tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710	Borehole Record	BH5

Project No: 18794 Client: Irish Asphalt Ltd Site Location: Rossmore, Co. Cork	Date: 24/2/2012 Driller: Eddie Hogan Drilling Method: DTH hammer/air flush Supervisor: Craig O'Connor Irish Grid Ref: 182422 71059

Lithology:

0 – 20m	LIMESTONE, dark grey, micritic, non-fossiliferous
20m	End of Hole

Comments:

Borehole Diameter: 120mm

Fractures: Broken rock 0 - 2m, solid rock 2 – 20m, no cavities, no significant fracture zones encountered below 2m

Water Strikes: No significant water strikes, returns wet from 7m

Completion: Open hole - 3m plastic liner installed at surface

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Borehole Record

BH10

Project No: 18794 Client: Irish Asphalt Ltd Site Location: Rossmore, Co. Cork	Date: 24/2/2012 Driller: Eddie Hogan Drilling Method: DTH hammer/air flush Supervisor: Craig O'Connor Irish Grid Ref: 182417 71009

Lithology:

0 – 20m	LIMESTONE, dark grey, micritic, non-fossiliferous
20m	End of Hole

Comments:

Borehole Diameter: 120mm

Fractures: Broken rock 0 - 2m, solid rock 2 – 20m, no cavities, no significant fracture zones encountered below 2m

Water Strikes: No significant water strikes, returns wet from 6m

Completion: Open hole - 3m plastic liner installed at surface

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Borehole Record

BH11

Project No: 18794 Client: Irish Asphalt Ltd Site Location: Rossmore, Co. Cork	Date: 13/2/2012 Driller: Eddie Hogan Drilling Method: DTH hammer/air flush Supervisor: Craig O'Connor Irish Grid Ref: 182417 71006

Lithology:

0 – 15m	LIMESTONE, dark grey, micritic, non-fossiliferous
15m	End of Hole

Comments:

Borehole Diameter: 120mm

Fractures: Solid rock, no cavities or significant fracture zones encountered

Water Strikes: No significant water strikes, returns wet from 9.5m

Completion: Open hole - 3m plastic liner installed at surface

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Borehole Log

Soil Mechanics

Drilled MN/AL Logged AO Checked AO	Start 23/02/2012 End 27/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 20.35m Diameter 121mm Casing Depth 2.30m	Ground Level - Coordinates E 182505.00 National Grid N 70970.00 Chainage	

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
0.00-1.15	87 N/A N/A				
1.15-2.30	100 46 22				
2.30-2.90	100 67 35				
2.90-4.40	100 89 72			23/02/2012 2.30	1.80
				24/02/2012 2.30	0800 0.80
4.40-5.90	100 81 51				
5.90-7.40	100 82 82				
7.40-8.85	100 95 95				
8.85-10.35	100 100 100				

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Light brown clayey sandy GRAVEL. (Compacted quarry floor) (MADE GROUND)	(1.15)		
Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick.	1.15		
Weathering: Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing.			
Fractures: Moderately fractured.			
Fracture Set 1) (Bedding Fractures) Subhorizontal closely to widely spaced undulating and stepped smooth fractures.			
Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures.			
1.15-2.90 m highly fractured			
1.55-1.75 m NI			
4.40-4.50 m NI			
5.78-5.90 m subvertical undulating smooth fracture			
8.75-8.85 m subvertical undulating smooth fracture			
Stratum continues to 20.35 m			

Depth | TCR SCR RQD | If | Records/Samples | Date Casing | Time Water

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Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	2.85	-	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

(c) ESG www.esg.co.uk 428.4928/05/2012 15:41:10

Project: Rossmore Site Investigation

Project No.: Y2110-12

Carried out for: Irish Asphalt Limited

Borehole: **RC2**

Borehole Log

Soil Mechanics

Drilled MN/AL Logged AO Checked AO	Start 23/02/2012 End 27/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 20.35m	Diameter 121mm	Casing Depth 2.30m	Ground Level - Coordinates E 182505.00 National Grid N 70970.00 Chainage

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
		NI 220 1020	Flush: 0.00-20.35 Air mist, 100 %		
10.35-11.85	100 93 91				
11.85-12.53	100 85 85				
12.53-13.40	100 98 98				
13.40-14.05	100 97 97				
14.05-14.95	100 93 93			24/02/2012 2.30	1.25
14.95-15.22	100 100 100		TCR 100, SCR 100, RQD 100	27/02/2012 2.30	0800 1.80
15.22-15.90	100 57 34				
15.90-16.08			TCR 100, SCR 83, RQD 83		
16.08-16.37	100 100 100		TCR 100, SCR 100, RQD 100		
16.37-16.60	100 57 48		TCR 100, SCR 57, RQD 48		
16.60-17.90	100 98 98				
17.90-19.35	100 94 91				
19.35-20.35	100 96 96				
Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Strata

Description (Continued from Sheet 1)

Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick.

Weathering:
Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing.

Fractures:
Moderately fractured.

Fracture Set 1) (Bedding Fractures)
Subhorizontal closely to widely spaced undulating and stepped smooth fractures.

Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures.

14.95-15.22 m subvertical undulating smooth fracture

15.45-15.90 m subvertical undulating smooth fracture

19.77-20.07 m subvertical

Stratum continues to 20.35 m

Depth, Level (Thickness): (19.20)

Legend

Backfill/ Instruments

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Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

: For explanation of symbols and viations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Project	Rossmore Site Investigation
Project No.	Y2110-12
Carried out for	Irish Asphalt Limited

Borehole **RC2**

Borehole Log

Soil Mechanics

Drilled MN/AL Logged AO Checked AO	Start 23/02/2012 End 27/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 20.35m Diameter 121mm Casing Depth 2.30m	Ground Level - Coordinates E 182505.00 National Grid N 70970.00 Chainage

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
				27/02/2012	

Strata

Description (Continued from Sheet 2)	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick. undulating smooth fracture Weathering: Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing. Fractures: Moderately fractured. Fracture Set 1) (Bedding Fractures) Subhorizontal closely to widely spaced undulating and stepped smooth fractures. Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures.	20.35		SP
EXPLORATORY HOLE ENDS AT 20.35 m			

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Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Project	Rossmore Site Investigation
Project No.	Y2110-12
Carried out for	Irish Asphalt Limited

Borehole **RC2**

APPENDIX B

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Point	Dip Angle (°)	Dip Direction (°)
Western face south		
1	75	88
2	65	145
3	70	145
4	72	155
5	68	165
6	70	105
7	68	180
8	5	90
9	75	175
10	80	168
11	28	40
12	78	190
13	50	8
14	70	110
15	50	350
16	78	96
17	53	115
18	72	100
19	78	108
20	70	175
21	75	142
22	74	104
23	60	185
24	78	96

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Point	Dip Angle (°)	Dip Direction (°)
Western face central		
25	82	90
26	76	100
27	58	350
28	4	238
29	70	180
30	72	115
31	78	108
32	68	178
33	12	270
34	82	90
35	80	90
36	75	166
37	82	80
38	3	80
39	17	255
40	18	280
41	60	122
42	62	168
43	89	270
44	86	280
45	68	176
46	66	164
47	65	168
48	14	286
49	42	178
50	56	180

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Point	Dip Angle (°)	Dip Direction (°)
Northern face		
51	80	305
52	85	85
53	75	184
54	70	180
55	82	182
56	60	172
57	85	98
58	16	285
59	82	65
60	65	190
61	83	70
62	63	268
63	24	270
64	22	270
65	78	65
66	72	170
67	64	172
68	70	176
69	12	240
70	72	162
71	65	172
72	88	68
73	70	176
74	88	70
75	72	170
76	82	70
77	8	245
78	72	165
79	58	88
80	72	178
81	70	167
82	12	244
83	58	85
81	70	167
82	12	244
83	58	85

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Appendix 7.3

Recorded discharge volumes

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Summary Table

Licence Limit - 500m^3/hr AND 12,000m^3/day					
Reading Date	No Of Days Elapsed Since Previous Reading	Flow Total Reading On Meter (m^3)	Total Flow For This Period (m^3)	Average Daily Flow For this Period (m^3/day)	Flow As a % Of Permitted Limit
26/08/2020	0	0	0	N/A	N/A
07/10/2020	42	20,607	20,607	491	4.1%
21/10/2020	14	27,881	7,274	520	4.3%
18/11/2020	28	50,205	22,324	797	6.6%
10/02/2021	84	106,534	56,329	671	5.6%
27/05/2021	106	153,094	46,560	439	3.7%
29/06/2021	33	155,023	1,929	58	0.48%
22/07/2021	23	157,136	2,113	91	0.75%
01/09/2021	41	161,427	4,291	104	0.86%

Excel spreadsheet on file for each minute's discharge record from flow meter, database too populous for inclusion here

Appendix 7.5

Wastewater Treatment & Discharge Details

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environmental solutions

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technical & installation manual

manual technique et installation

Tricel® wastewater treatment systems
Technical & installation manual

CE

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Table of contents:

It is important to read the full technical and installation guide prior to installation. This document should be retained for the lifetime of the product and in the event of change of ownership be transferred to the new owner.

Precaution
Prior to installation, please consider finished garden level when installing the system. If you envisage that a manhole riser/extension may be required to ensure manhole lid remains above finished ground level, the system must be installed with the appropriate excavation foundation and backfill to accommodate the riser. Please refer to page 14 for manhole riser details.

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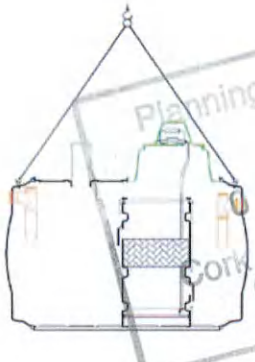
Health & safety precautions:

As safety and security are of vital importance, the following aspects are critical.

- Ensure that all the information contained in this manual is adhered to at all times
- All electrical work to be carried out by competent persons using suitable materials for the application.
- Do not open the Tricel® cover without firstly isolating the mains power
- Electrical work must be carried out strictly to the manufacturer's instructions and to the relevant national rules for electrical installations.
- When working with machinery / electrical equipment, proximity of water shall be noted.
- Equipment shall not be wet when working with it.
- There is potential danger when de-sludging and therefore this shall never be done alone.
- Never enter a tank unless qualified to do so.
- Naked flames shall not be used in the vicinity of the tank due to the danger of combustion.
- The manhole covers shall never be left off an unattended tank.
- Sewage and sewage effluent can carry micro-organisms and gases harmful to human health. Any person carrying out maintenance on the system must be appropriately trained. Suitable protective clothing; including gloves, goggles should be worn at all times. Always remove contaminated clothing and protective equipment after working with sewage treatment systems. Wash hands and face prior to eating, drinking or smoking.
- A second person shall be present when carrying out maintenance inside the tank.
- A sampling box shall be constructed to facilitate sampling and inspection without placing personnel at risk.
- Great care shall be taken when handling sludge.
- Always lock the cover of the system when maintenance is completed.
- Treated wastewater is not suitable for human consumption therefore it's important that locks are fitted to the lid to prevent accidental access.

Transportation, unloading and storage of tanks:

1. Tanks must be held down during transportation using nylon straps, do not use cables or chains to secure tanks. Do not over tighten straps to cause deformation of the tank shell
2. Always set the tank(s) on flat smooth ground free from debris etc. To prevent movement, tanks may need to be tied down and chocked.
3. Tanks are best lifted by crane and webbing lifting straps – do not use chains or wire ropes in contact with the tank. Ensure tank is empty when lifting.
4. Tanks from one to five modules (5.6m) in length should be lifted using the eyebolts that come with the tank.



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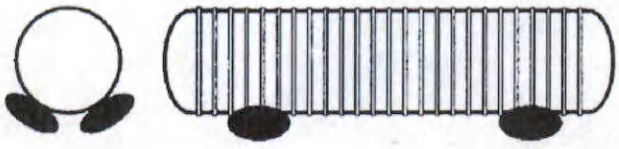
5. Smaller tanks may be lifted with other suitable site equipment but greater care is needed to control the lift and to ensure the tank is not damaged.
6. Move tanks only by lifting and setting, do not drag or roll
7. Do not drop or roll tanks from truck

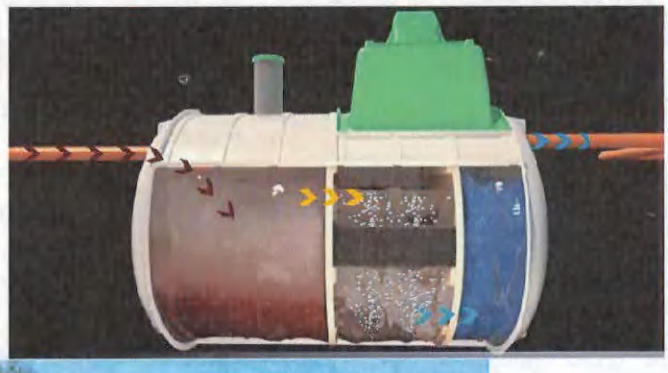


In high wind conditions, consideration should be given to strapping down the tanks to prevent damage

Introduction:

Tricel® SMC tanks:
The Tricel® SMC modular below ground tank & wastewater treatment systems "Design Registered & Patent Pending" are manufactured from Sheet Molding Compound (SMC) ensuring a durable and strong product. The Tricel is manufactured in modular components and these modules are fabricated together to make different size tanks. Tanks may also be supplied flat packed in larger quantities and detailed assembly instructions are available.

The Tricel® System is a Submerged Aeration System, suitable for domestic and light commercial applications. The system is relatively simple, using proven technology, to give superior results. Tricel Wastewater treatment systems have 3 treatment zones, generally in one tank. In each zone a different stage of the treatment occurs. Wastewater from the dwelling, toilets, sinks, shower etc, enters the system and the purification process begins.



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The wastewater purification process:

Stage 1: Primary settlement chamber

Anaerobic breakdown takes place in the primary settlement chamber where the wastewater is introduced into the system. The large volume of this chamber reduces velocity of the wastewater. This along with the long flow path allow the wastewater maximum time in the first chamber resulting in a higher settlement rate. Settlement occurs when the heavier solids, drop out of the wastewater and settle to the bottom of the tank to create sludge or when lighter solids, like fats or oils, float to the top of the water to create a scum. Up to 70% of the solids are removed in Primary settlement zone. Anaerobic breakdown begins to occur and improve the water quality.

A baffling system holds the sludge and scum in the primary settlement zone and ensures that water from the centre of the chamber moves into the aeration zone. The large sludge storage volume increases the de-sludging intervals.

Stage 2: Aeration (treatment) chamber

Stage 2 takes place in the aeration chamber where submerged aeration combines the principles of the bio film and activated sludge processes.

Masses of naturally occurring bacteria inhabit specially designed plastic filter media. The filter media, has large surface area, and is supported within the aeration zone. As the liquid flows slowly through the filter media the bacteria feed on the waste removing them from the liquid.

These bacteria are sustained with air, which is continuously supplied from a purpose built low pressure, high volume air compressor in the top section of the unit. The air is delivered through a diffused aeration system, which break the air into bubbles as they are dispersed through the aeration zone.

The continuous circulation of the wastewater within the aeration zone means that the wastewater is passed through the filter media over and over, thus ensuring very high treatment efficiency. The purified liquid is then passed into the final settlement zone.

Stage 3: Final settlement chamber

As the liquid flows from the aeration zone into the final settlement zone small quantities of bacteria may be carried with the liquid. Before discharge from the system, these solids must be separated from the liquid. With the velocity of the liquid once again slowed down and the flow path maximised the bacteria is encouraged to settle to the bottom of the tank, like sludge, through the up flow nature of the zone. A sludge return system pumps this sludge back to the primary settlement zone.

The remaining treated liquid now meets the required standard to be safely passed out of the Tricel Unit.

