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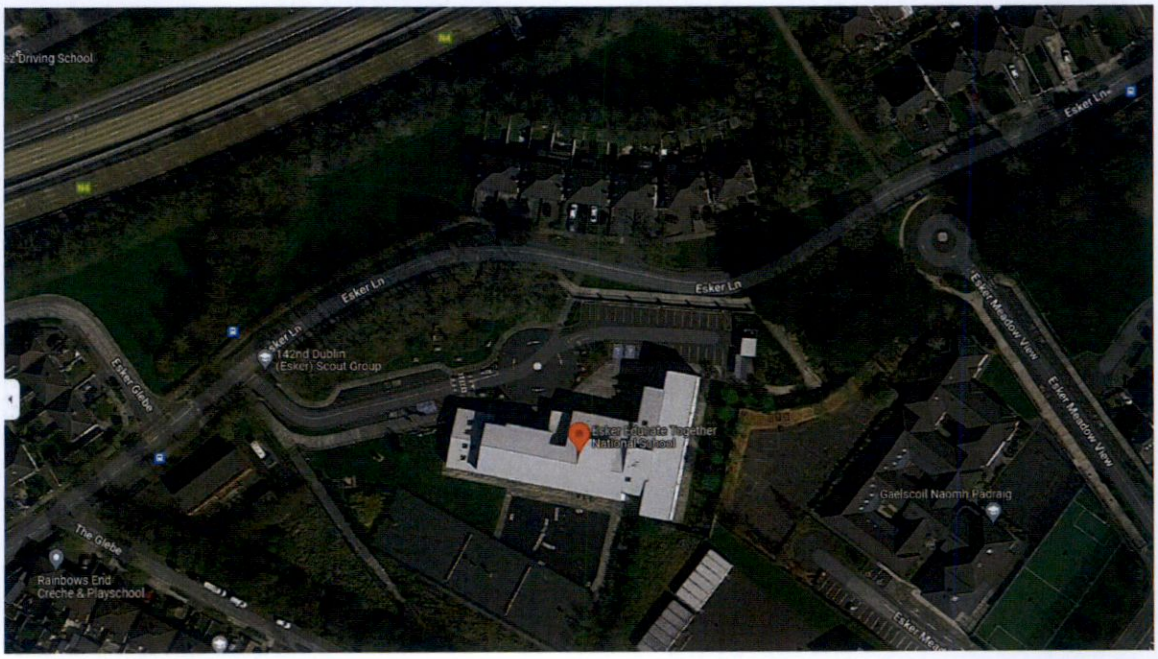
Register Reference :	SD22A/0461
PROJECT:	Esker Educate Together National School, The Glebe, Esker Lane, Lucan, Co. Dublin, K78 N239
PROJECT NO:	21.135
DOCUMENT TITLE:	Surface Water Attenuation Calculation and Reports FI



SURFACE WATER ATTENUATION CALCULATION EXISTING

The surface water attenuation calculation for the existing development is shown in Appendix 1. The existing tank is 440 m^3 and location of the tank shown in the drawing .

SURFACE WATER ATTENUATION CALCULATION FOR PROPOSED DEVELOPMENT

The surface water calculated for 1.25 hectare and sub divided the area into surface water types such as roofs, concrete paths , tarmac etc in m^2 shown in table 1.1 . The new calculation is done for a new two storey extension linked to the existing primary school consisting of a new 2 Class base Special Educational Needs the ground floor area is 532.5 m^2 show in appendix 1.

In infiltration test carried out in trial pit TPP01B, the absence of outflow from the pit 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.

AREA CALCULATION	
Roof	2057.82 M²
Concrete Path	1571.38 M²
Tarmac	2389.76 M²
Paving	129.3 M²
Grass	1464.69 M²
Hedgerow Area	1872.03 M²
Permeable Paving Area	1324.43 M²
Garden Area	426.73 M²
Wet Pour Safety Surface Play area	581.88 M²

Table 1.1

Resolute Group

INPUTS

Project Name	Esker ETNS Lucan
Project Reference	JN230198
Date	15-Mar-23
Designer	LP
Liner	Permeable
Chamber Model	SC740
Required Storage Volume	457 m^3
Stone Porosity	43%
Excavation Batter	60 °
Stone Above Chambers	0.15 m
Stone Foundation Depth	0.15 m
Chamber Seperation	0.15 m
Spacing at Sides	0.4 m
Spacing at Ends	0.4 m
No. of Rows	12
No. of Chambers per Row	16
Manholes - 1500mm dia.	1
Isolator Rows	1

