Mallow Town Park

Part 10 Planning

Civil Engineering Planning Report

&

Design Basis Document

Mallow Town Park, Part 10 Planning Report

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Review

Originator:	Tadgh Crowley
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Table of Contents

1.0 Introduction 4

2.0 Surface Water Drainage Strategy. 5

2.1 Proposed Carpark - Surface & Drainage Design Details. 5

2.2 Proposed Skate Park - Surface Drainage Design Details. 9

2.3 Proposed Pump Track - Surface Drainage Design Details. 11

2.4 Grass Pitches & Reinforced Grass Event & Temporary car park area - Surface Drainage Design Details. 12

2.5 Proposed Swale drainage Basin - Surface Drainage Design Details. 14

3.0 Site Management / Environnemental Protection & Mitigation Masures. 17

4.0 Construction Strategy for Structural Items. . . . 20

Appendix A – Horganlynch Planning Drawings

Appendix B – Infiltration Example

Appendix C – Site Investigation

1.0 Introduction

The following report outlines the design basis developed by Horgan lynch Consulting Engineers in connection with the proposed landscaping and amenity works for the Mallow Town Park, Part 10 Planning Application. These works are being designed on behalf of Cork County Council by landscape Architects Brady Shipman Martin and their wider team of consultants.

Full details of the proposed development works are set out in the BSM Landscape Architects part 10 planning submission drawings and supporting documentation.

The proposed development works include but are not limited to the construction of a new public porous surface carparks , new access, paths and landscaping, signage, skate park, pump track, Drainage / surface water management works, angling stands and the widening of an existing pedestrian bridge.

Site Location

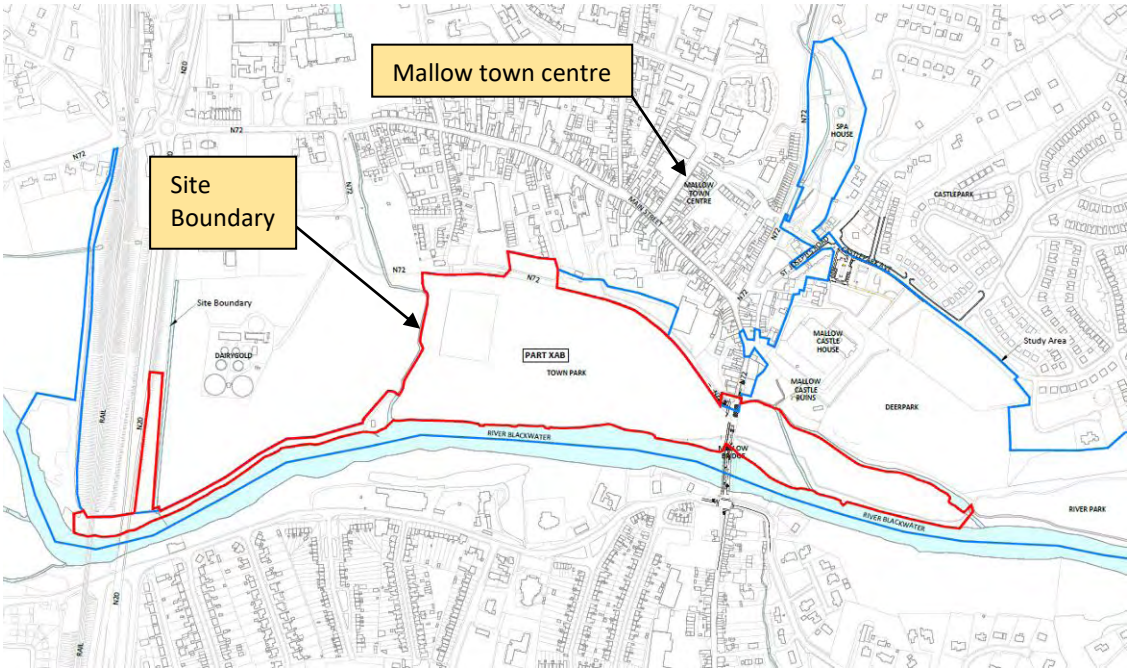


Figure 01 – Site location plan

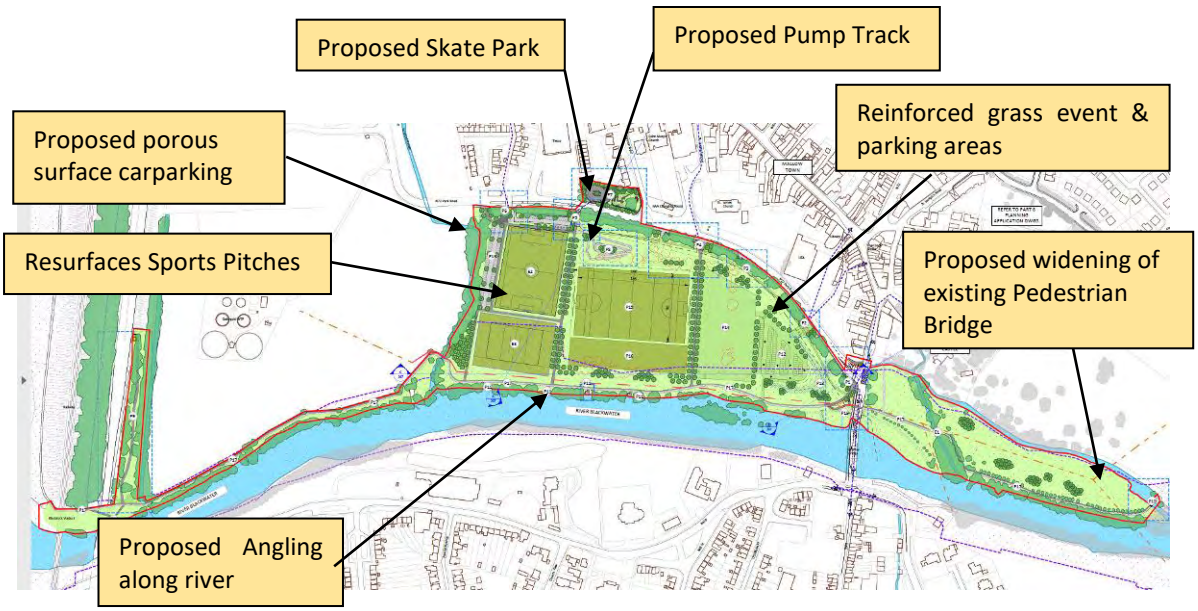


Figure 02 – Site General Arrangement plan

2.0Surface Water Drainage & Floor Risk Strategy

2.1 Proposed Carpark - Surface & Drainage Design Details.

- The proposed new porous surface carpark is to be constructed on an open green field site to the north west corner of the site. This area is currently used for car parking on occasions and is partly hardcore surfaces.
- The site is bounded to the north by a stone wall with existing entrances to the site. Proposed works will see these existing entrances upgraded to enhance the safety and astatic of these vehicular and pedestrian access. See details for entrance upgrade works in Architects planning drawings
- From current published floor risk assessments of the town park it is an establish floor zone.
- As part of this application Arup Consulting Engineers, who have a long involvement in the flood assessment and design of Mallow town floor relief scheme, have undertaken detailed flood

risk assessment and modelling of the proposed Town Park redevelopment to confirm the development is design appropriately and will not have an impact on the flooding of the area.

- The proposed development under this planning application are small scale improvement landscaping and non habitable surface level amenity facilities which will not generate additional flood displacement or impact the current flood scenario within the park.

- We can confirm that the proposed development of the various surface facilities including the porous carpark will not change or intensify the current land use or create additional flood risk to the area.

- The proposed carpark area has been laid out and levels set where possible in line with the existing ground contours to mitigate against flood displacement as well as to minimise the amount of excavation and ground disturbance to the site so mitigating where possible the impact to potential below ground archaeology.

- The Carpark and road surfaces are to be constructed with a porous asphalt surface on a free draining stone base build up. See details in figure 03 below.

- Hydrocarbons filtration and removal. The stone base to the carpark area is wrapped in a special 'Inbitex' geotextile filter material. The filtration membrane in conjunction with the stone build-up traps and breaks down any hydrocarbons build up within the sub-base by microbial action. The surface water is cleaned and filtered through the Inbitex Geotextile layers.

- Aco channel cut off drains are to be installed in front of the vehicle and pedestrian entrance to the carpark and these drainage channels are connected to a new 150mm dia storm drainage pipe which discharge to a proposed adjacent soakaway with-in the site.

- As noted above the use of a porous carpark surface and associated filter stone build up minimises the depth of excavation and extent of ground disturbance associated with standard hard paved carparks, piped gullies and drainage pipe network.

- This porous carpark system also allows flexibility in the depth of excavation when archology features are encountered as the stone build up can be altered as necessary without effecting the drainage flow.

- Refer to Architects Planning drawings for Carpark details. Refer also to Horganlynch drawings in Appendix A

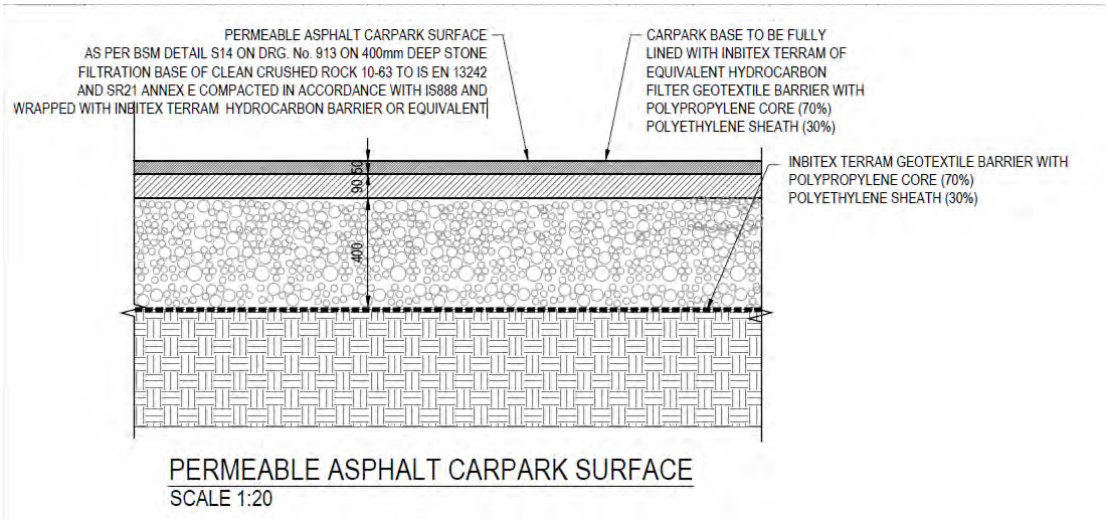


Figure 03 –Carpark buildup detail

Figure 04 – Extract from Carpark Layout drawing CQ15-021

Sustainable Drainage Design

- The carpark and site wide drainage design is based on Sustainable Drainage Design (SUDS) drainage design which both infiltrates and attenuates the surface water drainage on the site and ensures the storm water runoff from the developed site is restricted to at or below the current undeveloped green field run off.

- This attenuation of the storm water runoff will ensure the development of the site does not contribute to the increase flooding risk downstream from the area as the flow is being restricted to greenfield run-off. Hence there will be no increase in the overall discharge from the site as a result of the proposed development.

- As set out above and detailed in the accompanying drawings the carpark and surrounding surfaced covers approximately 4200m2.

- The carpark which is a porous asphalt surface drains into a 400mm deep clean drainage stone build up with 50% voids.

- Calculation for site attenuation:

  Surface paved area with attenuation under 3200m2

  Soil infiltration rate – f = 2.19×10^{-6}m/s

  Welted are of pit 50% full – a_s50 = 74.8m2

  Required Storage Estimate for site = 351m3

  Available storage capacity within carpark build up = 3200m2x0.4 = 1280m3 x 50% = 640m3

  Time for emptying attenuation to half volume due to soil infiltration – $t_s50 = 351 \times 10^6 \times \{0.5/(74.8 \times 10^6 \times 2.19 \times 10^{-6})\}$ = 1071350 sec = 297.6 Hours (12.4 days)

- As can be seen from the above figures there is significant storage capacity within the carpark build up to facilitate the attenuation of storm water.

- In addition to attenuation capacity, the proposed porous carpark surface and store build up system also provides for infiltration. The infiltration rate of the ground is poor but given the above figure are based on a 1:100 year storm event with the attenuation capacity only at 55% following this, the risk of the attenuation becoming flooded is very unlikely. See infiltration calculation attached in appendix B of this document.

- Details of the carpark layout and surface details are set out in the accompanying BSM part 10 planning drawings.

- The carpark layouts and details are set out on Horgan lynch drawing No. CQ15-021-Rev A – See Appendix B.

2.2 Proposed Skate Park - Surface Drainage Design Details.

- It is proposed to construct a new skate park in the area of the existing playground to the north of the site.
- The proposed skate park features will include a number of specific skating shapes, surface finishes and structures, including a Hags unplay buridos and Kompan triple cube play structures. Refer to the Architects planning drawings for details.
- The skate park is proposed to be installed using existing ground levels with limited excavations required.
- The new surfaces are a mix of concrete in the skate areas, tar and chip footpaths, grass and meadow areas and jungle mulch in the play areas. The concrete surfaces are laid to falls that will drain into free draining areas and localised soakaway within the site, there is an Aco-drain channel at the southern entrance to the skate park that will drain to adjacent soakaways within the site. Remaining surfaces are laid on a stone bedding which will be free draining.
- The existing playground areas are substantially covered in impermeable tarmac surfaces with marginal grass verges around the north west perimeter of the site. See google image Figure 05 below.
- The new proposed grass and play areas to the redeveloped playground will be permeable free draining surface.
- The total proposed new impermeable hard paved surfaces of the skate park and footpath will be substantially less then the existing impermeable tarmac surface area of the existing playground. Circa 40% reduction in hard surface area.
- The infiltration value of the ground over the areas of the surfaces are sufficient in dealing with the storm water run off values for the area.
- There will be no additional storm water runoff generated from the development of the playground surfaces within the existing site. The provision of soakaways and the free draining stone bedding has been made to facilitate additional infiltration of surface water away from the immediate play areas to prevent ponding of same during heavy rainfall.
- See figure 06 below for extract from Architects drawing for this area. See also appendix A for Horganlynch drawing No. CQ15-023.

Figure 05 – Ariel view of the existing tarmac surface playground

Figure 06 – Extract from Architects Skate Park Plan

2.3 Proposed Pump Track - Surface Drainage Design Details.

- It is proposed to construct a Pump Track in an existing green field area of the site. To the south of the proposed skate park.
- The proposed pump track consists of a porous asphalt surface which is laid to fall to create the desired mounds.
- The pump track is proposed to be installed using existing ground levels with limited excavations required. Excavated material from one area of the track can be used as fill in other areas in order to create the mounds. This limits the amount of imported fill required.
- The proposed regrading of the ground at the pump track and the surrounding park areas have been laid out and levels designed so that the overall surface volumes are equivalent to the existing area so as not to create any overall flood displacement issue with in the park.
- The bitumen macadam surface will be laid such that the surface water will run-off and drain locally into the surrounding grass margins.
- The mounds and levels will be shaped so water is not be trapped around the pump track area and will be free to naturally drain and flow towards the river.
- See figure 07 below for extract from Architects drawing for this area. See also appendix A for Horganlynch drawing No. CQ15-023.

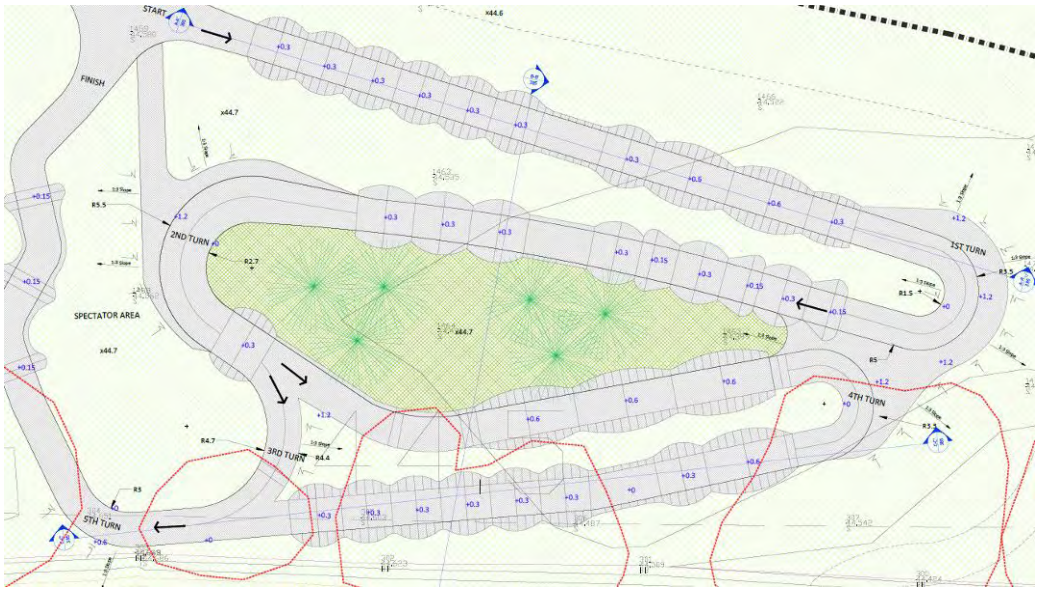


Figure 07 – Extract from Architects Pump Track Plan

2.4 Grass Pitches & Reinforced Grass Event & Temporary car park area

- Surface Drainage Design Details.

- There is an existing grass soccer, rugby and GAA pitch within the town park.
- Figure 08 shows the layout of new and refurbished grass soccer , rugby and GAA playing pitches and a grass training area which are proposed to be provide under this re development of the town park.
- The soccer and rugby pitched will be retain in their existing location.
- The GAA pitch will be reoriented and moved south, and the trees and embankment mounds removed to provide space for the pump track and also to improve the general layout and presentation of the Park area.
- The re grading of the grass pitches an the removal of the grass embankment spectator mounds will also assist in the better drainage and flood flow/release from the Park.
- All pitches and training area will be regraded and reseeded to provide free draining high quality sport standard grass playing surfaces.
- The sub base to the grass surfaces will be formed with a ameliorate soil and gravel mix which will aid in the natural drainage of the surfaces into the free draining sandy gravely sub soil which underlies the park area.
- It is proposed to form new temporary seasonal event and carpark areas to the south west of the Park by reseeding these areas with reinforced grass surfaces. See Figure 08.
- The areas will be natural grass with reinforced polypropylene plastic mesh elements blended with in the soil to from a composite mesh reinforced rootzone capable of taking vehicle loading.
- These surfaces will be naturally free draining grass surfaces with equal or better porosity then the existing grass surfaces of the park.

Figure 08 – Grass Pitches, Event & Car Park areas - Extract from Architects Plan

2.5 Proposed Swale drainage Basin - Surface Drainage Design Details.

- As stated, the town park is in a flood zone and is subject to seasonal flooding. Under fluvial 1% (1 in 100 year storm) AEP the flood depth across the park is >2.0m.
- During periods of flooding the Town Park , which is part of the natural flood pain for the river black water, floods as does the N72 Park road to the northern boundary of the Park.
- When the river flooding subsides the flood waters generally flow back from the roadway and the Park to the river. However, some water ponds and is trapped from flowing directly to the river due to the higher-level of the ground along the footpath to the southern side of the park.
- This trapped surface water eventually naturally drains through the sandy gravely soil of the Park.
- It is proposed to construct a swale drainage basin in an existing green field area to the south west of the site just east of the Bridge.
- The intention of the swale drainage basin is not to prevent flooding but to provide a drainage channel to which surface water from the park and the north west area of the Park Road can be directed and temporarily retained in periods of high river flood before discharged to the river as the flood level recede.
- The detention basin will have storage capacity is approximately 1450m^3
- The swale, as detailed on the drainage drawings, shall be a formed drainage basin channel to the low lying south west area of the park. The base of the channel shall be shaped and graded with a steady fall towards the river to the south west.
- When not in flood, the proposed swale detention basin will form a dry grass “amphitheatre” with grass meadow planting.
- The channel shall be pipes thought the raised footpath embankment and discharge on the river side of the embankment via a formed concrete outfall head wall and slip way directly to the river.
- The piped outfall from the swale detention basin shall be fitted with a Tideflex duckbill non return valve fitted to provide end of pipe backflow prevention and flooding protection to the line.
- See figures 09, 10 and 11 below for extracts from drawing for this area. See also appendix A for Horganlynch drawing No. CQ15-023.