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System dimensions:

Tricel® wastewater treatment systems, certified to EN 12566-3:2005

Design population		**IRL6**	**IRL9**	**IRL12**	**IRL18**	**IRL24**	**IRL30**
Nominal inlet/outlet pipe diameter	mm	110	110	110	110	150	150
Overall length	m	2.6	3.1	3.6	4.6	5.6	6.6
Overall width	m	1.64	1.64	1.64	1.64	1.64	1.64
Overall height	m	2.24	2.24	2.24	2.27	2.27	2.27
Inlet invert to base	m	1.375	1.375	1.375	1.375	1.35	1.35
Outlet invert to base	m	1.3	1.3	1.3	1.3	1.3	1.3
Inlet invert to ground level	m	0.545	0.545	0.545	0.545	0.57	0.57
Outlet invert to ground level	m	0.62	0.62	0.62	0.62	0.62	0.62
Height above ground level	m	0.32	0.32	0.32	0.35	0.35	0.35
Weight empty	kg	300	300	400	500	600	700
Design flow rate	litres/day	1200	1800	2400	3600	4800	6000
Air blower rating (mean)	watts	60	100	100	100 (x2)	270	270
Desludge period (minimum)	year	1	1	1	1	1	1
Thickness (minimum)	mm	5	5	5	5	5	5

Design population		**IRL36 ***		**IRL42***		**IRL50***	
		Plant A	Plant B	Plant A	Plant B	Plant A	Plant B
Nominal inlet/outlet pipe diameter	mm	150	150	150	150	150	150
Overall length	m	2.6	5.6	3.6	5.6	3.6	6.6
Overall width	m	1.64	1.64	1.64	1.64	1.64	1.64
Overall height	m	2	2.27	2	2.27	2	2.27
Inlet invert to base	m	1.35	1.35	1.35	1.35	1.35	1.35
Outlet invert to base	m	1.3	1.3	1.3	1.3	1.3	1.3
Inlet invert to ground level	m	0.47	0.57	0.47	0.57	0.47	0.57
Outlet Invert to ground level	m	0.52	0.62	0.52	0.62	0.52	0.62
Height above ground level	m	0.18	0.35	0.18	0.35	0.18	0.35
Weight empty	kg	300	600	400	600	500	700
Design flow rate	litres/day	7200		8400		10000	
BOD load	kg/day	2.16		2.52		3	
Air blower rating (mean)	watts	100 + 270		131 + 270		270 x 2	
Desludge period (minimum)	year	1		1		1	
Thickness (minimum)	mm	5		5		5	

**Systems may require a stepped foundation, with "Tank B" lower than "Tank A" by 100mm approx.*

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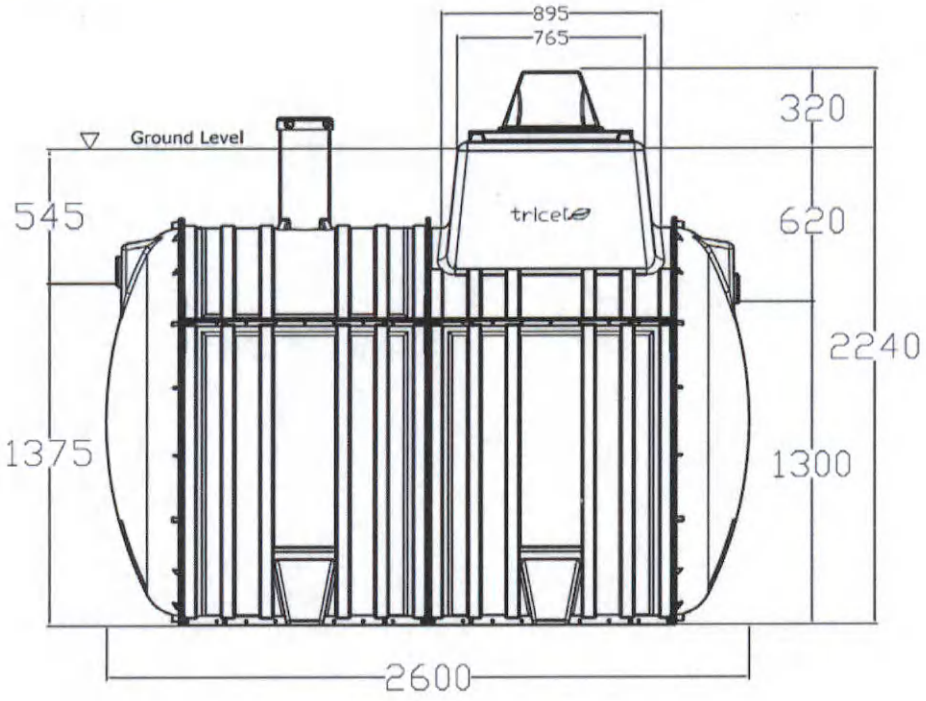
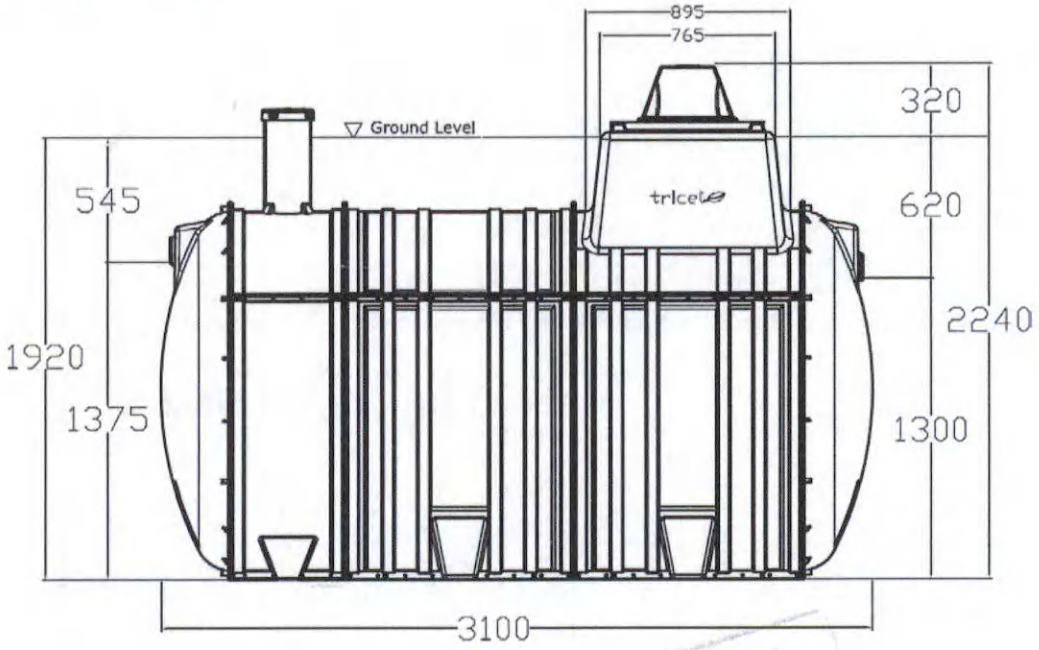
Technical drawings:

Tricel® IRL6 gravity system:



Tricel® IRL9 gravity system:



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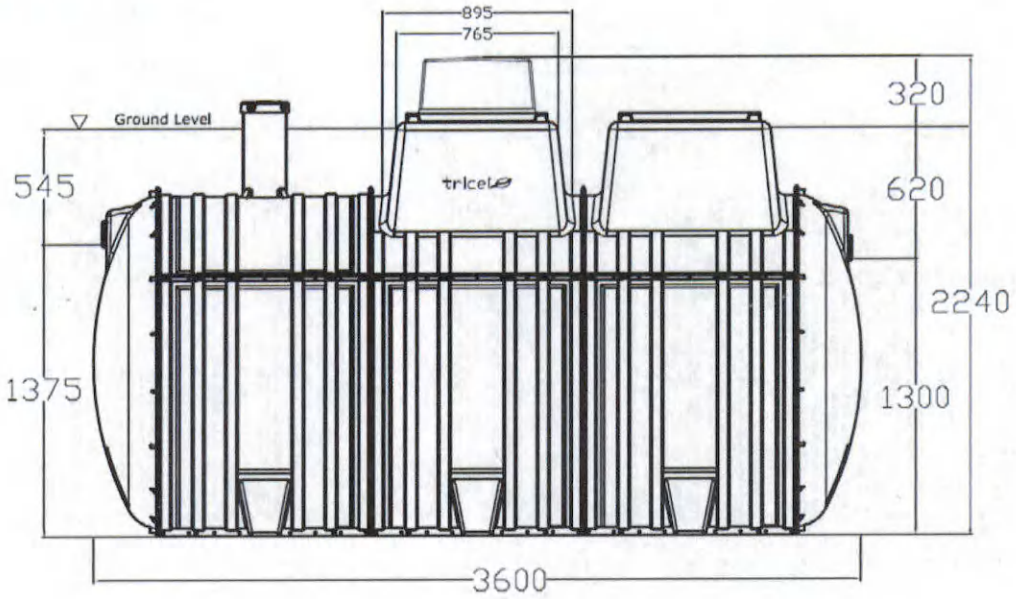
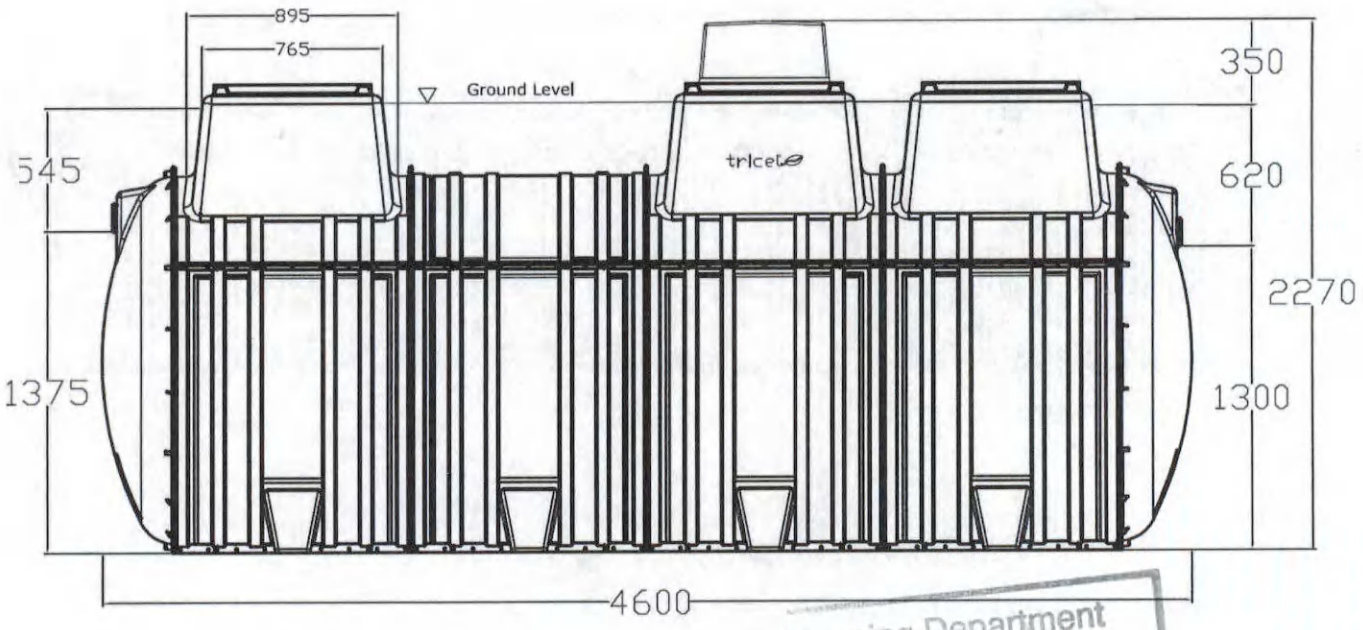
Tricel® IRL12 gravity system:



Tricel® IRL18 gravity system:



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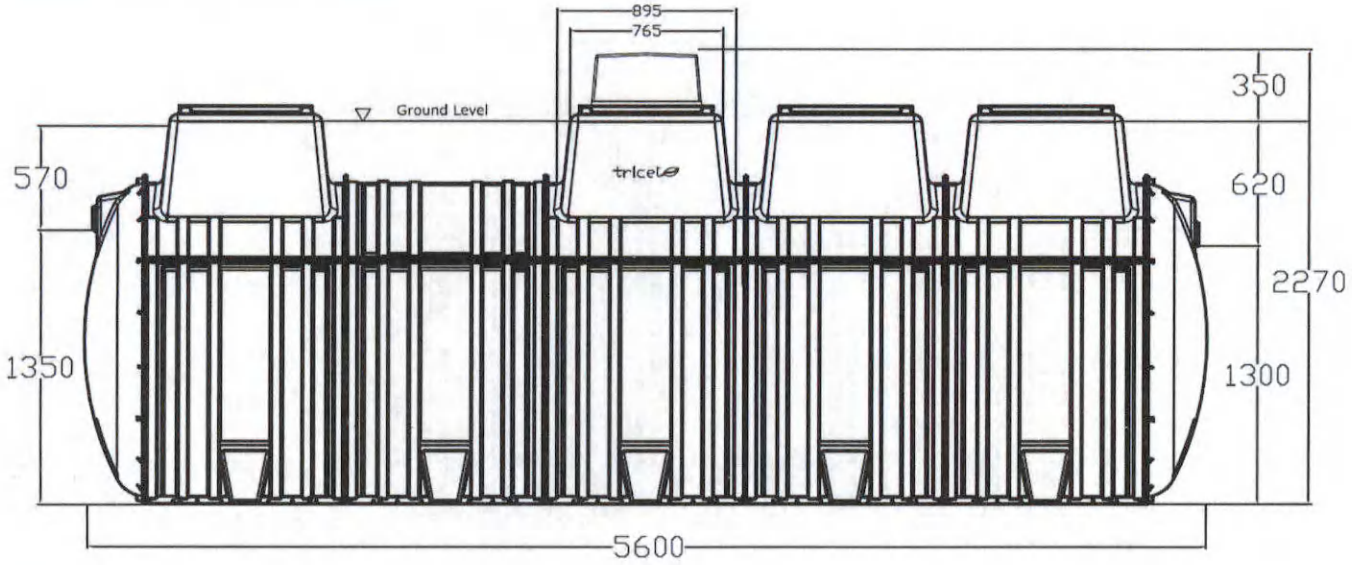
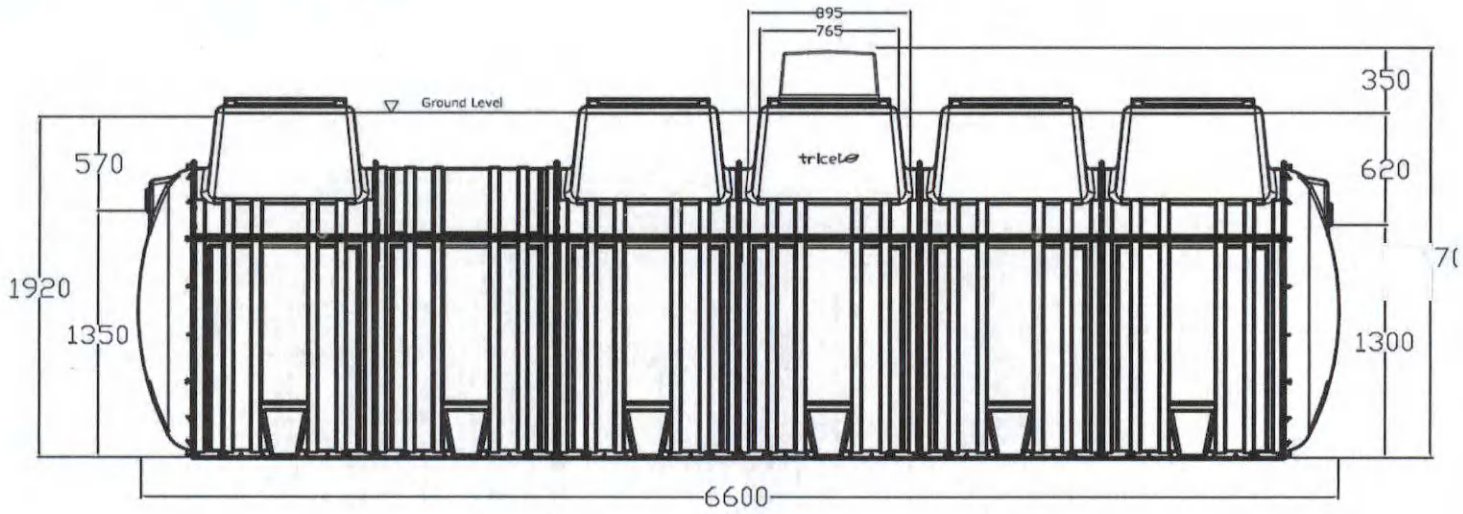
Tricel® IRL24 gravity system:



Tricel® IRL30 gravity system:



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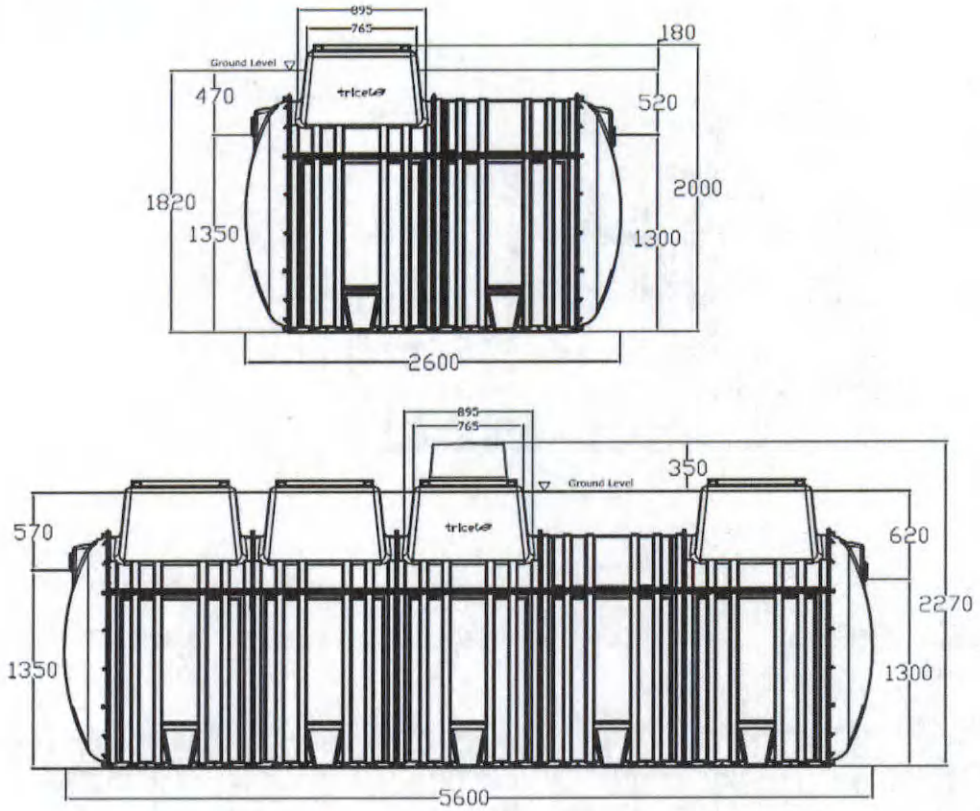
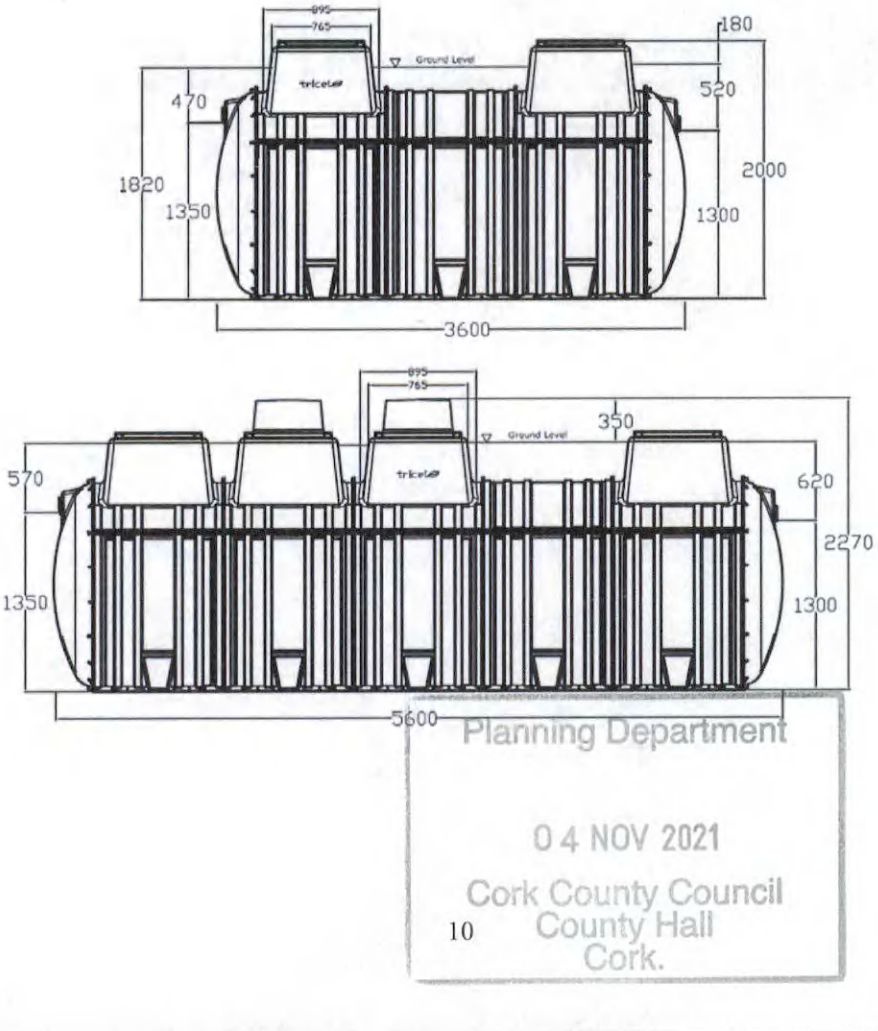
Tricel® IRL36 gravity system – 2 tank system:



Tricel® IRL42 gravity system – 2 tank system:



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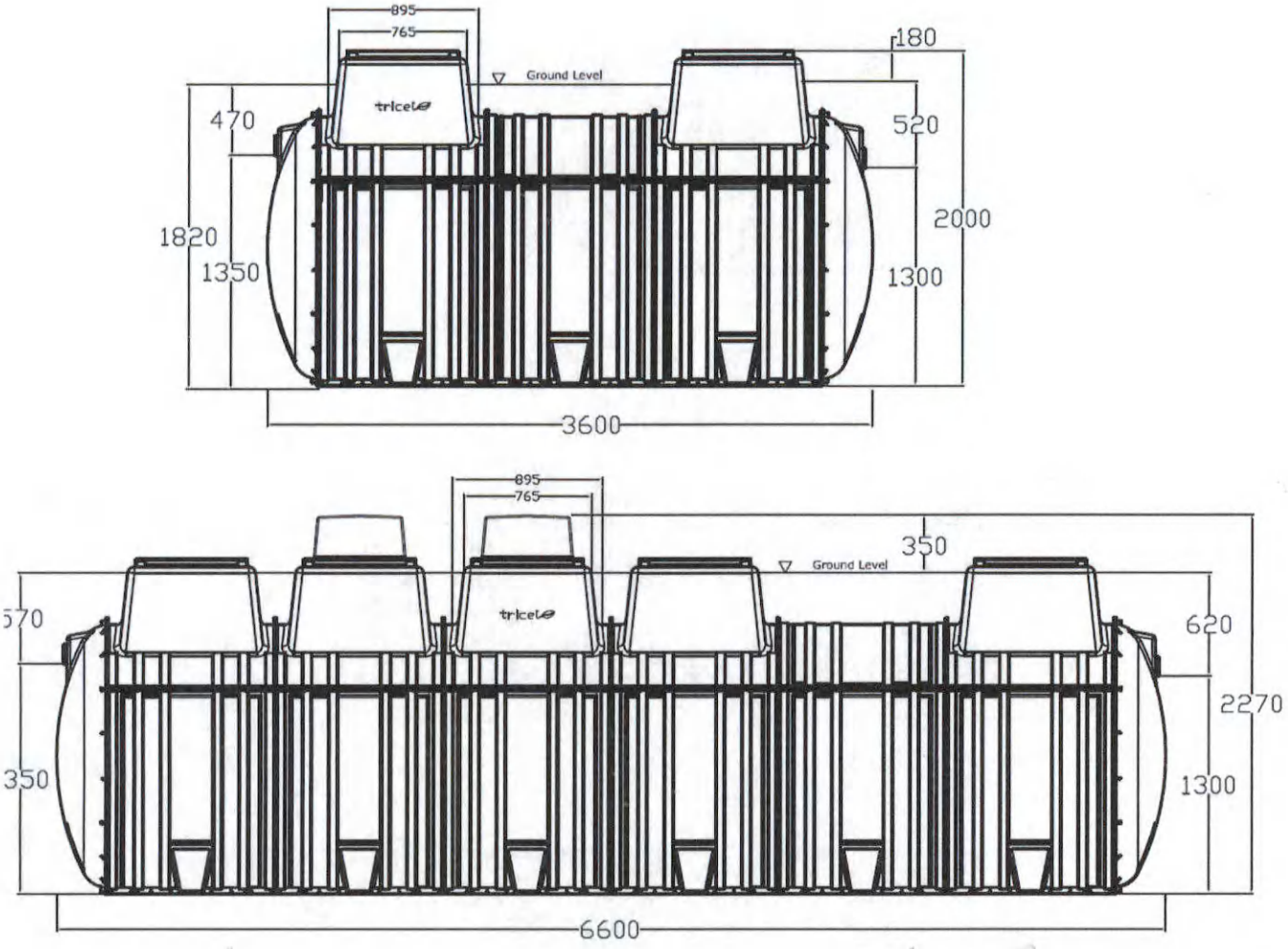
Tricel®IRL50 gravity system 2 tank system:



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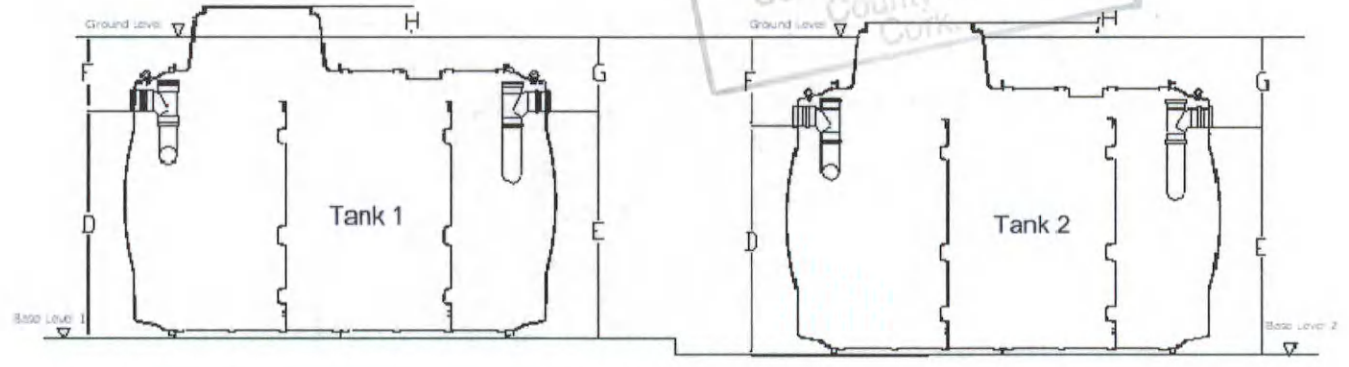
Example of "stepped installation".



Technical drawing of Tricel® pumped system :

All systems are available as pumped options. The pump is housed in the final settlement chamber of each system. The standard sewage pump will pump to, a maximum distance of 80 meters at a "Head" of 4 meters above the ground level. Larger pump options are available to customer specifications.

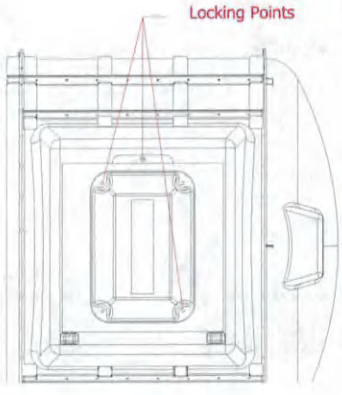
Pump Specification

- Capacity: 40m3/hr
- Head 4m
- Distance pumped up to 80m
- Continuous duty with 35°C liquids & fully submerged
- Dry motor (class F insulation)
- IP68 protection
- Max immersion 5m
  Single phase 220-240 V 50 Hz 2 poles
- 0.55 to 1.1 kW for single phase
- Rp 1 ½" delivery port (female gas)
- Handles solids upto 35mm

Lid locking points:

All manholes should be locked for safety. Manholes are rated to 125kg and are for pedestrian use only. All maintenance work is done through these manholes. Electrical equipment is situated under the housing on top of these manholes.

Note: Tanks are supplied with 3 optional locking points, as seen above. It is strongly recommended that all these points be locked with a suitable locking device to prevent unauthorised access.



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Manhole risers – (deep inverts):

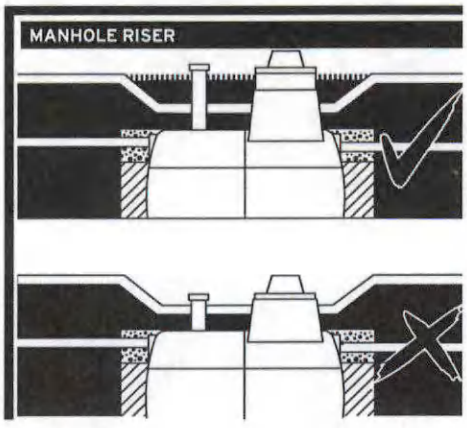
Manhole risers are available for deeper installation requirements

- **250mm** manhole risers require a standard installation.
- **500mm*** manhole risers require a **complete concrete** backfill – See notes on deeper tank installation and wet sites installation.
- **750mm*** manhole risers require a **complete concrete** backfill – See notes on deeper tank installation and wet sites installation.
- Never install the cover of the system under ground level.
- Never let groundwater enter the system.

Never place the covers of the tank below ground level.

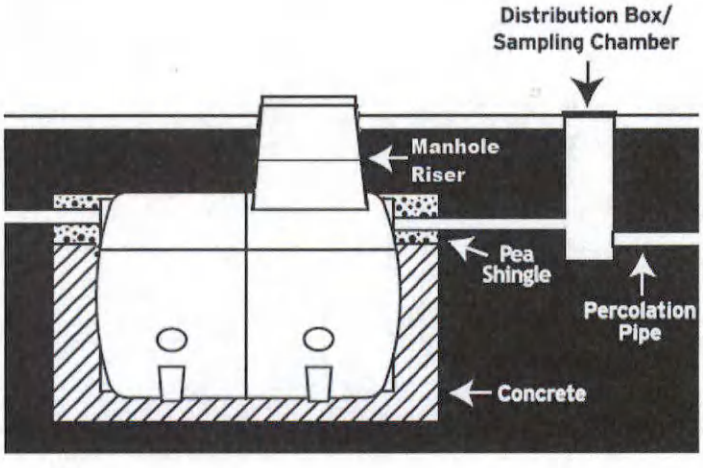
Do not allow ground water enter the system

Only a Tricel® manhole riser should be used



Manhole risers are available as standard
250mm
500mm
750mm

Systems with a manhole riser of 500mm or 750mm must have a concrete surround. 500mm and 750mm risers cannot be retrofitted unless the correct base and backfill requirements are adhered to.