RESULTS

System Volume and Bed Size

Installed Storage Volume	456.9 m^3
Height per Chamber	0.762
Width per Chamber	1.295
Length per Chamber	2.169
Depth of System	1.062 m
Tank Overall Installed Width at Base	18.0 m
Tank Overall Installed Length at Base	35.9 m
Area of Dig at Base of System	646 m^2
Area of Dig at Top of System	714 m^2

System Components

Chambers	192
Endcaps	24
Amount of Stone Required (m3)	474 m^3
Amount of Stone Required (tonne)	777 m^3
Volume of excavation (not including top-fill)	722 m^3
Volume within manhole	0 m^3

v2-01/22

ADDITIONAL WATER ATTENUATION :- RAIN GARDEN

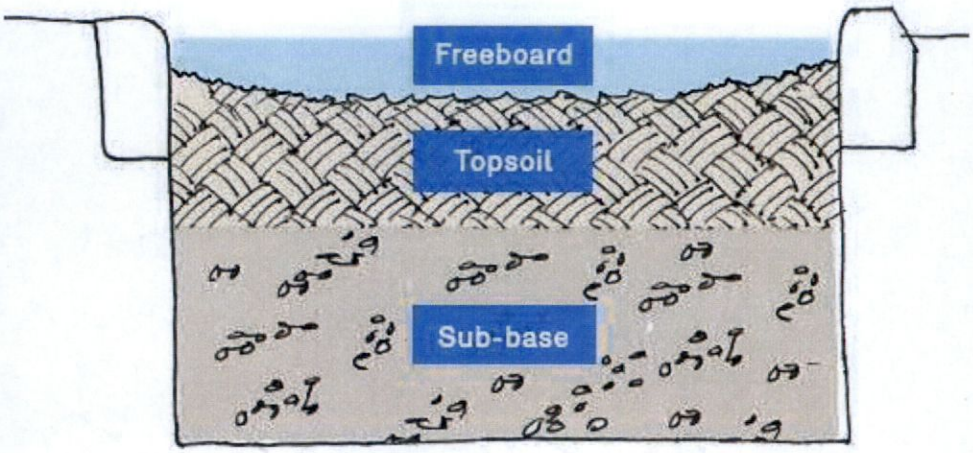
The requirement of 460m3 attenuation storage on the site to serve a 100year rainstorm event with climate change allowance with current available attenuation of 440m3 in the attenuation tank/cells with a short fall of 20m3 to be catered for using a small water garden Should be done as in series storage. The main attenuation storage of 440m3 would be allowed fill with the tide flex controlling the outflow to the green field flood runoff rate. Once the attenuation storage is nearing full a pipe connection to the rain garden provides pathway for the rainwater to flow into the rain garden where it can store. Over time this 20m3 of storage will infiltrate away to ground be it a relatively low rates.

This overflow and rain garden would be seldom used given that the main storage of 440m3 has to fill first of all However the levels in the rain garden should be set so that a gravity flow into the top level of the rain garden is available and that the 20m3in the garden is available below this level to fill. High or perched water table could prevent the garden from draining but given that the attenuation storage at 440m3 is at the same height then water table level must be lower .

The selection of soils and sub-soils to develop this bunded / depressional garden area should be somewhat free draining and compaction of soils avoided so that a permanent pond does not develop

The frequency that storm water will back flow into the rain garden is very low as 20m3 represents only 4.5% of the volume and the difference in volume between 50year and 100year rainstorm event is over 10%

CALCULATION OF RAIN GARDEN DEPTH SIZE



Freeboard :- The freeboard provides potential water storage space, above the topsoil. The freeboard depth is measured from the carriageway or footpath level to the top of the top soil. Freeboard depth of 200-300mm to encourage water to flow into rain garden and to accommodate silt accumulation and build up pf leaf litter.

Topsoil :- Topsoil usually consists of a mixture of soil, sand and compost. Soil permeability can be specified according to the ratio of these three components. Rain gardens often have a sandier soil composition than normal to allow faster infiltration. A ratio of approximately 50% sand, 30% topsoil and 20% compost will be suitable for most plants, although not all plants cope well in sandy soil conditions.