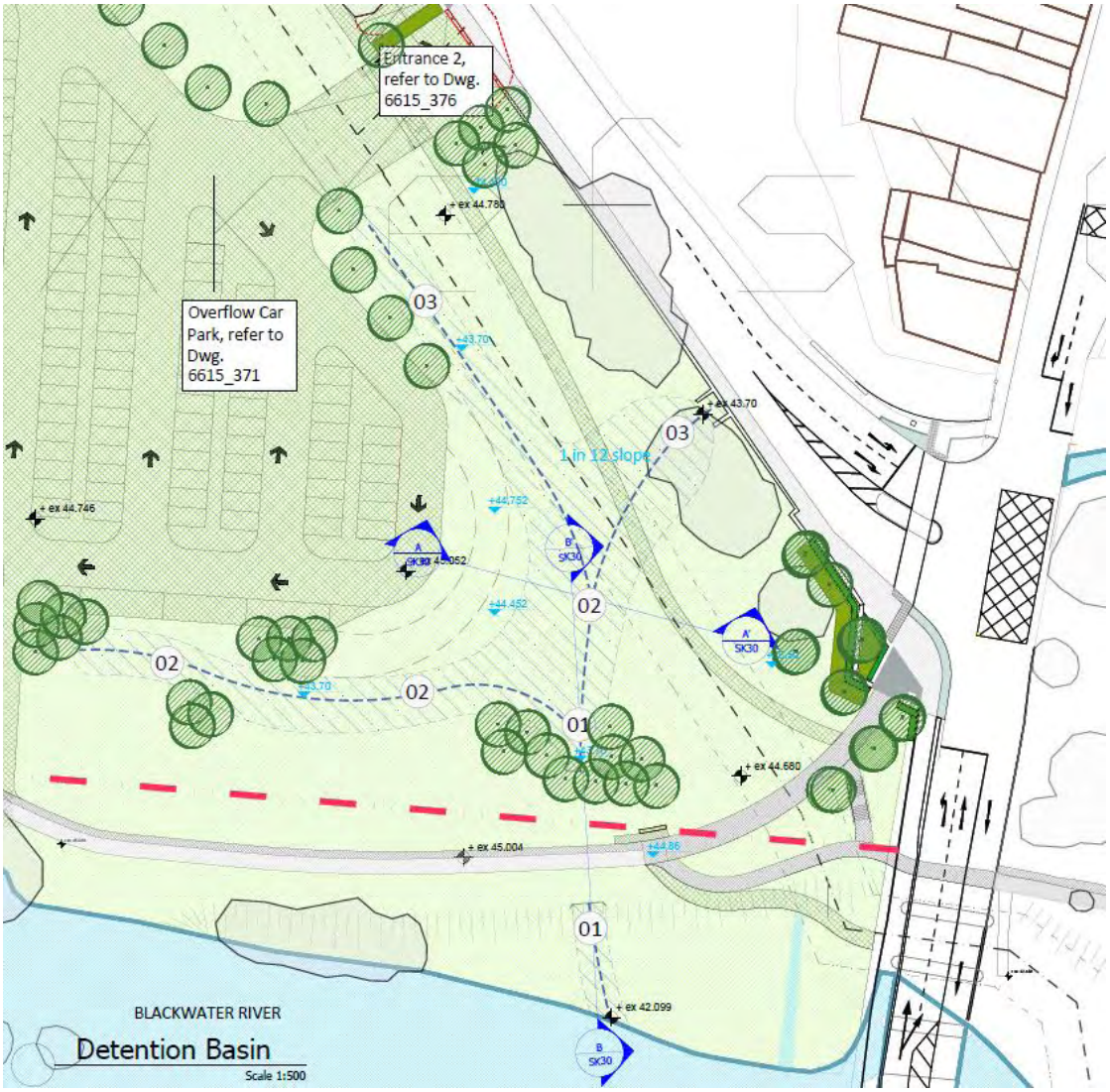


Figure 09 – Extract from Architects Detention Basin Plan

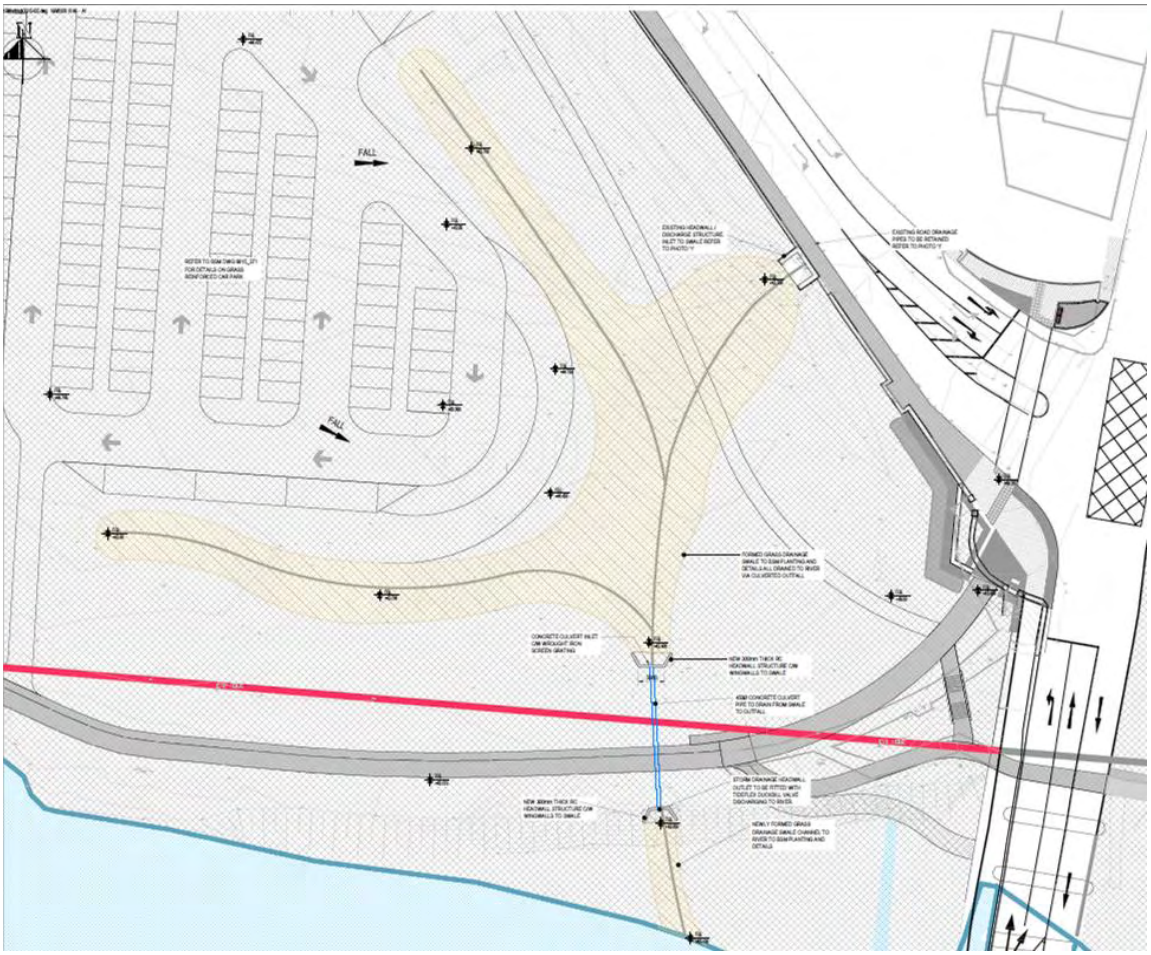


Figure 10 – Extract from CQ15-022

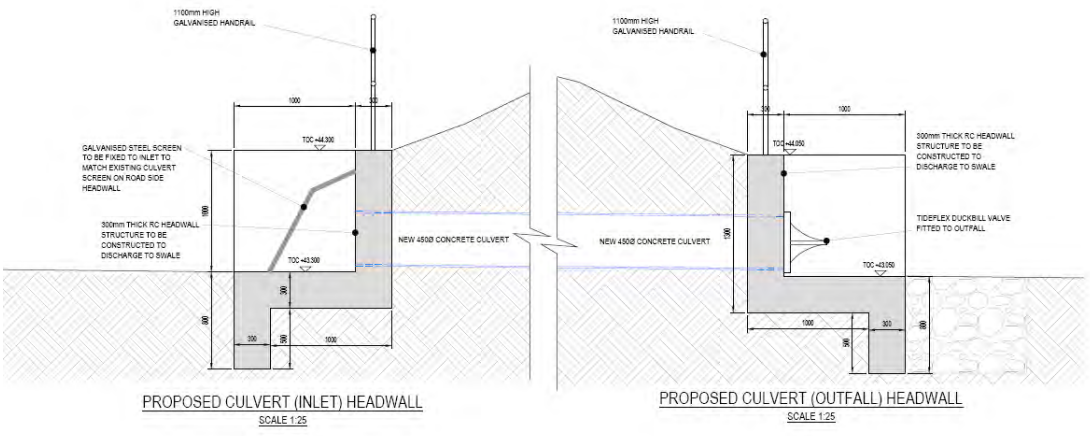


Figure 11 – Section through Swale Drainage Channel Outfall - Extract from CQ15-022

3.0 Site Management Plan /

Environnemental Protection & Mitigation Masures

Site Management

a) The following is an outline Preliminary Construction Environmental Management Plan (CEMP) has been produced to accompany the Planning Application.

b) The Construction Environmental Management Plan for the construction phase of the project will be prepared prior to execution of the works and the Preliminary Plan included here will form the basis on which the developer will be required to prepare the execution plan together with his own Environmental Quality Management Procedures.

c) The Preliminary CEMP takes account of Ciria Guildelines C532 *Control of Pollution from Construction Sites* in its preparation and the execution plan shall be prepared in full compliance with these guidelines. The CEMP also takes account of CIRIA 2010 (Third Edition C692) Environmental Good Practice on Sites CIRIA UK

d) The developer will be required to designate an Environmental Manager for the project whose duty it will be to identify and monitor all potential environmental impacts. He will be required to monitor and maintain registers for noise and dust impacts and shall be responsible for the integrity of the surrounding lands and their protection from potential impacts of the construction operations. His responsibilities will include adherence to CIRIA Guide 532.

e) All individual elements of work shall be covered by full method statements which shall be submitted well in advance of any works proceeding and approved prior to execution.

f) The site shall be fully secured at all times and a full health and Safety Management Plan shall be put in place in accordance with current HSA Health and Safety (Construction) Regulations. A site traffic management plan will be submitted for approval prior to commencement.

g) An Natura Impact Statement has been prepared by Ecological Consultant Dr. Sorcha Sheehy BSc PhD which accompanies the application and this preliminary CEMP should be read in conjunction with it.

Environmental Protection & Mitigation Measures

a) Measures shall be put in place to ensure no run-off from the fill site resulting from rainfall and or construction activities. The most vulnerable element to be protected on the site is the River Blackwater which traverses the site.

b) Silt fences shall be constructed with a series of silt traps installed as required to ensure against uncontrolled run-off into the river network.

c) The silt fence shall be as shown in Figure 12 below.

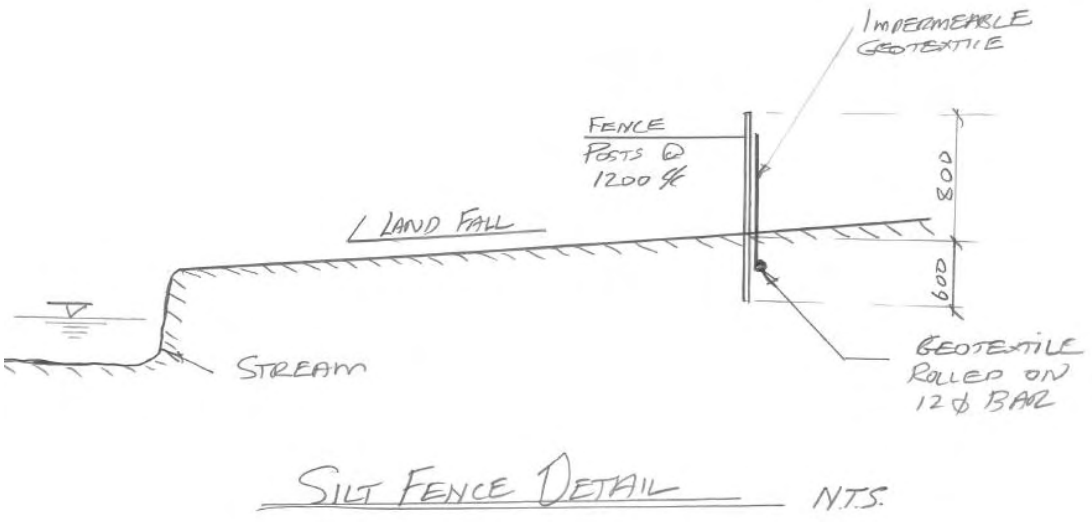


Figure 13 – Silt Fence Detail

d) Facilities will be put in place to dampen fill material to prevent airborne dust during periods of dry weather. Baseline dust monitoring will be carried out and monitoring will be carried out with trigger levels put in place to either cease operations or employ damping procedures.

e) Topsoil and subsoil shall not be stored on sloped areas of the site where washout could migrate and shall not be stored within 15 metres of the river. Topsoil storage areas shall be enclosed with silt fencing.

f) Where existing land drains are encountered they shall be re-established so that the pre-existing hydrological regime is maintained.

g) Waste separation shall follow standard construction site protocols.

h) Full method statements shall be produced as regards handling and final deposition on site of excavated site materials. These method statements shall propose mitigation measures to address potential environmental issues such as dust, noise, and potential water run-off.

i) A hydrocarbon spill kit shall be available on site at all times to deal with any hydrocarbon spill or hydraulic fluid leakage.

j) A wheel washing facility shall be set up at the site entrance which shall consists of the elements set out in the diagram in Figure 13 below.

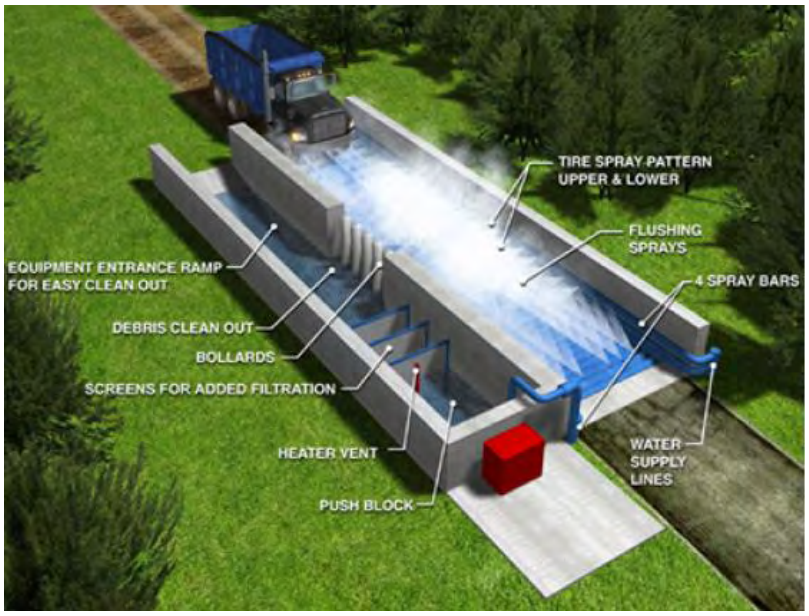


Figure 12 – Example of wheel washing facility to be provide byut the contractor for the duration of the site works

k) Welfare facilities shall be provided in accordance with legal requirements. Sanitary facilities shall have proprietary foul water storage facilities which shall be tankered away on a regular basis. No groundwater contamination will be tolerated.

l) Waste material shall be segregated and removed off site to licenced disposal areas.

4.0 Construction Strategy for Structural Items

Widening of Existing Pedestrian Bridge

- It is proposed to widen the existing pedestrian bridge on the far East corner of the site. The existing bridge is 1665mm wide and the proposal is to add another 1770mm to the bridge width making it 3000mm wide overall.
- The construction will involve the pouring of 2 no. reinforced concrete abutments. 1 to each side of the river. Precast concrete bridge beams will be placed on these abutments and a finished screed will be poured over to complete the bridge surface. New 1.1m high powder coated railings will be provided.
- This method allows for the construction without disturbing the existing trunk watermain contained within the existing bridge deck. The bridge abutments will be kept back from the river to ensure no debris enters same.
- The proposed bridge will match the other bridges on Mallow River walkway and Town park.
- See figure 10 + 11 below for extract from drawings for this area. See also appendix A for Horganlynch drawing No. CQ15-024.

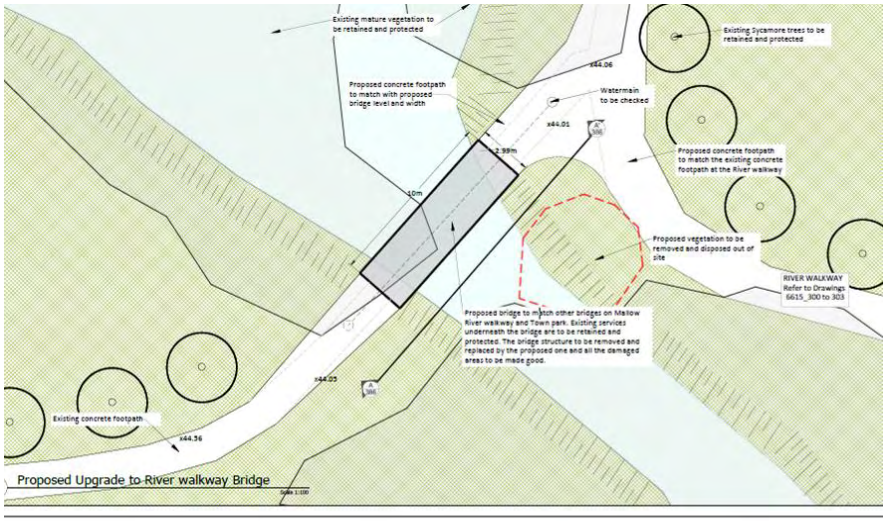


Figure 10 – Extract from Architects Proposed Bridge Widening Drawing

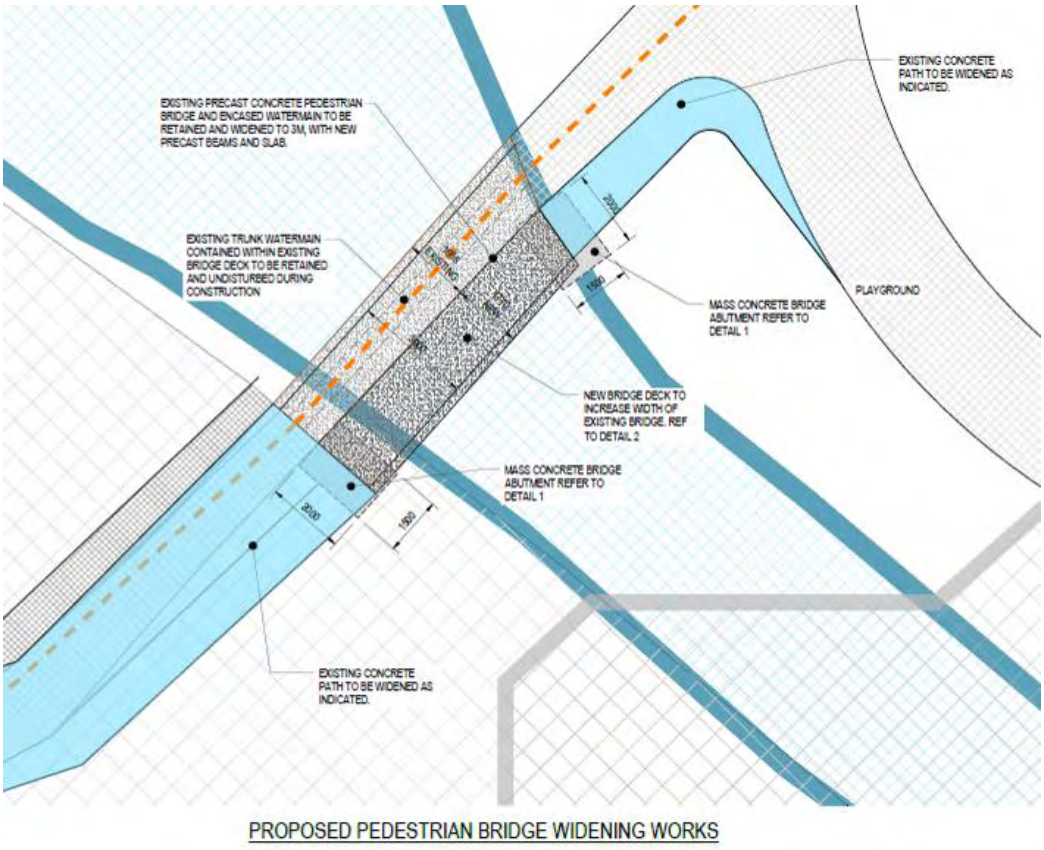


Figure 11 – Extract from Horganlynch Drawing CQ15-024

Angling Stands

- It is proposed to construct a series of angling stands on the Northern bank of the River Blackwater. 4 No. typical angling stands and 1 No. Accessible angling stand.
- These are to be located in the openings of the existing riverbank vegetation. This is to minimise the disruption to the existing riverbank and vegetation. Refer to BSM drawing 6615_309 for locations.
- Proposed grassed areas of disruption made good with geotextile protection matting (Enkamat), topsoiled and seeded with native grass / wild flower mix.
- The accessible angling stand will be formed with precast concrete slabs supported on screw piles and cantilevered reinforced ground beams. This will limit the excavation and works required along the river embankment. Refer to figure 12 below.

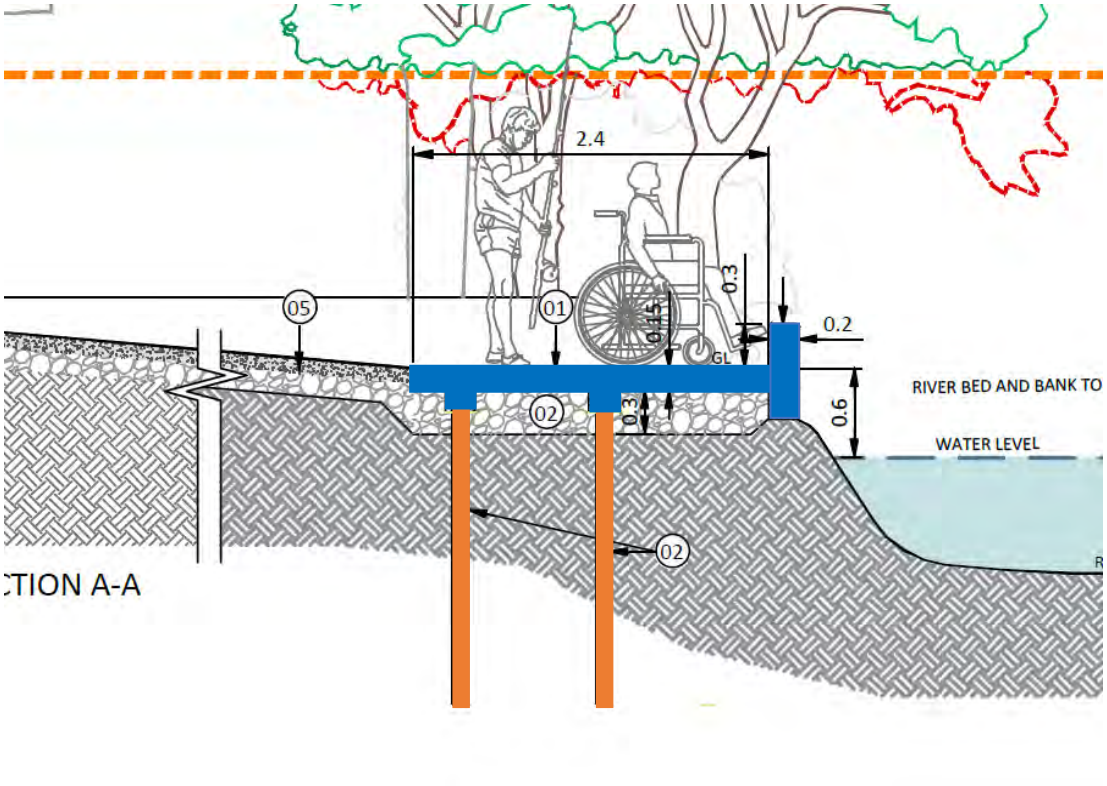


Figure 12 – Accessible Angling Stand Section

- The typical angling stands will consist of 900mm wide steps leading down to the platform. This platform will be formed with black recycled plastic posts and non-slip decking boards all supported from screw piles. These are lightweight pieces and as such the distruption and excavation works adjacent the river will be minimal. Refer to figure 13 below.