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Installation:

Pre –installation inspection:

- Tanks should be subject to a visual inspection prior to installation
- Check for, fractures to the shell or ribs, de laminations, scratches or abrasions deeper than 1.5mm.
- Any damage should be notified to the delivery driver and/or to your supplier
- Do not attempt to carry out any un-authorised repairs, as this will invalidate the warranty on the tank.
- Once the tank has been installed, we cannot accept claims for damage

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Quick installation overview:

*A **dry** site is one where the water table never rises higher than the base of the Tricel® unit.*
*A **wet** Site is one where the water table may rise higher than the base of the Tricel® unit.*
The unit should never be installed where ground water can rise higher than the outlet pipe.

Guidelines	**Dry Site**	**Wet Site**
All installations must be "fit for purpose" to suit the on-site conditions, which will vary from site to site. This is the responsibility of the onsite contractor.	✓	✓
Never roll the tank. Tanks shall be lifted into position in accordance with supplier's instructions.	✓	✓
The tank should be located as far away from the dwelling as is practically possible considering topography and pipe work levels. Separation distances must meet all National and Local regulations.	✓	✓
Dig a hole circa 500mm larger than the system in plan. Allow for manhole riser if using.	✓	
Remove any soft spots or boulders of significant size from the base or sides of the excavation.	✓	✓
Ground water must be pumped to give a dry excavation and excavation lined with polythene.		✓
A base is then formed using compacted gravel and this must be flat and level.	✓	
A base is constructed of a thin layer of compacted gravel covered with a 250mm layer of 25n semi dry concrete.		✓
Ensure gravel/concrete is clean and contains no large materials.	✓	✓
Lift tank into position and align as required for connecting pipe work, access shafts etc.	✓	✓
Ensure that the correct orientations are achieved of the system, which may contain 1 or more tanks.	✓	✓
Ensure that each tank is 100% level, and that inlet/outlets are in the correct orientations.	✓	✓
Secure anchor straps if required.	✓	✓
Connect any low-level pipe work, as required.	✓	✓
Ballast the tank with water.	✓	✓
Mount and seal any turret extensions.	✓	✓
Commence gravel backfilling in 300mm layers approximately up to 50mm over the cylindrical body of the tank, ensuring tank and any pipe work is properly supported.	✓	
Commence concrete backfilling in 300mm layers approximately up to the pipe work level, ensuring tank and any pipe work is properly supported.		✓
Continue backfilling with primary material up to 50mm over the cylindrical body of the tank		✓
Complete backfilling with topsoil up to the max ground level line. Ensure that surrounding finished ground level is never higher than the max ground level line.	✓	✓
Compaction should be by lightweight rollers or vibratory plate compactor until "traffic" depth has been achieved.	✓	✓
Compact evenly around the riser extensions to reduce risk of distortion.	✓	✓
Ensure that No surface loadings are transferred from the cover direct to the tank. Cover frame construction should allow movement.	✓	✓
An access chamber should be installed before and after the tank for sampling and to assist in clearing possible blockages	✓	✓
If sewage consists of high quantities of grease e.g. from a restaurant, a grease trap may have to be installed on a separate drain prior to the system.	✓	✓

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Note: The option of a reinforced concrete slabs or deadman anchor may also be used on wet sites. This should be designed by an on-site structural engineer to suit site conditions.

Detailed installation information:

The system must be situated a minimum of 7m from the dwelling and as far away as practically possible considering topography and pipe work levels.

Control of groundwater

Tanks must not be subjected to buoyant forces during installation, taking account of ground water levels and surface water run-off, and their accumulation in the tank pit, even if tanks are anchored.
The excavation area should be adequately drained, to permanently remove ground water from the proximity of the tank (or tanks). This is critical in order to avoid flotation of the tanks. Incorrectly installed tanks that are subject to movement, rotation or floatation may become damaged, for which we cannot accept liability. Water should be removed as much as possible from around the tanks using piped drains.

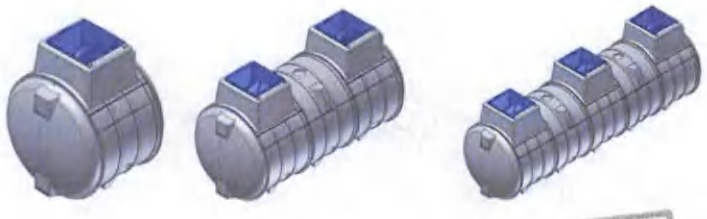
Note: water logged sites

The Tricel system is not suitable to be used in water logged sites, where the ground water may rise above the outlet level. Please contact the supplier of the system if there are difficulties on site due to adverse water logging. Adequate drainage is important to improve wet sites, or sites with a high water table level. It is critical that water is removed from the area surrounding the system to prevent flotation, or ingress of water that could cause electrical failure within the system. Excessive loading caused by site water can harm the system, please consult with the manufacturer or a qualified engineer if in doubt.

Excavation size:

Suitably sized equipment will be required to excavate the hole and to crane the system into place.
Installation depends on on-site conditions, water, slopes, location etc. Excavation should be planned with due regard to health and safety requirements, and should be either shored or battered back to a "safe" angle. The excavation should allow a minimum 250mm clearance between the tank and the excavation wall or face of shoring. A minimum of 500mm is also required between adjacent tanks. Unstable ground with excessive sand, peat swamps etc may require larger excavations. The excavation should be maintained dry by pumping or whatever suitable means.

External dimensions: Dia in meters x length in meters
Total excavation: {Dia + 250mm} x {Length + 250mm}
Excavation depth: Allow 250mm for a tank base/plinth.



Tank Size	Excavation Size Tank A (m)	Excavation Size Tank B (m)
IRL6	3.1 x 2.15	N/A
IRL9	3.6 x 2.15	N/A
IRL12	4.1 x 2.15	N/A
IRL18	5.1 x 2.15	N/A
IRL24	6.1 x 2.15	N/A
IRL30	7.1 x 2.15	N/A
IRL36	3.1 x 2.15	6.1 x 2.15
IRL42	4.1 x 2.15	6.1 x 2.15
IRL50	4.1 x 2.15	7.1 x 2.15

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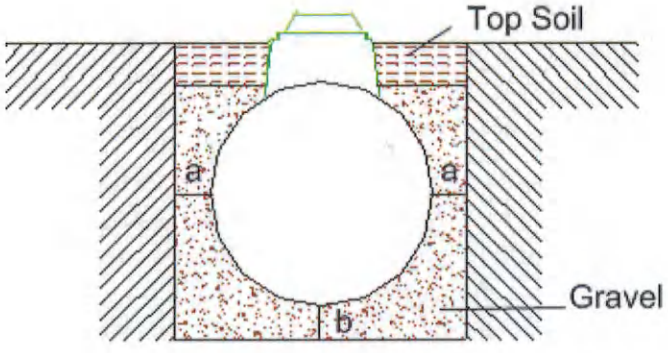
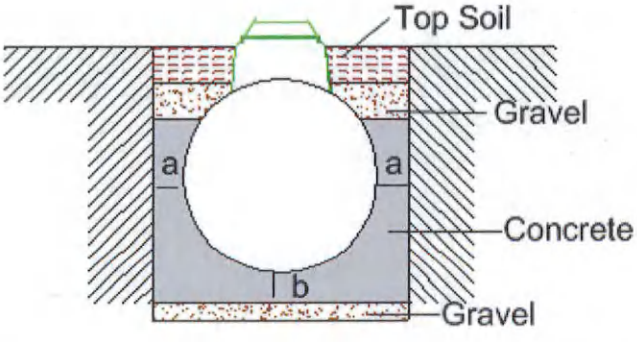
Excavation depth:
The excavation depth is determined by the inlet and outlet pipe, invert levels relative to the bottom of the tank, and allowing for the minimum base thickness shown. Dimension details of the tank are shown on the relevant drawing, supplied with the system. Ground instability at formation level e.g. running sand may necessitate over-excavation and stabilisation with hardcore or blinding concrete.

NOTE: Check that the depth to the base slab is within the Service Specification requirements for the tank.

Dry site



Wet site



Tank Dia in mm	"a" minimum in mm	"b" minimum in mm
1650	250	250

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Dry site installation :

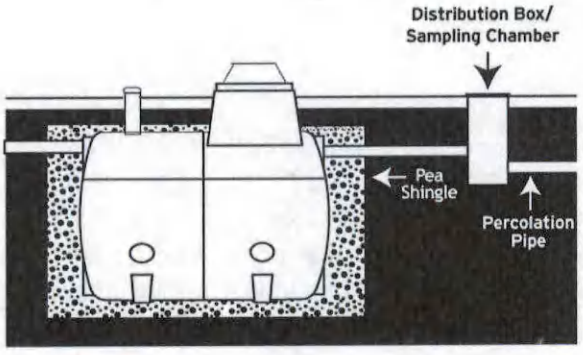
Tank base/plinth:

- Remove any soft spots or large stones and boulders.
- The base is constructed of compacted gravel *(please see below specification details for compacted gravel).*
- Ensure that base is level and ensure that correct orientations are determined to accommodate the incoming pipe work.

Installing onto the base/plinth:

- Lift the unit carefully into the hole and place on the prepared plinth
- The unit must sit dead level on the plinth
- The higher pipe on the tanks is to be connected to the inlet pipe work and the lower pipe on the tank is to be connected to the outlet pipe work. Connect and seal the pipe work to the tank, checking alignment to ensure there is an adequate fall for each pipe.
- Mount and seal manhole extensions (if used)

Backfilling dry site:



ɛfer to backfill specification appropriate for site conditions

- Fill each chamber of the unit with clean water to a depth of 300mm and recheck the pipe work levels. Commence backfilling evenly around the tank ensuring that there are no voids. Continue filling the chambers whilst backfilling, ensure that the progressive water level is no more than 300mm above the backfill level.
- Continue to backfill until material has reached 50mm over the cylindrical body of the tank.
- Complete backfilling with topsoil up to the max ground level line.

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04 NOV 2021
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Deeper tank installation & wet site installation:

A concrete surround is required, where a tank is buried greater than 800mm from ground level to the top of the tank and where sites conditions are considered wet.
A wet site is one where the water table may rise higher than the base of the Tricel® unit.

The option of a reinforced concrete slab or deadman anchor may also be used. This should be designed by an on-site structural engineer to suit site conditions.

Concrete surround and plinth:

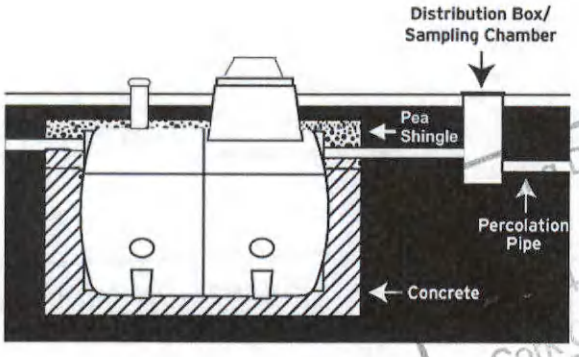
Tank base/plinth:

- Remove any soft spots or large stones and boulders.
- The base is constructed of a thin layer of compacted gravel, covered with a 250mm layer of semi dry concrete *(please see below specification details for compacted gravel and concrete plinths and surrounds).*
- Ensure that base is level and ensure that correct orientations are determined to accommodate the incoming pipe work.
- It is important to maintain a completely dry excavation until the final pour of concrete is set. It may be necessary to line the excavation with a continuous layer of 1200 gauge polythene to maintain the integrity of the concrete.

Installing onto the base/plinth:

- Lift the unit carefully into the hole and place on prepared plinth before the concrete sets
- The unit must be dead level on the plinth
- The higher pipe on the tanks is to be connected to the inlet pipe work and the lower pipe on the tank is to be connected to the downstream outlet pipe work. Connect and seal the pipe work to the tank, checking alignment to ensure there is an adequate fall for each pipe.
- Mount and seal manhole extensions (if used)

Backfilling a wet site:



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NOV 2021
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Refer to backfill specification appropriate for site conditions

- Fill each chamber of the unit with clean water to a depth of 300mm and recheck the pipe work levels. Commence backfilling evenly around the tank ensuring that there are no voids. Continue filling the chambers whilst backfilling, ensure that the progressive water level is no more than 300mm above the backfill level.
- Backfill with concrete until it has reached the invert of the outlet pipe.

- Continue backfilling with stone until has reached 50mm over the cylindrical body of the tank.
- Complete backfilling with topsoil up to the max ground level line.

Concrete backfill specification:

Semi dry concrete 25n grade with a ratio of 4.5 aggregate to 1 cement.
Note: Standard concrete mixes should not be used, where sulphates or similar aggressive chemicals are present in the groundwater.

Lift height (rate of rise):
Determine the lift height (m), or rate of rise (m/h) for the specific concrete type used, to ensure that a design pressure (P max) of 15kN/m^2 on the tank is not exceeded.

Vibration:
The design of the tank assumes minimal compaction of the surrounding concrete. Where necessary, this ay be extended to include light internal vibration. Never use deep revibration which will substantially ıncrease the pressure on the tank, possibly causing failure.

Impact of concrete on discharge:
Under no circumstances should concrete be discharged directly onto the tank.

Gravel backfill specification:

Primary backfill specification:
Primary backfill material should be free-flowing granular material. Compaction should be by lightweight rollers or vibratory plate compactor until "traffic" depth has been achieved. Compact backfill evenly around the turret extensions to reduce risk of distortion. Tanks must be installed with Primary Backfill only within the region immediately surrounding the tanks. This Primary Backfill must extend a minimum of 250mm outward from the tank, and directly beneath the tank.
The following materials are approved as Primary Backfill:

ʀounded pea gravel:
Minimum particle size 3mm, maximum 18 mm, compacted to a relative density of >70%. Gravel shall be clean and free flowing, free from large rocks, dirt, sand, roots, organic materials or debris. Upon screening analysis the backfill material shall have no more than 5% by weight passing 2.36 mm Sieve

Or

Crushed or processed stone:
Minimum particle size 3 mm, maximum 12 mm, compacted to a relative density of >40%
Dry Gravel density must be at least 1500 kg/m^3. Material should be washed or screened to remove fine particles. Upon screening analysis the backfill material shall have no more than 5% by weight passing 2.36 mm Sieve
Use of other than specified backfill and bedding materials will void the tank warranty.
Backfill material shall not be frozen or contain lumps of frozen material at any time during placement.

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04 NOV 2021
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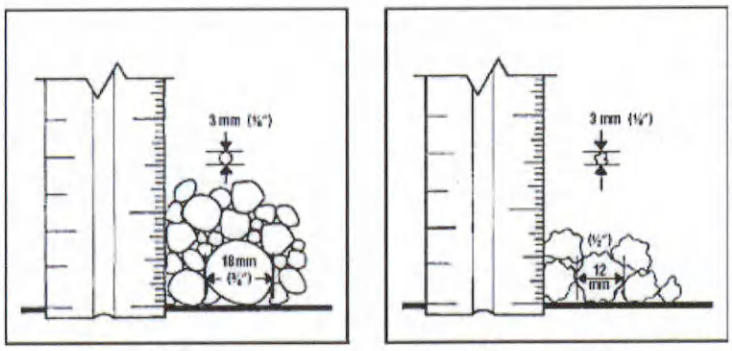

Pea Gravel **Crushed Stone**

Top soil:
Clean native top soil shall not contain rocks larger than 36mm on largest dimension.