A minimum depth of 300mm of topsoil is recommended for shrubs and herbaceous plants. A shallower depth of 200mm can be considered for rain gardens that will be turfed or seeded with wildflowers.

A layer of mulch should be added to planted rain gardens to help suppress weeds and reduce competition for water and nutrients whilst the planting becomes established.

Sub-base :- The sub-base should be 100-500mm deep. The depth of sub-base will vary depending on the required storage capacity and budget. A deeper sub-base will help store more water. Typically the sub-base will be 100-500mm deep, and a minimum depth of 100mm is recommended in most instances. In the instance where the sub-soil is free draining or the catchment area is small it may be considered appropriate to eliminate the sub-base layer entirely.

Depth of Rainfall in Lucan , Dublin for 1 in 100 year event is 41.6 mm in 60 minute.

Considering 1 in 100 year event 50mm depth of rainfall, rainfall design events based on a 60 minute duration storm .

Catchment area of new roof extension = 533 m^2

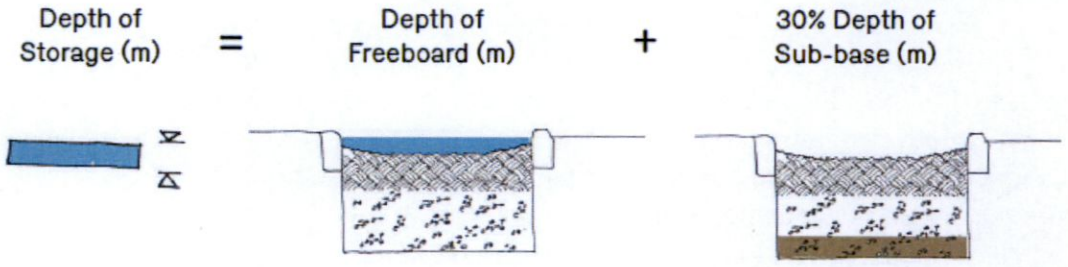
Volume of rain fall (m^3) = Depth of Rainfall (m) x Catchment Area (m^2)

= 50 mm x 533 m^2

= <u>26.65 m^3</u>

Volume of storage (m^3) = Depth of storage (m) x Area of Rain Garden (m^2)

<u>Depth of Storage</u>



Only 30% of the depth of sub-base is used because this is the typical porosity of the gravel layer, i.e. 30% of gravel volume is space available for storing water

Depth of storage (m) = Depth of Freeboard (m) + 30% depth of sub - base (m)

