to the east of the proposed development site are located within low vulnerability classified aquifers.

Trial pits from the site investigation works were dug to 3m deep and all demonstrated the subsoil depth to be a minimum of 3m below the ground surface. Bedrock was not encountered in Trial Hole logs on the proposed development site which were dug to 3m below ground level.

Bedrock was not encountered to a depth of 3m within adjoining lands to the South, as per IGSL Ltd Site Investigation Report for earlier phases of 'The Willows' development which are currently under construction.

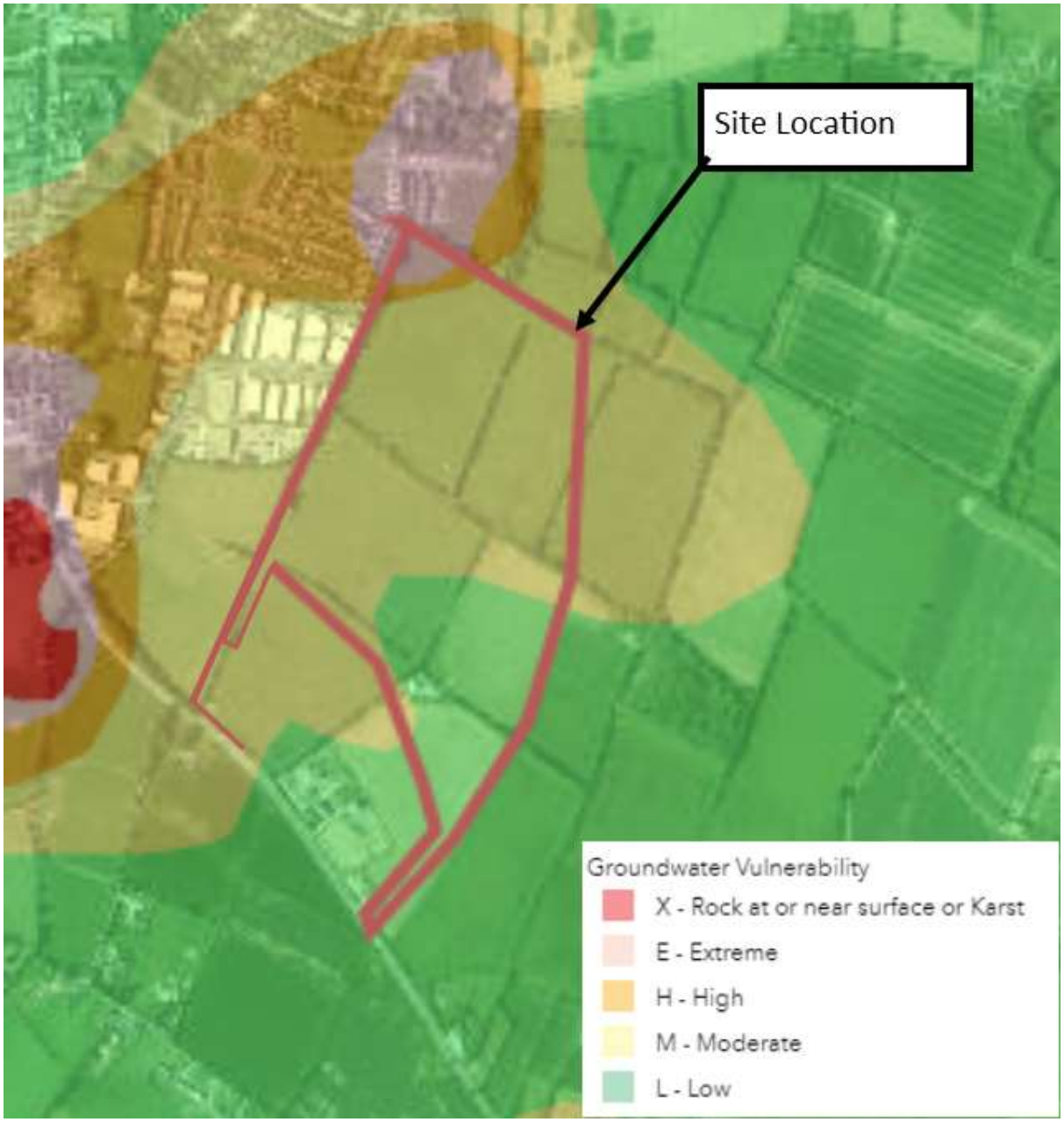

Figure 7.7 – GSI Groundwater Vulnerability Map (Feb 5, 2018)

7.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The Strategic Housing Development is for a 10-year permission and is a continuation of 'The Willows' development currently under construction.

The proposed development consists of a residential development comprising of 913 no. residential units, a neighbourhood centre, including 2 no. retail units, a café / restaurant unit, a primary healthcare / gym, a community facility and a childcare facility, all associated open space, a section of the Dunshaughlin Outer Relief Road, internal roads, cycle and pedestrian infrastructure, services and all other associated development on a site of c. 28.3 hectares.

The 913 no. residential units proposed consist of 505 no. houses (single, two, and three storey), 186 no. duplex units (three storey), and 222 no. apartments (four and five storey).

The 505 no. houses proposed consist of the following:

- 45 no. 2-bedroom houses
- 382 no. 3-bedroom houses (including 4 no. bungalows)
- 50 no. 4-bedroom houses (including 5 no. bungalows)
- 28 no. 4/5-bedroom houses (three storey)

The 186 no. duplex units consist of the following:

- 20 no. 1-bedroom duplex units
- 84 no. 2-bedroom duplex units
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The 222 no. apartments consist of the following:

- 50 no. 1-bedroom apartments
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- 21 no. 3-bedroom apartments

The development includes the delivery of a section of the Dunshaughlin Outer Relief Road from the Phase 1 site boundary to the northern site boundary, including connections to adjacent lands, improvements to a section of the Outer Relief Road delivered with the Phase 1 development to the south, a bus bay and toucan crossing on the Dublin Road, all associated open space, boundary treatment, internal roads, cycle and pedestrian infrastructure, foul and surface water drainage, a pumping station, attenuation tanks, car and cycle parking, ESB substations, other services and all other associated development.

A Site Specific Flood Risk Assessment has been completed by Hydrocare Environmental Ltd and is included with the planning application submission. Relevant details of the Site-Specific Flood Risk Assessment and separate Stormwater Assessment prepared by JBA Consulting contribute to this chapter of the EIAR.

The surface drainage, foul water drainage, water supply and a new road network will be constructed to service the proposed development.

The proposed foul drainage will discharge to Irish Water foul sewer and is not discharged to the ground within the site.

Surface water will be diverted to downstream watercourses, controlled to greenfield runoff rates, via SUDS devices, attenuation tanks, and a piped network.

7.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

We have endeavoured to identify any significant environmental effects likely to occur during construction and operational phases of the development relating to land and soil. The effect of the reduction of the availability of agricultural land over the lifetime of the development is to be of moderate significance, permanent duration and will have neutral effect on the quality of the

environment. The subject lands are located immediately east and north of residential housing and employment developments; the proposed land usage is considered to be following the baseline trends.

7.5.1 Construction Phase

During the construction phase excavating, hauling and depositing of large quantities of soil material will occur. There are no basements proposed in the development or underground car parks. All construction excavations including drainage works will be within the upper soil and subsoil depths, likely to be no more than 3m in depth.

Dust and silt are potential contaminants relating to construction activities. Spillages of fuels, oils, and greases from tools and machinery are other potential sources of contamination to soils and water. The potential pathway for contamination to occur under scrutiny in this section is via, the soil i.e. infiltration or runoff. The potential receptors regarded as sensitive to contaminants are groundwater and surface water bodies.

The aquifer is classified by the EPA as low to moderately vulnerable with 5m to >10m depths of subsoil overlying a limestone bedrock for 95% of the site area.

The aquifer is classified by the EPA as high to extreme vulnerability with 0m to 5m depth of subsoil overlying a limestone bedrock for ca. 5% of the site area in the furthermost North West corner of the development site. There are no exposed rock surfaces within the site development.

The permeability of the subsoil is very low as determined from on-site infiltration testing, SI and as indicated on EPA mapping datasets for soil and subsoil. The groundwater quality is classified as good and is likely well protected by the poorly draining soils in this locality.

Contamination (of water bodies) during construction activities is considered likely to have a negative effect on the water environment. Adequate controls must be implemented to mitigate the risks to contaminating the groundwater and surface water which will be included in the construction and environmental management plan. Surface water is considered to be more vulnerable and is discussed further in the EIAR Chapter 8 - Water. The development site is located within the Broadmeadow Catchment which has a poor water quality status (2015). The poor permeating soil and subsoil in the local catchment results in higher quantities of runoff to surface waters compared to groundwaters. Recharge is estimated to be very low <100mm/yr per EPA data sets. The proposed development is not likely to have a negative impact on the groundwater body. Mitigation measures during the construction phase to ensure chemicals, oils, grease and other spillages do not enter the groundwater are necessary.

It is evident that 95% of the site area is considered to be well protected with low to moderate vulnerability classification. The further most NW corner of the development site, ca. 5% of the total site area which is located in high to extremely vulnerable classification lands, should be given appropriate attention prior to construction to establish bedrock levels and mitigate any potential spillages in this location.

Any contamination instances during construction will likely occur in localised areas only, with effects likely to be negative if no remedial action is taken. The negative effect would be minor for small spillages due to the deep low permeable subsoils overlying the aquifer, which offers a high degree of protection to the aquifer. Implementing a construction and environmental management plan which focuses on restricting use of harmful substances, the containment of substances in segregated bunded locations and an emergency spillage remedial action procedure, will allow for the effect of such spillages to be reduced to a brief duration event with neutral overall effect once remedial action is taken.