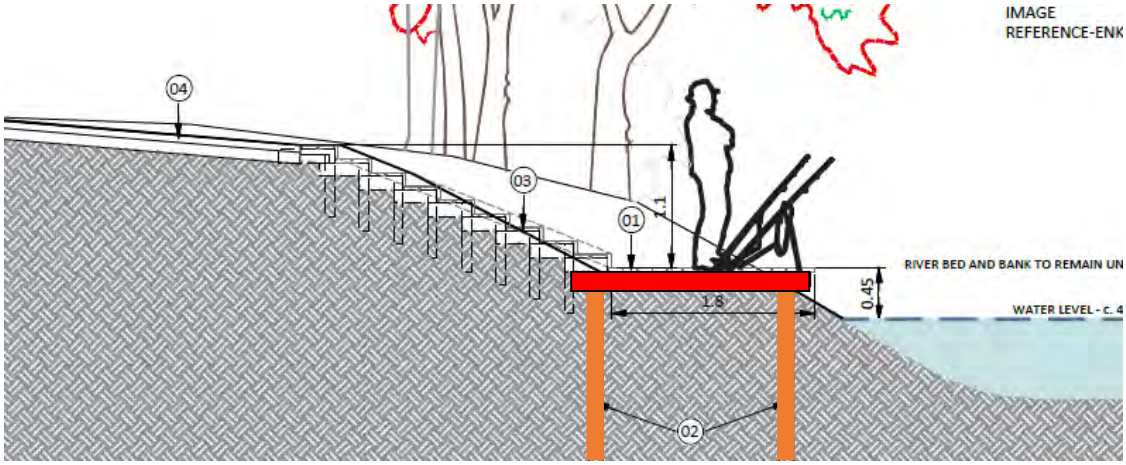


Figure 13 – Typical Angling Stand Section

Appendix A –

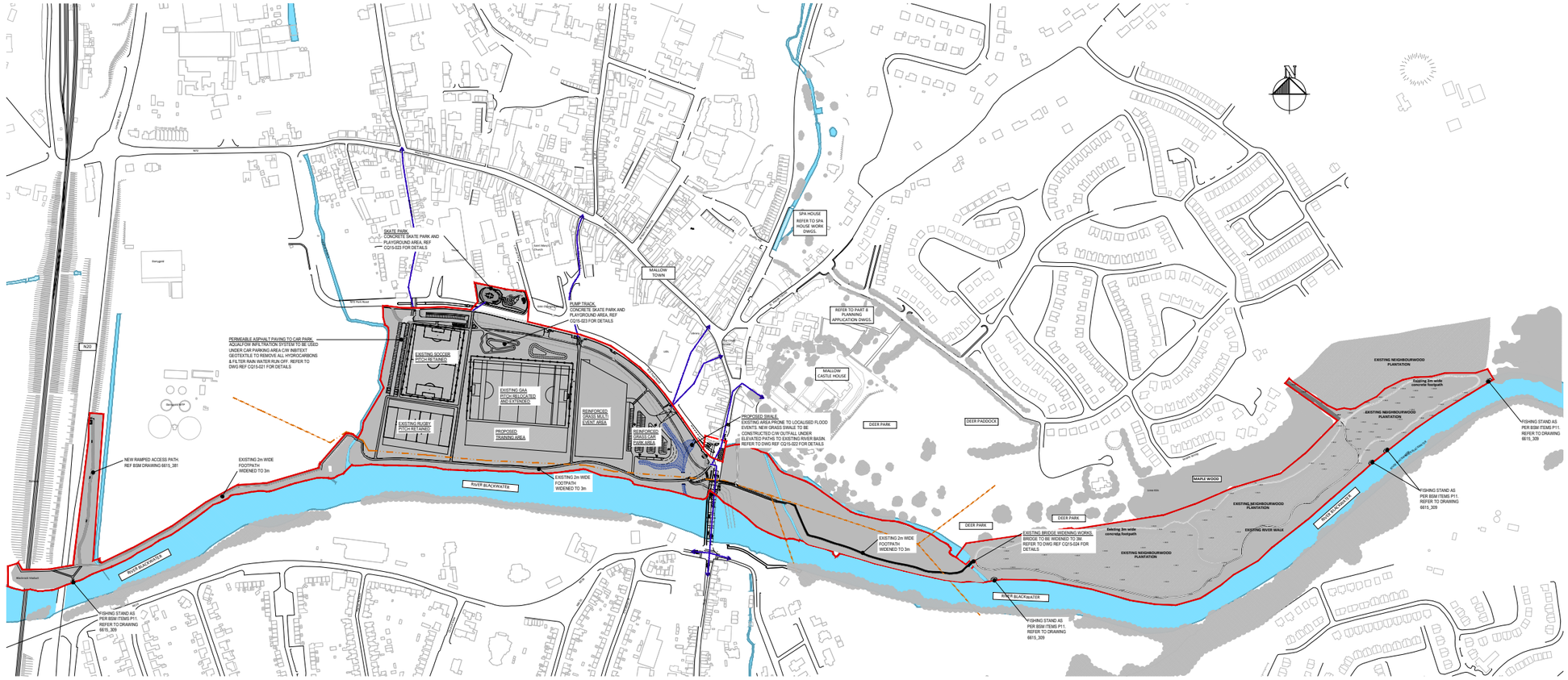
Drawing Title 'Proposed Site Civil Works Layout Plan' - Drg No. CQ15-020- Rev A

Drawing Title 'Proposed Carpark Drainage' - Drg No. CQ15-021- Rev A

Drawing Title 'Proposed Swale Drainage - Drg No. CQ15-022- Rev A

Drawing Title 'Proposed Skate Park and Pump Track' - Drg No. CQ15-023- Rev A

Drawing Title 'Proposed Pedestrian Bridge Widening Works - Drg No. CQ15-024- Rev A



PROPOSED SITE LAYOUT PLAN

SCALE 1:2500

NOTES

REV	DATE	BY	CHKD	DESCRIPTION
A	05.02.21	SC	PB	ISSUED FOR AXB PLANNING

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JOB TITLE
MALLOW TOWN PARK

DRG. TITLE
PROPOSED SITE CIVIL WORKS LAYOUT PLAN

Scales 1:2500	A0	Drawn KL	
Date JAN '21		CAD REF - CO15-020-REV.dwg	
DRAWING NUMBER	CO15-020	REV.	A

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ACO DRAIN

ACO DRAIN DISCHARGE TO SOAKAWY (DESIGNED TO BRE DIGEST 365)

PROPOSED CONCRETE FOOTPATH, SURFACE WATER RUN OFF TO DRAIN TO GRASS MARGINS.

TOTAL CAR PARK AREA - 2705m²

FALL

PROPOSED CONCRETE FOOTPATH, SURFACE WATER RUN OFF TO DRAIN TO GRASS MARGINS.

PERMEABLE ASPHALT PAVING TO CAR PARK. AQUALFOW INFILTRATION SYSTEM TO BE USED UNDER CAR PARKING AREA C/W INBITEXT GEOTEXTILE TO REMOVE ALL HYDROCARBONS & FILTER RAIN WATER RUN OFF.

PERMEABLE ASPHALT PAVING TO CAR PARK. AQUALFOW INFILTRATION SYSTEM TO BE USED UNDER CAR PARKING AREA C/W INBITEXT GEOTEXTILE TO REMOVE ALL HYDROCARBONS & FILTER RAIN WATER RUN OFF.

EXISTING SOCCER PITCH NATURALLY DRAINED TO BE RETAINED

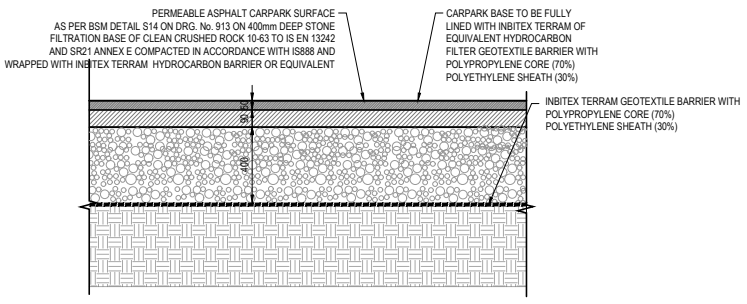
PROPOSED CONCRETE FOOTPATH, SURFACE WATER RUN OFF TO DRAIN TO GRASS MARGINS.

PERMEABLE ASPHALT PAVING TO CAR PARK. AQUALFOW INFILTRATION SYSTEM TO BE USED UNDER CAR PARKING AREA C/W INBITEXT GEOTEXTILE TO REMOVE ALL HYDROCARBONS & FILTER RAIN WATER RUN OFF.

PROPOSED CONCRETE FOOTPATH, SURFACE WATER RUN OFF TO DRAIN TO GRASS MARGINS.

PROPOSED STORM WATER LAYOUT TO NEW CAR PARK

SCALE 1:250



PERMEABLE ASPHALT CARPARK SURFACE

SCALE 1:20

NOTES

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   6615_379
   6615_380
6. ALL PEDESTRIAN PATHS AND ANGLING STANDS TO DRAIN LOCALLY TO GRASS MARGINS, REF TO DWG REF BSM 6615_371 FOR DETAILS OF PATHS AND SURFACES.
7. ALL GRASSED AREAS INCLUDING PITCHES AND REINFORCED GRASS PARKING AREAS ARE TO BE NATURALLY DRAINED VIA INFILTRATION.

Rev	By	Date	Description
A	KL	05.02.21	ISSUED FOR AXB PLANNING

Scales 1:250 | A1 | Date JAN '21 | Drawn KL | C.A.D. REF. CQ15-021-REV.dwg

JOB TITLE
MALLOW TOWN PARK

DRG. TITLE
PROPOSED CAR PARK DRAINAGE

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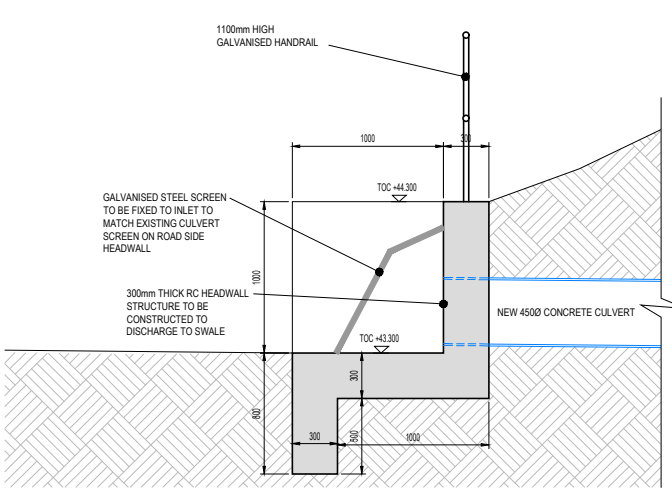
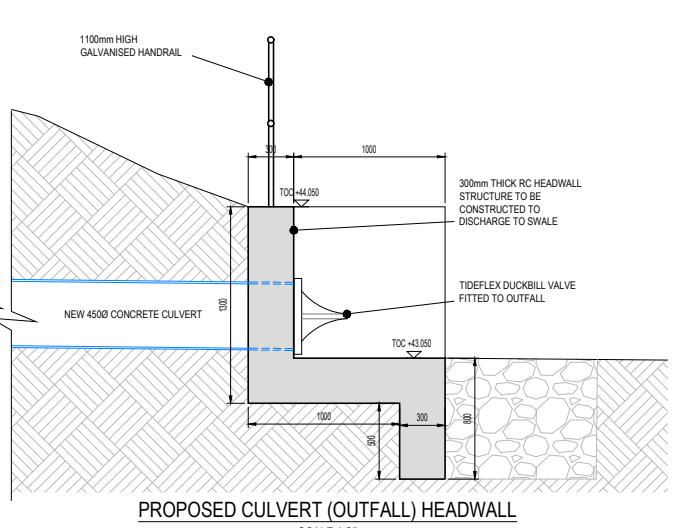
PROPOSED SWALE LAYOUT
SCALE 1:250



PROPOSED CULVERT (INLET) HEADWALL
SCALE 1:25



PROPOSED CULVERT (OUTFALL) HEADWALL
SCALE 1:25

PHOTO '1'
EXISTING HEADWALL AND SCREEN DETAIL AT ROADSIDE

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CENTRAL PLANTER AREA
SOAKAWAY DESIGNED TO
BRE DIGEST 365

SKATE PARK CONCRETE SURFACE
DRAINS INTO CENTRAL PLANTER
AREA AND TO GRASS MARGIN /
SOAK-AWAY ON SOUTH SIDE

SKATE PARK

JUNGLE MULCH SURFACING TO PLAY
AREA TO BE DRAINED VIA
INFILTRATION TO GRAVEL BEDDING
REFER TO DETAIL 001 BELOW

PLAYGROUND

ACO DRAIN

ACO DRAIN TO BE CONNECTED
TO LINEAR SOAKAWAY

CONCRETE SURFACE TO SKATE PARK
DRAINING TO SOAKAWAY DESIGNED TO
BRE DIGEST 365 (SOAKAWAY TO BE
SITUATED UNDER GRASS MARGIN / SHRUBS

TAR & CHIP SURFACE TO PATHS, ALL
TO FALL TO LOW SHRUB PLANTING
AND GRASS MARGINS

GAA Chan

CONCRETE FOOTPATHS TO
FALL TO LOW SHRUB PLANTING
/GRASS MARGINS

BITUMEN MACADAM SURFACE TO
PUMP TRACK, ALL TO DRAIN LOCALLY
TO GRASS MARGINS

PUMP TRACK

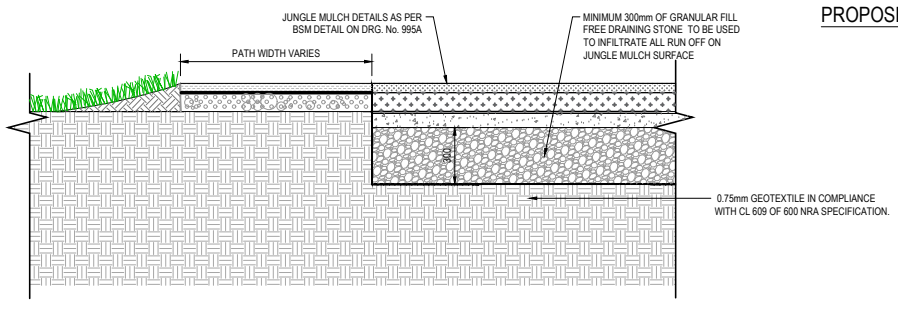
BITUMEN MACADAM SURFACE TO
PUMP TRACK, ALL TO DRAIN LOCALLY
TO GRASS MARGINS

PROPOSED CONCRETE FOOTPATH,
SURFACE WATER RUN OFF TO DRAIN
TO GRASS MARGINS.

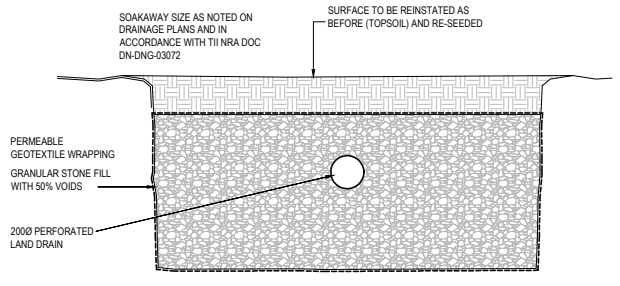
BITUMEN MACADAM SURFACE TO
PUMP TRACK, ALL TO DRAIN LOCALLY
TO GRASS MARGINS

EXISTING GAA PITCH TO BE
RELOCATED AND EXTENDED
NATURALLY DRAINED VIA
INFILTRATION

PROPOSED STORM WATER LAYOUT TO NEW CAR PARK
SCALE 1:250



TYPICAL JUNGLE MULCH SAFETY SURFACE
SCALE 1:20



DETAIL 01 - TYPICAL 'SOAKAWAY' DETAIL
SCALE 1:20

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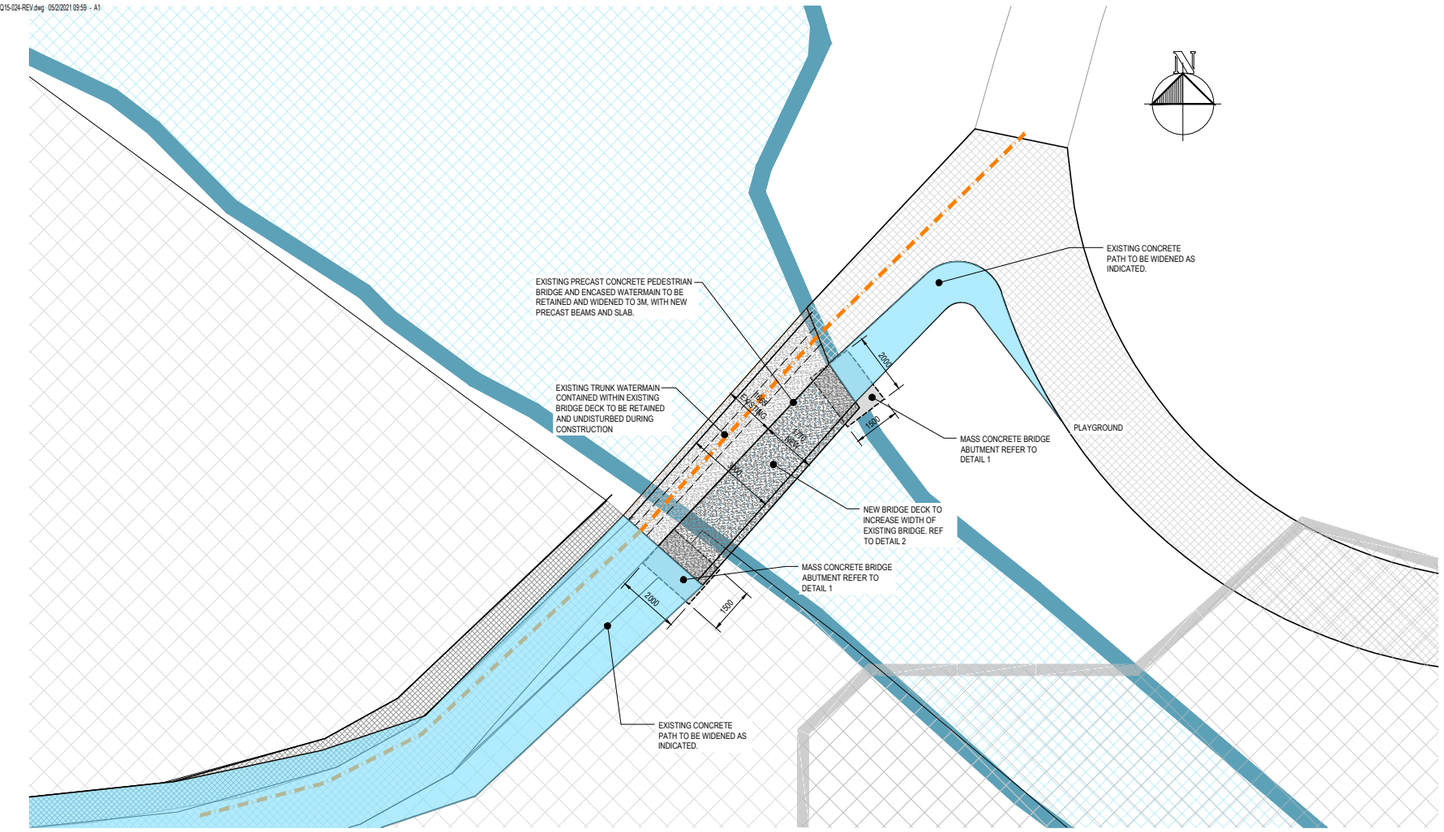
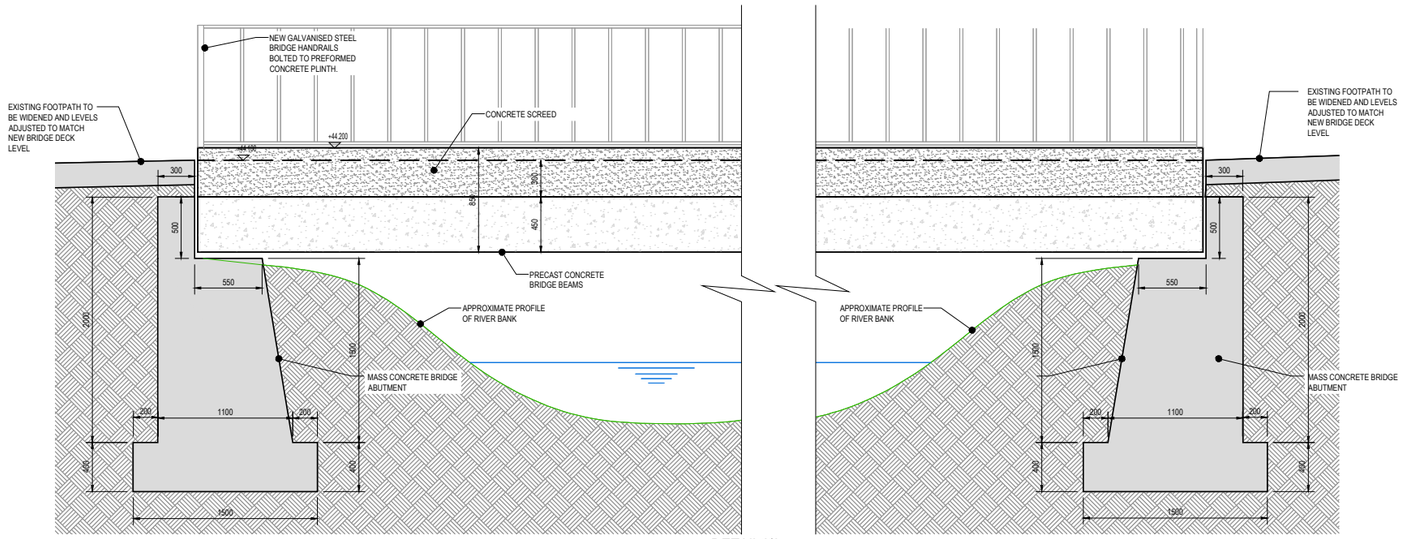


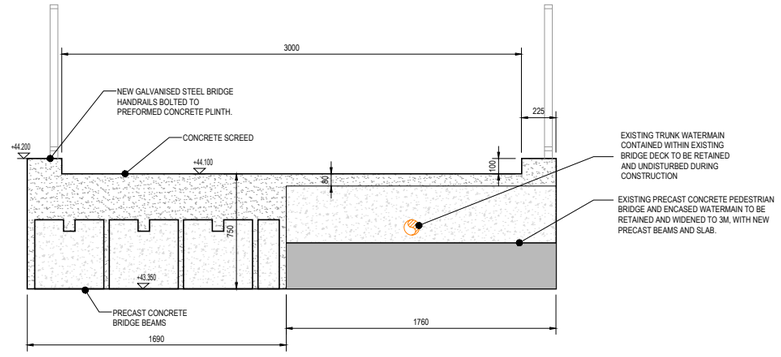
PROPOSED PEDESTRIAN BRIDGE WIDENING WORKS

SCALE 1:100



DETAIL '1'
BRIDGE ABUTMENT SECTION

SCALE 1:25



DETAIL '2'
BRIDGE TYPICAL SECTION

SCALE 1:20

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Scales		Date	Drawn	C.A.D. REF.
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DRAWING NUMBER	CQ15-024	REV. A