= 0.2 m + 30% of .6m

= <u>.38m</u>

Volume of storage (m^3) = Depth of storage (m) + Area of Rain garden

= .38 m X 80

= <u>30.4 m^3</u>

Which is above than the recommended attenuation capacity of 26.65 m^3

Rain Garden Measurements

Area = 80 m²

Depth = 0.8 m

Volume = 64 m³ , Rainwater attenuation Volume = 30.4 m³

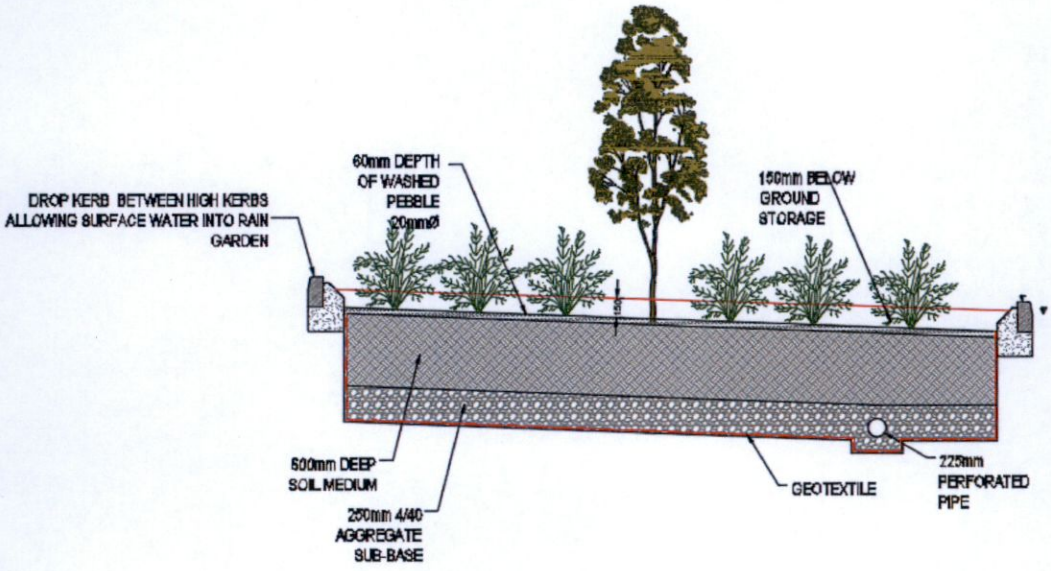


Fig.1 Rain Garden System

Resolute Engineering Group Ltd		Page 1
1a Moyne Road Baldoyle Co. Dublin, D13 YV4X	Esker ETNS Lucan 100YRP+20% 2.5 l/s	
Date 23/03/2023 11:31 File	Designed by STORMTECH SC740 Checked by LP	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 1623 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.297	0.297	0.0	2.4	2.4	129.2	O K
30 min Winter	0.409	0.409	0.0	2.4	2.4	178.1	O K
60 min Winter	0.526	0.526	0.0	2.4	2.4	229.2	O K
120 min Winter	0.655	0.655	0.0	2.4	2.4	285.1	O K
180 min Winter	0.734	0.734	0.0	2.4	2.4	319.5	O K
240 min Winter	0.791	0.791	0.0	2.4	2.4	344.5	O K
360 min Winter	0.870	0.870	0.0	2.4	2.4	379.0	O K
480 min Winter	0.924	0.924	0.0	2.4	2.4	402.3	O K
600 min Winter	0.962	0.962	0.0	2.4	2.4	419.1	O K
720 min Winter	0.991	0.991	0.0	2.4	2.4	431.6	O K
960 min Winter	1.028	1.028	0.0	2.4	2.4	448.0	O K
1440 min Winter	1.060	1.060	0.0	2.5	2.5	461.6	O K
2160 min Winter	1.055	1.055	0.0	2.5	2.5	459.7	O K
2880 min Winter	1.041	1.041	0.0	2.4	2.4	453.5	O K
4320 min Winter	0.987	0.987	0.0	2.4	2.4	429.8	O K
5760 min Winter	0.919	0.919	0.0	2.4	2.4	400.1	O K
7200 min Winter	0.845	0.845	0.0	2.4	2.4	368.3	O K
8640 min Winter	0.769	0.769	0.0	2.4	2.4	335.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	87.705	0.0	123.3	26
30 min Winter	60.634	0.0	167.9	41
60 min Winter	39.339	0.0	231.8	70
120 min Winter	24.830	0.0	291.7	128
180 min Winter	18.804	0.0	329.0	186
240 min Winter	15.417	0.0	355.4	244
360 min Winter	11.615	0.0	379.1	362
480 min Winter	9.488	0.0	379.6	478
600 min Winter	8.106	0.0	376.7	594
720 min Winter	7.126	0.0	373.4	708
960 min Winter	5.812	0.0	367.6	936
1440 min Winter	4.360	0.0	360.7	1376
2160 min Winter	3.268	0.0	696.1	1796
2880 min Winter	2.661	0.0	729.4	2224
4320 min Winter	1.989	0.0	682.3	3160
5760 min Winter	1.617	0.0	930.8	4096

7200 min	Winter	1.377	0.0	990.0	4984
8640 min	Winter	1.207	0.0	1040.8	5888

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	0.684	0.684	0.0	2.4	2.4	298.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.080	0.0	1085.0	6768

Resolute Engineering Group Ltd		Page 3
1a Moyne Road Baldoyle Co. Dublin, D13 YV4X	Esker ETNS Lucan 100YRP+20% 2.5 l/s	
Date 23/03/2023 11:31 File	Designed by STORMTECH SC740 Checked by LP	
Innovyze	Source Control 2020.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.700	Shortest Storm (mins)	15
Ratio R	0.276	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.715

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.2384	4	8	0.2388	8	12	0.238

Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	726.0		1.200	726.0	845.2
1.100	726.0	845.2			