Note: The use of geo textile barrier fabrics surrounding the Primary Backfill material is considered good installation practice. The fabric must be chosen to allow the flow of water in and out of the excavation but to prevent the movement of fine soil particles into the Primary Backfill material.

Burial depth:
Generally, the depth from finished ground level to the top crown of the main shell should be no more than 1 meter. This may vary dependant upon ground water conditions.

Loadings:
If the tank is installed in an area where traffic or other superimposed loadings can be applied, consult a structural engineer for the design of a reinforced concrete slab to prevent the load being transmitted to the tank (or its concrete surround). If this slab is constructed immediately above the tank, it should be separated from the concrete surrounding the tank by a compressible material. *Installation guidelines are available from Tricel® upon request.*

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Electrical installation:

Notes:
Electrical installations vary from country to country. Please ensure that the system supplied complies with all local requirements.

The customers' minimum responsibility shall consist in the provision of:

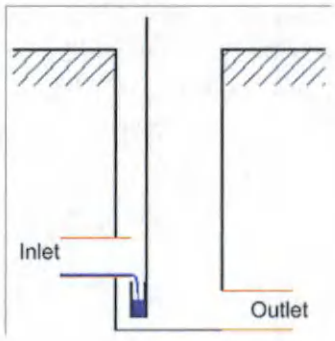
- A single run of 1.5mm² 3 core (two conductors plus earth conductor) steel wire armoured (SWA) cable from the customer's distribution cabinet to the tank unit socket box.
- Cable protection via 10 amp MCB protected by (RCD), rated 230V, 30mA.
- The cable armour must be properly bonded to the main earth at the premises.
- Never disconnect the power to the air pump. It is imperative that it is running 24 hours a day, every day.

The relevant wiring (diagram to instruction) is supplied with each unit.

Plumbing the system:

Do not: Plumb storm-water (water) from roofs, drains, footpaths etc., into the Tricel® Wastewater treatment system. A competent person in accordance with this manual should connect the plumbing from the dwelling to the wastewater treatment system.

Sampling chamber:
Best practice indicates that a chamber be fitted after every unit to allow easy access for sampling purposes. The inlet of the chamber must be 150mm up from the base of the chamber to facilitate sampling cup.



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Finishing the garden to ground level:

The finished ground level should be to the level indicated on the system.

Ventilation:
Ventilation is crucial to the system. The unit has a built in vent in the primary access cover. Further information is available from BS8301, BS6297, EPA Wastewater Treatment Manuals 1999.

Control housings:
Monitoring equipment, alarms, blowers or pumps if supplied, may be placed into separate control housing. These can be fitted with visual / audio / alarms along with other equipment. If so, a mains supply may be required. Only a qualified and competent person should attempt to do this wiring. This is not our responsibility. Only appointed personnel are allowed to hold a key this cabinet or kiosk. Mains must be

disconnected before maintaining the system. The tank & control housing should be fenced off in a lockable compound along with the Tricel® underground system.

Fencing (optional):
Once the system has been completely installed, we recommend that a suitable fenced area should be constructed to ensure that access is restricted to the system and/or cabinet / kiosk. Access must be restricted to suitable trained personnel only. Access for maintenance or de-sludging must be available. Local authority / government regulations must be adhered to in relation to fence specifications and design.

System start up:

Once installation, plumbing and the electrical installation are completed, the Tricel® is now operational. The system should already be filled with water during installation. If not, it should be filled before its first use. If the system is running correctly, a slight "hum" will be heard from the air blower and there will be air bubbles coming up from the bottom of the middle chamber, rising to the surface. The unit runs 24hours a day 7 days a week all year round for optimum purification. In periods of low occupancy the sludge return re-circulates the liquid in the system ensuring continuous performance. In periods of overload the sludge return system passes the liquid back into the primary so it passes through the aeration chamber again ensuring continuous performance. It may take up to 13 weeks for the biomass to become fully established and to reach optimum purification.
All units are fitted with an alarm, which will alert of irregularities in the system.

Disposal of treated water:

The Tricel® Sewage treatment plant discharges treated water to the required standards (20:30:20) or better once maintained and operated as per manufacturer guidelines. The best disposal method can depend on a variety of site factors. Refer to planning regulations applicable to your application.

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Maintenance:

Precaution
Any maintenance carried out inside the tank represents a confined space. Therefore the maintenance person must be suitably trained to work in confined spaces. Sewage and sewage effluent can carry micro-organisms and gases harmful to human health. Any person carrying out maintenance on the system must be appropriately trained. Suitable protective clothing; including gloves, goggles should be worn at all times. Always remove contaminated clothing and protective equipment after completion of work. Wash hands and face prior to eating, drinking or smoking.

A certain amount of system maintenance is required, on an ongoing basis to ensure that the system is working correctly. This is the responsibility of the homeowner.

3 - monthly maintenance:

There are two vents on the Tricel®. The vent under the blower housing, guarantees a fresh supply of air to the system through the blower. The vent under the de-sludging cover allows gas to escape and stops the tank from becoming pressurised. The vents should be checked to make sure they are not blocked or obscured by overgrown grass.

Yearly maintenance:

The inlet and outlet should be inspected and rodded to remove any chance of blockages. The Tricel® system will require a full service (available from your supplier) every year to guarantee the efficiency of the system is maintained.

Yearly service (available from your supplier)

During routine servicing contracts the following items are checked:

Sludge return	Functionality of blower and / or pump
Pump pressures	Pump filters are replaced
Pump Diaphragm checked	Alarm checked
Ventilation function tested	Diffuser monitored to check for dispersion of air
Tricel® Covers and locks inspected	

Production of sludge:

When the sludge is occupying 50% of the volume of the primary chamber de-sludging is required. This is when the sludge is 700mm deep.

Approximate de-sludging periods are shown in the table on page 6. The de-sludging of the Tricel® system is the responsibility of the homeowner. The Tricel® system has a separate 180mm de-sludging access, the smaller of the two covers. De-sludging is done with a vacuum tanker (we recommend the use of a licensed company).

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De-sludging (emptying the solid waste from chamber 1 the primary chamber)

- Remove the de-sludging access cover.
- Empty the Tricel® system using the vacuum tanker. Care must be taken not to damage the Tricel® system with the hose of the vacuum tanker.
- Replace the de-sludging access cover securely.

Notes:

- Do not allow this equipment drive over the system. Maintain a distance of at least 4 meters away from the covers on the Tricel® wastewater treatment system.
- The access cover should never be left off while the unit is unattended.
- De-sludging should never be carried out alone.

The property owner has a legal responsibility to ensure that the system does not cause pollution, a health hazard or nuisance.

Operating conditions:

- The manufacturers instructions outlined in the technical manuals must be followed at all times. A service contract does not remove this responsibility from the customer / homeowner.
- It is important that the unit is operated under the conditions for which it is designed. Any variation in these conditions could lead to the unit not performing to its full potential and the discharge may not meet the required standards.
- The end user of the wastewater treatment system is responsible for the operation of the unit and for ensuring that the quality of the effluent does not breach the required discharge standards.
- De-sludging is a critical part of the successful operation of the Tricel®® Wastewater treatment system and is the responsibility of the customer. Only competent approved personnel should carry out de-sludging. De-sludging must be carried out yearly, however the system should by inspected regularly to check the depth of sludge in the primary chamber. If desludging is required it should be done as soon as possible.
- If the electrical connection fails to the air blower in the system, the system will not function correctly. It is imperative that a continuous air supply, via the air blower, enters the system in order for the system to function correctly.
- The discharge to the ground is also a critical part of the operation of the system. Correctly constructed distribution chambers and distribution drains or polishing filters are necessary as part of the treatment process. Incorrectly constructed drains or polishing filters could result in poor treatment of effluent and the manufacturer does not accept any responsibility in this regard.
- If the system is not installed correctly, flooding, overloading, electrical shock or floatation may occur. We are not responsible for incorrectly installed systems.
- Soak ways, drains and the emptying of primary chamber remains the responsibility of the client. Damage to the installation due to the influx of surface water or the backing up of soak ways or drains is not covered by the manufacturer.
- The manufacturer shall not be liable for any damage or loss, including consequential loss, caused by the failure of any plumbing equipment or failure caused by the inclusion of gross solids, (e.g. – disposable diapers or sanitary towels etc) in the wastewater treatment unit.
- To ensure the continuance of the systems performance, the user has to take certain precautions including the following:
- The design loading of the plant should not be exceeded.
- High volume discharges such, as those from swimming pools and Jacuzzi's must never enter the system.
- Surface water must not enter the system.
- Do not allow large quantities of chemicals to enter the system including:
    - Water softener regenerate.
    - Disinfectants.
    - Strong Acids and Alkalis, or Photographic Chemicals.
    - Oil or Grease.
    - Petrol or diesel.
    - Pesticides.
    - Large quantities of milk, alcohol or food.
    - Large quantities of bleaches or cleaners
    - Baby wipes
    - Sanitary towels
    - Kitchen paper

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- Nappies
- Medication

- Service personnel must be accommodated with clear access to the system.
- If others size the system, we will supply a system to these specifications and not it's own specifications. In this case, the responsibility lies with others, in relation to the maximum flow / litres per day, the system capacity and retention times.
- If we size the system, and a greater load is placed on the system by the addition of extra houses, bedrooms in the houses, schools, crèche etc or by any other means, we are not responsible for the system in terms of overloading or the quality of the effluent as the retention times may be compromised.
- Should the system be used intermittently or if extended periods of non-use are expected, it is recommended that the system remain on and in operation. The contents of the system should not be allowed to go septic due to non-use.
- The unit is not suitable for vehicular traffic. We also recommend fencing off the area to prevent livestock herds from accessing the system. Where possible, unnecessary human traffic around the system should be avoided.

Terms & conditions

Subject to our standard terms and conditions, which are available on request.

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Certification:

The Tricel® Wastewater treatment systems have successfully passed the stringent European testing and are now approved to the new European standard EN 12566-3 Small wastewater treatment systems for up to 50 PT-Part 3: Packaged and/ or site assembled domestic wastewater treatment plants.
Tricel® Wastewater treatment systems were placed through a rigorous 38-week test, by the certified laboratory PIA GmbH-Testing Institute for wastewater technology in Aachen, Germany www.pia-gmbh.com. Results received from the biological tests carried out in Aachen on the Tricel® system shows a treatment efficiency of 95.8% for BOD_5 and 95.2% for SS.
Tricel® passed all structural testing (crush test & durability test) carried out by PIA staff. Watertightness tests were performed by PIA at our headquarters on the range of tanks up to P50 successfully passed all of the required tests.

CE

Tricel®

I.S. EN 12566-3
Packaged domestic wastewater treatment plant for treatment of domestic wastewater
Product's reference code: "Tricel IRL6-IRL50"
Material: GRP

Effectiveness of treatment:	
Treatment efficiency ratios	**BOD5: 95.8 %** **SS: 95.2 %**
Nominal organic daily load (BOD5) **Nominal hydraulic daily flow (*Q*N)**	**See table** **See table**
Water tightness:	**Pass**
Crushing resistance:	**Pass**
Durability	**Pass**

Tank	BOD5	QN
IRL6	0.36 kg/d	1.2 m3/d
IRL9	0.54 kg/d	1.8 m3/d
IRL12	0.72 kg/d	2.4 m3/d
IRL18	1.08 kg/d	3.6 m3/d
IRL24	1.44 kg/d	4.8 m3/d
IRL30	1.8 kg/d	6.0 m3/d
IRL36	2.2 kg/d	7.2 m3/d
IRL42	2.52 kg/d	8.4 m3/d
IRL50	3.0 kg/d	10.0 m3/d

Troubleshooting :

The number of Tricel® systems, when properly installed, experiencing any problem will be extremely small. All units are fitted with an alarm, which will alert of irregularities in the system. If the blower or pump stops working a buzzer will sound to indicate there is a problem with the unit. The buzzer can be muted until the problem is fixed. Once fixed, the alarm will reset automatically and the mute switch should be turned on. All electrical work shall be carried out by a qualified person.

Symptom	Possible causes	Corrective action
Blower/Pump won't start or run	Blown Fuse	Replace with fuse of proper size
	Tripped Breaker	Reset Breaker
	Low line voltage	If voltage under recommended minimum, check size of wiring from main switch on property. If OK contact, power company.
	Defective Blower/Pump	Replace Blower/Pump
Blower operates but delivers no air	Low Line voltage	If voltage under recommended minimum, check size of wiring from main switch on property. If OK contact, power company.
	Filter blocked	Replace Filter
	Diaphragm Broken	Replace diaphragm
	Defective Blower	Replace blower
Pump operates but delivers no water	Low Line voltage	If voltage under recommended minimum, check size of wiring from main switch on property. If OK contact, power company.
	Something caught in impellers	Clean out impellers or replace pump
	Delivery hose blocked	Find blockage and remove or replace damaged hose
	Defective Pump	Replace Pump
Blowers runs termittently	Thermal overload tripped	Protect installation from Sun. Air supply vent blocked, clean if necessary Filter blocked, replace if necessary Discharge hose blocked or kinked, remove obstruction
Pump runs intermittently	Thermal overload tripped	Check for clogged impeller The Pump has run dry so add water. Ensure the pump is plugged out before you attempt to unclog it.
System fills above working water level	Subsurface disposal system clogged	Contact installer to repair sub surface disposal system/ Percolation area.
	Storm water flooding	Redirect storm water drains. Storm water must never enter the system
	Pump not working	Check pump is functioning properly as above
	Discharge hose/pipe blocked	Find blockage and remove or replace damaged hose/pipe
Alarm is sounding but the pump and blower are working	Air return pipe to the alarm not returning an air signal.	Check that the air pipe is not damaged or bent. Ensure there is air blowing through this pipe. Check that the pipe is inserted to the alarm correctly.
	Electrical fault.	Get a qualified person to check that the alarm is installed correctly.

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Please Note:
Before taking any corrective action, always positively identify the real source of the odour. Check if the odour is coming from another outside source such as a storm drain. All wastewater disposal systems vent gases back through soil pipe and out roof vents. Improperly installed roof vents can cause odour problems. Traps in drains prevent odours from entering the home. To function they must contain water and be sealed correctly.