Erosion of soils during the construction phase is highly likely if appropriate mitigation measures are not implemented. Topsoil contains a high quantity of nutrients, drainage qualities and is highly fertile. Topsoil should be removed and stockpiled to be used within the site for gardens and landscaped areas.

Stockpiling of topsoil and subsoil may result in runoff water with high quantities of silt. Silt can cause contamination and blockage of drainage networks and watercourses. Erosion of soil and subsoil will result in silt runoff which contains high quantities of nutrients and is likely to have a negative impact to local watercourses. The immediate receiving environment drains to the Broadmeadow River which is noted by the EPA to be of poor water quality status.

Stockpiling of soils will be temporary and localised, without mitigation a short term negative local impact to downstream watercourses is possible which is likely to have an short term negative effect on the Broadmeadow River water quality further downstream. It is recommended that soils are not stockpiled within 20m of drainage ditches, to mitigate this potential risk, which will be outlined as a mitigation procedure to be noted in the construction and environmental management plan.

Dust blown from dry soil mounds is likely from stockpiles of CLAY in summer months. The effect of CLAY blown particles are likely to have momentary to temporary negative impact. Dust suppression procedures, such as wetting the stockpile, and personal protection measures, must be detailed in the construction and environmental management plan.

7.5.2 Operational Phase

The operation of the development is unlikely to have any significant effect with regards to the soils and hydrogeology. The development operation phase can be considered to generate a neutral, continuous effect with regards to land and soil.

In the event of exfiltration of foul waters from the foul sewer to the ground as a result of a blockage, the effect is not considered to be significant. The deep low permeable subsoils will offer protection to the local aquifer and such an event within a small localised area will only be brief to temporary.

Recharge to the groundwater will be permanently reduced as the development will replace greenfield lands with impermeable hard standing, which will result in significantly reduced infiltration to the groundwater. Recharge is currently expected to be <100mm per year in any case so this effect is considered imperceptible and not significant.

The stormwater drainage system will include for a petrol interceptor, to be located upstream of the outfall locations, thereby reducing potential impact to the receiving environment in the event of oil or fuel spillages. The stormwater drainage is designed in accord with Greater Dublin Strategic Drainage Study guidance to ensure the greenfield runoff rate is maintained to mimic the pre-development runoff rates. Attenuation tanks will be constructed as part of the stormwater drainage system to cater for the 1 in 100 year rainfall event & aid in the controlled release of runoff waters at outfall locations.

Stormwater discharges will be at outfall locations only and the impact to the receiving environment is considered to be insignificant with routine maintenance of the full stormwater system proposed.

7.6 POTENTIAL CUMULATIVE IMPACTS

The land-take of this development is considerable and will replace agricultural lands with residential lands. The surrounding environment has capacity to accommodate a development of this nature. The development is not likely to give rise to any significant effects cumulatively or, in combination with,

other developments in the area, other than the conversion of agricultural land to residential housing. A slight negative impact with regards to agricultural yield in the locality can be expected. This impact is likely to be insignificant in the overall context of the agricultural land available outside of the Dunshaughlin town environs.

7.7 DO NOTHING IMPACT

If the proposed development did not proceed there would be no impact on the existing soils or geology of the site. It is envisaged that the land use would remain unchanged as mainly agricultural, should this development not take place. The 'Do Nothing' impact is neutral should the lands remain in their current use as agricultural land.

7.8 REMEDIAL AND MITIGATION MEASURES

7.8.1 Construction Phase

Proposed mitigation measures are outlined below to avoid significant adverse effects to the land and soils.

L&S CONST 1

- A construction and environmental management plan is to be implemented prior to construction. The plan must be agreed with the local authority prior to development.
- Topsoil and subsoil to be stockpiled temporarily during construction.
- Reduced soil levels should be infilled with the required construction materials in a timely manner to reduce erosion risk.
- Stockpiled soil mounds, should be kept a minimum distance of 20m from any ditch drain to reduce the risk of contaminated runoff entering the stream networks. On completion of works, any excess soil must either be landscaped into the development or removed off-site.
- The storm water drainage system must include petrol interceptors to minimise the risk of contamination of the receiving water and soils.
- Dust control measures are required and are to be included in the construction and environmental management plan. Measures to prevent and reduce dust, by covering or wetting stockpiles, must be included to greatly reduce the effect of dust. Personal Protective Equipment must be worn by workers in areas susceptible to dust to reduce exposure.
- Control measures to ensure continuous monitoring in relation to spillages of hazardous substances, fuels, oils must be detailed in the construction and environmental management plan including remedial actions in the event of spillages of hazardous substances, fuels, oils & grease during the construction phase of works.
- Fuels, Oils, Chemicals, Hazardous Substances, etc., must be stored in a suitably designated, bunded area to reduce the potential extent of contamination should accidental spillages occur.
- A detailed Site Investigation for each future phase of the development should be carried out.

7.8.2 OPERATION PHASE

No significant long-term input to Land and Soils is predicted during the operation phase of the development. Risks to land and soils ill be from pollutants contaminating runoff waters.

L&S Operat 1:

- The drainage design for surface water run-off is to include a mechanism for removal of pollutants i.e. by way of oil interceptor or suitable treatment within a sustainable urban drainage system per Greater Dublin Strategic Drainage Study CIRIA guidance.

7.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

Construction Phase

The proposed development will have an estimated 10-year duration of construction. Over this time, the land use will change from agricultural lands to a residential and neighbourhood centre development with associated infrastructure and open space areas. The construction of the development will have a minimal impact on soil, hydrogeology and geology once the appropriate mitigation and monitoring measures be implemented throughout the construction duration. Accidental spillages of oils, grease, fuels and chemicals used during the construction phase will have no long-term significant adverse effects on the soil, geology and hydrogeology when stored and used in a responsible manner. Any such spillages would have moderate negative impact and will be short term in nature only once the appropriate mitigation measures to minimise impact are implemented.

Implementation of the mitigation measures outlined above will minimise potential adverse impacts of the construction phase to the land and soils environment. It is predicted that the construction phase is likely to have a neutral effect on the land and soils environment.

Operational Phase

There are no long term negative impacts on soils predicted during the operational phase of this development. A slight negative impact with regards to agricultural yield in the locality can be expected, this impact is likely to be insignificant in the overall context of the agricultural land available outside of the Dunshaughlin town environs.

7.10 MONITORING

Execution of the construction and environmental management plan during the construction phase is to be monitored by the Construction Supervisor to local authority requirements.

Monitoring is to include:

- Dust management and monitoring
- Storage of hazardous materials
- Remove and importing of soil material.

7.11 REINSTATEMENT

Stockpiled topsoil and subsoil is to be reused for landscaping within the site or to be removed off site upon completion of the construction phase of works. Landscaped areas should be seeded in a timely manner to reduce weathering.

7.12 INTERACTIONS

The design team has had regular contact with Joseph O'Reilly Consulting Engineers in relation to drainage proposals, who in turn has liaised with the wider design and EIAR team in progressing the detailed design for the proposed development.

7.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties in compiling this section of the EIAR.

7.14 REFERENCES

Joseph O'Reilly Consulting Engineer Report, *Proposed Storm, Foul & Watermain Services For Possible Future Development.*
Environmental Protection Agency Mapping Viewers and Online Data Sources.
Geological Survey of Ireland Mapping Viewers and Online Data Sources.
Trial Pit Site Investigation Data carried out by Hydrocare Environmental Ltd.
Flood Risk Assessment Report by Hydrocare Environmental Ltd.
OPW and Meath County Council Flood Mapping Databases.
Foul and Stormwater Drainage Proposal by Joseph O'Reilly Consulting Engineers.
Site Walkover and Inspection on three occasions in January 2018.
Guidelines on the information to be contained in environmental impact assessment reports, EPA, 2017 (Draft)
EIA Directive 2014/EU/52
Guidelines on the information to be contained in Environmental Impact Statements, EPA, 2002.
Advice notes on current practice in the preparation of Environmental Impact Statements, EPA, 2003.
Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003).
Development Management Guidelines (DoEHLG, 2007).
Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DHPLG, 2018).
European Commission Guidance on EIAR, 2017.