Hydro-Brake® Optimum Outflow Control

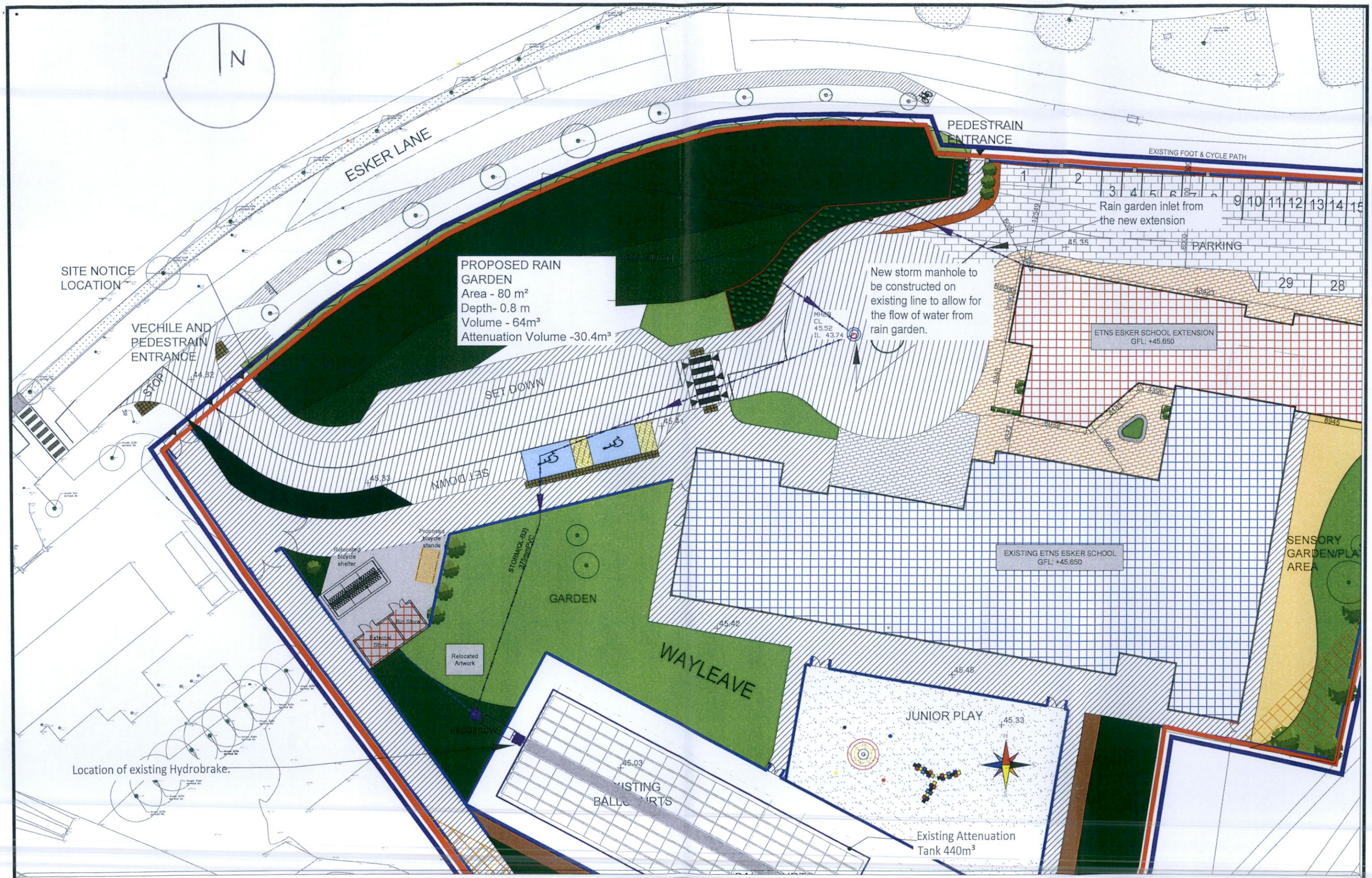
Unit Reference	MD-SHE-0074-2500-1100-2500
Design Head (m)	1.100
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	74
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	2.5	Kick-Flo®	0.658	2.0
Flush-Flo™	0.326	2.4	Mean Flow over Head Range	-	2.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	2.6	3.000	4.0	7.000	5.9	0.200	
	2.4	1.400	2.8	3.500	4.3	7.500	6.1	0.300	
	2.4	1.600	3.0	4.000	4.5	8.000	6.3	0.400	
	2.4	1.800	3.1	4.500	4.8	8.500	6.5	0.500	
	2.4	2.000	3.3	5.000	5.0	9.000	6.7		
0.600		2.200		3.500		9.500	6.8		
0.800		2.400		3.666	5.5				
1.000		2.600		3.766	5.7				