Appendix B –

Infiltration estimate

Horganlynch Consulting Engineers	Project				Job Ref.	
	Mallow Town PArk				CQ15	
	Section				Sheet no./rev.	
	Car Park Attenuation and Infiltration				1	
Tellengana Blackrock Rd Cork	Calc. by KC	Date 12/10/2020	Chk'd by KC	Date	App'd by KC	Date

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **4200.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.320**
5-year return period rainfall of 60 minutes duration	M5_60min = **17.2** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **10** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **400** mm
Width of pit	w = **168000** mm
Length of pit	l = **19000** mm
Percentage free volume	V_{free} = **50** %

Soil infiltration rate (BRE digest 365)

Length of trial pit	l_{trial} = **1000** mm
Width of trial pit	b_{trial} = **300** mm
Depth of trial pit (below invert)	d_{trial} = **500** mm
Free volume (if fill used)	V_{trial} = **100** %
75% depth of pit	d_{75} = (d_{trial} * 0.75) = **375.00** mm
50% depth of pit	d_{50} = (d_{trial} * 0.50) = **250.00** mm
25% depth of pit	d_{25} = (d_{trial} * 0.25) = **125.00** mm
Test 1 - time to fall from 75% depth to 25% depth	T1 = **200** min
Test 2 - time to fall from 75% depth to 25% depth	T2 = **600** min
Test 3 - time to fall from 75% depth to 25% depth	T3 = **600** min
Longest time to fall from 75% depth to 25% depth	t_{lg} = max(T1, T2, T3) = **600** min
Storage volume from 75% to 25% depth	V_{p75_25} = (l_{trial} * b_{trial} * (d_{75} - d_{25})) * V_{trial} = **0.08** m^3
Internal surface area to 50% depth	a_{p50} = ((l_{trial} * b_{trial}) + (l_{trial} + b_{trial}) * 2 * d_{50}) = **0.95** m^2
Surface area of soakaway to 50% storage depth	A_{s50} = 2 * (l_{trial} + b_{trial}) * d_{trial} / 2 = **0.650** m^2
Soil infiltration rate	f = V_{p75_25} / (a_{p50} * t_{lg}) = **2.19*10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l * d + w * d = **74800000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 * A
Outflow (cl.3.3.2)	O = a_{s50} * f * D
Storage (cl.3.3.3)	S = I - O

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.35	6.6	1.89	12.4	52.18	0.05	52.13
10	0.50	9.4	1.96	18.4	77.23	0.10	77.13
15	0.60	11.4	1.97	22.5	94.58	0.15	94.44
30	0.78	14.7	1.98	29.1	122.16	0.30	121.87

Horganlynch Consulting Engineers Tellengana Blackrock Rd Cork	Project Mallow Town PArk			Job Ref. CQ15	
	Section Car Park Attenuation and Infiltration			Sheet no./rev. 2	
	Calc. by KC	Date 12/10/2020	Chk'd by KC	Date	App'd by KC	Date

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
60	1.00	18.9	1.94	36.7	154.22	0.59	153.63
120	1.24	23.4	1.90	44.5	186.99	1.18	185.81
240	1.54	29.2	1.86	54.2	227.67	2.36	225.31
360	1.75	33.0	1.83	60.3	253.39	3.54	249.85
600	2.07	39.1	1.78	69.5	291.86	5.91	285.95
1440	2.68	50.7	1.72	87.1	365.70	14.17	351.52

Required storage volume S_{req} = **351.52** m^3

Soakaway storage volume $S_{act} = l * d * w * V_{free}$ = **638.40** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{req} * 0.5 / (a_{s50} * f)$ = 297hr 37min 59s

FAIL - Soakaway discharge time greater than 24 hours

Appendix C –

Site Investigation Report

Mallow Town Park Redevelopment – Ground Investigation

Client:	Cork County Council
Client's Representative:	Horganlynch Consulting Engineers
Report No.:	20-0967
Date:	October 2020
Status:	Final for Issue

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CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1 AUTHORITY 5

2 SCOPE 5

3 DESCRIPTION OF SITE 5

4 SITE OPERATIONS 6
4.1 Summary of site works 6
4.2 Boreholes 6
4.3 Dynamic probes 7
4.4 Trial Pits 7
4.5 Infiltration tests 7
4.6 Surveying 7

5 LABORATORY WORK 8
5.1 Geotechnical laboratory testing of soils 8
5.2 Environmental laboratory testing of soils 8

6 GROUND CONDITIONS 8
6.1 General geology of the area 8
6.2 Ground types encountered during investigation of the site 9
6.3 Groundwater 9

7 DISCUSSION 10
7.1 Proposed construction 10
7.2 Recommendations for construction 10
7.2.1 Summary 10
7.2.2 Soil strength parameters 10
7.2.3 Bearing resistance 11
7.2.4 Foundations and ground floor construction 12
7.2.5 Soil aggressivity 13
7.3 Infiltration drainage 14
7.4 Site contamination and waste disposal 14

8 REFERENCES 15

APPENDICES

Appendix A	Site and exploratory hole location plans
Appendix B	Borehole and dynamic probe logs
Appendix C	Soakaway test results
Appendix D	Soakaway pit photographs
Appendix E	Geotechnical laboratory test results
Appendix F	Environmental laboratory test results
Appendix G	SPT hammer energy measurement report

Document Control Sheet

Report No.:		20-0967			
Project Title:		Mallow Town Park Redevelopment			
Client:		Cork County Council			
Client's Representative:		Horganlynch Consulting Engineers			
Revision:	A00	**Status:**	Final for Issue	**Issue Date:**	23 October 2020
Prepared by:		**Reviewed by:**		**Approved by:**	
 Sean Ross BSc MSc MIEI		 Matthew Gilbert MEarthSci FGS		 Darren O'Mahony BSc MSc MIEI EurGeol PGeo	

The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum) measured in millimetres.

Mallow Town Park Redevelopment

1 AUTHORITY

On the instructions of Horganlynch Consulting Engineers, ("the Client's Representative"), acting on the behalf of Cork County Council ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the redevelopment of Mallow Town Park.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, trial pits, soil sampling, environmental sampling, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted within Mallow Town park, just south of Mallow Town Centre, Co. Cork. The site is relatively flat and comprised of gassed areas on the banks of the River Blackwater. Majority of locations were undertaken wets of Mallow Bridge, with BH04 and BH05 being the only undertaken east of Mallow Bridge on the eastern extremities of the site where a local tributary enters the River Blackwater.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 28th and 29th October 2020, comprised:

- five boreholes by dynamic (windowless) sampling methods
- five follow-on dynamic probes
- two machine dug trial pits
- two soakaway tests.

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

Five boreholes (WSBH01-WSBH05) were put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down clear of services or subsurface obstructions. The boreholes were taken to depths ranging between 2.40m and 3.80m where they were terminated on encountering virtual refusal on obstructions.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at standard intervals throughout the boreholes. Undisturbed (U100) samples were taken as appropriate within fine grained strata.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The *N*-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix G.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded. Details of the water strikes are presented on the individual borehole logs.

Appendix B presents the borehole logs.

4.3 Dynamic probes

Five dynamic probes were conducted as a follow on from the boreholes using the DPSHB method as described in BS EN ISO 22476-3:2005+A1:2011. The method entails a 63.5kg hammer falling 0.75m onto a 50.5mm diameter cone with an apex angle of 90°.

Appendix B provides the dynamic probe logs on the sheet following the relevant borehole log in the form of plots, against depth, of the number of blows per 100mm penetration.

4.4 Trial Pits

Two trial pits (TP01–TP02) were excavated using a 5t tracked excavator fitted with a 600mm wide bucket, to depths of 2.00 and 2.20m. Both trial pits were excavated to allow completion of infiltration test.

Environmental samples were taken at depths of 0.50, 1.00 and 2.00m in each trial pit.

Disturbed (bulk bag) samples were taken at standard depth intervals and at change of strata.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arising provided in Appendix D.

4.5 Infiltration tests

A soakaway test was carried out at two locations (TP01-TP02) in accordance with BRE Digest 365 - Soakaways (BRE, 2016). The tests were conducted in similarly numbered trial pits.

Appendix C presents the results and analysis of the infiltration test. The absence of the outflow from the pits precluded calculation of infiltration coefficients.

4.6 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation (mOD Malin (Irl)) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** pH and water soluble sulphate content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix e.

5.2 Environmental laboratory testing of soils

Environmental testing was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for a range of determinants, including:

- Metals
- Speciated polycyclic aromatic hydrocarbons (PAH)
- pH.

Results of environmental laboratory testing are presented in Appendix F.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise alluvium. These deposits are underlain by Waulsortian Limestones.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered across the site with a thickness range of 200-500mm.
- **Alluvial (cohesive):** typically soft to firm sandy gravelly clay/silt encountered across the site to a maximum depth of 2.00m in TP02.
- **Alluvial (granular):** typically loose to medium dense sands and gravels interspersed with layers of sandy gravelly clay encountered across the site to a maximum depth of 3.80m in WSBH04. It should be noted that all boreholes hit refusal in the alluvial sands and gravels so the full extent of the stratum has not conclusively been proven on site.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during light percussion boring and trial pit excavation through soil as water strikes as shown in Table 1 below.

Table 1: Groundwater strikes encountered during the ground investigation

GI Ref	Water Level (mbgl)	Comments
WSBH01	2.00	Rose to 1.50mbgl after 20 mins
WSBH02	2.20	Rose to 2.20mbgl after 20 mins
WSBH04	3.60	Rose to 3.50mbgl after 20 mins
WSBH05	2.60	Rose to 2.00mbgl after 20 mins
TP01	1.90	Fast seepage at 1.90mbgl

Groundwater was not noted during drilling at WSBH03. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any additional groundwater strikes and the possibility of encountering groundwater at other depths during excavation works should not be ruled out.

Groundwater was not encountered during excavation of TP02.

7 DISCUSSION

7.1 Proposed construction

It is proposed to redevelop Mallow Town Park by construct a new pump park, skate park and multiple sports playing fields. A new footbridge is proposed to be constructed on the east side of the site.

No further details were available to Causeway Geotech at the time of preparing this report and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Summary

Based on the findings of the ground investigation and anticipated small loadings from proposed structures as part of the proposed development, the implementation of traditional shallow (spread) foundations (strip/pad and trench fill) are considered suitable.

However, based on the findings at the location of the proposed bridge structure the thickness of soft or loose alluvial deposits, coupled with the relatively shallow groundwater table will render the implementation of any shallow (spread) foundations problematic. The variation between fine- and coarse-grained soils could also lead to the occurrence of differential settlements, which should be avoided. It follows that the most practicable solution for installing safe working foundations across the site will be by a "deep" foundation method, such as piling or mini-piling to transfer loadings to depth.

Should piling be adopted as the preferred foundation type, it is highly recommended that further ground investigation works involving rotary drilling be carried out at the bridge location to prove strata below 5.50m.

7.2.2 Soil strength parameters

When estimating the shear strength of fine soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of fine soils can be estimated using the correlation developed by Stroud & Butler:

$$C_u = f_1 \times N$$

where f_1 is typically in the range 4 to 6. A median f_1 value of 5 is adopted for this report.

For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance, φ, has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the gravel soils.

7.2.3 Bearing resistance

The ultimate bearing resistance for conventional strip or pad foundations can be obtained from Brinch Hansen's general equation:

$$q_n = cN_c s_c d_c l_c b_c + p_o N_q s_q d_q l_q b_q + \frac{1}{2}\gamma B N_\gamma s_\gamma d_\gamma l_\gamma b_\gamma$$

(Equation 1)

where:

q_n = ultimate bearing resistance
c = undrained cohesion of soil
B = foundation width
p_o = effective overburden pressure at foundation level
Nc, Nq, Nγ = bearing capacity factors
s_c, s_q, s_γ = shape factors
d_c, d_q, d_γ = depth factors
l_c, l_q, l_γ = load inclination factors
b_c, b_q, b_γ = base inclination factors

For conventional strip and pad foundations constructed on fine soils, the general equation has been simplified by Terzaghi to:

Net ultimate bearing resistance = cN_c

(Equation 2)

where:

c = undrained cohesion
N_c = bearing capacity factor

For cohesionless soils (sand/gravel, c=0), the calculation of ultimate bearing resistance is generally required only for loose sands. This is because coarser gravel soils would not be expected to suffer a bearing capacity failure. However, limits are placed on the allowable bearing resistance in order to control settlement. For shallow conventional pad foundations on granular soils, Terzaghi's simplified equation can be used as follows:

$q_n = p_o(N_q\text{-}1) + 0.4BN + p$

(Equation 3)

where:

p = total overburden pressure

It is obvious from the equations 1 to 3 that some knowledge of the foundation width and depth is required before the ultimate bearing resistance can be calculated.

Table 2 provides an indication of minimum founding depth at each borehole location. Also shown are approximate soil strengths based on the Stroud and Butler (1975) correlations with SPT N-values and visual examination of recovered samples of the clay deposits.

The table also suggests allowable bearing resistance using Equations 2 and 3 for cohesive and cohesionless soils respectively.

This table does not take into account the variations in soil composition, and the effects of differential movement within a particular structure. Calculation of the design bearing resistance over the entire structure will entail a knowledge of the magnitude and distribution of the structural actions.

7.2.4 Foundations and ground floor construction

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and allowable bearing pressure (ABP) at the borehole locations are presented in Table 2.

Table 2: Construction recommendations

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Groundwater
WSBH01	1.20m	190	Medium dense GRAVEL	Strip & pad	Strike at 2.00m
WSBH02	2.20m**	50	Medium dense GRAVEL	Trench fill (with trench support and possible sump pumping)	Strike at 2.20m
WSBH03	3.00m	250	Dense GRAVEL	Trench fill (with trench support)	None encountered
WSBH04	>5.50m	>250	Dense GRAVEL	Mini-piling	Strike at 3.60m

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Groundwater
WSBH05	>5.50m	>250	Dense GRAVEL	Mini-piling	Strike at 2.60m

*Existing Ground Level
**with reinforcement

Based on the findings of the site investigation, spread foundations (strip/pad and trench fill) are considered suitable for smaller elements of the proposed development with estimated allowable bearing pressures between 50kPa and 250kPa at depths between 1.20m and 3.00m on soft alluvial clay or dense gravels.

At the locations of WSBH04 and WSBH05 where a proposed bridge structure is proposed, the thickness of soft or loose alluvial soils will render the use of shallow foundations problematic. Dynamic probes at this location terminated at depths of 5.50m in dense gravels. Should piling or mini-piling be adopted, it is recommended that rotary drilling is undertaken to prove ground conditions below this depth.

The base of shallow foundation excavations should be thoroughly inspected and tested in accordance with the Earthworks Specification; any soft or loose soils removed with the resultant void backfilled with ST1 concrete or engineered backfill. A consistent bearing stratum should be provided for any building unit to limit differential settlements.

The use of geosynthetics in the construction of paved areas and concrete structures, will be beneficial and will minimize long term or differential settlements. These could include a geosynthetic (e.g., a geogrid) at subgrade level with further benefit gained by incorporating further layer(s) within the capping/sub-base layer. Pavement design should be undertaken by a specialist earthworks contractor/designer.

Given the predominance of the silt and granular strata, excavations for foundations are not likely to be stable. Where space allows, instability can be minimised by battering the side slopes at 2 vertical to 1 horizontal, by limiting the duration that the excavation is open or by utilising a system of trench boxes. Groundwater control, where required, will be possible by pumping from sumps formed in the base of excavations.

7.2.5 Soil aggressivity

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2017).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous industrial development and not perceived as containing pyrite;
- Sites not subjected to previous industrial development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as not having been subject to previous industrial development and not perceived as containing pyrite.

The results of chemical tests (pH and water soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-1 and ACEC Class AC-1 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater that 140mm thick.

7.3 Infiltration drainage

In infiltration tests carried out in trial pits TP01 and TP02, the absence of outflow precluded the calculation of infiltration rates. The low-permeability fine-grained soils are therefore considered to be poor infiltration media and would be deemed unsuitable for the implementation of infiltration drainage systems.

Reference should be made the Sustainable Drainage Systems (SuDS) design guidance, taking into account meteorological conditions and a hydrogeological assessment.

7.4 Site contamination and waste disposal

Selected soil samples were analysed for a range of potential contaminants including:

- Metals;
- Speciated polycyclic aromatic hydrocarbons (PAH);
- Sulphates; and
- Phenols

In the initial examination of the potential risk of site contamination, the laboratory results have been compared to the LQM/CIEH S4UL's assessment criteria relevant to the proposed land use.

The results from the tested samples do not identify significantly elevated concentrations above the available S4UL's.

It should be noted that the above assessment is based on the results of the soil samples against available S4UL's and this assessment has not been undertaken following the CLR11 guidelines. Any potential contamination identified during site development by visual or olfactory means should be investigated, including further laboratory testing, and appropriate health & safety, waste disposal and remediation measures adopted.

8 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. National Standards Authority of Ireland.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground.

Building Research Establishment (2007), BRE Digest 365: Soakaways.

Contaminated Land Report (CLR) 11, (2009) Model Procedures for the Management of Land Contamination, The Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency.

CAUSEWAY GEOTECH

APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLAN

CAUSEWAY GEOTECH

Project No.:	20-0967	**Client:**	Cork County Council
Project Name:	Mallow Town Park Redevelopment	**Client's Representative:**	Horganlynch Consulting Engineers

Legend Key

Title:

Site Location Plan

Last Revised:	**Scale:**
22/10/2020	1:25000

CAUSEWAY GEOTECH

Project No.:	20-0967	**Client:**	Cork County Council
Project Name:	Mallow Town Park Redevelopment	**Client's Representative:**	Horganlynch Consulting Engineers

Legend Key

- Locations By Type - CP
- Locations By Type - TP

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
22/10/2020	1:5000

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0967	Mallow Town Park Redevelopment	WSBH01
	Client: Cork County Council	
	Client's Rep: Horganlynch Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.40	555991.50 E 598233.20 N

Final Depth:	2.40 m	Start Date:	28/09/2020	Driller:	JC	Sheet 1 of 1 Scale: 1:40
Elevation:	44.16 mOD	End Date:	28/09/2020	Logger:	CH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.50	ES1				43.66	0.50		TOPOSIL with rootlets		
0.50 - 2.00	B4							Medium dense becoming dense light brown sandy silty subangular to subrounded fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.		
1.00	ES2									
1.20 - 1.65	SPT (C)	N=19 (3,4/5,5,4,5) Hammer SN = 0696	1.20	Dry						
2.00	ES3									
2.00 - 2.45	SPT (C)	N=39 (4,8/10,9,10,10) Hammer SN = 0696 Water strike at 2.00m	2.00	1.50						
					41.76	2.40		End of Borehole at 2.40m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.00	2.00	20	1.50

Casing Details

To (m)	Diameter
2.30	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated on sampler refusal, continued by dynamic probe.

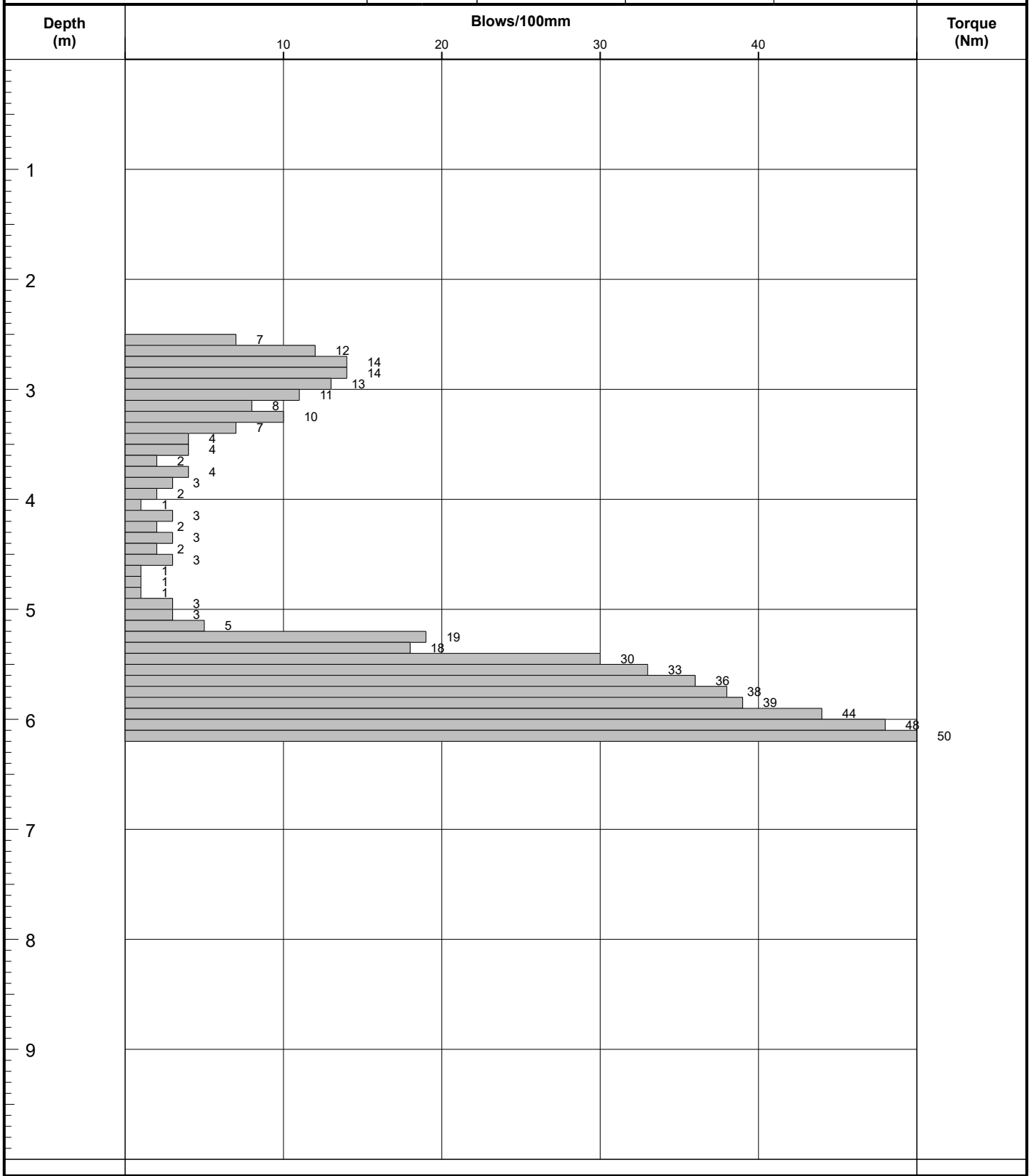
Last Updated

23/10/2020

AGS

CAUSEWAY GEOTECH

Project No. 20-0967	**Project Name:** Mallow Town Park Redevelopment				**Probe ID** **WSBH01DP**
Coordinates E	**Client:** Cork County Council				
Method: Dynamic Probing	N	**Client's Representative:** Horganlynch Consulting Engineers			Sheet 1 of 1 Scale: 1:50
Probe Type: DPSH-B	**Elevation** mOD	**Final Depth:** 6.10	**Date:** 28/09/2020	**Operator:** JC	FINAL



Fall Height: 750 mm	**Remarks:**
Hammer Mass: 64 kg	
Cone Diameter: 51 mm	

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0967	Mallow Town Park Redevelopment	WSBH02
	Client: Cork County Council	
	Client's Rep: Horganlynch Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.00	555822.90 E 598337.90 N

Final Depth:	3.00 m	Start Date:	28/09/2020	Driller:	JC
Elevation:	44.38 mOD	End Date:	28/09/2020	Logger:	CH

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL with rootlets		
0.30 - 0.90	B1				44.08	0.30		Soft light brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine of mixed lithologies.		
0.50	ES6									
0.90 - 1.90	B2				43.48	0.90		Soft grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine of mixed lithologies.		
1.00	ES7									
1.20	D3									
1.20 - 1.65	SPT (S)	N=5 (1,0/2,0,1,2) Hammer SN = 0696	0.00	Dry						
1.90 - 2.20	B4				42.48	1.90		Soft grey SILT with occasional lenses of dark brown peat.		
2.00	ES8									
2.00	U5	Ublow=70 0%	0.00	Dry	42.18	2.20		Medium dense greyish brown very sandy slightly silty subangular to subrounded fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.	▼	
2.00	W10									
2.20 - 3.00	B9	Water strike at 2.20m								
3.00 - 3.45	SPT (C)	N=12 (3,3/4,4,3,1) Hammer SN = 0696	0.00	2.00	41.38	3.00		End of Borehole at 3.00m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.20	2.20		

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated due to borehole collapse, continued by dynamic probe.