Appendix 7.1- Trial Hole logs by Hydrocare Environmental Ltd

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP1

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 100.150 mOD
Coords: 53.503181, -6.534258
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Firm grey brown CLAY with occasional pebbles	0.1						
	0.2						
	0.3			0.35	Bulk	18-11	
----------	0.4						
Firm to stiff orange blue brown CLAY mottled, occasional pebbles, blocky & massive	0.5			0.55	Bulk	18-12	
	0.6						
	0.7						
	0.8						
----------	0.9						
Stiff blue brown CLAY, occasional pebbles, massive, mottled	1.0						
	1.1			2.1	Bulk	18-13	
	1.2					***WTL^^^WTL***	
	1.3					***at 1.2m BGL***	
	1.4						
	1.5						
	1.6						
	1.7						
	1.8						
	1.9						
	2.0						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
	2.8						
	2.9						
	3.0						
END----------END	3.1						
	3.2						
	3.3						
	3.4						
	3.5						
	3.6						
	3.7						
	3.8						

Plan View (TP)

Width: 1.7m
Length: 3.3m

Remarks: Very stiff CLAY

Groundwater Depth: 1.2m (mottled to 0.35m BGL)

TRIAL PIT 1

Dims:	3.3m L x 1.7m W x 3.1m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP2

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 100.60 mOD
Coords: 53.505377, -6.532668
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Grey brown gravelly CLAY with humus,	0.1						
freq. pebbles, soft to firm	0.2						
----------	0.3			0.3	Bulk	18-21	
Soft to firm, grey brown CLAY mottled below	0.4						
0.5m BGL freq. pebbles & cobbles, very damp	0.5				Bulk	18-22	
& blocky	0.6						
	0.7			0.7			
	0.8						
	0.9						
----------	1.0						
Firm grey brown CLAY occasional pebbles &	1.1				Bulk	18-23	
cobbles, wet, blocky & massive	1.2						
	1.3						
	1.4						
	1.5						
	1.6					***WTL^^^WTL***	
	1.7					***at 1.6m BGL***	
	1.8			1.8			
	1.9						
	2.0						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
END----------END	2.8						
	2.9						
	3.0						
	3.1						
	3.2						
	3.3						

Plan View (TP)

Width: 2.1m
Length: 4.2m

Remarks: Very wet side walls collapsing immediately following dig

Groundwater Depth: 1.6m (mottled to 0.5m BGL)

TRIAL PIT 2

Dims:	4.2m L x 2.1m W x 2.8m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP3

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 104.2 mOD
Coords: 53.507614, -6.531006
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Light brown firm gravelly CLAY, humus	0.1						
crumb, blocky, freq. pebbles	0.2						
	0.3			0.35	Bulk	18-31	
----------	0.4						
Firm brown gravelly CLAY pebbles & freq.	0.5				Bulk	18-32	
occasional cobbles & boulders, blocky &	0.6						
massive	0.7			2.65			
	0.8						
	0.9						
	1.0						
	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	1.7						
	1.8						
	1.9						
	2.0						
	2.1						
	2.2						
	2.3					***WTL^^^WTL***	
	2.4					***at 2.3m BGL***	
	2.5						
	2.6						
	2.7						
	2.8						
	2.9						
END----------END	3.0						
	3.1						
	3.2						
	3.3						
	3.4						
	3.5						

Plan View (TP)

Width: 1.6m
Length: 3.7m

Remarks: On the Northern slope away from sight. Higher ground content than TP 1, 2, 4, 5, 6

Groundwater Depth: 2.3m

TRIAL PIT 3

Dims:	3.7m L x 1.6m W x 3.0m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP4

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 103.50 mOD
Coords: 53.506620,-6.528515
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Grey brown gravelly CLAY with humus,	0.1						
freq. pebbles, soft to firm	0.2						
	0.3			0.4	Bulk	18-41	
----------	0.4						
Soft to firm, grey brown CLAY mottled below	0.5				Bulk	18-42	
0.7m BGL freq. pebbles & cobbles, very damp	0.6						
& blocky	0.7			0.6			
	0.8						
	0.9						
----------	1.0						
Firm grey brown CLAY occasional pebbles &	1.1				Bulk	18-43	
cobbles, wet, blocky & massive	1.2						
	1.3						
	1.4						
	1.5					***WTL^^^WTL***	
	1.6					***at 1.5m BGL***	
	1.7						
	1.8			1.8			
	1.9						
	2.0						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
END----------END	2.8						
	2.9						
	3.0						
	3.1						
	3.2						
	3.3						

Plan View (TP)

Width: 2.0m
Length: 3.5m

Remarks: Very wet side walls collapsing immediately following dig

Groundwater Depth: 1.5m (mottled to 0.7m BGL)

TRIAL PIT 4

Dims:	3.5m L x 2.0m W x 2.8m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP5

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 98.7 mOD
Coords: 53.503733, -6.529158
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Grey brown gravelly CLAY with humus,	0.1						
freq. pebbles, soft to firm	0.2						
	0.3			0.45	Bulk	18-51	
	0.4						
----------	0.5				Bulk	18-52	
Soft to firm, grey brown CLAY mottled below	0.6						
0.6m BGL freq. pebbles & cobbles, very damp	0.7			0.55			
& blocky	0.8						
	0.9						
----------	1.0						
Firm grey brown CLAY occasional pebbles &	1.1				Bulk	18-53	
cobbles, wet, blocky & massive	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	1.7					***WTL^^^WTL***	
	1.8			1.8		***at 1.7m BGL***	
	1.9						
	2.0						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
END----------END	2.8						
	2.9						
	3.0						
	3.1						
	3.2						

Plan View (TP)

Width: 1.4m
Length: 3.7m

Remarks: Very wet side walls collapsing immediately following dig

Groundwater Depth: 1.7m (mottled to 0.6m BGL)

TRIAL PIT 5

Dims:	3.7m L x 1.4m W x 2.8m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Hydrocare Environmental Ltd

Trial Pit Investigation

HOLE ID: TP6

Job No: 18-030
Client: Rockture One Limited
Site Location:'The Willows', Dunshaughlin, Co. Meath
Type of Excavator: Hitachi EX130

Ground Level (mOD): 97.60 mOD
Coords: 53.502007, -6.529953
Logged By: Daniel Nolan
Date: 01/02/2018

Strata Description	Unit Depth (m)	Legend	Elevation (mOD)	Samples & Tests: Depth (m)	Type	Ref No.	Water Depth (m)
	0.0						
TOPSOIL - Grey brown gravelly CLAY with humus,	0.1						
freq. pebbles, soft to firm	0.2						
	0.3			0.4	Bulk	18-61	
----------	0.4						
Soft to firm, light brown CLAY mottled below	0.5				Bulk	18-62	
0.7m BGL freq. pebbles & cobbles, very damp	0.6						
& blocky	0.7			2.4			
	0.8						
	0.9						
	1.0						
	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	1.7						
	1.8					***WTL^^^WTL***	
	1.9					***at 1.8m BGL***	
	2.0						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
END----------END	2.8						
	2.9						
	3.0						
	3.1						
	3.2						
	3.3						

Plan View (TP)

Width: 1.5m
Length: 3.1m

Remarks: Very wet side walls collapsing immediately following dig

Groundwater Depth: 1.8m (mottled to 0.7m BGL)

TRIAL PIT 6

Dims:	3.1m L x 1.5m W x 2.8m D
Date:	01/02/2018
Client:	Rockture One Limited
Location:	The Willows', Dunshaughlin, Co. Meath

Appendix 7.2- IGSL Ltd Pre-Construction Site Investigation Report for Adjoining 'Willows'

PROPOSED HOUSING
DEVELOPMENT
DUNSHAUGHLIN
COUNTY MEATH

JOSEPH O REILLY
CONSULTING ENGINEERS

CONTENTS

APPENDICES

REPORT ON A SITE INVESTIGATION
FOR A HOUSING DEVELOPMENT
AT THE WILLOWS DUNSHAUGHLIN
FOR GEM CONBSTRUCTION
(ROCKTURE 1)

JOSPH O REILLY
CONSULTING ENGINEERS

Report No. 19890 **MARCH 2017**

I Introduction

A new housing development is proposed at The Willows in Dunshaughlin, County Meath.

An investigation of sub soil conditions in the area of the new construction has been ordered by Rockture 1 Limited, as directed by Joseph O Reilly, Consulting Engineers.

The investigation included In Situ Plate Bearing Tests to establish CBR values along the proposed road network and Heavy Duty Dynamic Probing and Window Sampling in the area of proposed house construction.

Work was carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999) and the appropriate Euro-codes.

This report includes all factual data pertaining to the project and comments on the geotechnical findings relative to foundation design.

II Fieldwork

The new development is to take place at an existing residential development in Dunshaughlin, County Meath.

Plate Test, Probe and Window Sample locations are indicated on the site plan enclosed in Appendix IV. This drawing was provided by the project engineers.

Plate Tests were referenced PBT 1 to PBT 9 and Dynamic Probes and Window Samples referenced DP10 to DP14 and WS10 and WS14.

a. Plate Bearing Tests

A 450mm diameter plate is loaded and off loaded incrementally and deflections measured by dial gauge. Testing is carried out over two phases, the initial test to compact any sub soil loosened during excavation and the second (reload phase) to confirm modulus of subgrade reaction and equivalent CBR.

The reaction load to facilitate the plate tests was provided by Gem Contractors.

Test results are presented in Appendix I, and the re-load results are tabulated in the following table.

TABLE 1 PLATE TEST DATA RELOAD CYCLE

TEST NO.	Modulus of Subgrade Reaction (MPa/m)	CBR %
PBT 1A	19	1.6
PBT 2	26	2.7
PBT 3	18	1.4
PBT 4	14	0.9
PBT 5	84	21.0 *
PBT 6	15	1.1
PBT 7	13	0.8
PBT 8	21	2.0
PBT 9	22	2.0

The unusually high result at PBT 5 may indicate the presence of a boulder or obstruction directly under the plate. Otherwise the results are quite consistent with CBR values between about 1% and 2.7% recorded.

b. Dynamic Probes

A tracked Competitor Probe Rig was used to establish a strength/depth pattern at five specified locations. A 50kg hammer falling through 500mm is used to drive a 43.7mm diameter cone into the soil.

Probing is in accordance with the DPH specification of BS 1377: Part 9: 1990. In these tests, the soil resistance is measured in terms of the number of drop-hammer blows required to drive the test probe through each 100 mm increment of penetration. The results are presented in both graphical and tabular form in Appendix 1I. Probing is generally terminated following successive blow counts in excess of 25, to avoid damage to the apparatus.

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

The probes indicate soils of firm consistency from about 0.50 to 2.50 metres BGL. This would be indicated by probe resistances in the range $N_{100} = 3$ to $N_{100} = 5$.