Symptom	Possible causes	Corrective action
Effluent odour directly outside the house or inside the house	Pipe connections to toilets / drains not connected correctly.	Check that the traps / U - bends in the drains are fitted and the joints sealed
	Air vent on pipe work not fitted or fitted incorrectly	Ensure all effluent pipes are vented correct, vents are normally fitted to all pipes and they should be higher that the eve of the roof.
	Pipe work is damaged or blocked or fitted incorrectly	Inspect pipe work to ensure it is undamaged and clear of obstructions or sagging
Bad effluent odour directly over the tank	Pipe work to or from the tank is blocked	Check the level of liquid in the tank. Ensure the pipes are not blocked and are fitted correctly to the tank. Ensure Pumps are working properly if applicable.
	Chemical kill of bacteria	If symptom persists for 48 hours or more, remove all liquid and replace with clean water.
	No air delivery	Check blower is functioning properly
	Hydraulic/Organic Overloading	Reduce flow and/or organic load
	Tank vent blocked	Clear tank vents

In accordance with our normal policy of product development, this specification is subject to change without notice. July 2012

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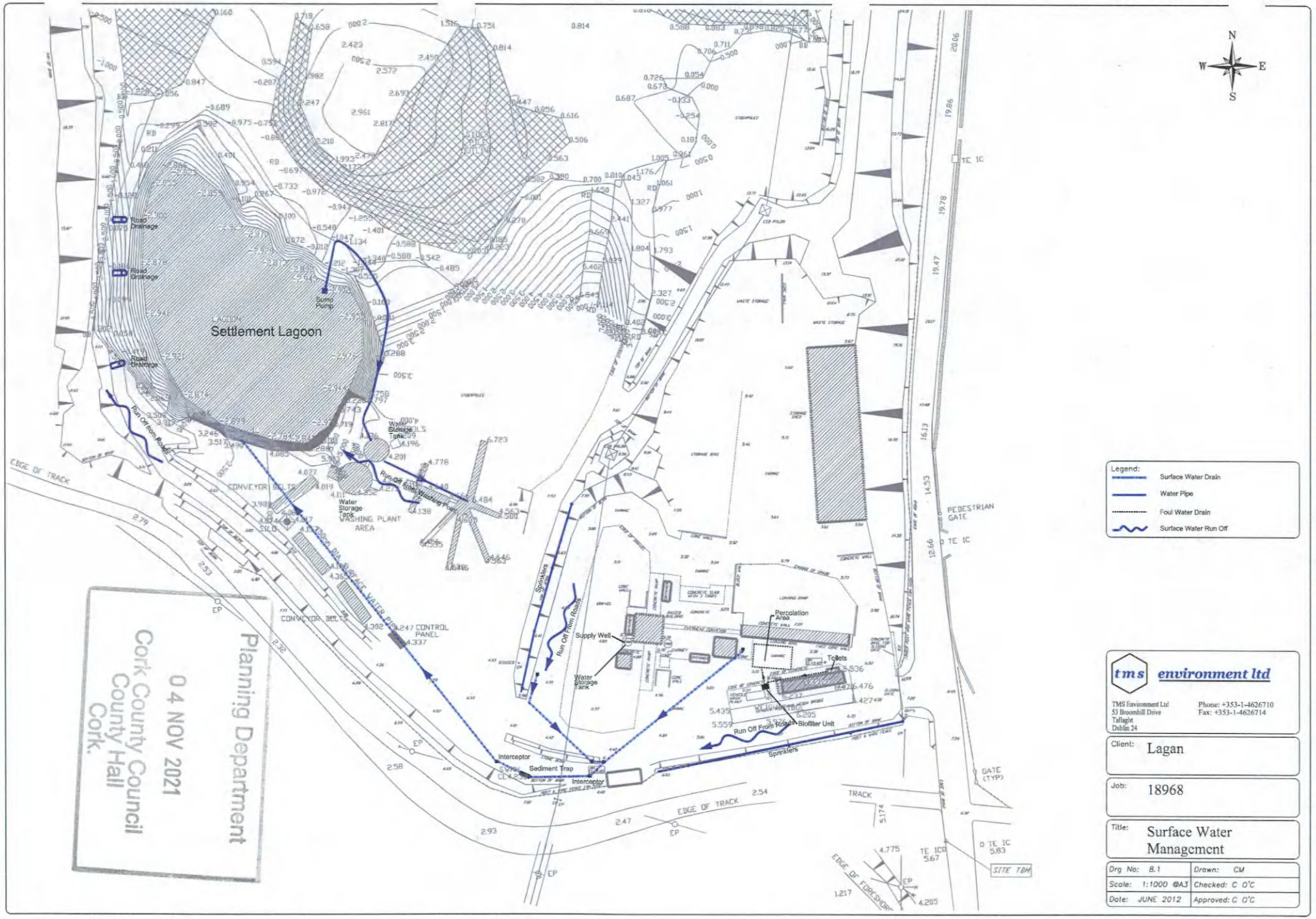

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tms environment ltd
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53 Broomhill Drive
Tallaght
Dublin 24
Phone: +353-1-4626710
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Client: Lagan

Job: 18968

Title: Surface Water Management

Drg No: 8.1	Drawn: CM
Scale: 1:1000 @A3	Checked: C O'C
Date: JUNE 2012	Approved: C O'C

[redacted]

Appendix 7.6

Water Management Systems & Designs (2015)

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Predicted Storm Water Inflows and Attenuation Volumes - Lagan, Rossmore

Total Contributing Area	87511	m2
Excess Rate from Attenuation Pond	47	l/s

10 Year Storm

Storm Duration		Rainfall (mm)	Rainfall + 10% (mm)	Excess Rainfall (mm)	Excess Rainfall (m)	Storm Water (m3)	Outflow (m3)	Required Storage (m3)	Time to Empty (hrs.)
5	min	6.4	7.04	2.04	0.00204	178.57344	14.10	164	1.0
10	min	8.9	9.79	4.79	0.00479	419.17769	28.20	391	2.3
15	min	10.5	11.55	6.55	0.00655	573.19705	42.30	531	3.1
30	min	14.3	15.51	10.51	0.01051	919.74061	84.60	835	4.9
1	hr	18.8	20.68	15.68	0.01568	1372.17248	169.20	1203	7.1
2	hr	25.1	27.61	22.61	0.02261	1978.62371	338.40	1640	9.7
3	hr	29.7	32.67	27.67	0.02767	2421.42937	507.60	1914	11.3
4	hr	33.5	36.85	31.85	0.03185	2787.22535	676.80	2110	12.5
6	hr	39.7	43.67	38.67	0.03867	3384.05037	1015.20	2369	14.0
9	hr	47.1	51.81	46.81	0.04681	4096.38993	1522.80	2574	15.2
12	hr	53.1	58.41	53.41	0.05341	4673.96252	2030.40	2644	15.6
18	hr	62.9	69.19	64.19	0.06419	5617.33109	3045.60	2572	15.2
24	hr	71	78.1	73.1	0.0731	6397.0541	4060.80	2336	13.8
2	day	84.5	92.95	87.95	0.08795	7696.59245	8121.60	-425	-2.5
3	day	95.6	105.16	100.16	0.10016	8765.10176	12182.40	-3417	-20.2
4	day	105.4	115.94	110.94	0.11094	9708.47084	16243.20	-6535	-38.6
6	day	122.7	134.97	129.97	0.12997	11373.80467	24364.80	-12991	-76.8
8	day	138	151.8	146.8	0.1468	12846.6148	32486.40	-19640	-116.1

30 Year Storm

Storm Duration		Rainfall (mm)	Rainfall + 10% (mm)	Excess Rainfall (mm)	Excess Rainfall (m)	Storm Water (m3)	Outflow (m3)	Required Storage (m3)	Time to Empty (hrs.)
5	min	8	8.8	3.8	0.0038	332.5418	14.10	318	1.9
10	min	11.2	12.32	7.32	0.00732	640.58052	28.20	612	3.6
15	min	13.2	14.52	9.52	0.00952	833.10472	42.30	791	4.7
30	min	17.6	19.36	14.36	0.01436	1256.65796	84.60	1172	6.9
1	hr	23.4	25.74	20.74	0.02074	1814.97814	169.20	1646	9.7
2	hr	33.2	34.32	29.32	0.02932	2565.82252	338.40	2227	13.2
3	hr	37	40.7	35.7	0.0357	3124.1427	507.60	2617	15.5
4	hr	41.7	45.87	40.87	0.04087	3576.57457	676.80	2900	17.1
6	hr	49.4	54.34	49.34	0.04934	4317.79274	1015.20	3303	19.5
9	hr	58.4	64.24	59.24	0.05924	5184.15164	1522.80	3661	21.6
12	hr	65.9	72.49	67.49	0.06749	5906.11739	2030.40	3876	22.9
18	hr	78	85.8	80.8	0.0808	7070.8888	3045.60	4025	23.8
24	hr	87.9	96.69	91.69	0.09169	8023.88359	4060.80	3963	23.4
2	day	102.4	112.64	107.64	0.10764	9419.68404	8121.60	1298	7.7
3	day	114.4	125.84	120.84	0.12084	10574.82924	12182.40	-1608	-9.5
4	day	125.1	137.61	132.61	0.13261	11604.83371	16243.20	-4638	-27.4
6	day	143.7	158.07	153.07	0.15307	13395.30877	24364.80	-10969	-64.8
8	day	160.2	176.22	171.22	0.17122	14983.63342	32486.40	-17503	-103.4

100 Year Storm

Storm Duration		Rainfall (mm)	Rainfall + 10% (mm)	Excess Rainfall (mm)	Excess Rainfall (m)	Storm Water (m3)	Outflow (m3)	Required Storage (m3)	Time to Empty (hrs.)
5	min	10.2	11.22	6.22	0.00622	544.31842	14.10	530	3.1
10	min	14.2	15.62	10.62	0.01062	929.36682	28.20	901	5.3
15	min	16.7	18.37	13.37	0.01337	1170.02207	42.30	1128	6.7
30	min	22.2	24.42	19.42	0.01942	1699.46362	84.60	1615	9.5
1	hr	29.5	32.45	27.45	0.02745	2402.17695	169.20	2233	13.2
2	hr	39.3	43.23	38.23	0.03823	3345.54553	338.40	3007	17.8
3	hr	46.5	51.15	46.15	0.04615	4038.63265	507.60	3531	20.9
4	hr	52.4	57.64	52.64	0.05264	4606.57904	676.80	3930	23.2
6	hr	62	68.2	63.2	0.0632	5530.6952	1015.20	4515	26.7
9	hr	73.3	80.63	75.63	0.07563	6618.45693	1522.80	5096	30.1
12	hr	82.6	90.86	85.86	0.08586	7513.69446	2030.40	5483	32.4
18	hr	97.7	107.47	102.47	0.10247	8967.25217	3045.60	5922	35.0
24	hr	110.1	121.11	116.11	0.11611	10160.90221	4060.80	6100	36.1
2	day	125.4	137.83	132.83	0.13283	11624.08613	8121.60	3502	20.7
3	day	138.7	152.02	147.02	0.14702	12865.86722	12182.40	683	4.0
4	day	149.4	164.56	159.56	0.15956	13963.25516	16243.20	-2280	-13.5
6	day	169.3	186.67	181.67	0.18167	15898.12337	24364.80	-8467	-50.0
8	day	187.5	206.25	201.25	0.20125	17611.58875	32486.40	-14875	-87.9

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WATER MANAGEMENT SYSTEM FOR

PROPOSED DEEPENING OF EXISTING QUARRY
AT
ROSSMORE, CARRIGTWOHILL, CO. CORK

Prepared on behalf of

LAGAN BITUMEN LTD.

Planning Department

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Report Ref 18968-3 Rev. 1.0
31st October 2013

1.0 Introduction

This report has been prepared to outline the design of the water treatment system to deal with water discharged from a proposed deepening of the existing Lagan Bitumen Ltd quarry at Rossmore. It is proposed that the water treatment system will be constructed in the lands to the east of the Lagan quarry to treat the water generated in the quarry. The proposed system will incorporate an attenuation pond, oil interceptors, two settlement lagoons and an infiltration pond. The design of the treatment system is described in this report. In particular, the design takes account of the worst-case potential impacts identified in the assessment.

2.0 Proposed surface and ground water management

The surface water management of the existing quarry is summarised in Drawing 8.1 of Chapter 8 of the EIS for the proposed development. The existing permitted development does not require groundwater dewatering since the excavations do not extend below the water table.

The proposed development comprises the continuation of the existing quarry activity and the deepening of the existing quarry floor by one bench to 20m below Ordinance Datum (OD) which will result in extending this section of the quarry below the water table. The features of the water management and treatment system are summarised as follows:

a) A surface water attenuation pond
b) Interceptors
c) A settlement pond system to settle out fine solids
d) An infiltration pond to recycle water back to the aquifer

Excess surface water from a 1/100 year storm will be managed by the construction of an attenuation pond, and discharged water will be treated in settlement ponds to

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remove suspended solids before return to the groundwater system by recharge through an infiltration pond. The expected volumes of storm water resulting from a 100-year return period event of 24 hours duration was chosen for designing the worst case attenuation volume. Details of the projected 1/100 year storm water volumes are presented in Appendix 8.7 of the EIS.

The area of the settlement lagoons has been designed to settle out particles of 0.004mm (fine silt) or greater with a residence time of 24 hours. The design philosophy is based on the following approach:

$$A = Q / v$$

Where:

A - Settlement Lagoon Area (m^2)
Q - Inflow/Outflow rate (m^3/s)
v - design settlement velocity (10-5 m/s)

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For the expected worst case scenario described in the EIS:

$A = 0.143 / 0.00001 = 14{,}300m^2$

Thus the total area of the settlement lagoons is chosen to cater for this worst case potential discharge volume. In practice as shown in the assessment, it is not expected that this volume of water will be generated to require settlement. It is of course prudent to ensure that the worst-case scenario is catered for but the likely discharge volumes are lower. Accordingly a phased approach to the design and installation of the settlement ponds is proposed. Two parallel settlement lagoons are proposed and it is proposed that the lagoons will be built in stages. The southern larger lagoon will be constructed initially and the monitoring infrastructure described in the EIS will be installed. If the monitoring data shows that a larger settlement lagoon is required, the second lagoon will be built. This approach would be subject

to agreement with the Local Authority and would be based on an interpretation of detailed monitoring data from the proposed monitoring programme. It is extremely unlikely that the worst-case scenarios would arise, and the phased approach will minimise land-take and removal of potential habitat for avian fauna.

Infiltration Trials were carried out to establish the infiltration rate and the Trials returned an estimated infiltration rate of 2.8m/d (section 8.4.5 of the EIS). As noted in section 8.4.5, a conservative design infiltration rate of 2.5m/d was chosen for the proposed infiltration pond. Based on the worst-case assessment of 143L/s discharged water requiring settlement and infiltration, an infiltration pond area of 4,942m^2 is required and proposed. Again it is highly unlikely that the worst-case impacts will be realised so the system is unlikely to operate at capacity.

In evaluating the potential worst-case impacts considered in the EIS, the design of the proposed surface water management system was chosen to cope with (a) the combined impact of the neighbouring Cemex and Lagan Bitumen Ltd quarries, (b) potential recycling of groundwater pumped from the quarry through the infiltration pond and (c) the potential impacts of a cessation in activity at the Cemex quarry. The net effect of these potential worst-case scenarios is a significant volume of water to be treated in the settlement ponds and infiltration pond which is summarised below.

a) The combined impact of the Cemex and Lagan Bitumen Ltd quarries could result in a slight extension of the radius of influence of the Lagan quarry with the potential for recycling of up to 50% of the discharge water from the infiltration pond. Thus the settlement pond and infiltration pond would have to be capable of managing up to 70.5 L/s.

b) Potential recycling of groundwater pumped from the quarry through the infiltration pond could result in requirement to treat up to 70.5L/s of water.

c) In the event that the Cemex operation ceased, Lagan would have to dewater both quarries and a treatment capacity of up to 95L/s would be required. If

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this scenario arose combined with the potential for an additional 50% of recycled infiltration water, a treatment capacity of up to 143L/s would be required. The proposed management system has the capacity to treat this volume of water if the worst-case scenarios arose.

d) The attenuation pond volume has been designed to deal with a 1/100 year event.

It is considered unlikely that these volumes will arise and require settlement and infiltration based on the assessments carried out. Nevertheless a water management system to manage these potentially large volumes of up to 143L/s of water is proposed as outlined in Drawing Reference 121_068_200-D23. There is enough space on lands in the ownership of the applicant and within the red-line planning boundary to accommodate the potential additional treatment capacity as shown on this Drawing. The system has more than sufficient capacity to treat the volume of water that could arise if the worst-case scenarios occurred.

Construction of the proposed water management system will follow standard engineering construction procedures. In summary, the required area will be excavated and berms will be constructed around the various lagoons and ponds to contain water. The ponds will be lined as outlined in section 8.4.10 of the EIS and Appendix 8.11 presents typical construction details and Quality Assurance procedures. In particular, piezometers will be installed around the perimeter of the ponds to check that the pond bases are sealed effectively, are not leaking and that the ponds are fit for purpose.