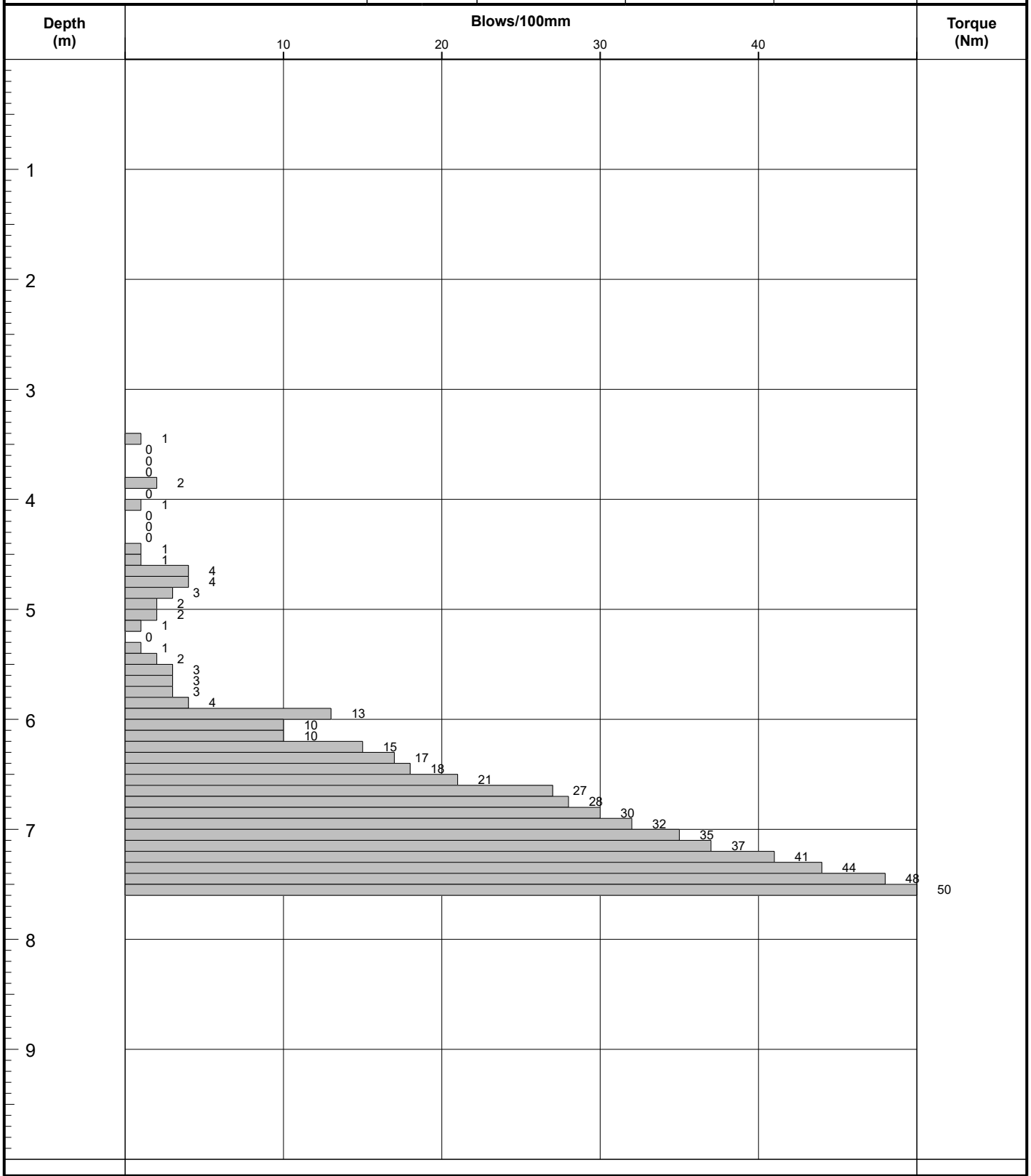
Last Updated

23/10/2020

AGS

CAUSEWAY GEOTECH

Project No. 20-0967	**Project Name:** Mallow Town Park Redevelopment				**Probe ID** **WSBH02DP**
Coordinates E	**Client:** Cork County Council				
Method: Dynamic Probing	N	**Client's Representative:** Horganlynch Consulting Engineers			Sheet 1 of 1 Scale: 1:50
Probe Type: DPSH-B	**Elevation** mOD	**Final Depth:** 7.50	**Date:** 28/09/2020	**Operator:** JC	FINAL



Fall Height: 750 mm	**Remarks:**
Hammer Mass: 64 kg	
Cone Diameter: 51 mm	

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0967	Mallow Town Park Redevelopment	WSBH03
	Client: Cork County Council	
	Client's Rep: Horganlynch Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.00	555845.50 E 598164.20 N

Final Depth:	3.00 m	Start Date:	29/09/2020	Driller:	JC
Elevation:	44.78 mOD	End Date:	29/09/2020	Logger:	CH

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL with rootlets		
0.50	ES1				44.28	0.50				
0.50 - 1.90	B4							Very loose brown slightly silty fine to coarse SAND with occasional rootlets.		
1.00	ES2									
1.20 - 1.65	SPT (C)	N=1 (1,1/0,0,1,0) Hammer SN = 0696	0.00	Dry						
1.90 - 2.60	B5				42.88	1.90				
2.00	ES3							Very loose grey very silty fine to coarse SAND.		
2.00 - 2.45	SPT (C)	N=0 (0,0/0,0,0,0) Hammer SN = 0696	0.00	Dry						
2.60 - 3.00	B6				42.18	2.60		Dense grey sandy silty subangular to subrounded fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.		
3.00 - 3.45	SPT (C)	N=47 (7,10/13,14,11,9) Hammer SN = 0696	0.00	Dry	41.78	3.00		End of Borehole at 3.00m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

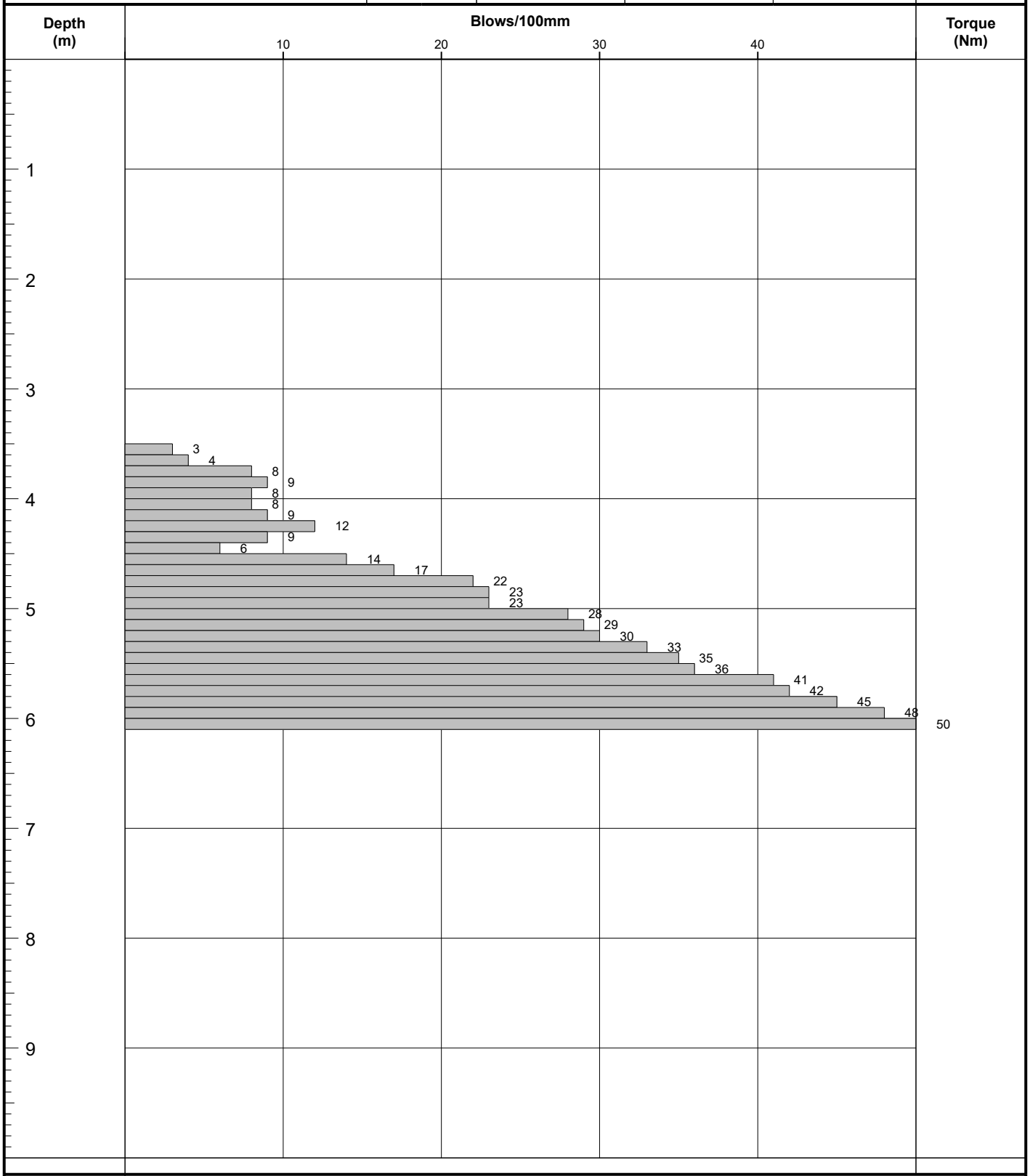
Terminated due to borehole collapse, continued by dynamic probe.

Last Updated

23/10/2020

AGS

CAUSEWAY GEOTECH	**Project No.** 20-0967	**Project Name:** Mallow Town Park Redevelopment			**Probe ID** WSBH03DP
	Coordinates E	**Client:** Cork County Council			
Method: Dynamic Probing	N	**Client's Representative:** Horganlynch Consulting Engineers			Sheet 1 of 1 Scale: 1:50
Probe Type: DPSH-B	**Elevation** mOD	**Final Depth:** 6.00	**Date:** 29/09/2020	**Operator:** CH	FINAL



Fall Height: 750 mm	**Remarks:**
Hammer Mass: 64 kg	
Cone Diameter: 51 mm	

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0967	Mallow Town Park Redevelopment	WSBH04
	Client: Cork County Council	
	Client's Rep: Horganlynch Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.80	556474.90 E 597987.10 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1
3.80 m	29/09/2020	JC	Scale: 1:40
Elevation: 44.64 mOD	**End Date:** 29/09/2020	**Logger:** CH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								TOPSOIL		
0.20 - 1.00	B5				44.44	0.20		Loose brown very silty fine to medium SAND with rootlets.		
0.50	ES1									
1.00	ES2									
1.00 - 2.00	B6									
1.20 - 1.65	SPT (C)	N=4 (1,2/1,1,1,1) Hammer SN = 0696	1.20	Dry						
2.00	ES3									
2.00 - 2.80	B7									
2.00 - 2.45	SPT (C)	N=5 (1,0/1,1,1,2) Hammer SN = 0696	2.00	Dry						
					41.84	2.80		Dark brown slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine of mixed lithologies.		
3.00	ES4				41.64	3.00		Very dense brown very sandy slightly silty subangular to subrounded fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.		
3.00 - 3.80	B8									
3.00 - 3.44	SPT (C)	N=50 (3,7/50 for 285mm) Hammer SN = 0696	3.00	Dry						
		Seepage at 3.60m								
3.80 - 4.25	SPT (C)	N=38 (11,10/9,13,8,8) Hammer SN = 0696	3.00	3.60	40.84	3.80		End of Borehole at 3.80m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
3.60	3.60	20	3.50

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Casing Details

To (m)	Diameter
3.00	200

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated on sampler refusal, continued by dynamic probe.

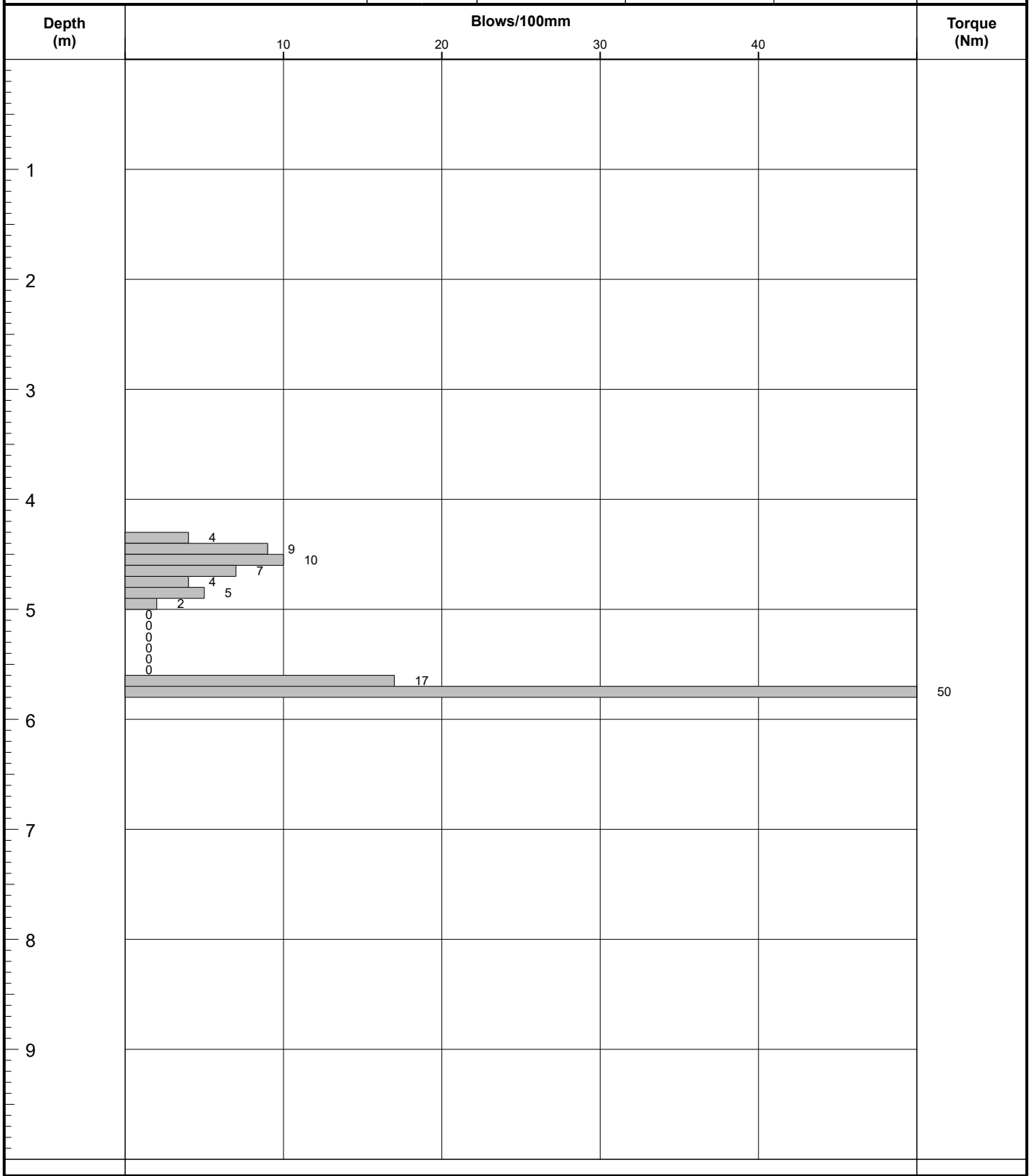
Last Updated

23/10/2020

AGS

CAUSEWAY GEOTECH

	Project No. 20-0967	**Project Name:** Mallow Town Park Redevelopment			**Probe ID** **WSBH04DP**
	Coordinates E	**Client:** Cork County Council			
Method: Dynamic Probing	N	**Client's Representative:** Horganlynch Consulting Engineers			Sheet 1 of 1 Scale: 1:50
Probe Type: DPSH-B	**Elevation** mOD	**Final Depth:** 5.70	**Date:** 29/09/2020	**Operator:** JC	FINAL



Fall Height: 750 mm	**Remarks:**
Hammer Mass: 64 kg	
Cone Diameter: 51 mm	

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0967	Mallow Town Park Redevelopment	WSBH05
	Client: Cork County Council	
	Client's Rep: Horganlynch Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.65	556517.10 E 598000.30 N

Final Depth:	3.65 m	Start Date:	29/09/2020	Driller:	JC
Elevation:	43.54 mOD	End Date:	29/09/2020	Logger:	CH

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								MADE GROUND: Reworked TOPSOIL		
0.50	ES1				43.04	0.50				
0.60	D5							MADE GROUND: Soft brown sandy gravelly CLAY with fragments of brick, concrete and ash. Sand is fine. Gravel is subangular to subrounded fine to coarse. of mixed lithologies.		
1.00	ES2				42.54	1.00				
1.00 - 1.90	B6							Soft brown slightly sandy slightly gravelly SILT. Sand is to coarse. Gravel is subrounded fine of limestone.		
1.20	D15									
1.20	D7									
1.20 - 1.65	SPT (S)	N=4 (1,0/1,1,1,1) Hammer SN = 0696	1.20	Dry						
1.90 - 2.40	B9				41.64	1.90				
2.00	ES3							Soft greyish brown slightly sandy SILT. Sand is fine.		
2.00	U8	Ublow=40 0%	0.00	Dry						
2.40	W14				41.14	2.40				
2.50	D10							Dark greyish brown fine to medium SAND.		
2.50	W12				40.94	2.60				
2.50	W13							Medium dense brown sandy silghty silty subangular fine to coarse GRAVEL of mixed lithologies with low cobble content. Sand is fine to coarse. Cobbles are subrounded of mixed lithologies.		
2.60 - 3.65	B11									
		Water strike at 2.60m								
3.00	ES4									
3.00 - 3.45	SPT (C)	N=26 (2,5/6,7,6,7) Hammer SN = 0696	2.90	Dry						
3.65 - 4.10	SPT (C)	N=13 (15,9/6,4,1,2) Hammer SN = 0696	2.90	2.40	39.89	3.65		End of Borehole at 3.65m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.60	2.60	20	2.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Casing Details

To (m)	Diameter
2.90	200

Water Added

From (m)	To (m)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated on sampler refusal, continued by dynamic probe.

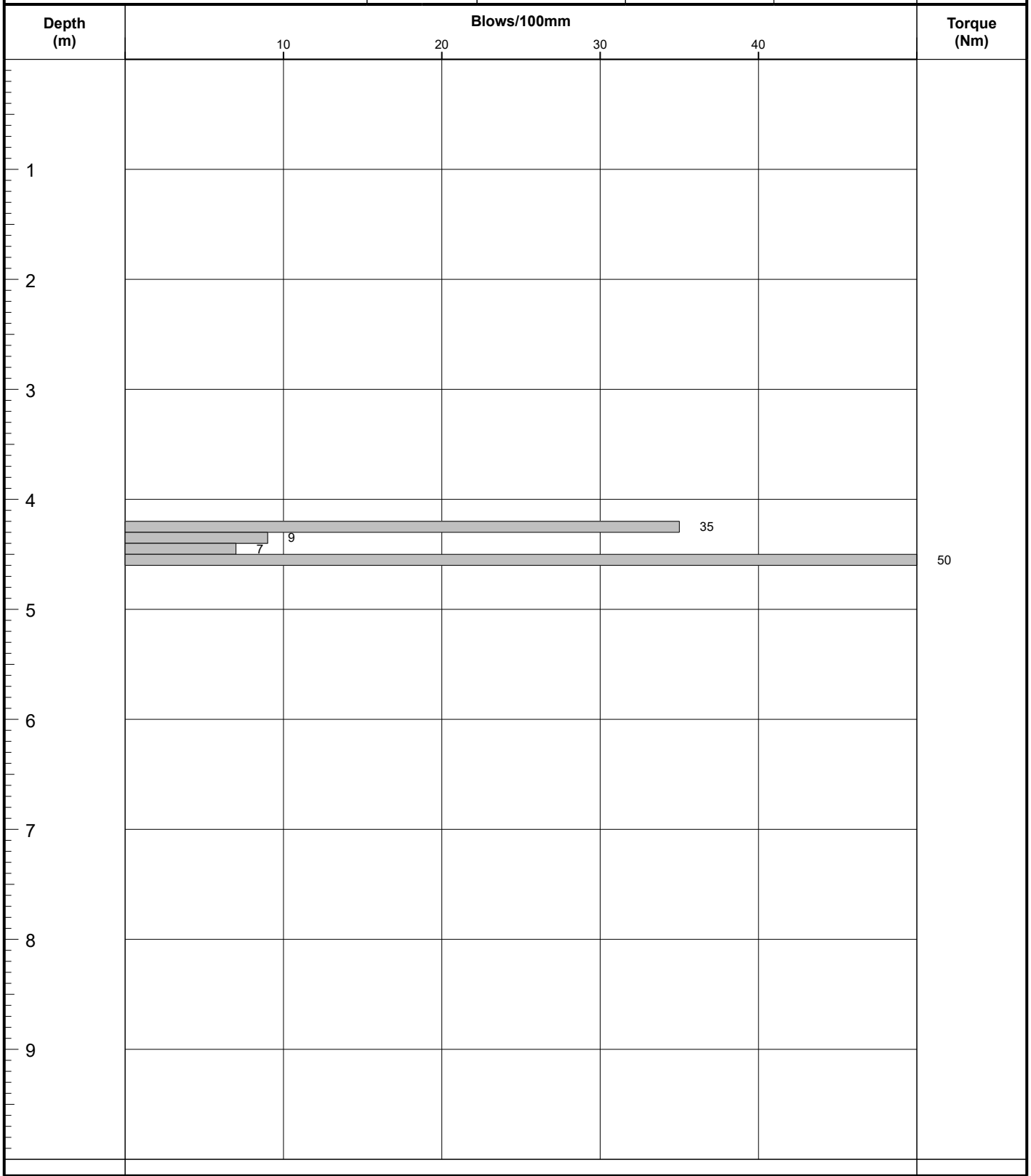
Last Updated

23/10/2020

AGS

CAUSEWAY GEOTECH

	Project No. 20-0967	**Project Name:** Mallow Town Park Redevelopment			**Probe ID** **WSBH05DP**
	Coordinates E	**Client:** Cork County Council			
Method: Dynamic Probing	N	**Client's Representative:** Horganlynch Consulting Engineers			Sheet 1 of 1 Scale: 1:50
Probe Type: DPSH-B	**Elevation** mOD	**Final Depth:** 4.50	**Date:** 29/09/2020	**Operator:** JC	FINAL



Fall Height: 750 mm	**Remarks:**
Hammer Mass: 64 kg	
Cone Diameter: 51 mm	

AGS

CAUSEWAY GEOTECH

APPENDIX C

SOAKAWAY TEST RESULTS

CAUSEWAY GEOTECH

Project No. 20-0967	**Project Name:** Mallow Town Park Redevelopment		**Trial Pit ID** TP01
Coordinates 555692.30 E 598364.30 N	**Client:** Cork County Council		
Method: Trial Pitting	**Client's Representative:** Horganlynch Consulting Engineers		Sheet 1 of 1 Scale: 1:25
Plant: 5T Tracked Excavator	**Elevation** 44.69 mOD	**Date:** 28/09/2020	**Logger:** RS	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			44.54	0.15		TOPSOIL	
						Firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.	
0.50	B4						
0.50	ES1						
1.00	ES2						
			43.39	1.30		Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	
1.50	B5						
			42.99	1.70		Grey sandy silty subrounded fine to coarse GRAVEL of mixed lithologies predominantly limestone with low cobble content. Sand is fine to coarse. Cobbles are of limestone.	
		Fast seepage at 1.90m					▼
2.00	B6						
2.00	ES3						
			42.49	2.20		End of trial pit at 2.20m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks
1.90	Fast seepage at 1.90m

Depth: 2.20
Width: 0.30
Length: 2.20

Remarks:

Stability: Unstable

Termination Reason: Terminated on refusal.