Very stiff soils are noted below about 2.50 metres reflected by probe resistance in excess of $N_{100} = 8$. Probe refusals were recorded at depths between 3.00 and 4.00 metres.

c. Window Samples

While dynamic probing gives an indication of soil strength with penetration, it does not identify soil type. Consequently a 100mm diameter soil core has been recovered at two locations using Window Sampling methods. A steel mandrel is driven into the sub soil and core is recovered in 1.0 metre long plastic liners. These cores are taken to the laboratory, extruded and logged.

Sampling took place beside Dynamic Probes DP10 and DP14.

The detailed records, contained in Appendix III, indicate the presence of firm brown gravelly CLAY below surface top soil. This stratum continues to approximately 2.50 metres where very stiff sandy gravelly clay is found. Sampling was completed at 3.00 metres BGL.

III. Discussion:

The investigation has been carried out to assess CBR values along the proposed road network and to indicate allowable bearing pressures for the soils where new construction is proposed.

1. CBR TESTS FOR PROPOSED ROADS

Nine plate bearing tests were carried out and the results indicate a consistent pattern of CBR values at 0.50 metres BGL ranging from about 1.0 to 2.5%. One exceptionally high result is probably due to coarse material (boulder) directly below the test plate.

An average CBR of 1.5 to 2% would be suggested for pavement design purposes. The low results would indicate that the use of a geotextile or geo-grid would be appropriate.

It should be noted that the testing was carried out in wet winter conditions. An increase in CBR values will be associated with a reduction in moisture content. This could be effected by site drainage or by construction in dry summer conditions.

2. ALLOWABLE BEARING PRESSURE

The five dynamic probes and two widow sample cores consistently indicate firm gravelly CLAY underlying surface top-soil.

A dynamic probe resistance of $N_{100} = 3$ to 4 with no dramatic reduction in underlying resistance is indicative of an allowable bearing pressure of 90 to 100 kn/sq.m.. This intensity of bearing is available at a depth of about 0.70 metres for conventional reinforced strip or pad foundations.

Careful inspection of excavated formation is advised to ensure uniformity and suitability of the founding medium. Any soft, organic or suspect material should be removed and replaced with low-grade concrete.

The clay soils will be sensitive to moisture content variation and foundation excavations should be blinded or concrete placed quickly to avoid deterioration.

IGSL/JC
March 2017

Appendix I Plate Bearing Tests

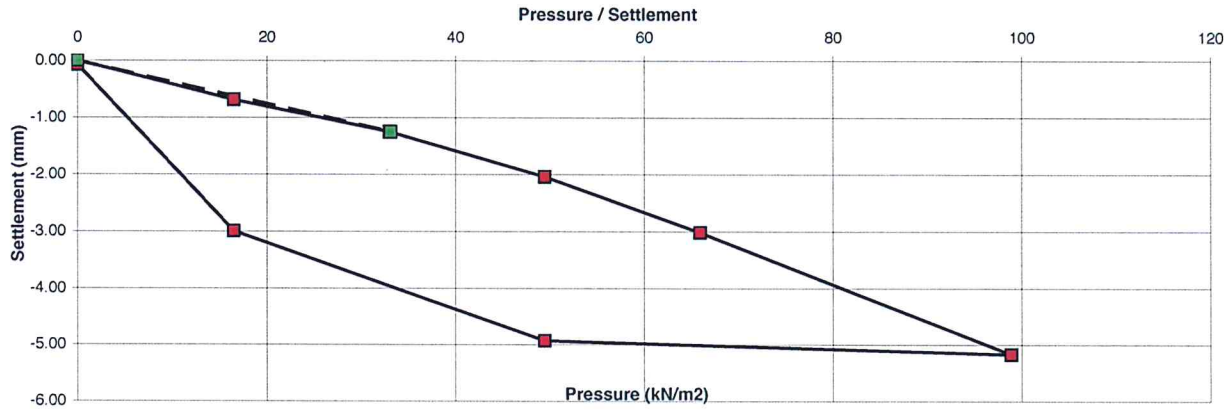
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R77330
Contract	The Willows Dunshaughlin
Test No.	PBT1A
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)
Loose brown gravelly sand

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 26
Modulus of subgrade reaction = 17 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.3 %

PLATE TEST REPORT SHEET (F3.1)

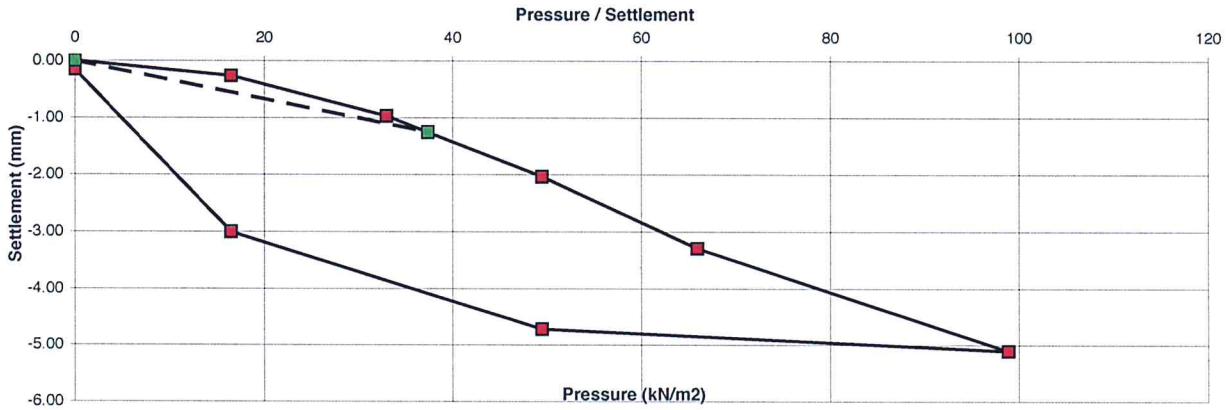
Applied Pressure/Settlement Curve

Reference No.	R77330
Contract	The Willows Dunshaughlin
Test No.	PBT1A RELOAD
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 30
Modulus of subgrade reaction = 19 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

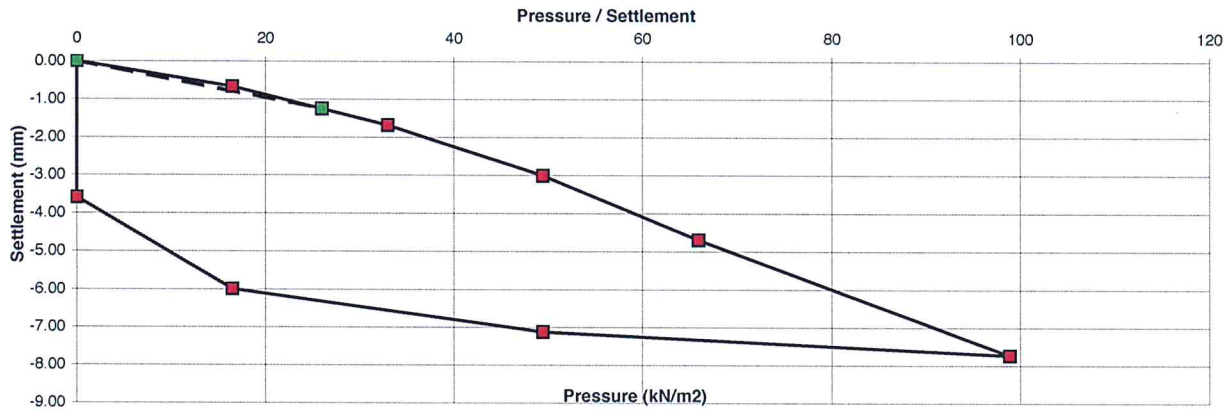
Reference No.	R77331
Contract	The Willows Dunshaughlin
Test No.	PBT2
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 21

Modulus of subgrade reaction = 13 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.9 %

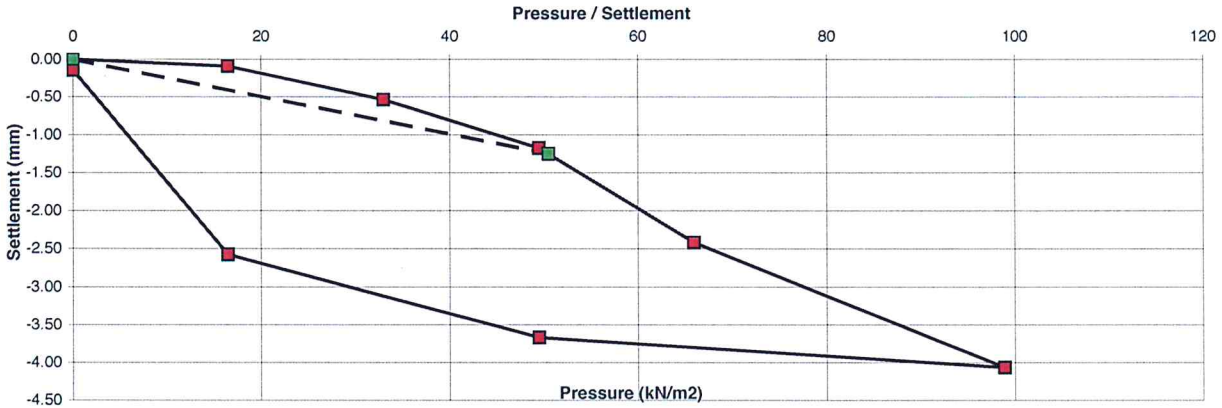
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R77331
Contract	The Willows Dunshaughlin
Test No.	PBT2 RELOAD
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)
Loose brown gravelly sand