APPENDIX 1



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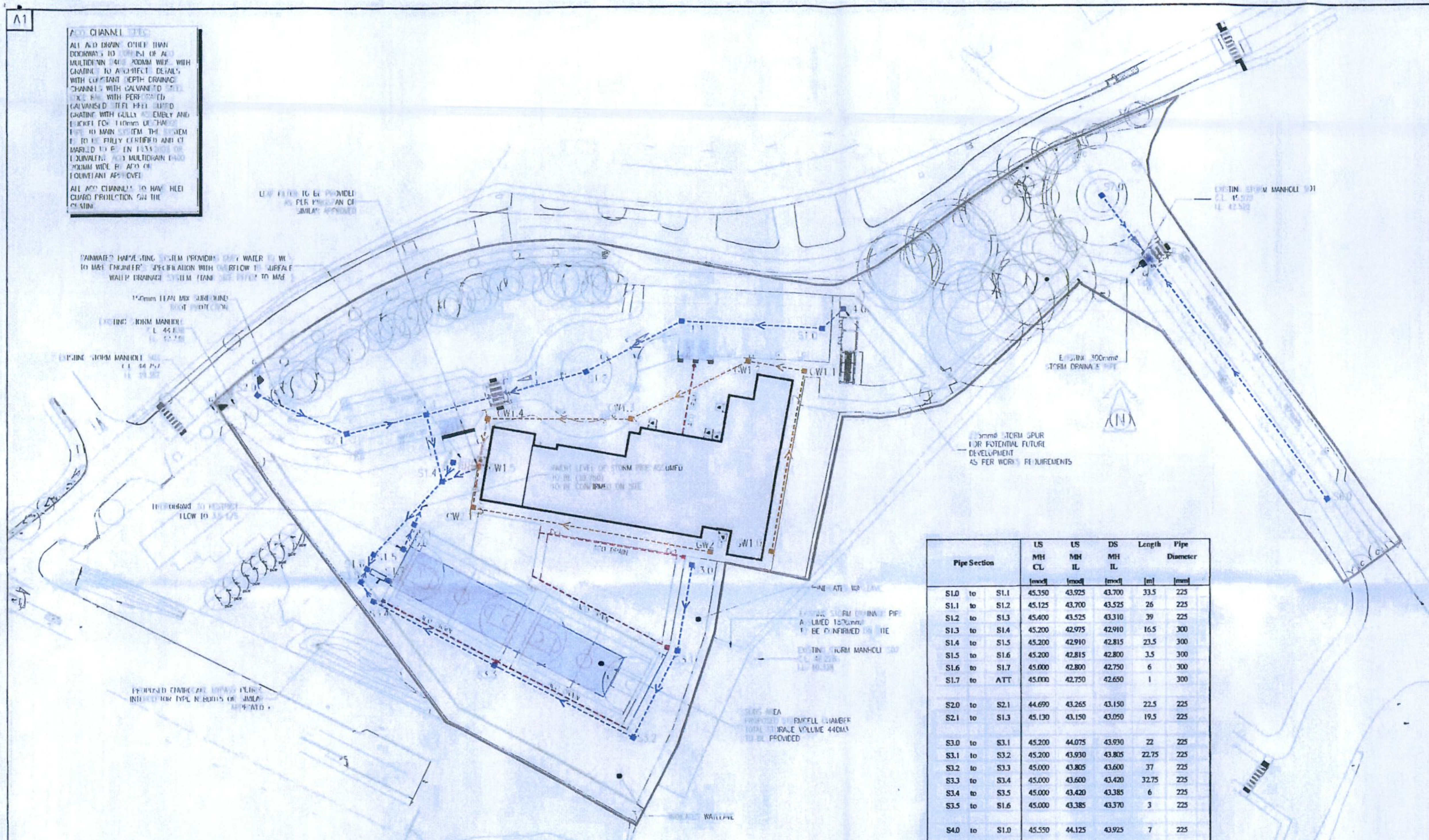
Client:
BoM Esker Educate Together National School , Esker Lane

Drawing Title:
Proposed Rain Garden

Job Title:
Proposed Additional Accommodation Scheme to Esker Educate Together National School , Esker Lane