Last Updated 22/10/2020

AGS

Soakaway Infiltration Test

Project No.: 20-0967
Site: Mallow Town Park Redevelopment
Test Location: TP01
Test Date: 28 September 2020

	width (m)	length (m)
test pit top dimensions	0.30	1.30
test pit base dimensions	0.30	0.70

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.34	0.87
0.5	0.34	0.86
1	0.35	0.86
2	0.36	0.85
4	0.38	0.83
6	0.39	0.81
8	0.40	0.80
10	0.42	0.79
15	0.44	0.76
20	0.46	0.74
25	0.48	0.72
30	0.50	0.71
45	0.54	0.66
60	0.57	0.63
90	0.62	0.58
105	0.64	0.56

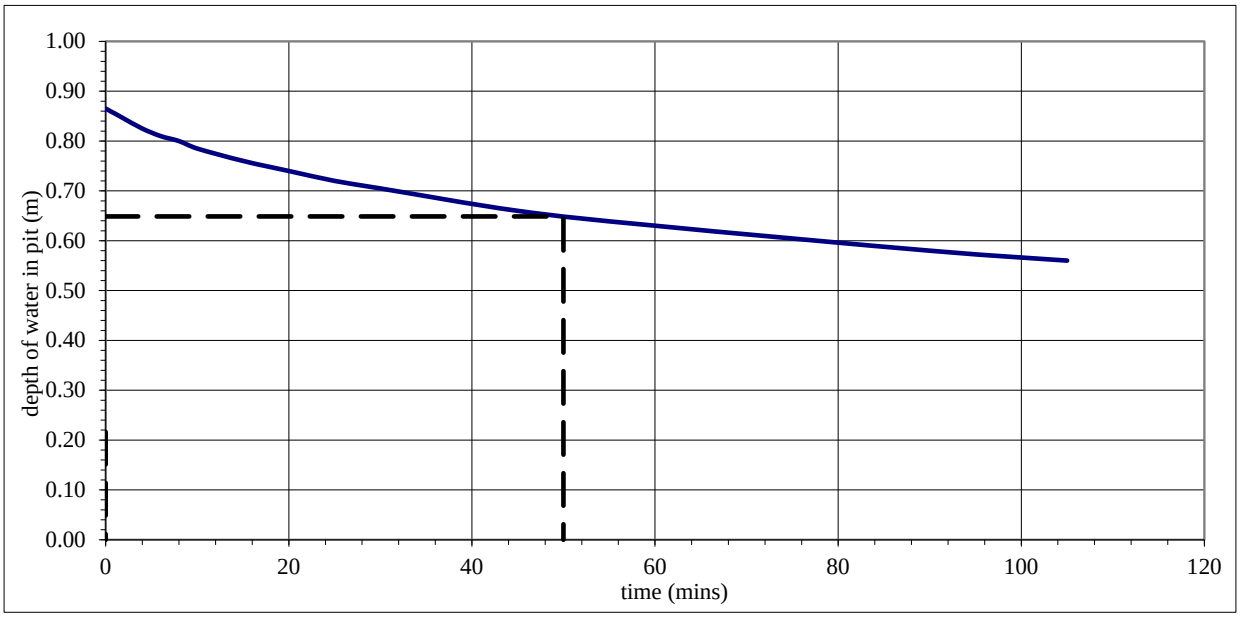
From graph below:

test start - 75% depth at
0.64875 m water depth
time is 50.0 minutes

test end - 25% depth at
0.21625 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
50	0.55	0.64875					
	0.98	0.21625					



CAUSEWAY GEOTECH

Project No.	Project Name:	Trial Pit ID
20-0967	Mallow Town Park Redevelopment	TP02
Coordinates	**Client:**	
555625.70 E	Cork County Council	
598283.60 N	**Client's Representative:**	Sheet 1 of 1
	Horganlynch Consulting Engineers	Scale: 1:25
Elevation	**Date:** / **Logger:**	
45.04 mOD	28/09/2020 / RS	FINAL

Method: Trial Pitting

Plant: 5T Tracked Excavator

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			44.84	0.20		TOPSOIL	
0.50	B4					Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine of mixed lithologies.	
0.50	ES1						
			44.09	0.95			
1.00	B5					Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse of limestone.	
1.00	ES2						
			43.59	1.45		Stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	
2.00	B6		43.04	2.00		End of trial pit at 2.00m	
2.00	ES3						

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks

Depth: 2.00
Width: 0.80
Length: 2.10

Remarks: No groundwater encountered.

Stability:	Termination Reason:	Last Updated
Stable	Terminated on refusal.	22/10/2020

AGS

Soakaway Infiltration Test

Project No.: 20-0967
Site: Mallow Town Park Redevelopment
Test Location: TP02
Test Date: 28 September 2020

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

	width (m)	length (m)
test pit top dimensions	0.30	1.30
test pit base dimensions	0.30	0.60

test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.34	0.86
0.5	0.35	0.86
1	0.35	0.85
2	0.35	0.85
4	0.35	0.85
6	0.36	0.85
8	0.36	0.84
10	0.37	0.84
15	0.37	0.83
20	0.38	0.83
25	0.39	0.81
30	0.39	0.81
45	0.40	0.81
60	0.40	0.80
75	0.41	0.79
90	0.42	0.78
120	0.44	0.76
135	0.45	0.76
150	0.45	0.75

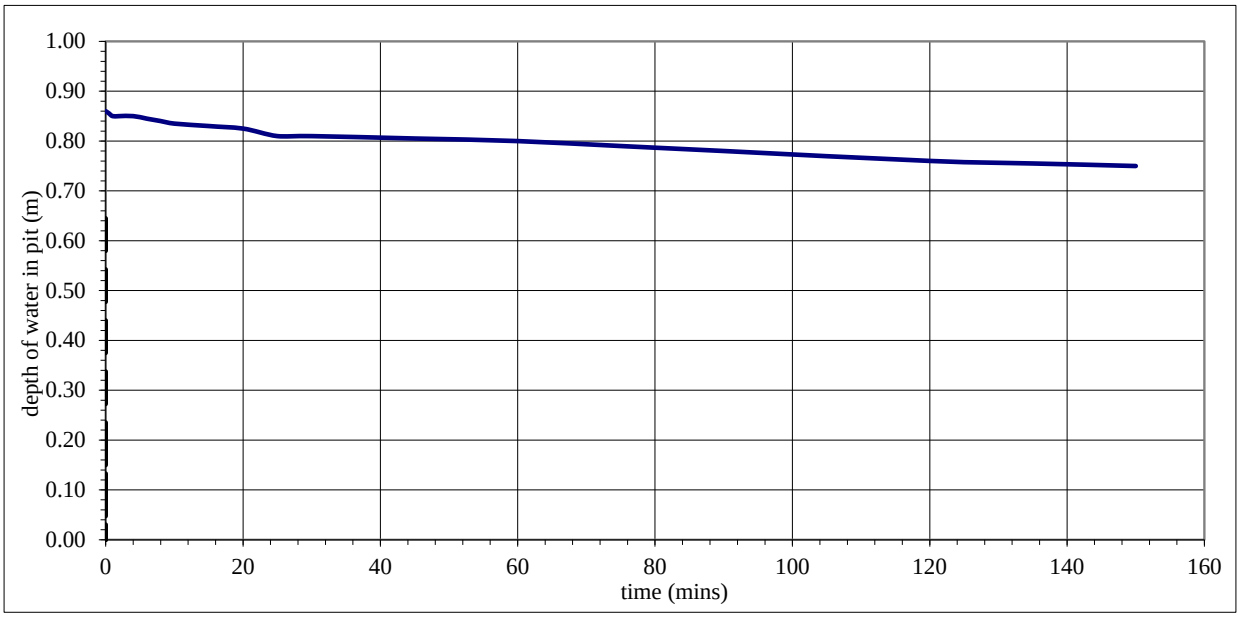
From graph below:

test start - 75% depth at
0.645 m water depth
time is not determined

test end - 25% depth at
0.215 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.56	0.645					
	0.99	0.215					



CAUSEWAY GEOTECH

APPENDIX D

SOAKAWAY PIT PHOTOGRAPHS


CAUSEWAY
GEOTECH
Project Number
20-0967
Project Name
Mallow Town Park
TP 01
Date
28/09/2020

TP01

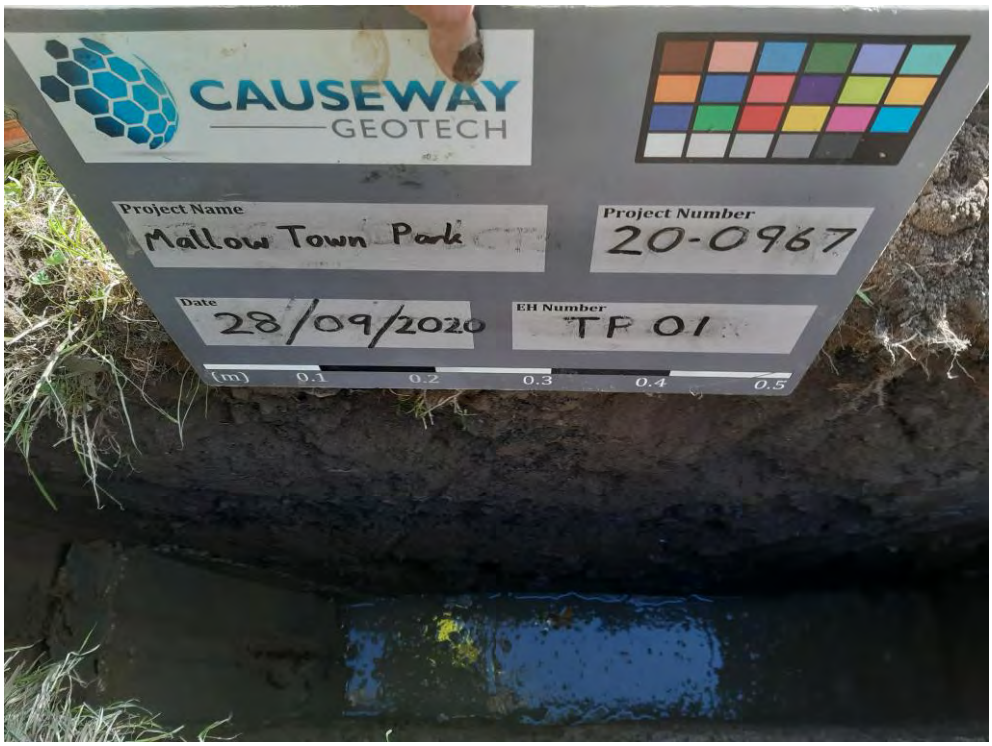

CAUSEWAY
GEOTECH
oject Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 01
0.2
0.3
0.5

TP01


CAUSEWAY
GEOTECH
Project Number
20-096
Project Name
allow Town Park
EH Number
TP 01
Date
28/09/2020
0.1
0.2
0.3
0.4

TP01

TP01


CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 01
(m) 0.1 0.2 0.3 0.4 0.5

TP01


Project Name
Mallow Town Park
Date
28/09/2020
Project Number
20-0967
EH Number
TP 01

TP01

TP01


CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 01
(m)
0.1
0.2
0.3
0.4
0.5

TP01

TP01


CAUSEWAY
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 02
(m) 0.1 0.2 0.3 0.4 0.5

TP02


CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 02
(m)
0.1
0.2
0.3
0.4
0.5

TP02

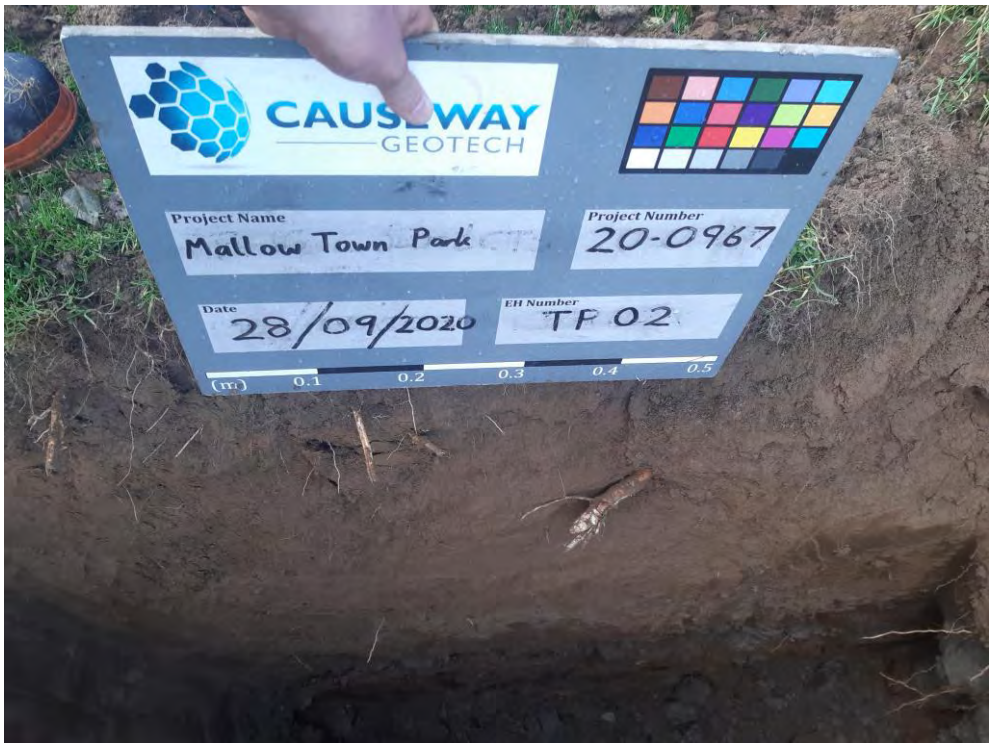

CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Date
28/09/2020
Project Number
20-0967
EH Number
TP 02
(m) 0.1 0.2 0.3 0.4 0.5

TP02

TP02


CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 02
(m)
0.1
0.2
0.3
0.4
0.5

TP02


CAUSEWAY
GEOTECH
Project Name
Mallow Town Park
Project Number
20-0967
Date
28/09/2020
EH Number
TP 02
(m)
0.1
0.2
0.3
0.4
0.5

TP02


CAUSEWAY
GEOTECH
Mallow Town Park
20-0967
28/09/2020
TP 02
0.1
0.2
0.3
0.4
0.5

TP02

TP02

CAUSEWAY GEOTECH

APPENDIX E

GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

HEAD OFFICE
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Registered in Northern Ireland.
Company Number: NI610766

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Unit 3 Balbriggan Business Park, Balbriggan
Co Dublin, Ireland, K32 EH36
ROI: +353 (0)1 526 7465
Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

22 October 2020

Project Name:	Mallow Town Park Redevelopment
Project No.:	20-0967
Client:	Cork County Council
Engineer:	Horgan Lynch

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: Mallow Town Park Redevelopment

Report Reference: Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	4
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	4
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	10
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	6

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	pH Value of Soil		5
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	Sulphate Content water extract		5

Summary of Classification Test Results

Project No.	Project Name
20-0967	Mallow Town Park Redevelopment

Hole No.	Sample				Soil Description	Density bulk	Density dry	*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		Mg/m3		%	%	%	%	%	Mg/m3	
TP01	4	0.50		B	Brown sandy slightly gravelly SILT.			34.0	97	53 -1pt	30	23		MH
TP02	5	1.00		B	Brown sandy slightly gravelly silty CLAY.			33.0	92	59 -1pt	29	30		CH
WSBH02	2	0.90		B	Brown sandy silty CLAY.			32.0	96	46 -1pt	24	22		CI
WSBH05	6	1.00		B	Brown sandy silty CLAY.			32.0	98	48 -1pt	27	21		CI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

22/10/2020

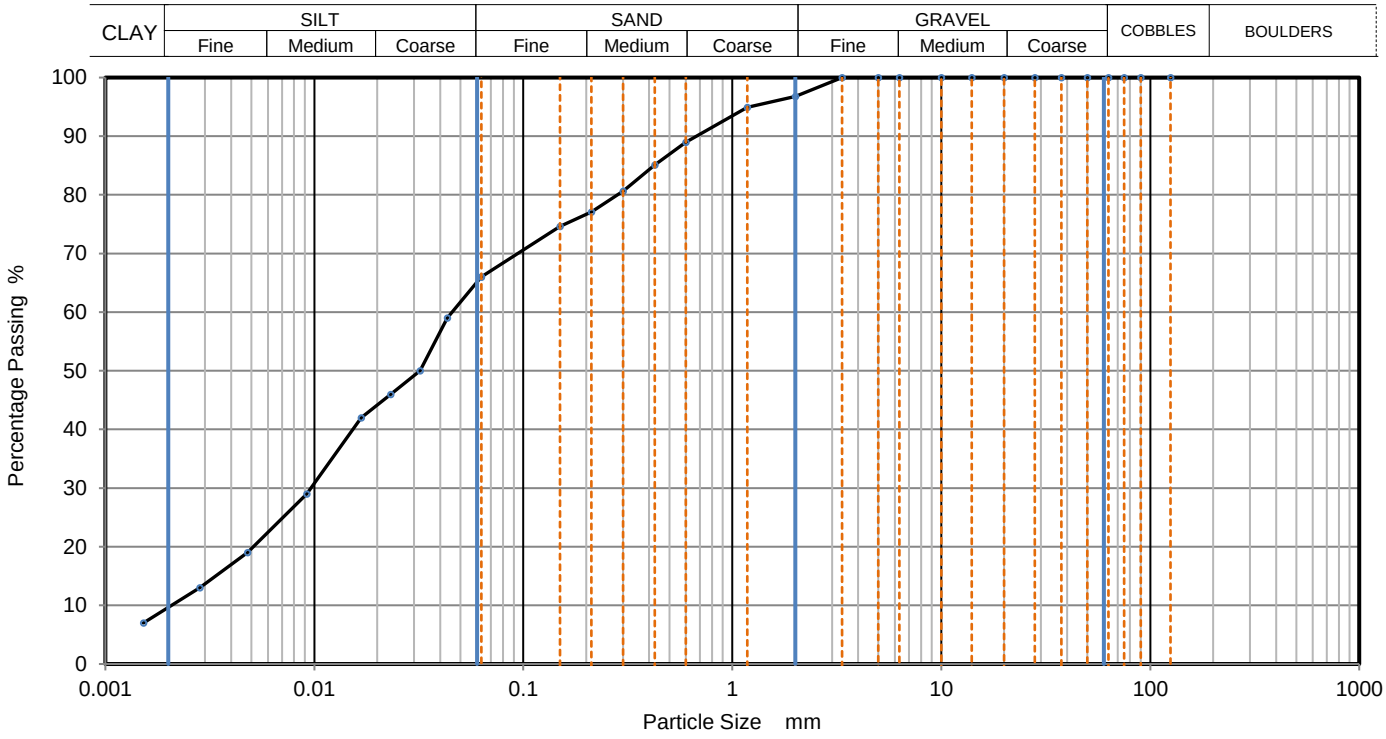
Approved By

Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-0967
					Borehole/Pit No.	TP01
Site Name	Mallow Town Park Redevelopment				Sample No.	4
Soil Description	Brown sandy slightly gravelly SILT.				Depth, m	0.50
Specimen Reference	6	Specimen Depth	0.5	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus202010020



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	66
90	100	0.04328	59
75	100	0.03211	50
63	100	0.02322	46
50	100	0.01677	42
37.5	100	0.00919	29
28	100	0.00479	19
20	100	0.00283	13
14	100	0.00152	7
10	100		
6.3	100		
5	100		
3.35	100		
2	97		
1.18	95		
0.6	89	Particle density	(assumed)
0.425	85	2.65	Mg/m3
0.3	81		
0.212	77		
0.15	75		
0.063	66		

Dry Mass of sample, g	212

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	3.2
Sand	30.7
Silt	56.4
Clay	9.7