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 40
Modulus of subgrade reaction = 26 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

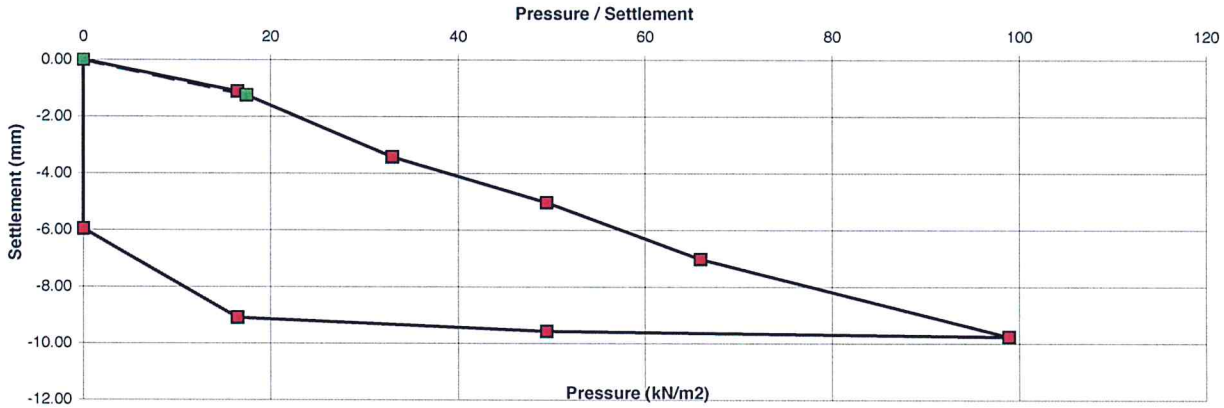
Reference No.	R77332
Contract	The Willows Dunshaughlin
Test No.	PBT3
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 14

Modulus of subgrade reaction = 9 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.4 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

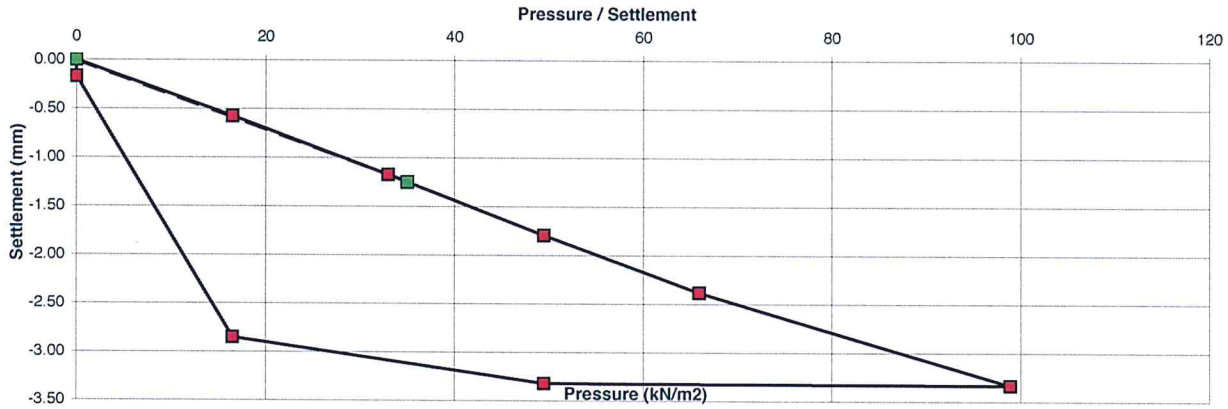
Reference No.	R77332
Contract	The Willows Dunshaughlin
Test No.	PBT3 reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 28
Modulus of subgrade reaction = 18 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.4 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

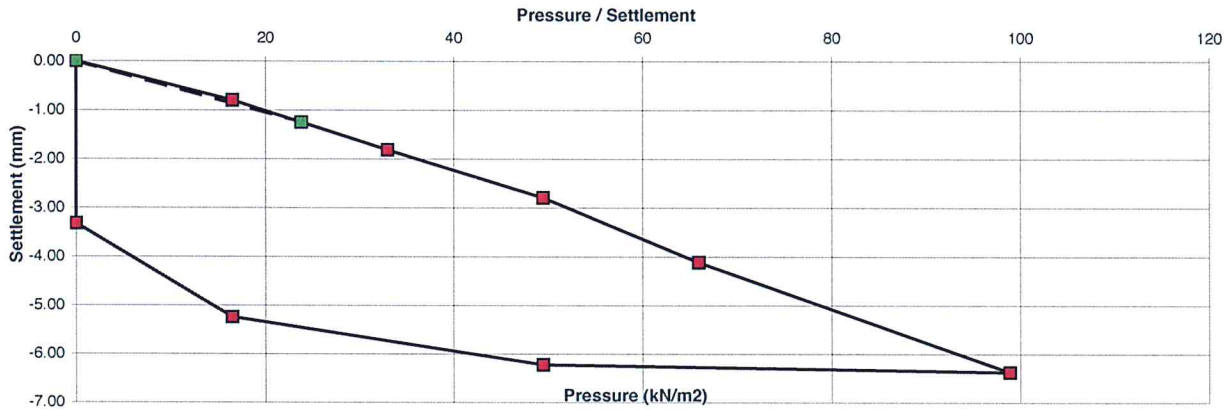
Reference No.	R77333
Contract	The Willows Dunshaughlin
Test No.	PBT4
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 19
Modulus of subgrade reaction = 12 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

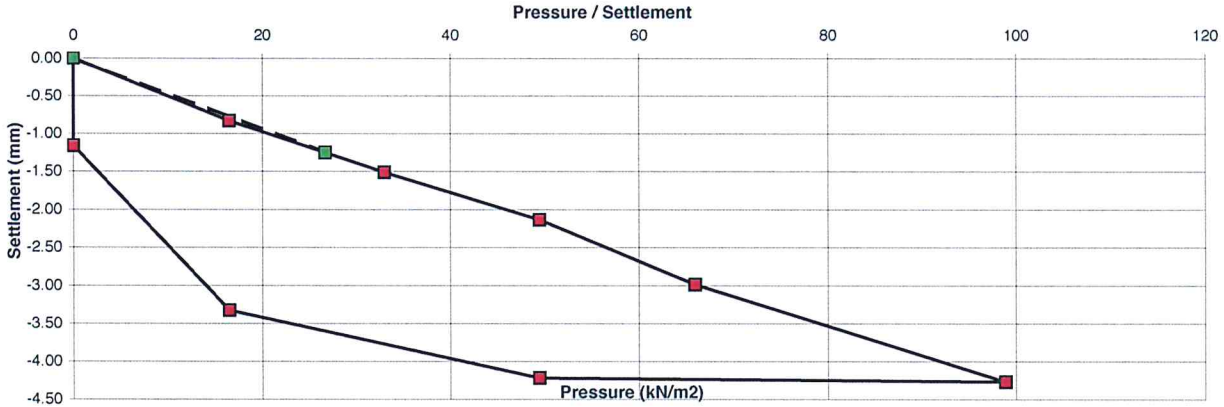
Reference No.	R77333
Contract	The Willows Dunshaughlin
Test No.	PBT4 RELOAD
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 21
Modulus of subgrade reaction = 14 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

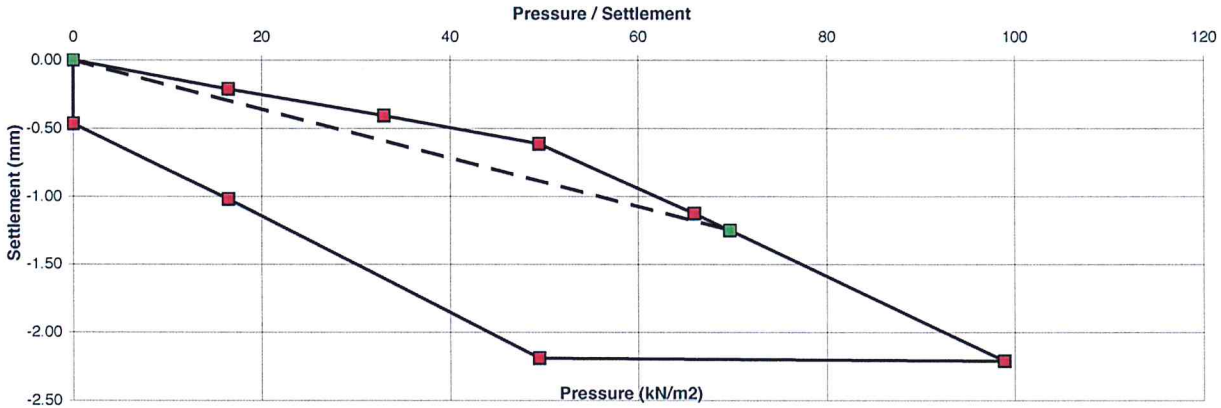
Reference No.	R77334
Contract	The Willows Dunshaughlin
Test No.	PBT5
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 56
Modulus of subgrade reaction = 36 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.8 %

PLATE TEST REPORT SHEET (F3.1)