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Appendix 7.7

Manual Water Level dips and elevations

Table G1 Manual Dips for Water Level and Equivalent Elevations

	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)
MONITORING POINT	BHA	BH A	BHC	BHC	PW1	MW1	MW1	MW3	MW3
Easting	582898.74	582898.74	5826.54.45	5826.54.45	182474.0	582329.8	582329.81	582194.3	582194.3
Northing	571052.06	571052.06	571509.5	571509.49	71027.0	570883.1	570883.05	571501.1	571501.1
Elevation mOD (toc)	23.62	23.62	28.3	28.26	No Data	4.6	4.57	12.2	12.2
BH Depth (mbtoc)	48.84	48.84	51.92	51.92	42.41	74.17	74.17	80.22	80.22
BH Depth (mOD)	-25.22	-25.22	-23.7	-23.66	No Data	-69.6	-69.60	-68.0	-68.0
Date	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)
13/06/2018	22.55	1.07	23.31	4.95	3.58	6.35	-1.85	13.02	-0.82
30/08/2018	23.15	0.47	26.17	2.09	6.32	7.14	-2.64	15.59	-3.39
24/10/2018	23.74	-0.12	26.64	1.63	5.96	7.33	-2.83	18.44	-6.24
23/01/2019	22.24	1.39	22.72	5.54	3.73	6.28	-1.78	13.65	-1.45
29/03/2019	21.92	1.71	22.12	6.14	3.37	6.12	-1.62	13.26	-1.06
29/04/2019	21.92	1.71	22.12	6.14	3.37	6.12	-1.62	13.26	-1.06
23/07/2019	23.87	-0.24	24.91	3.36	5.58	6.91	-2.41	15.68	-3.48
12/12/2019	22.04	1.59	22.12	6.14	4.02	6.72	-2.22	13.77	-1.57
12/03/2020	21.76	1.87	22.17	6.09	-	6.55	-2.05	12.22	-0.02
04/06/2020	23.00	0.62	26.28	1.98	-	7.23	-2.73	15.62	-3.42
24/06/2020	22.96	0.67	26.70	1.56	-	7.05	-2.55	17.57	-5.37
21/07/2020	23.21	0.42	27.24	1.02	-	7.36	-2.86	16.75	-4.55
21/09/2020	22.72	0.90	26.49	1.77	-	6.93	-2.43	15.86	-3.66
11/11/2020	22.20	1.42	24.37	3.89	-	6.88	-2.38	14.05	-1.85
26/01/2021	22.05	1.57	23.95	4.31	-	6.95	-2.45	15.56	-3.36
29/04/2021	22.93	0.69	23.20	5.06	-	7.22	-2.72	18.46	-6.26
25/05/2021	22.40	1.22	24.73	3.54	-	7.08	-2.58	15.79	-3.59
29/06/2021	23.10	0.52	25.38	2.88	-	-	-	15.02	-2.82
15/07/2021	23.27	0.36	26.32	1.95	-	7.37	-2.87	15.64	-3.44
21/09/2021	23.67	-0.05	24.84	3.42	-	-	-	15.49	-3.29

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2021

Table G1 Continued Manual Dips for Water Level and Equivalent Elevations

	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)
MONITORING POINT	MW4	MW4	MW5a	MW5a	MW5b	MW5b	BH2*	BH2*	BH17	BH17	BH18	BH18	TW2	TW2
Easting	582450.7	582450.7	582325.9	582325.9	582325.9	582325.9	582515.37	582515.37	582390.364	582390.364	582374.27	582374.27	582400.998	582400.998
Northing	571483.1	571483.1	570884.9	570884.9	570884.9	570884.9	571143.67	571143.67	570809.416	570809.416	570801.18	570801.18	570822.104	570822.104
Elevation mOD (toc)	18.8	18.8	4.5	4.5	4.5	4.5	20.76	20.76	5.19	5.19	2.971	2.971	5.418	5.418
BH Depth (mbtoc)	84.95	84.95	50.52	50.52	23.50	23.50	92.67	92.67	26.09	26.09	13.69	13.69	52.80	52.80
BH Depth (mOD)	-66.2	-66.2	-46.0	-46.0	-19.0	-19.0	-71.9	-71.9	-20.9	-20.9	-10.7	-10.7	-47.39	-47.4
Date	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)	SWL (mbtoc)	WL Elevation (m OD)
13/06/2018	15.13	3.65	6.51	-2.01	6.43	-1.93	22.03	-1.27	5.70	-0.51	3.84	-0.87	5.88	-0.46
30/08/2018	17.80	0.97	7.09	-2.59	7.01	-2.51	23.63	-2.87	6.47	-1.28	4.33	-1.36	6.66	-1.24
24/10/2018	19.36	-0.59	7.38	-2.88	7.27	-2.77	23.77	-3.01	6.68	-1.49	4.55	-1.58	6.80	-1.38
23/01/2019	14.79	3.99	6.27	-1.77	6.25	-1.75	21.79	-1.03	5.52	-0.33	3.99	-1.02	5.58	-0.16
29/03/2019	14.16	4.61	6.13	-1.63	6.12	-1.62	21.32	-0.56	5.35	-0.16	3.66	-0.68	5.66	-0.24
29/04/2019	14.16	4.61	6.13	-1.63	6.12	-1.62	21.32	-0.56	5.35	-0.16	3.66	-0.68	5.66	-0.24
23/07/2019	19.69	-0.92	8.29	-3.79	8.29	-3.79	23.70	-2.94	7.49	-2.30	5.91	-2.93	8.92	-3.50
12/12/2019	14.95	3.82	6.70	-2.20	6.43	-1.93	22.50	-1.74	5.57	-0.38	4.16	-1.18	3.64	1.78
12/03/2020	14.22	4.55	6.10	-1.60	6.24	-1.74	22.77	-2.01	5.16	0.03	2.96	0.01	5.23	0.19
04/06/2020	17.97	0.80	6.99	-2.49	9.87	-5.37	24.63	-3.87	-	-	-	-	-	-
24/06/2020	18.87	-0.10	6.88	-2.38	6.77	-2.27	24.35	-3.59	8.75	-3.56	6.96	-3.98	5.96	-0.54
21/07/2020	18.88	-0.11	7.30	-2.80	7.01	-2.51	24.82	-4.06	9.15	-3.96	7.24	-4.26	6.11	-0.69
21/09/2020	18.15	0.62	6.91	-2.41	6.54	-2.04	25.30	-4.54	5.46	-0.27	3.30	-0.33	5.62	-0.20
11/11/2020	15.15	3.62	7.02	-2.52	5.57	-1.07	23.65	-2.89	5.58	-0.39	4.26	-1.29	3.78	1.64
26/01/2021	16.78	1.99	7.02	-2.52	6.63	-2.13	24.25	-3.49	5.69	-0.50	5.82	-2.85	5.27	0.15
29/04/2021	19.79	-1.02	7.17	-2.67	6.84	-2.34	26.67	-5.91	5.81	-0.62	3.54	-0.57	5.85	-0.43
25/05/2021	16.60	2.17	7.03	-2.53	6.72	-2.22	24.78	-4.02	5.67	-0.48	3.49	-0.52	5.76	-0.34
29/06/2021	17.14	1.63	-	-	-	-	-	-	-	-	-	-	-	-
15/07/2021	17.96	0.81	7.48	-2.98	7.18	-2.68	26.88	-6.12	6.22	-1.03	3.96	-0.99	6.29	-0.87
21/09/2021	17.26	1.51	7.32	-2.82	7.08	-2.58	25.17	-4.41	6.14	-0.95	6.38	-3.41	6.22	-0.80

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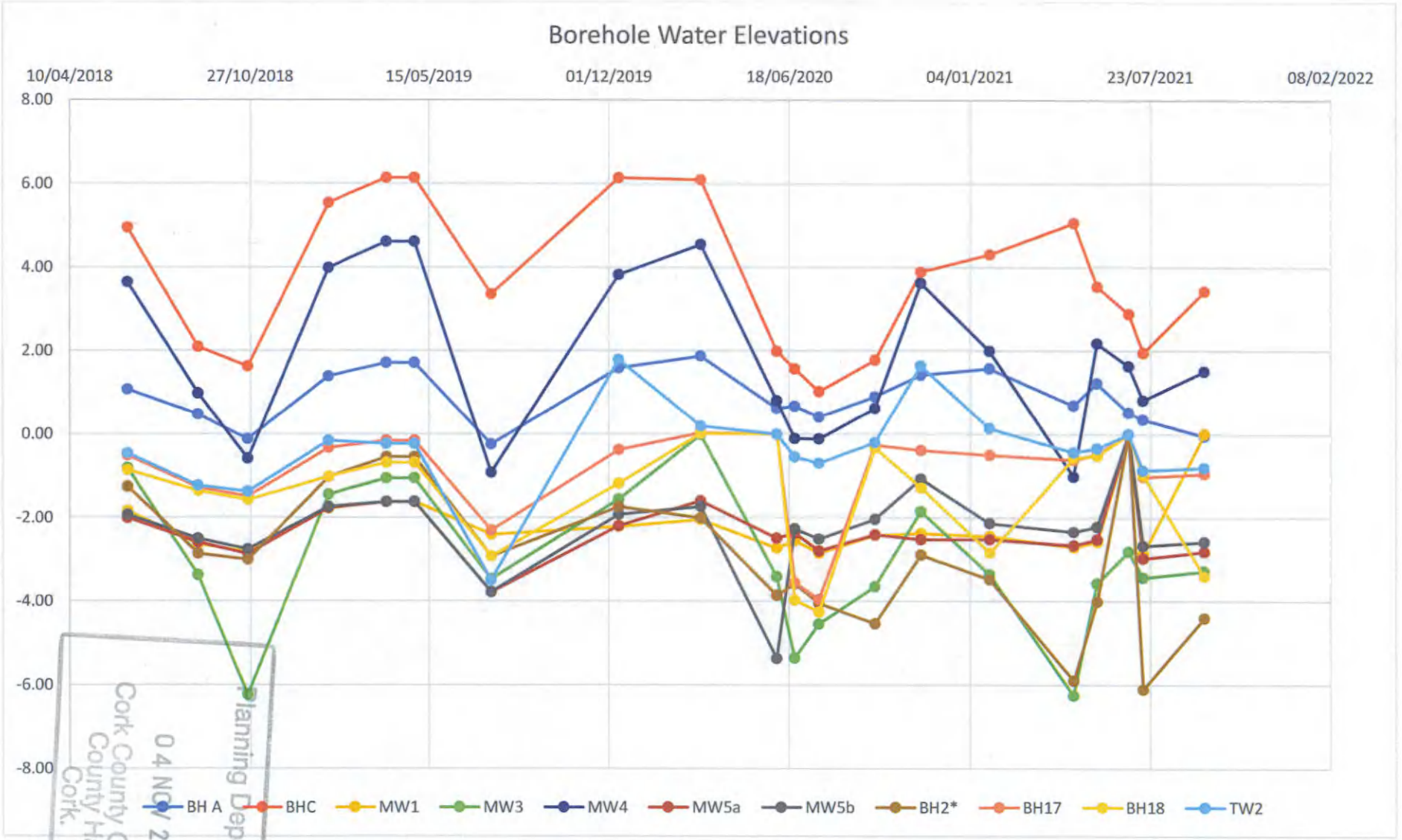

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Appendix 7.8

2021 Production Well Drilling Logs

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Figure Production Well Locations

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Hydro-G

Drilling ID:	**PW1 Rossmore 2021**
Site:	Lagan (Breedon Group) Quarry @ Rossmore, Carrigtwohill, Co. Cork
Site Location:	Townland = Rossmore
Hydro-G Project Ref:	21-P04 Rossmore Lagan
National Grid Co-ordinates:	Easting 582363.315; Northing 570948.452

Client:	Lagan (Breedon Group)
Date Drilled:	26/04/2021
Drilled By:	P Briody & Sons ltd. (Aidan Drilling)
Method:	DTH Hammer & Compressed Air flush with Atlas Compco Stand alone compressor.
Logged By:	Pamela Bartley
BH Location on Site:	Inside the area that was the sump previously, now has a work area.
BH GL Elevation (m OD)	minus 4 m OD
BH BASE Elevation (m OD)	minus 54m OD
Proposed Deepest Bench Elevation in Future (m OD)	minus 50m OD
Proposed Bench Depth at this location of the site	No future quarrying is planned here. This drill location is immediatley south of the 2021 proposed red line. This drill location is between the proposed work zone and the estuary, within the blue line.

Important Note: This is a BH Log created from Observations during drilling with a Rotary HAMMER Rig rather than Rotary CORE. This log is a description by a hydrogeologist with hydrology, hydrogeological and civil engineering expertise.

Depth (m bgl)	Elevation (m OD)	Description	Colour	Water Strike (m bgl)	Drill Diameter	Installation Details	Notes
0	-4				10" (250mm)	8" diameter Steel (1m AGL, 5m bgl)	
1	-5						
2	-6						
3	-7						
4	-8						
5	-9						Water Level 27/5/21 = 4 m bgl
6	-10						
7	-11						
8	-12						
9	-13						
10	-14						
11	-15						Curent permitted Level in the working floor @ 50m north of drill location (-20m OD)
12	-16						
13	-17						
14	-18						
15	-19						
16	-20						
17	-21	Solid Limestone	Pale GREY				
18	-22						
19	-23						
20	-24						
21	-25						
22	-26						
23	-27						
24	-28						
25	-29						
26	-30						
27	-31				8" (200mm)	OPEN HOLE TO BASE @ 50m bgl (-54m OD)	
28	-32						
29	-33						
30	-34						
31	-35						
32	-36						
33	-37						
34	-38						
35	-39						
36	-40	small CLAY Band	orange	180m3/d @ 37m bgl			Electrical Conductivity of BH Water Strike = 6,300 uS/cm
37	-41	300mm D SAND	BLUE / GREY				NOTE: EC of Estuary Water at the same time = 48,000 uS/cm
38	-42						
39	-43						
40	-44						
41	-45						
42	-46						
43	-47	Solid Limestone	Pale Grey				
44	-48						
45	-49						
46	-50						
47	-51						
48	-52						
49	-53	Dark Brown SAND	DARK BROWN				
50	-54						
END BH @ 50m bgl = minus 60m OD							

NO FUTURE QUARRYING HERE. PROPOSED 2021 Application FLOOR DEPTH TO THE NORTH OF THIS ZONE = to -50m OD

Notes:

PUMP TESTED 6th May 2021 = 6m3/hr = 144m3/d with WL @ 27m bgl

Water Level:	27/05/2021 = 4.71m bcl

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Hydro-G

Drilling ID:	**PW2 Rossmore 2021**
Site:	Lagan (Breedon Group) Quarry @ Rossmore, Carrigtwohill, Co. Cork
Site Location:	Townland = Rossmore
Hydro-G Project Ref:	21-P04 Rossmore Lagan
National Grid Co-ordinates:	Easting 582402.109; Northing 571061.218
Client:	Lagan (Breedon Group)
Date Drilled:	27/04/2021
Drilled By:	P Briody & Sons ltd. (Aidan Drilling)
Method:	DTH Hammer & Compressed Air flush with Atlas Compco Stand alone compressor.
Logged By:	Pamela Bartley
BH Location on Site:	On the Floor, SE corner of the working area
BH GL Elevation (m OD)	(-18.5 m OD)
BH BASE Elevation (m OD)	(-54m OD)
Proposed Deepest Bench Elevation in Future (m OD)	(-50m OD)
Proposed Bench Depth at this location of the site	Quarry Floor, Working Floor at Present. Propose two more Benches = 30m further into the floor from permitted -20m OD = -50m OD.

Important Note: This is a BH Log created from Observations during drilling with a Rotary HAMMER Rig rather than Rotary CORE. This log is a description by a hydrogeologist with hydrology, hydrogeological and civil engineering expertise.