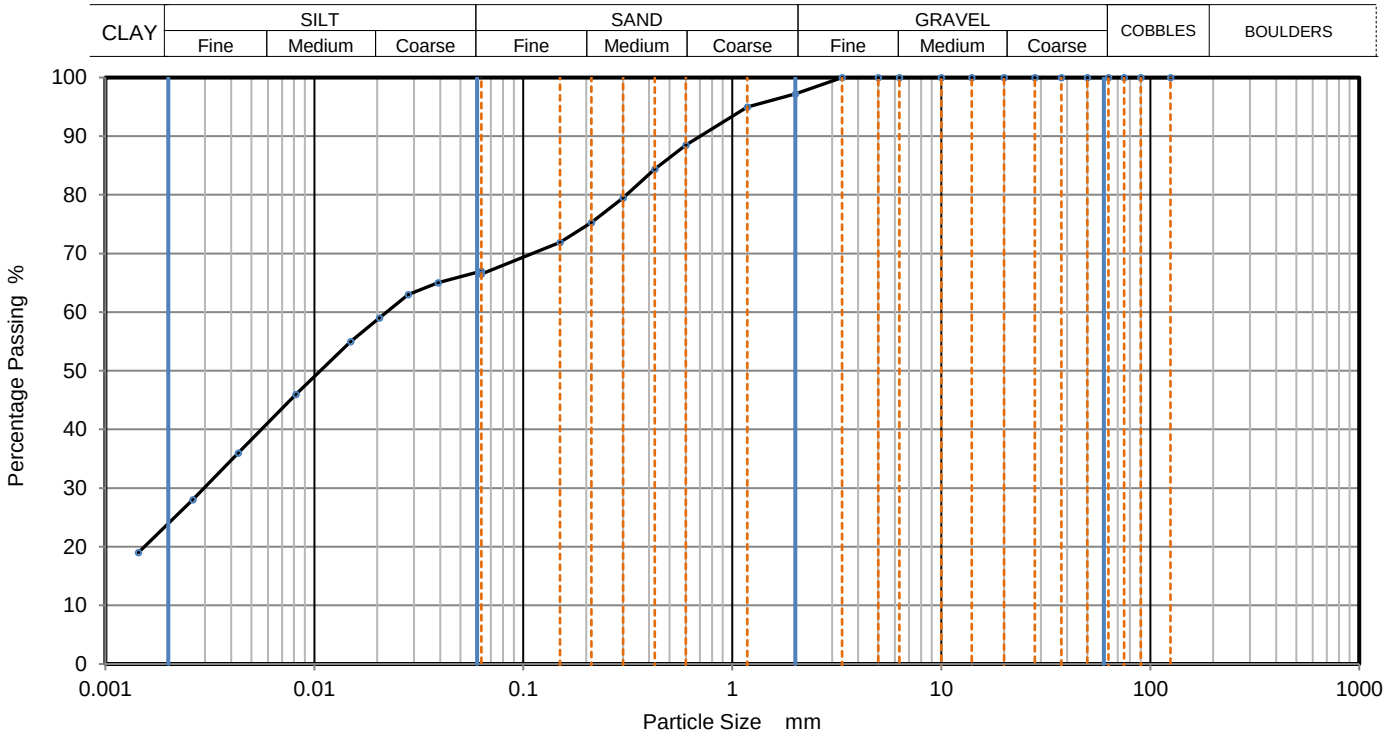
Grading Analysis		
D100	mm	
D60	mm	0.046
D30	mm	0.00977
D10	mm	0.00206
Uniformity Coefficient		22
Curvature Coefficient		1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-0967
					Borehole/Pit No.	TP02
Site Name	Mallow Town Park Redevelopment				Sample No.	5
Soil Description	Brown sandy slightly gravelly silty CLAY.				Depth, m	1.00
Specimen Reference	6	Specimen Depth	1	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus202010021



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	67
90	100	0.03907	65
75	100	0.02819	63
63	100	0.02052	59
50	100	0.01491	55
37.5	100	0.00816	46
28	100	0.00433	36
20	100	0.00262	28
14	100	0.00144	19
10	100		
6.3	100		
5	100		
3.35	100		
2	97		
1.18	95		
0.6	89	Particle density	(assumed)
0.425	84	2.65	Mg/m3
0.3	80		
0.212	75		
0.15	72		
0.063	67		

Dry Mass of sample, g	202

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	2.8
Sand	30.6
Silt	43.0
Clay	23.6

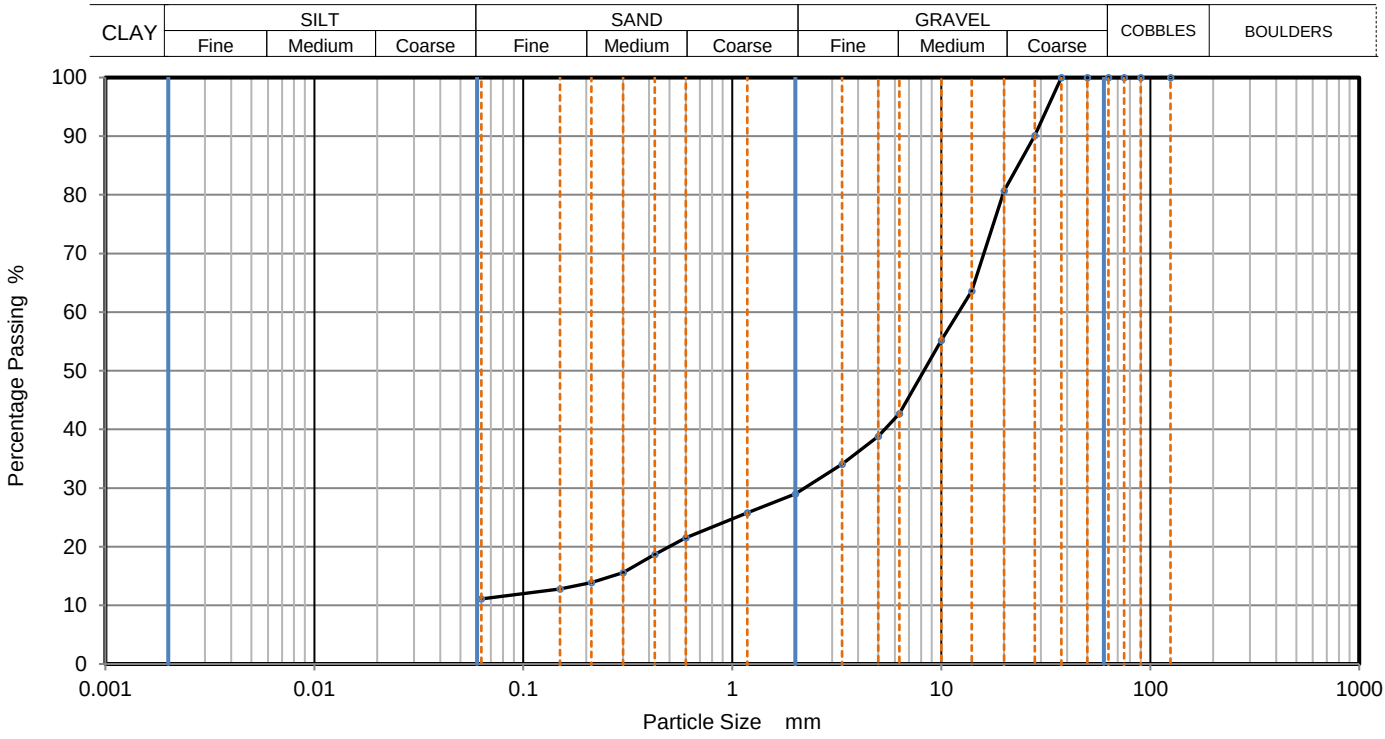
Grading Analysis		
D100	mm	
D60	mm	0.0224
D30	mm	0.003
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-0967**
				Borehole/Pit No.	WSBH01
Site Name	Mallow Town Park Redevelopment			Sample No.	4
Soil Description	Brown gravelly silty fine to coarse SAND.			Depth, m	0.50
Specimen Reference	2	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus202010022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	90		
20	81		
14	64		
10	55		
6.3	43		
5	39		
3.35	34		
2	29		
1.18	26		
0.6	22		
0.425	19		
0.3	16		
0.212	14		
0.15	13		
0.063	11		

Dry Mass of sample, g	5877

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	71.0
Sand	17.8
Fines <0.063mm	11.0

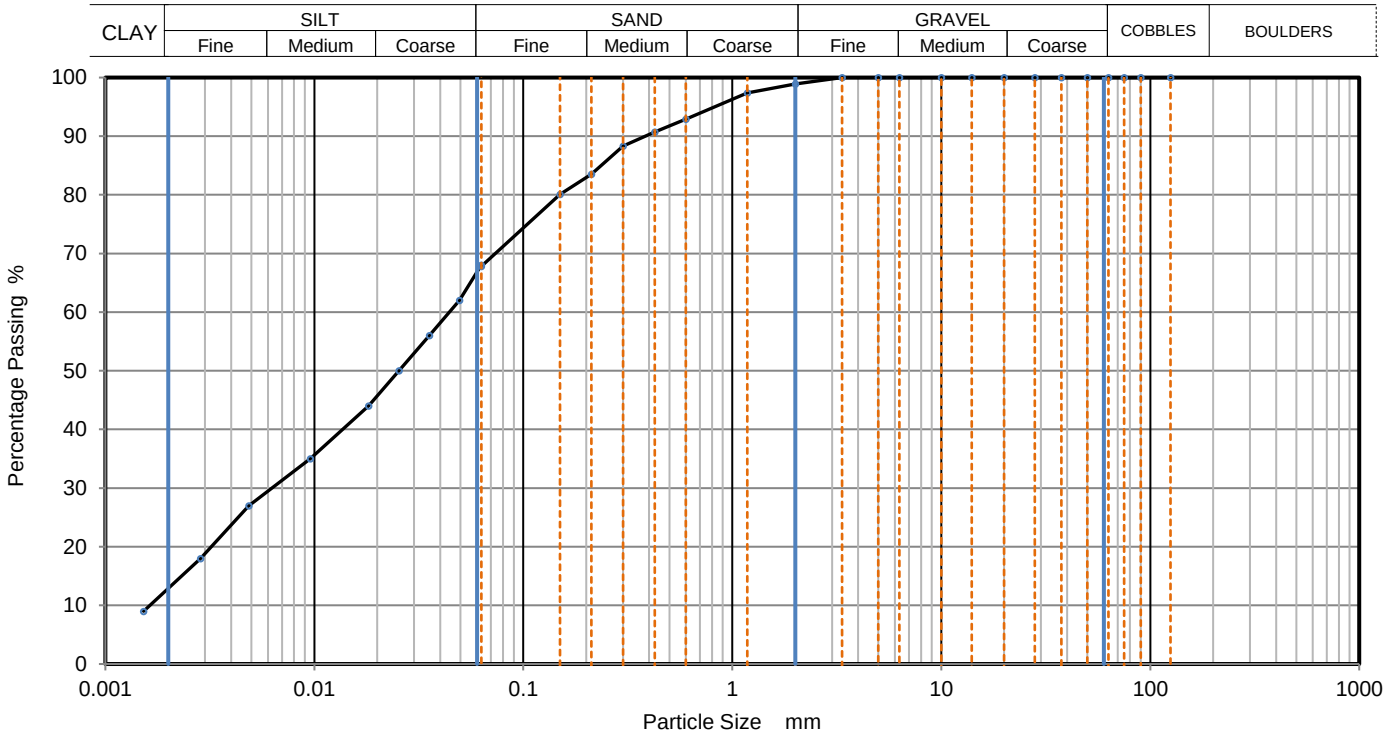
Grading Analysis		
D100	mm	
D60	mm	12.1
D30	mm	2.22
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-0967**
				Borehole/Pit No.	WSBH02
Site Name	Mallow Town Park Redevelopment			Sample No.	2
Soil Description	Brown sandy silty CLAY.			Depth, m	0.90
Specimen Reference	6	Specimen Depth	0.9 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202010023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	68
90	100	0.04953	62
75	100	0.03547	56
63	100	0.02539	50
50	100	0.01817	44
37.5	100	0.00955	35
28	100	0.00486	27
20	100	0.00285	18
14	100	0.00152	9
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	97		
0.6	93	Particle density	(assumed)
0.425	91	2.65	Mg/m3
0.3	88		
0.212	84		
0.15	80		
0.063	68		

Dry Mass of sample, g: 203

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	1.1
Sand	31.2
Silt	55.0
Clay	12.7

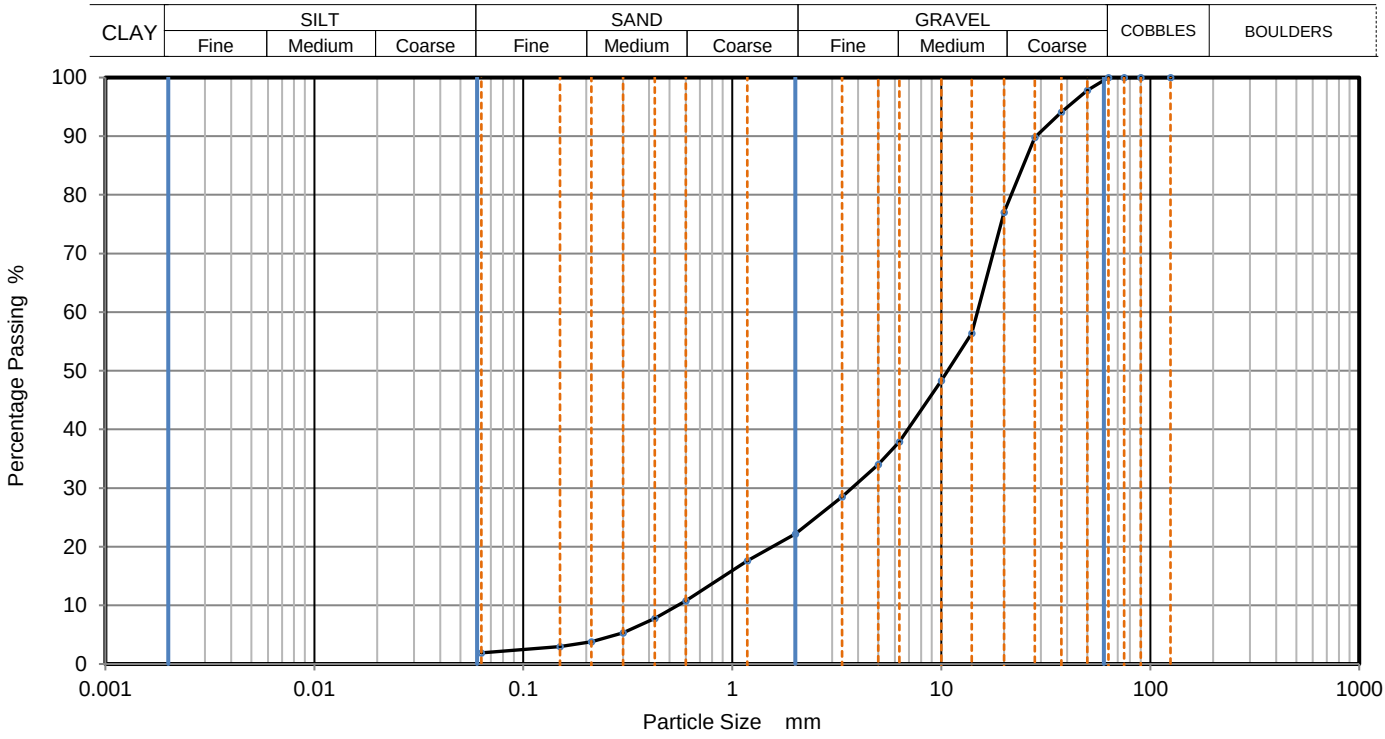
Grading Analysis		
D100	mm	
D60	mm	0.0445
D30	mm	0.00633
D10	mm	0.00165
Uniformity Coefficient		27
Curvature Coefficient		0.55

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-0967
					Borehole/Pit No.	WSBH02
Site Name	Mallow Town Park Redevelopment				Sample No.	9
Soil Description	Brown gravelly silty fine to coarse SAND.				Depth, m	2.20
Specimen Reference	2	Specimen Depth	2.2	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus202010024



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	98		
37.5	94		
28	90		
20	77		
14	56		
10	48		
6.3	38		
5	34		
3.35	29		
2	22		
1.18	18		
0.6	11		
0.425	8		
0.3	5		
0.212	4		
0.15	3		
0.063	2		

Dry Mass of sample, g	8053

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	77.8
Sand	20.3
Fines <0.063mm	2.0

Grading Analysis		
D100	mm	
D60	mm	14.9
D30	mm	3.73
D10	mm	0.55
Uniformity Coefficient		27
Curvature Coefficient		1.7

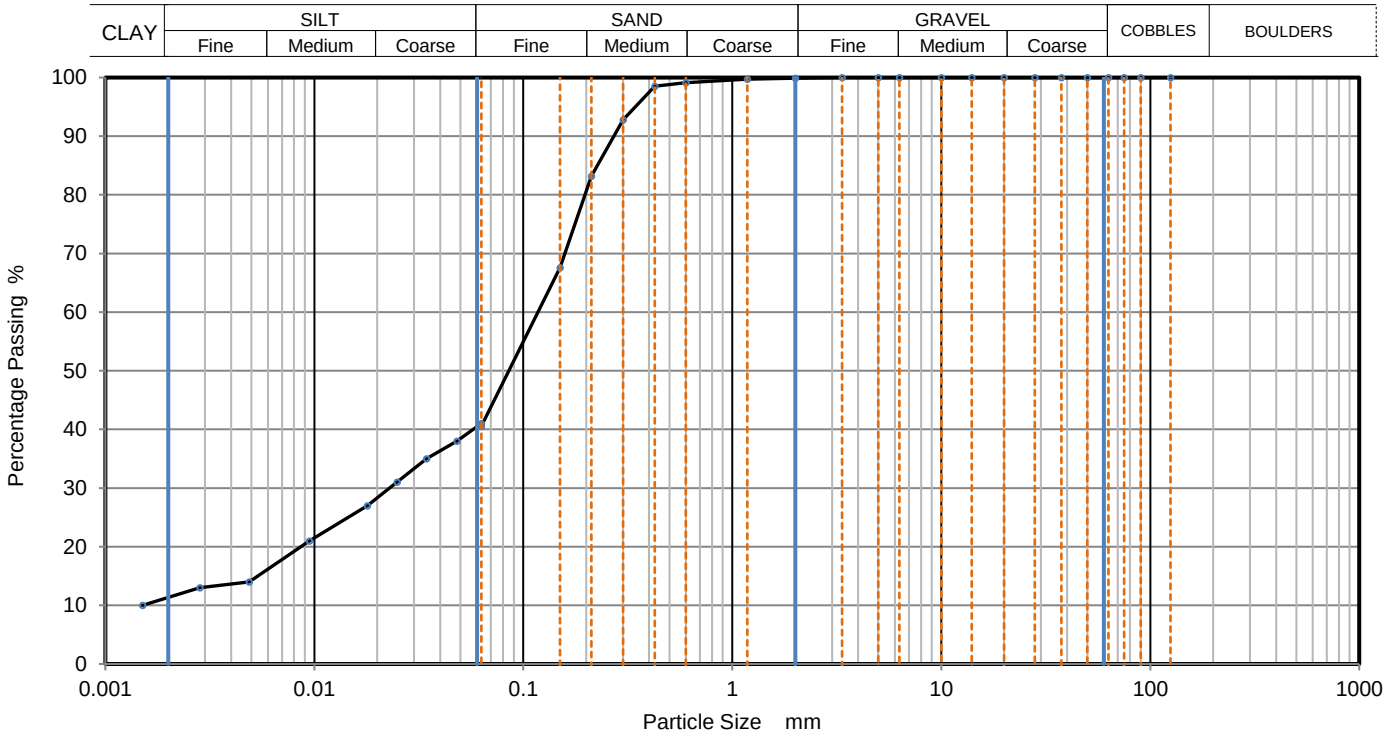
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-0967**
				Borehole/Pit No.	WSBH03
Site Name	Mallow Town Park Redevelopment			Sample No.	5
Soil Description	Brown gravelly silty fine to coarse SAND			Depth, m	1.90
Specimen Reference	2	Specimen Depth	1.9 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202010025



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	41
90	100	0.04810	38
75	100	0.03447	35
63	100	0.02485	31
50	100	0.01791	27
37.5	100	0.00947	21
28	100	0.00487	14
20	100	0.00283	13
14	100	0.00150	10
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	93		
0.212	83		
0.15	68		
0.063	41		

Dry Mass of sample, g	207

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.1
Sand	59.4
Silt	29.5
Clay	11.0

Grading Analysis		
D100	mm	
D60	mm	0.118
D30	mm	0.0235
D10	mm	0.00158
Uniformity Coefficient		74
Curvature Coefficient		3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

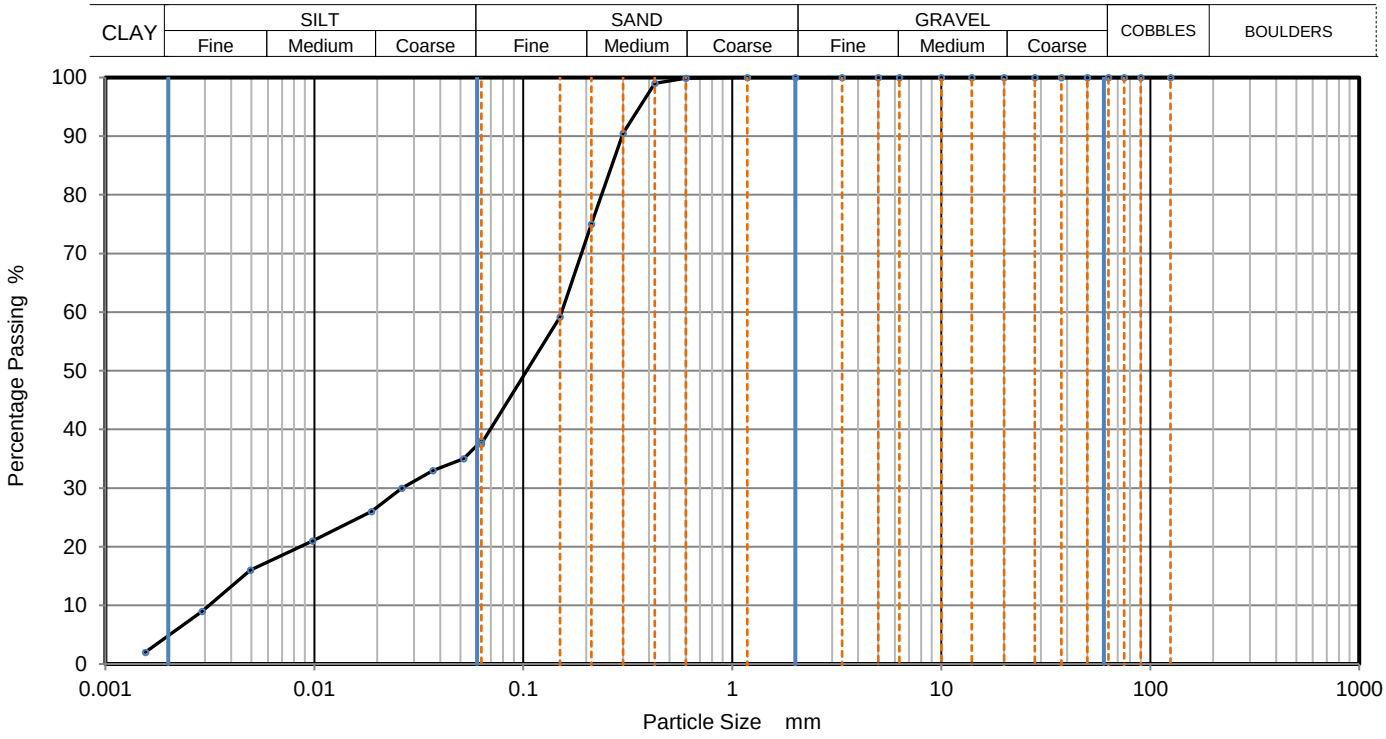
Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING