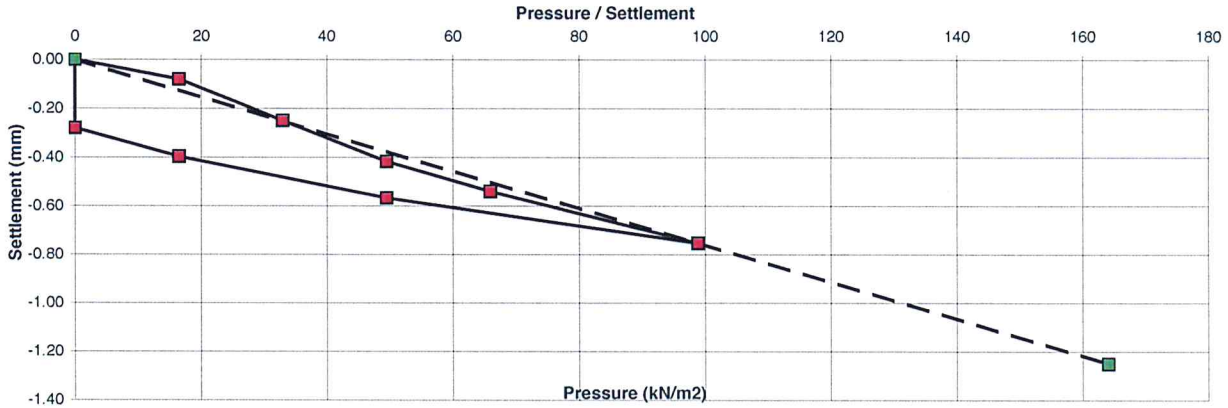
Applied Pressure/Settlement Curve

Reference No.	R77334
Contract	The Willows Dunshaughlin
Test No.	PBT5 reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 131
Modulus of subgrade reaction = 84 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 21.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

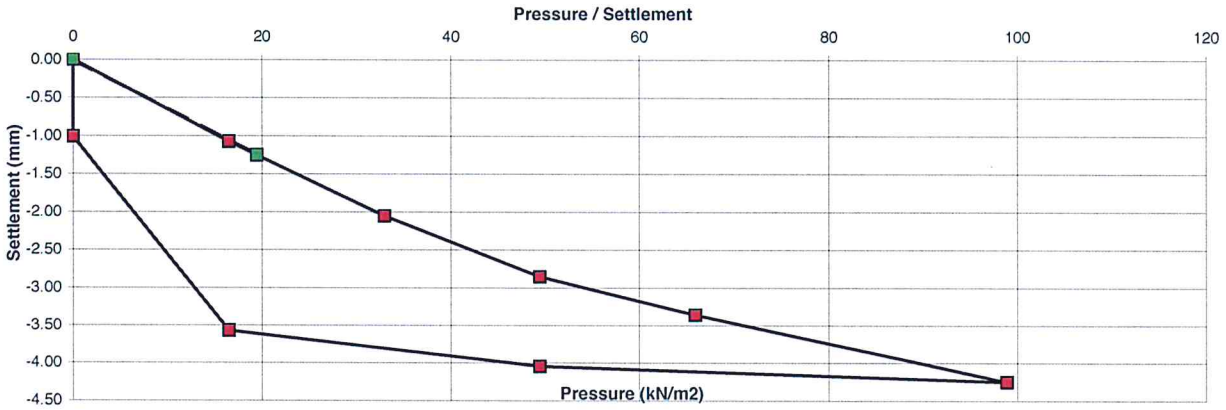
Reference No.	R77335
Contract	The Willows Dunshaughlin
Test No.	PBT6
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 16

Modulus of subgrade reaction = 10 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

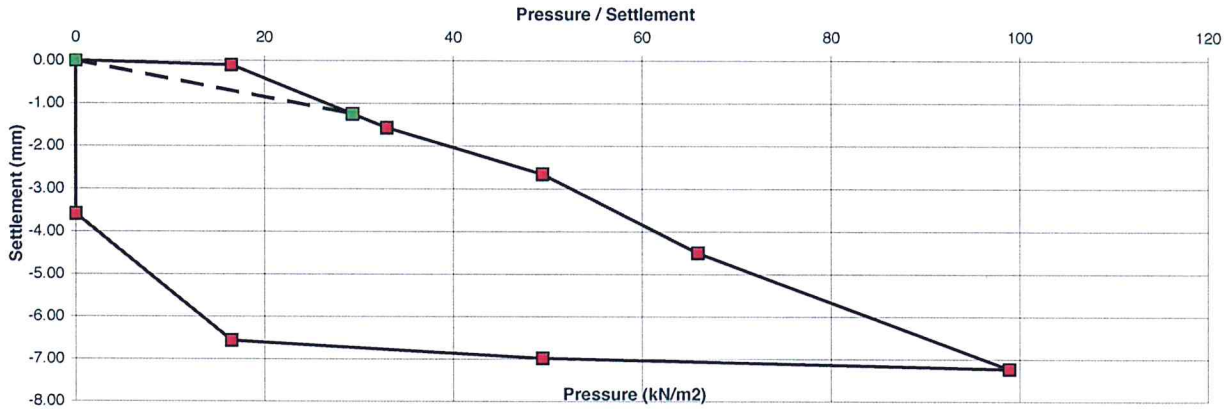
Reference No.	R77335
Contract	The Willows Dunshaughlin
Test No.	PBT6 Reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	10-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 23

Modulus of subgrade reaction = 15 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

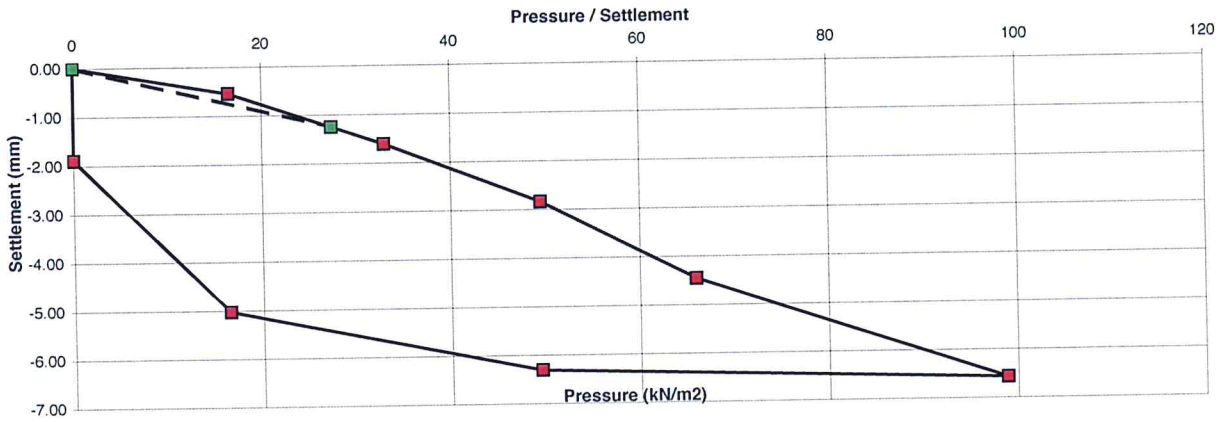
Reference No.	R77336
Contract	The Willows Dunshaughlin
Test No.	PBT7
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 22
Modulus of subgrade reaction = 14 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

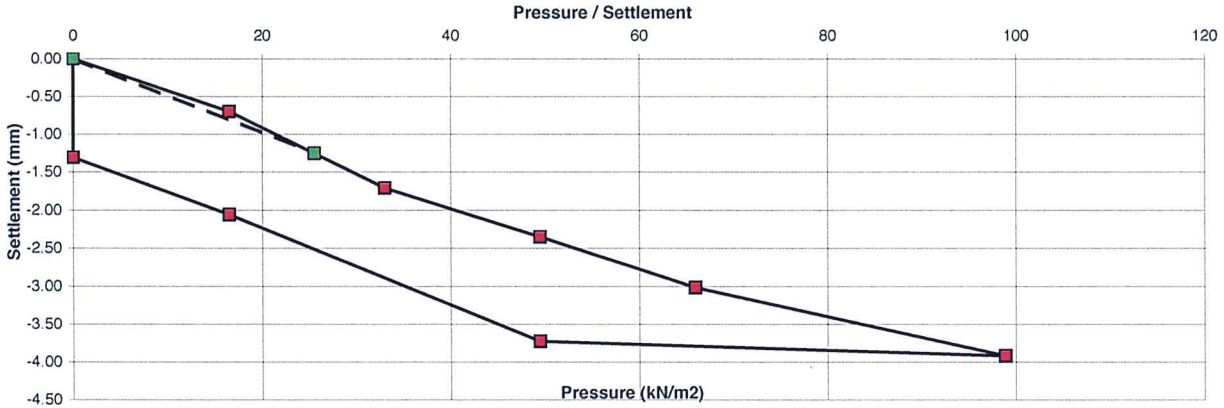
Reference No.	R77336
Contract	The Willows Dunshaughlin
Test No.	PBT7 reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 20
Modulus of subgrade reaction = 13 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