Depth (m bgl)	Elevation (m OD)	Description	Colour	Water Strike (m bgl)	Drill Diameter	Installation Details		Water Level after Drilling (m bgl)	Notes
0	-19	Solid Limestone	Pale GREY		10" (250mm)		6" diameter Steel (1m AGL, 2m bgl)	0.3	Water here is floor water, cracked rock floor, machines, rainfall
1	-20								
2	-21								Curent permitted Level in the working floor = -20m OD
3	-22								
4	-23								
5	-24								
6	-25								
7	-26								
8	-27								
9	-28								
10	-29								
11	-30								
12	-31								Electrical Conductivity of Borehole Water Strike = 4,800 uS/cm Brackish Groundwater
13	-32								
14	-33								NOTE: EC of Estuary Water at the same time = 48,000 uS/cm
15	-34	Soft Limestone with SAND bands	Creamy White						
16	-35								
17	-36								
18	-37								
19	-38				8" (200mm)		OPEN HOLE TO BASE 53m below Sea Level (-53mOD)		
20	-39								
21	-40								
22	-41								
23	-42								
24	-43								
25	-44								
26	-45								
27	-46								
28	-47								
29	-48	SAND BAND	CREAM						
30	-49								
31	-50								2021 Application PROPOSED FLOOR DEPTH @ -50m OD
32	-51	Soft Limestone	Cream						
33	-52								
34	-53								
END BH @ 34m bgl = minus m OD									

Limestone cannot transmit the water. Yield = very low. Water Level Bottoms out.

Notes:

PUMP TESTED 10th May 2021 = <2m3/hrYIELD = 45m3/d with WL @ 27m bgl (bottomed out)

Water Level:	27/05/2021 = 0.8m bcl

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Drilling ID:	**PW3 Rossmore 2021**
Site:	Lagan (Breedon Group) Quarry @ Rossmore, Carrigtwohill, Co. Cork
Site Location:	Townland = Rossmore
Hydro-G Project Ref:	21-P04 Rossmore Lagan
National Grid Co-ordinates:	Easting 582328.268; Northing 571275.845

Client:	Lagan (Breedon Group)
Date Drilled:	26/04/2021
Drilled By:	P Briody & Sons ltd. (Aidan Drilling)
Method:	DTH Hammer & Compressed Air flush with Atlas Compco Stand alone compressor.
Logged By:	Pamela Bartley
BH Location on Site:	In the norhtern part of the working area.
BH GL Elevation (m OD)	0 m OD
BH BASE Elevation (m OD)	minus 75m OD
Proposed Bench Depth at this location of the site	minus 50m OD

Important Note: This is a BH Log created from Observations during drilling with a Rotary HAMMER Rig rather than Rotary CORE. This log is a description by a hydrogeologist with hydrology, hydrogeological and civil engineering expertise.

Depth (m bgl)	Elevation (m OD)	Description	Colour	Water Strike (m bgl)	Drill Diameter	Installation Details	Water Level (m bcl)	Notes
0	0				10" (250mm)	8" diameter Steel (1m AGL, 5m bgl)		
1	-1							
2	-2							
3	-3							
4	-4							
5	-5							
6	-6							
7	-7							
8	-8							
9	-9							
10	-10							
11	-11							
12	-12							
13	-13							
14	-14							
15	-15							
16	-16						15.8	
17	-17							
18	-18							Adjacent area has a floor level here at 19m OD, immediately South of
19	-19							
20	-20							
21	-21							Curent permitted Level in the working floor @ 80m sorth of
22	-22							
23	-23							
24	-24							
25	-25	Solid Limestone	Pale GREY					
26	-26							
27	-27							
28	-28							
29	-29							
30	-30							
31	-31							
32	-32							
33	-33							
34	-34							
35	-35							No Water Strikes above proposed floor level of -50m OD
36	-36							
37	-37							
38	-38							
39	-39							
40	-40				8" (200mm)	OPEN HOLE TO BASE @ 75m bgl (-75m OD)		
41	-41							
42	-42							
43	-43							
44	-44							
45	-45							
46	-46							
47	-47							
48	-48							
49	-49							
50	-50							2021 Application PROPOSED FLOOR DEPTH @ -50m OD
51	-51							
52	-52							
53	-53	broken rock with CLAY	brown	24m3/d @ 37m				Electrical Conductivity of Borehole Water Strike = 1,625 uS/cm
54	-54							NOTE: EC of Estuary Water at the same time = 48,000 uS/cm
55	-55							
56	-56							
57	-57							
58	-58	Solid Limestone	Pale Grey					
59	-59							
60	-60							
61	-61							
62	-62							
63	-63	Sand Layer	Blue Grey	100m3/d @62m				
64	-64							
65	-65							
66	-66							
67	-67							
68	-68							
69	-69							
70	-70	Solid Limestone	Pale Grey	Additional Water (Total at END of BH) = 300m3/d MAYBE (i.e. Drilling estimate)				
71	-71							
72	-72							
73	-73							
74	-74							
75	-75							

END BH @ 50m bgl = minus 60m OD

PROPOSED 2021 Application FLOOR DEPTH -50m OD

Notes:

TESTED 12th May 2021 = 10m3/hr = 240m3/d

Water Level: 27/05/2021 = 15.66m bcl

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Appendix 7.9

Pump Test Results

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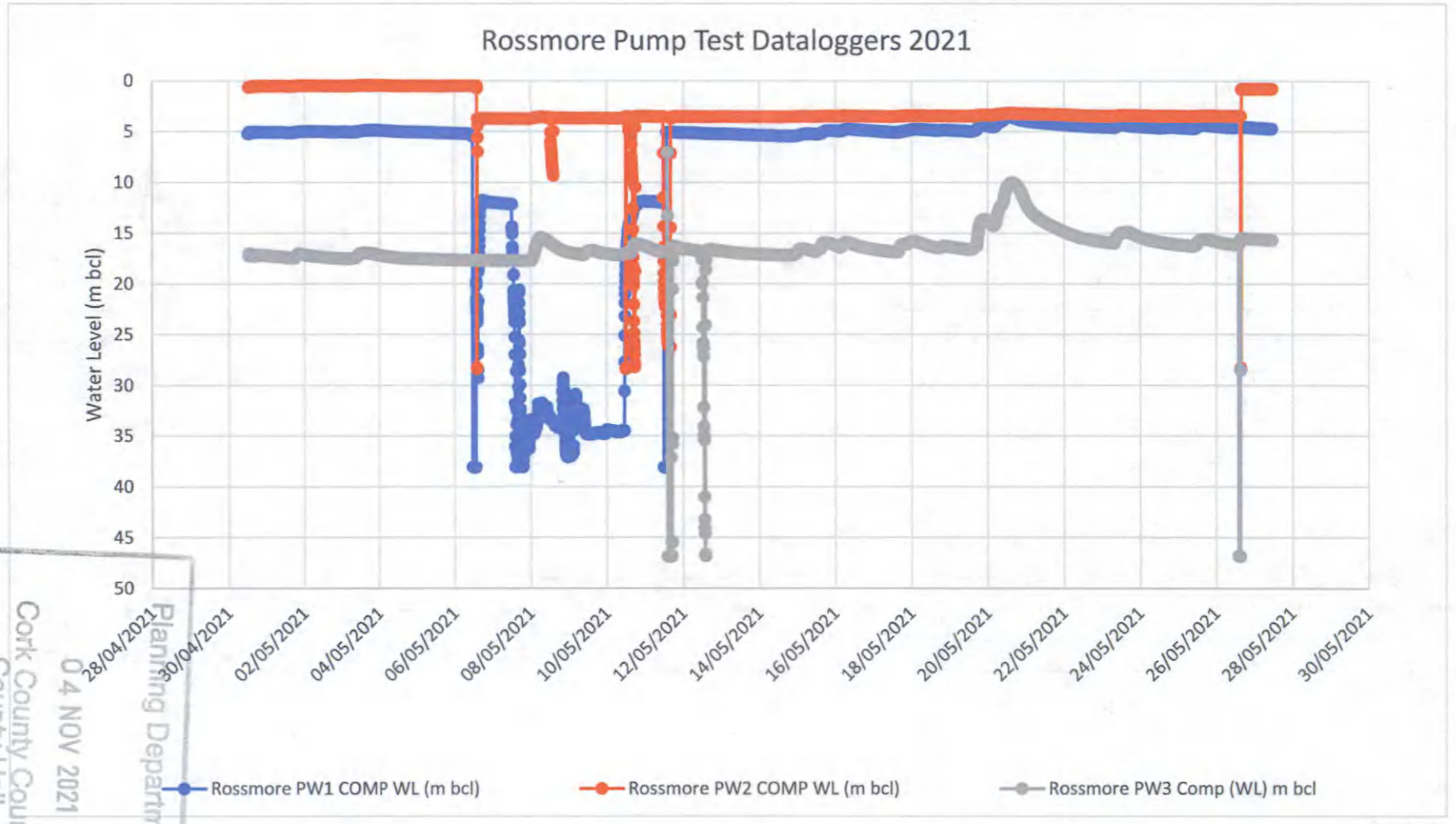

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Lagan Rossmore PW1 Step test 6th May

Time	W.L.	Flow p/h	M.R.						
11:45	5.4m	0m3	43855.27						
12:00	5.4m	4m3	43855.27						
12:30	10.7m	4m3	43858.30						
13:00	10.8m	8m3	43860.86						
13:30	15.4m	8m3	43865.34						
14:00	19.2m	12m3	43868.25						
14.30	33m	12m3	43874.06						
14:35	33m	0m3		Pump Off					

PW1 Continuous Test 7th to 10th May

Time	W.L	Flow	M.R.	Date					
16:30	14m	6m3	43884.28	7th					
11:45	26m	8m3	44032.69	8th					
14:20	26.8m	8m3	44053.11	8th					
11:00	27.8m	8m3	44396.50	10th					
11:15				10th	Pump Off				

@ 8m3 per hour, still dropping 0.5m/d

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PW2 Step Test 10th May 2021

Time	W.L.	Flow	M.R.		Conductivity				
13:30	1m	0m3	12684						
13:45	1m	1m3	12684		4.5				
14:30	1.9m	2m3	12685		4.9				
15:15	2.75	3m3	12687		3.5				
16:00	7m	4m3	12689.7		3.5				
16:45	17.6m	5m3	12692.4		3.4				
15:30	25.6m	5m3	12697.1		3.59				
15:45	Bottomed out	5m3		Pump off					

Well capacity <3m3 per hour

PW2 Continuous test 11th May (day)

Time	W.L	Flow	M.R.	Date					
11:25	1m	3.5m3	12694	11th					
15:40	23.7m3	3.5m3	12708	11th					
15:45	Pump Off								

PW3 Step Test 12th

Time	W.L.	Flow	M.R.	conductivity					
11:00	16.4m	0m3	44411.56						
11:30	16.4m	3m3	44411.56	1.98					
12:00	19.6m	6m3	44412.13	2.13					
12:30	26m	9m3	44415.36	2.01					
13:00	34.4	12m3	44420.16	2.08					
13:30	43m	15m3	44425.68	1.97					
13:32	Bottomed out	15m3							
13:40	Pump off								

Estimated 10m3 per hour yield in PW3

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Pump test Summary data sheet (2015 EIS)

Refer to EIS (2015) Appendices for more details

Summary of Aquifer Parameters derived from Pumping Tests

Pumping Test 1

	TW1	PW1	BH13	BH14	BH9	RC2	BH12	BH7	BH6	BH15	BH10	BH5	BH3	BH2	BH16	MW2	MW5
Radial Distance (m)	0	5.5	17.07	22.68	23.09	29.09	35.73	36.86	54.59	58.89	61.82	66.44	66.45	102.61	103.86	146.07	229.68
Saturated Thickness (m)	24	60	19	23	8	19	5	14	5	-	11	13	61	62	-	62	-
T (m^2/d) - Pumping	5.8	8.87	28.35	127.56	3.51	182.9	5.96	15.62	15.31		25.18	7.41	24.22	75.04	-	170.08	-
K (m/d) - Pumping	0.24	0.06	1.49	5.55	0.44	8.97	1.16	1.12	3.06	-	2.29	0.57	0.40	1.21		2.74	
S (-)	-	0.082	-	0.085	0.002	-	0.001	0.006	0.003	-	0.001	0.002	0.001	0.0022	-	0.003	-
T (m^2/d) - Recovery	3.07	7.79	19.33	133.35	5.35		8.99	-	-		10.41	-	34.29	89.71	-	169.67	-
K (m/d) - Recovery	0.09	0.13	1.02	5.80	0.67	-	1.49	-	-		3.40	-	0.55	1.44		2.67	-

Pumping Test 2

	TW1	PW1	BH13	BH14	BH9	RC2	BH12	BH7	BH6	BH15	BH10	BH5	BH3	BH2	BH16	MW2	MW5
Radial Distance (m)	0	5.5	17.07	22.68	23.09	29.09	35.73	36.86	54.59	58.89	61.82	66.44	66.45	102.61	103.89	146.07	229.68
Saturated Thickness (m)	21.5	60.5	18.7	22.8	6.7	18.4	5.1	14.5	4	-	10.5	12	60.5	61	-	61.8	-
T (m^2/d) - Pumping	1.64	3.16	11.28	234.28	4.22	186	5.75	16.65	10.17		19.89	16.22	20.14	44.23	-	168.23	-
K (m/d) - Pumping	0.32	0.07	0.70	10.28	0.63	10.11	1.13	1.15	2.54		1.89	1.35	0.33	0.73		2.72	-
S (-)	-	0.006	-	0.06	0.002	-	0.001	0.017	0.004	-	0.001	0.004	0.001	0.0026	-	0.003	-
T (m^2/d) - Recovery	1.07	9.03	15.44	119.35	4.58	184.6	6.85		7.49		22.03	30.12	24.9	69.89	-	221.37	-
K (m/d) - Recovery	0.05	0.12	0.83	5.23	0.68	7.81	1.25	-	1.80	-	2.57	2.51	0.41	1.08	-	3.58	-

Short Test on TW2

	TW2	BH18
Radial Distance (m)	0.075	34.2
Saturated Thickness (m)	42.2	13.6
T (m^2/d) - Pumping	250.55	389.75
K (m/d) - Pumping	5.94	28.66
S (-)	-	0.0004
T (m^2/d) - Recovery	277.19	
K (m/d) - Recovery	6.57	

Pumping Test 3

	TW3	TW2	RC1	BH17	BH18
Radial Distance (m)	0.1	4.1	13.2	20.3	37.6
Saturated Thickness (m)	34	44.6	19.6	19.9	13.9
T (m^2/d) - Pumping	11.31	337.53	451.3	505.24	586.4
K (m/d) - Pumping	0.33	7.57	23.03	25.39	42.18
S (-)	-	0.036	0.005	0.003	0.001
T (m^2/d) - Recovery	5.97	281.38	334.7	478.37	472.6
K (m/d) - Recovery	0.18	6.31	17.08	24.04	34.00

Pumping Test 4

	TW3	TW2	RC1	BH17	BH18
Radial Distance (m)	0.1	4.1	13.2	20.3	37.6
Saturated Thickness (m)	20	44.5	19.5	19.8	13.8
T (m^2/d) - Pumping	8.91	317.46	477.4	542.66	825.5
K (m/d) - Pumping	0.45	7.13	24.48	27.41	59.83
S (-)	-	0.065	0.006	0.003	0.001
T (m^2/d) - Recovery	7.05	261.56	294.6	410.95	472.1
K (m/d) - Recovery	0.35	5.88	15.11	20.76	34.21

Notes:
Radial Distance - distance between pumping well and observation point
Saturated Thickness - depth of water in borehole at end of pumping test
T - Transmissivity (m^2/d)
K - Hydraulic Conductivity (m/d)
S - Storativity (unitless)

Planning Department
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Cork County Council
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Cork.