10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-0967
					Borehole/Pit No.	WSBH04
Site Name	Mallow Town Park Redevelopment				Sample No.	7
Soil Description	Brownish grey silty fine to coarse SAND.				Depth, m	2.00
Specimen Reference	2	Specimen Depth	2	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus202010026



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	38
90	100	0.05188	35
75	100	0.03690	33
63	100	0.02624	30
50	100	0.01877	26
37.5	100	0.00980	21
28	100	0.00495	16
20	100	0.00290	9
14	100	0.00155	2
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	91		
0.212	75		
0.15	59		
0.063	38		

Dry Mass of sample, g	208

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.0
Sand	62.5
Silt	32.3
Clay	5.2

Grading Analysis		
D100	mm	
D60	mm	0.153
D30	mm	0.0254
D10	mm	0.00305
Uniformity Coefficient		50
Curvature Coefficient		1.4

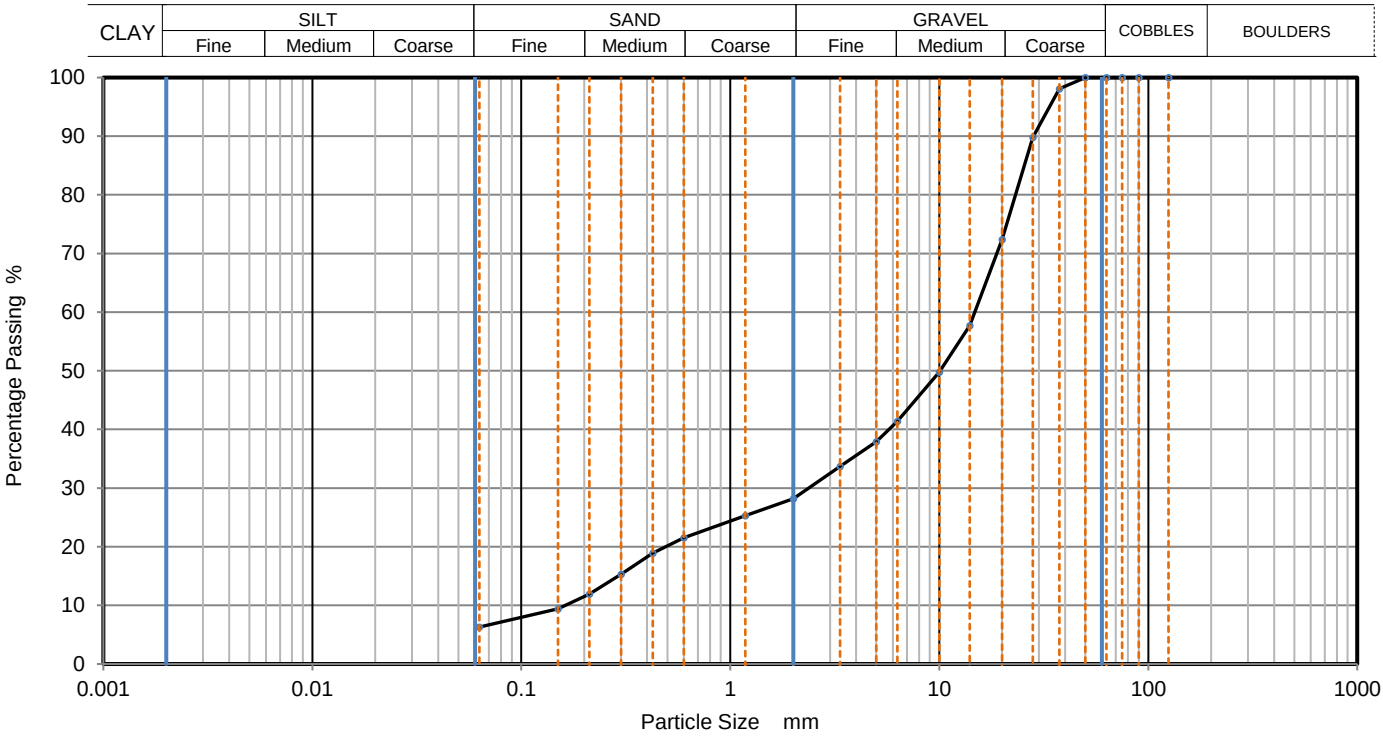
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-0967**
				Borehole/Pit No.	WSBH04
Site Name	Mallow Town Park Redevelopment			Sample No.	8
Soil Description	Brown sandy silty subangular fine to coarse GRAVEL.			Depth, m	3.00
Specimen Reference	2	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus202010027



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	90		
20	72		
14	58		
10	50		
6.3	41		
5	38		
3.35	34		
2	28		
1.18	25		
0.6	22		
0.425	19		
0.3	15		
0.212	12		
0.15	9		
0.063	6		

Dry Mass of sample, g	4764

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	71.8
Sand	21.9
Fines <0.063mm	6.0

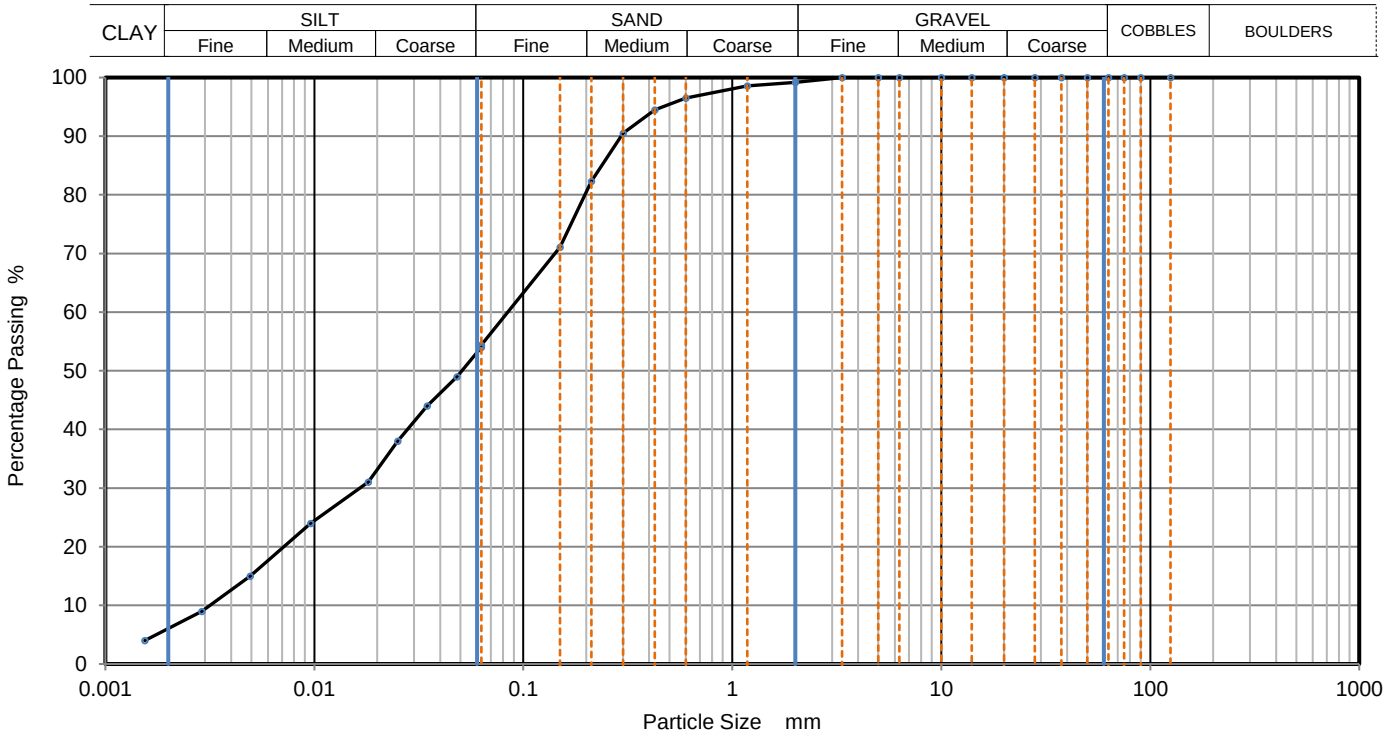
Grading Analysis		
D100	mm	
D60	mm	14.8
D30	mm	2.38
D10	mm	0.163
Uniformity Coefficient		91
Curvature Coefficient		2.3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	20-0967
				Borehole/Pit No.	WSBH05
Site Name	Mallow Town Park Redevelopment			Sample No.	6
Soil Description	Brown sandy silty CLAY.			Depth, m	1.00
Specimen Reference	6	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202010028



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	54
90	100	0.04810	49
75	100	0.03470	44
63	100	0.02501	38
50	100	0.01813	31
37.5	100	0.00958	24
28	100	0.00493	15
20	100	0.00289	9
14	100	0.00154	4
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	97	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	91		
0.212	82		
0.15	71		
0.063	54		

Dry Mass of sample, g	212

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	0.8
Sand	44.9
Silt	48.4
Clay	5.9

Grading Analysis		
D100	mm	
D60	mm	0.0843
D30	mm	0.0169
D10	mm	0.00317
Uniformity Coefficient		27
Curvature Coefficient		1.1

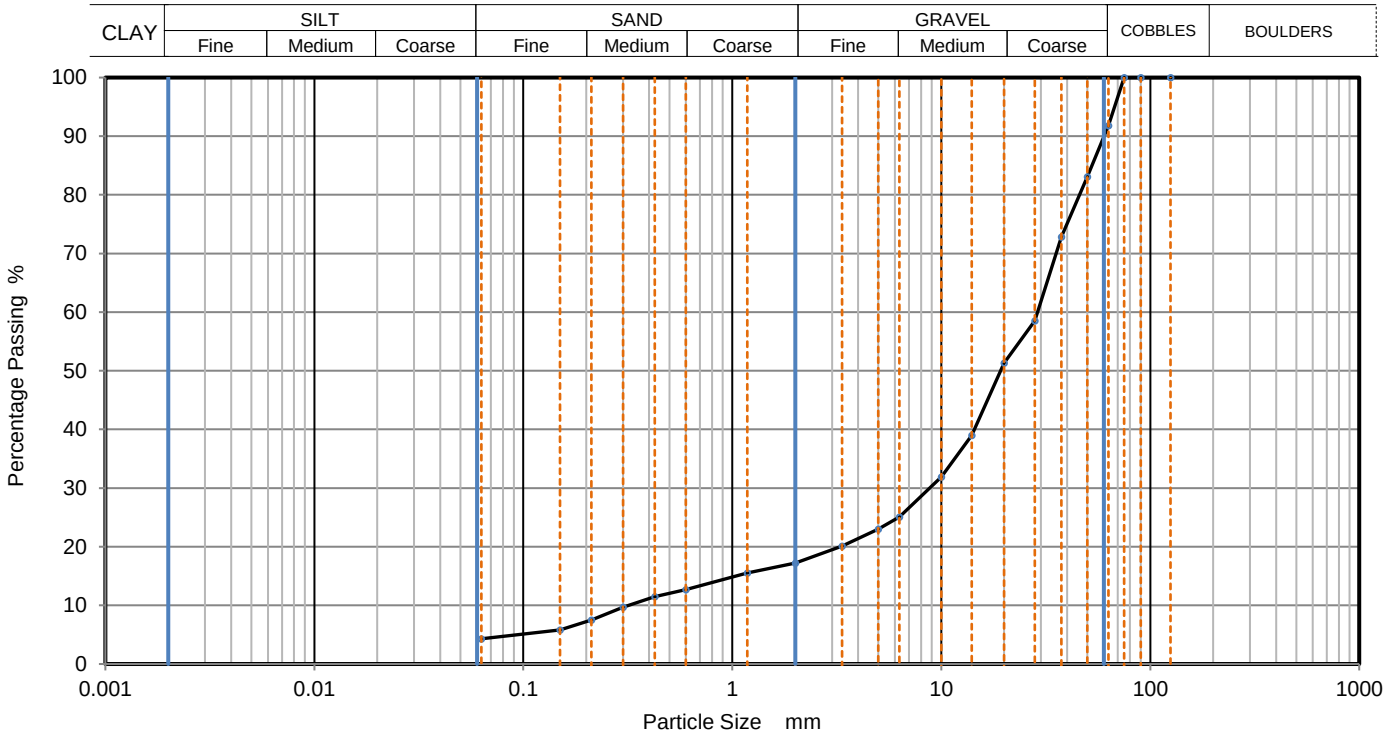
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-0967
					Borehole/Pit No.	WSBH05
Site Name	Mallow Town Park Redevelopment				Sample No.	11
Soil Description	Brown sandy slightly silty subangular fine to coarse GRAVEL.				Depth, m	2.60
Specimen Reference	2	Specimen Depth	2.6	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus202010029



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	92		
50	83		
37.5	73		
28	59		
20	51		
14	39		
10	32		
6.3	25		
5	23		
3.35	20		
2	17		
1.18	16		
0.6	13		
0.425	12		
0.3	10		
0.212	8		
0.15	6		
0.063	4		

Dry Mass of sample, g	7489

Sample Proportions	% dry mass
Cobbles	8.2
Gravel	74.6
Sand	12.9
Fines <0.063mm	4.0

Grading Analysis		
D100	mm	
D60	mm	28.9
D30	mm	8.77
D10	mm	0.317
Uniformity Coefficient		91
Curvature Coefficient		8.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

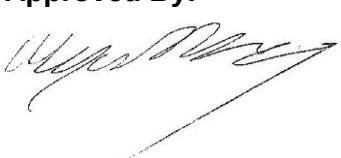
UKAS TESTING
2183

Final Report

Report No.:	20-27378-1
Initial Date of Issue:	14-Oct-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham Thomas McAllis
Project	20-0967 Mallow Town Park Redevelopment

Quotation No.:		**Date Received:**	09-Oct-2020
Order No.:		**Date Instructed:**	09-Oct-2020
No. of Samples:	5		
Turnaround (Wkdays):	5	**Results Due:**	15-Oct-2020
Date Approved:	14-Oct-2020		

Approved By:



Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 20-0967 Mallow Town Park Redevelopment

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-27378	20-27378	20-27378	20-27378	20-27378
Quotation No.:			**Chemtest Sample ID.:**		1078417	1078418	1078419	1078420	1078421
Order No.:			Client Sample Ref.:		4	2	4	5	6
			Sample Location:		WSBH01	WSBH02	WSBH03	WSBH04	WSBH05
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	0.90	0.50	0.20	1.00
			Date Sampled:		08-Oct-2020	08-Oct-2020	08-Oct-2020	08-Oct-2020	08-Oct-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Moisture	N	2030	%	0.020	9.9	24	20	22	24
pH	U	2010		4.0	8.1	8.1	7.3	7.8	8.1
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	0.019	< 0.010	< 0.010

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

CAUSEWAY GEOTECH

APPENDIX F

ENVIRONMENTAL LABORATORY TEST RESULTS

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-26458-1
Initial Date of Issue:	07-Oct-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham Thomas McAllis
Project	20-0967 Mallow Town Park

Quotation No.:	Q20-21382	**Date Received:**	01-Oct-2020
Order No.:		**Date Instructed:**	01-Oct-2020
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	07-Oct-2020
Date Approved:	07-Oct-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 20-0967 Mallow Town Park

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-26458
Quotation No.: Q20-21382			**Chemtest Sample ID.:**		1073441
			Sample Location:		TP01
			Sample Type:		SOIL
			Top Depth (m):		1.00
			Date Sampled:		28-Sep-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	24
pH	U	2010		4.0	8.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.048
Arsenic	U	2450	mg/kg	1.0	13
Cadmium	U	2450	mg/kg	0.10	0.43
Chromium	U	2450	mg/kg	1.0	34
Mercury	U	2450	mg/kg	0.10	0.11
Nickel	U	2450	mg/kg	0.50	44
Lead	U	2450	mg/kg	0.50	32
Selenium	U	2450	mg/kg	0.20	0.41
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

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B - Sample age exceeds stability time (sampling to extraction)

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E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

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All soil samples will be retained for a period of 45 days from the date of receipt

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If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-26590-1
Initial Date of Issue:	08-Oct-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham Thomas McAllis
Project	20-0967 Mallow Town Park

Quotation No.:	Q20-21382	**Date Received:**	02-Oct-2020
Order No.:		**Date Instructed:**	02-Oct-2020
No. of Samples:	11		
Turnaround (Wkdays):	5	**Results Due:**	08-Oct-2020
Date Approved:	08-Oct-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 20-0967 Mallow Town Park

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-26590	20-26590	20-26590	20-26590	20-26590	20-26590	20-26590	20-26590	20-26590
Quotation No.: Q20-21382			**Chemtest Sample ID.:**		1074111	1074112	1074113	1074114	1074115	1074116	1074117	1074118	1074119
			Sample Location:		BH02	BH02	BH02	BH04	BH04	BH04	BH04	BH05	BH05
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	1.00	2.00	0.50	1.00	2.00	3.00	0.50	1.00
			Date Sampled:		28-Sep-2020	28-Sep-2020	28-Sep-2020	29-Sep-2020	29-Sep-2020	29-Sep-2020	29-Sep-2020	29-Sep-2020	29-Sep-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	16	22	41	16	16	19	19	23	25
pH	U	2010		4.0	7.1	7.7	6.3	7.3	7.4	7.0	7.1	7.9	8.2
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.23	< 0.010	0.30	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Arsenic	U	2450	mg/kg	1.0	11	5.3	4.2	10	6.6	6.4	6.4	12	11
Cadmium	U	2450	mg/kg	0.10	0.41	0.33	0.95	0.43	0.18	0.18	0.24	0.45	0.48
Chromium	U	2450	mg/kg	1.0	20	16	15	25	16	15	15	18	21
Mercury	U	2450	mg/kg	0.10	0.12	< 0.10	< 0.10	0.13	< 0.10	< 0.10	< 0.10	1.2	0.58
Nickel	U	2450	mg/kg	0.50	24	21	26	30	21	20	21	24	29
Lead	U	2450	mg/kg	0.50	73	16	14	27	9.7	8.8	8.5	110	58
Selenium	U	2450	mg/kg	0.20	0.40	0.29	0.84	0.46	0.32	0.31	< 0.20	0.38	0.34
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	61	4.6
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Results - Soil

Project: 20-0967 Mallow Town Park

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-26590	20-26590
Quotation No.: Q20-21382			**Chemtest Sample ID.:**		1074120	1074121
			Sample Location:		BH05	BH05
			Sample Type:		SOIL	SOIL
			Top Depth (m):		2.00	3.00
			Date Sampled:		29-Sep-2020	29-Sep-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	23	6.6
pH	U	2010		4.0	8.0	8.2
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.080
Arsenic	U	2450	mg/kg	1.0	9.3	4.3
Cadmium	U	2450	mg/kg	0.10	0.24	0.16
Chromium	U	2450	mg/kg	1.0	18	21
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	25	22
Lead	U	2450	mg/kg	0.50	15	12
Selenium	U	2450	mg/kg	0.20	0.35	< 0.20
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

CAUSEWAY GEOTECH

APPENDIX H

SPT HAMMER ENERGY MEASUREMENT REPORT

Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

SPT Hammer Ref: .T7
Test Date: 22/02/2020
Report Date: 03/03/2020
File Name: .T7.spt
Test Operator: NPB

Instrumented Rod Data

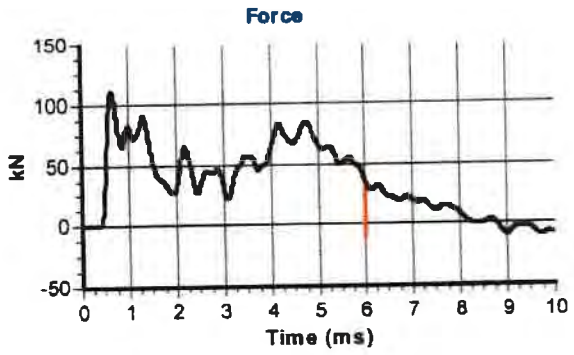
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 6458
Accelerometer No.2: 9607

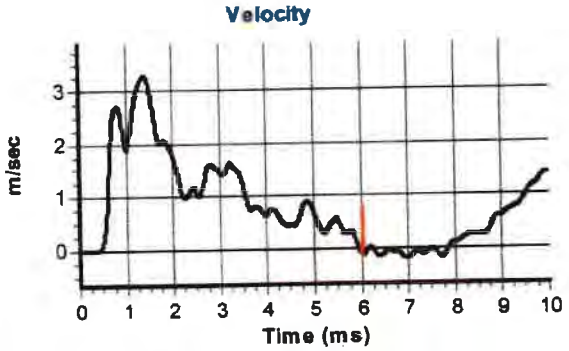
SPT Hammer Information

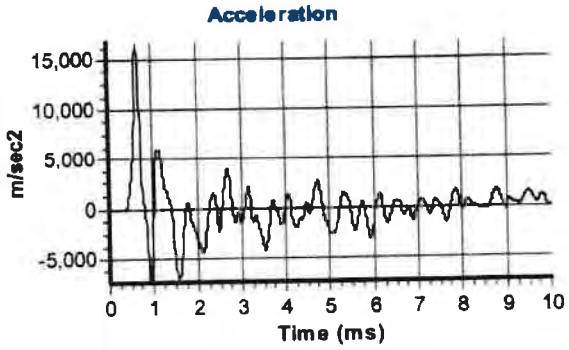
Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

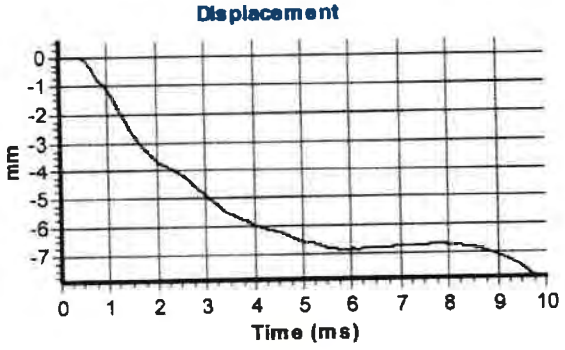
Comments / Location

BALLEYMONEY









Calculations

Area of Rod A (mm2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 399

Energy Ratio E_r (%): 84

Signed: Neil Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months