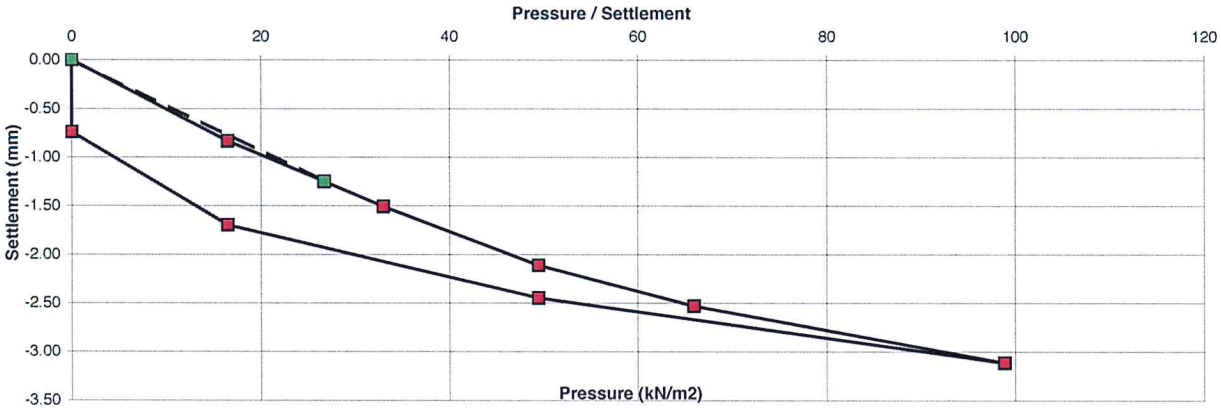
Reference No.	R77336
Contract	The Willows Dunshaughlin
Test No.	PBT8
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test
(natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 21
Modulus of subgrade reaction = 14 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

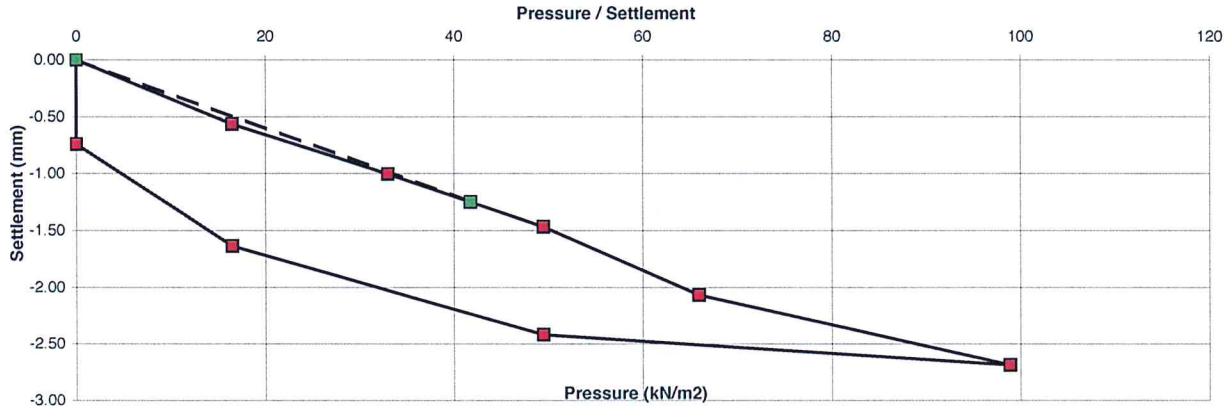
Reference No.	R77337
Contract	The Willows Dunshaughlin
Test No.	PBT8 reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 33

Modulus of subgrade reaction = 21 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

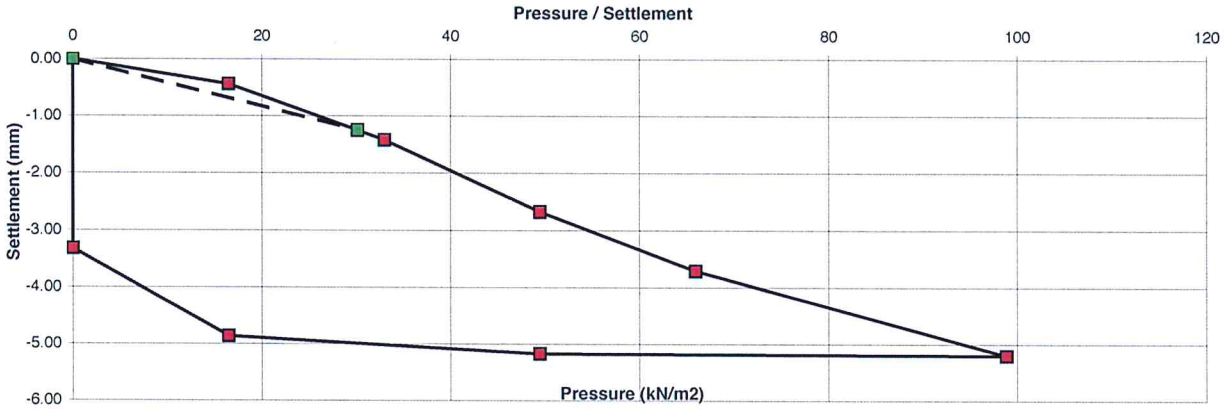
Reference No.	R77338
Contract	The Willows Dunshaughlin
Test No.	PBT9
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 24

Modulus of subgrade reaction = 15 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

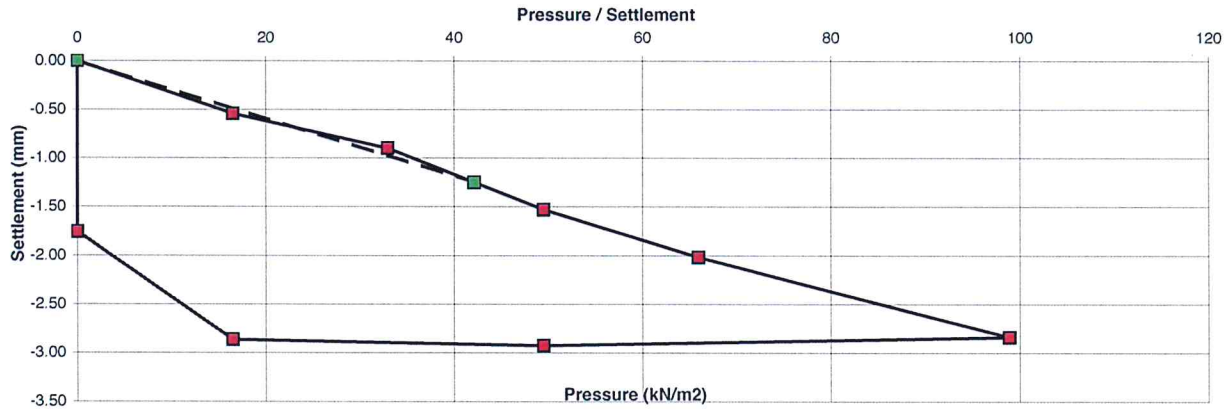
Reference No.	R77338
Contract	The Willows Dunshaughlin
Test No.	PBT9 reload
Location	Dunshaughlin
Depth	0.50m
Client	Gem Construction
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	LD
Authorised by	
Date	09-02-17

Description of soil under test (natural soil, placed fill, sub-base)

Loose brown gravelly sand

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 34

Modulus of subgrade reaction = 22 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.0 %

Appendix II Dynamic Probes

DYNAMIC PROBE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows , Dunshaughlin	**PROBE NO.**	**DP10**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE DRILLED**	09/02/2017
GROUND LEVEL (mOD)		**DATE LOGGED**	09/02/2017
CLIENT	Rockture 1 Ltd	**PROBE TYPE**	DPH
ENGINEER	GEM		
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	1
						0.20	2
						0.30	3
						0.40	2
						0.50	2
						0.60	3
						0.70	4
						0.80	4
						0.90	5
1.0						1.00	7
						1.10	8
						1.20	7
						1.30	5
						1.40	4
						1.50	3
						1.60	3
						1.70	5
						1.80	7
						1.90	5
2.0						2.00	5
						2.10	4
						2.20	6
						2.30	5
						2.40	7
						2.50	16
						2.60	8
						2.70	4
						2.80	10
						2.90	11
3.0						3.00	10
						3.10	10
						3.20	7
						3.30	19
						3.40	23
						3.50	25
	End of Probe at 3.60 m						
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 19890.GPJ IGSL.GDT 10/2/17

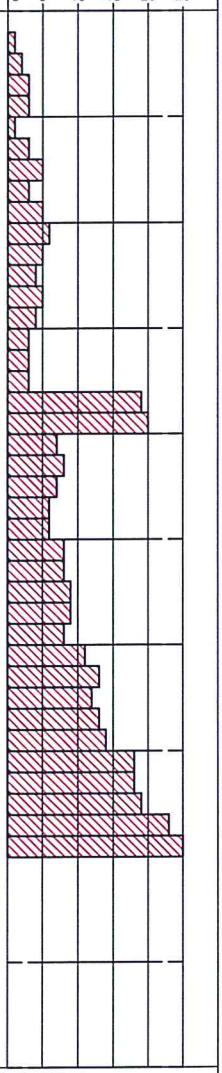
DYNAMIC PROBE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows , Dunshaughlin	**PROBE NO.**	**DP11**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE DRILLED**	09/02/2017
GROUND LEVEL (mOD)		**DATE LOGGED**	09/02/2017
HAMMER MASS (kg)	50		
CLIENT	Rockture 1 Ltd	**INCREMENT SIZE (mm)**	100
ENGINEER	GEM	**FALL HEIGHT (mm)**	500
		PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	1
						0.20	2
						0.30	3
						0.40	3
						0.50	1
						0.60	3
						0.70	5
						0.80	3
						0.90	5
1.0						1.00	6
						1.10	5
						1.20	4
						1.30	5
						1.40	4
						1.50	3
						1.60	3
						1.70	3
						1.80	19
						1.90	20
2.0						2.00	7
						2.10	8
						2.20	7
						2.30	6
						2.40	6
						2.50	8
						2.60	8
						2.70	9
						2.80	9
						2.90	8
3.0						3.00	11
						3.10	13
						3.20	12
						3.30	13
						3.40	14
						3.50	18
						3.60	18
						3.70	19
						3.80	23
						3.90	25
4.0	End of Probe at 4.00 m						