Status: Further Information
Date: May 2023
Scale: 1:200 @ A1
Drawn by: SAM

JOB No.	DRG No.	REV.
21.135	213A	FI



Pipe Section			US MH CL	US MH IL	DS MH IL	Length	Pipe Diameter
			[mod]	[mod]	[mod]	[m]	[mm]
S1.0	to	S1.1	45.350	43.925	43.700	33.5	225
S1.1	to	S1.2	45.125	43.700	43.525	26	225
S1.2	to	S1.3	45.400	43.525	43.310	39	225
S1.3	to	S1.4	45.200	42.975	42.910	16.5	300
S1.4	to	S1.5	45.200	42.910	42.815	23.5	300
S1.5	to	S1.6	45.200	42.815	42.800	3.5	300
S1.6	to	S1.7	45.000	42.800	42.750	6	300
S1.7	to	ATT	45.000	42.750	42.650	1	300
S2.0	to	S2.1	44.690	43.265	43.150	22.5	225
S2.1	to	S1.3	45.130	43.150	43.050	19.5	225
S3.0	to	S3.1	45.200	44.075	43.930	22	225
S3.1	to	S3.2	45.200	43.930	43.805	22.75	225
S3.2	to	S3.3	45.000	43.805	43.600	37	225
S3.3	to	S3.4	45.000	43.600	43.420	32.75	225
S3.4	to	S3.5	45.000	43.420	43.385	6	225
S3.5	to	S1.6	45.000	43.385	43.370	3	225
S4.0	to	S1.0	45.550	44.125	43.925	7	225
S5.0	to	S5.1	45.200	42.550	42.510	6.2	225
S5.1	to	EX	45.200	39.880	39.750	4.75	225
S6.0	to	S6.1	45.905	44.480	43.920	71.25	225
S6.1	to	EX MH	45.675	43.920	43.880	5.25	225
S7.0	to	S6.1	45.500	44.075	43.920	18.75	225
GW1.0	to	GW1.1	45.200	44.225	44.005	43.75	225
GW1.1	to	GW1.2	45.200	44.005	43.935	13.75	225
GW1.2	to	GW1.2	45.200	43.935	43.780	30.7	225
GW1.3	to	GW1.4	45.200	43.780	43.610	33.85	225
GW1.4	to	GW1.5	45.200	43.610	43.550	12	225
GW1.5	to	RWHT	45.200	43.550	43.540	1.75	225
GW2.0	to	GW2.1	45.200	44.225	43.940	57	225
GW2.1	to	GW1.5	45.200	43.940	43.890	10	225

NOTES:

uPVC PIPES ASSUMED AS THE DRAINAGE MATERIAL, PLEASE NOTIFY ENGINEER IF DIFFERENT

* = CONCRETE PROTECTION WILL BE PROVIDED OVER PIPES

STORM DRAINAGE DESIGN TABLE

NOTES

GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SERVICE ENGINEERS DRAWINGS & SPECIFICATIONS
2. ALL LEVELS ARE STRUCTURAL UNLESS NOTED OTHERWISE
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DRAWING LEGEND

- S3.0 — PROPOSED STORM DRAINAGE
- GW2.0 — PROPOSED GREYWATER DRAINAGE
- PROPOSED ACO DRAIN (REFER TO NOTE)
- EXISTING STORM DRAINAGE
- PROPOSED ROAD GULLY

ALL GULLIES TO BE CONNECTED TO MAIN DRAINS WITH 150mmø STORM PIPE @ 1:80 GRADIENT

ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH 'RECOMMENDATIONS FOR SITE DEVELOPMENT WORKS FOR HOUSING AREAS', DEPARTMENT OF THE ENVIRONMENT

CONCRETE PROTECTION WILL BE PROVIDED OVER PIPES WHERE THE DEPTH OF COVER TO PIPES UNDER ROADS IS LESS THAN 1200MM & 900MM UNDER GRASSED/PAVED AREAS

QUALITY ISO 9001:2000 NSAI Certified

ENGINEERS IRELAND cpd ACCREDITED COMPANY

Client: DEPARTMENT OF EDUCATION AND SKILLS

Job Description: LOT [illegible] ESKER FINS, ESKER LANE LUCAN, CO. DUBLIN

Status: PLANNING COMPLIANCE

Drawing Title: STORM WATER DRAINAGE LAYOUT PLAN

Project No	Drawing Ref	Rev
13KK028	12.1/C-020	PC2

Date	Scale
25.11.13	1:500

Drawn By	Checked By	Approved By
MC	NP	NP

Hayes Higgins Partnership

Gas House Lane, Kilkenny