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 19890.GPJ IGSL.GDT 10/2/17

DYNAMIC PROBE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows , Dunshaughlin	PROBE NO.	DP12
		SHEET	Sheet 1 of 1
CO-ORDINATES		DATE DRILLED	09/02/2017
GROUND LEVEL (mOD)		DATE LOGGED	09/02/2017
CLIENT	Rockture 1 Ltd	PROBE TYPE	DPH
ENGINEER	GEM		
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	3
						0.20	4
						0.30	3
						0.40	6
						0.50	3
						0.60	4
						0.70	8
						0.80	8
						0.90	9
1.0						1.00	7
						1.10	7
						1.20	7
						1.30	3
						1.40	8
						1.50	4
						1.60	4
						1.70	5
2.0						1.80	2
						1.90	2
						2.00	4
						2.10	3
						2.20	5
						2.30	7
						2.40	5
						2.50	7
						2.60	12
						2.70	8
						2.80	15
						2.90	32
3.0	End of Probe at 3.10 m					3.00	25
4.0							

Graphic Probe Record: 0 5 10 15 20 25; 32

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 19890.GPJ IGSL.GDT 10/2/17

DYNAMIC PROBE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows , Dunshaughlin	**PROBE NO.**	**DP13**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE DRILLED**	09/02/2017
GROUND LEVEL (mOD)		**DATE LOGGED**	09/02/2017
CLIENT	Rockture 1 Ltd	**HAMMER MASS (kg)**	50
ENGINEER	GEM	**INCREMENT SIZE (mm)**	100
		FALL HEIGHT (mm)	500
		PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	3
						0.20	2
						0.30	3
						0.40	3
						0.50	4
						0.60	5
						0.70	4
						0.80	4
						0.90	3
1.0						1.00	3
						1.10	5
						1.20	10
						1.30	9
						1.40	9
						1.50	7
						1.60	6
						1.70	9
						1.80	5
						1.90	4
2.0						2.00	6
						2.10	6
						2.20	6
						2.30	7
						2.40	6
						2.50	15
						2.60	15
						2.70	15
						2.80	21
						2.90	20
3.0						3.00	21
						3.10	25
	End of Probe at 3.20 m						
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 19890.GPJ IGSL.GDT 10/2/17

DYNAMIC PROBE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows , Dunshaughlin	**PROBE NO.**	**DP14**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE DRILLED**	09/02/2017
GROUND LEVEL (mOD)		**DATE LOGGED**	09/02/2017
CLIENT	Rockture 1 Ltd	**PROBE TYPE**	DPH
ENGINEER	GEM		
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	2
						0.20	2
						0.30	2
						0.40	2
						0.50	3
						0.60	4
						0.70	6
						0.80	5
						0.90	5
1.0						1.00	6
						1.10	5
						1.20	4
						1.30	3
						1.40	2
						1.50	2
						1.60	3
						1.70	2
						1.80	4
						1.90	3
2.0						2.00	3
						2.10	4
						2.20	4
						2.30	5
						2.40	7
						2.50	8
						2.60	9
						2.70	18
						2.80	19
						2.90	17
3.0						3.00	20
						3.10	22
						3.20	25
	End of Probe at 3.30 m						
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 19890.GPJ IGSL.GDT 10/2/17

Appendix III Window Samples

WINDOW SAMPLE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows Dunshaughlin
PROBE NO.	**WS10**
SHEET	Sheet 1 of 1
CO-ORDINATES	
GROUND LEVEL (mOD)	
DATE DRILLED	10/02/2017
DATE LOGGED	10/02/2017
CLIENT	GEM Construction
ENGINEER	
SAMPLED BY	CK
LOGGED BY	LD

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm light brown gravelly CLAY		0.30			0.00-1.00	90	91 blows		
1.0	Firm grey brown gravelly CLAY		1.00			1.00-2.00	80	167 blows		
2.0	Firm to stiff grey brown gravelly sandy CLAY		2.50			2.00-3.00	80	103 blows		
3.0	Final Depth 3.00m		3.00							
4.0										
5.0										

General Remarks

Installations

IGSL WS LOG 19890.GPJ IGSL.GDT 2/3/17

WINDOW SAMPLE RECORD

REPORT NUMBER 19890

CONTRACT	The Willows Dunshaughlin
PROBE NO.	WS14
SHEET	Sheet 1 of 1
CO-ORDINATES	
GROUND LEVEL (mOD)	
DATE DRILLED	10/02/2017
DATE LOGGED	10/02/2017
CLIENT	GEM Construction
ENGINEER	
SAMPLED BY	CK
LOGGED BY	LD

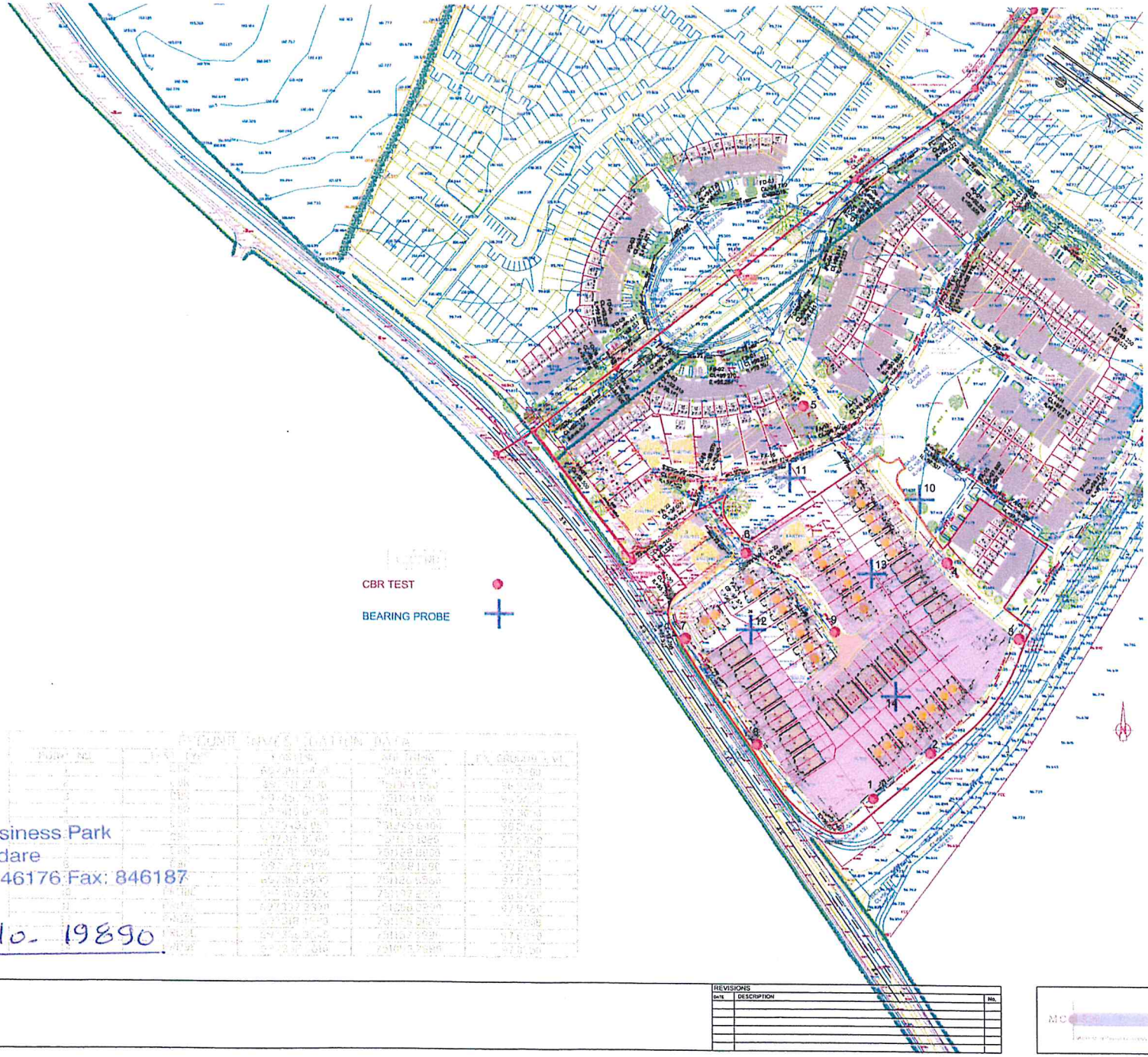
Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm light brown gravelly CLAY		0.50			0.00-1.00	100	84 blows		
1.0	Soft to firm brown gravelly CLAY		1.10			1.00-2.00	70	103 blows		
2.0	Firm to stiff dark brown gravelly CLAY		2.30							
	Stiff dark brown to black gravelly CLAY		2.60			2.00-3.00	70	74 blows		
3.0	Final Depth 3.00m		3.00							
4.0										
5.0										

General Remarks

Installations

IGSL WS LOG 19890.GPJ IGSL.GDT 2/3/17

Appendix IV Site Plan



IGSL LTD.
Unit F, M7 Business Park
Naas, Co. Kildare
Phone: 045 846176 Fax: 846187
info@igsl.ie

REPORT NO. 19890

NOTES:
DO NOT SCALE FROM DRAWINGS. WORK TO FIGURED DIMENSIONS ONLY. ARCHITECT TO BE NOTIFIED OF ALL DISCREPANCIES.

REVISIONS		
DATE	DESCRIPTION	No.

PROJECT TITLE
The Willows, Dunshaughlin
DRAWING TITLE
MASTER SITE PLAN