Drainage Impact Assessment

Proposed Aldi Store
Portobello Road
Edinburgh

For

Aldi Stores Limited

Contents

Report ref	Issue	Prepared by	Date	Reviewed by	Date
14517	1	M.Pearse	Feb 2015	A.Wallace	Feb 2015

1.0 Introduction

1.01 This report is commissioned by Aldi Stores Limited to examine the drainage impact associated with the proposed redevelopment of land at Portobello Road, Edinburgh. This Assessment is reviewed in accordance with the current Scottish planning Policy (SPP).

1.02 This phase of the development site occupies a total area of approximately 0.7 hectares and currently falls in a northerly towards Portobello Road.

1.03 Aldi Stores Limited plans to redevelop this phase of the site to provide a new store and associated car parking and delivery areas. A new access road off Portobello Road will be provided.

1.04 This report is based on information received from Scottish Water together with a review of the online SEPA flood maps. A Phase 2 Geo Environmental Assessment has been undertaken by 3e Consulting Engineers. A Flood Risk Assessment and Drainage Impact Assessment was undertaken by WSP Group for the whole development area.

1.05 Section 2.00 of this report describes the site location and topography. Section 3.00 identifies the flood risks. Section 4.00 discusses the surface water drainage. Section 5.00 discusses the foul water drainage. Section 6.00 provides conclusions and recommendations.

2.0 Site Location and Topography

2.01 The site is centred at National Grid Reference 330130, 674220 and is located to the northern end of Portobello approximately 4.25km east of Edinburgh City Centre.

2.02 The site is currently occupied by a former fuel filling station, areas of car parking used for vehicle sales and a building occupied by mixed commercial businesses.

2.03 Existing ground levels fall in a northerly direction from the southern boundary, from a level of around 12.00mAOD, down to 10.40mAOD at the back of the footway on Portobello Road at the northern boundary.

2.04 Portobello High Street to the north falls in an easterly direction from 10.85mAOD to the west of the new access down to 10.00m to the east of the site.

2.05 The land to the east and south of the site rises with a fall towards to the site boundary.

2.06 The Figgate Burn is located approximately 95m east of the site and is culverted under Portobello High Street. The Figgate Burn is then an open watercourse where it then discharges into the Firth of Forth 250m to the north.

2.07 Aldi Stores Limited plans to redevelop the site to provide a new store, associated car parking and delivery areas. A site access will be provided which will be used to serve the proposed housing development to the south of the site area of the site.

2.08 Levels will be reduced across the site to provide the gradients required by Aldi Stores Ltd. This will result in batters/retaining being required along the southern and eastern boundaries.

2.09 See Appendix C for a copy of the Proposed Development Plan.

3.0 Flood Risk

3.01 As required by Scottish Planning Policy, all potential sources of flooding need to be considered; Rivers, Sea, Land, Groundwater, Sewers and Artificial Sources i.e. reservoirs and canals.

3.02 A Flood Risk assessment has been undertaken by WSP Group for the whole development site. This confirmed that the SEPA flood maps do not show any signs of fluvial flooding which may affect the development.

3.03 They also confirmed the 1 in 200 year flood level at the Figgate Burn to the East of the site is 6.02mAOD. This flood level is approximately 4m below the proposed site levels. As such the site is at low risk of fluvial flooding.

3.04 A 300mm diameter public combined sewer is located within Portobello High Street to the north which flows in an easterly direction away from the site. Surface water from the existing hard standings and buildings are shown to currently discharge into this combined sewer.

3.05 It is proposed for surface water flows from the development to be directed to Figgate Burn via the public surface water sewer to the east of the site. This will remove the surface water from this combined sewer for the area being developed. This will reduce the risk of flooding from the combined sewer. Should any flooding occur within Portobello High Street due to blockage it is considered that flood water would flow in an easterly direction away from the development.

3.06 Overland flows will need to be considered from the land to the south and east of the site as the development in these areas will be at a higher elevation in relation to the site. A cut off drain will be required along these boundaries to reduce any risk of overland flows from these future areas of development.

Drainage Impact

4.0 Surface Water Run Off

4.01 The existing site is currently classed as a brownfield development. A Drainage Impact Assessment for the residential and Aldi development was undertaken by WSP Group as part of the original planning application.

4.02 WSP Group consulted Scottish Water as part of this process and they confirmed that surface water flows from the site should discharge to the 300mm diameter surface water sewer in Portobello High Street to the east of the site.

4.03 Further to discussions with the Edinburgh City Council Flood Prevention Officers any discharge to the surface water sewer will need to be restricted to a greenfield run off rate due to this sewer ultimately discharging into the Figgate Burn.

4.04 Surface water flows are to be restricted to a maximum flow of 4.5 l/s/hectare. This will result in a maximum discharge from the Aldi development of 2.5 l/s. (Based on an impermeable area of 0.55 hectares). The overall development will have a total restriction of approximately 12 l/s prior to connection into the public surface water sewer. (This will be subject to the final confirmation of impermeable areas for the remainder of the site.)

4.05 Surface water attenuation will be required within the Aldi site. This will be provided by a mixture of porous paving with storage within the sub base and within a cellular storage tank located under the car park.

4.06 The surface water storage volumes have been designed to accommodate a 1 in 200 year storm event with no flooding to the site as required by Edinburgh City Council Flood Prevention Team.

4.07 In line with Scottish Planning Policy, the implementation of SUDS to restrict flows and improve water quality will be utilised on this scheme. Surface water run-off from the car park should receive two levels of treatment prior to discharge to the drainage network. This will be done with the use of porous car parking and granular stone sub base under the parking bays.

4.08 The attenuation required on the site to accommodate a 1 in 100 year storm event is in the order of 260m3. The storage required to accommodate the 1 in 200 year storm event is 310m3. This is to be provided within the proposed drainage system, the stone sub base of the parking bays and within an online cellular storage tanks under the car park.

4.09 Storm events in excess of the 1 in 200 year event will be stored at surface within the car park until such time as water will exit the front of the site into Portobello High Street with no flooding to the proposed store.

4.10 It is proposed for the outfall sewer from the site to be adopted by Scottish Water

4.11 A copy of the preliminary drainage layout is shown in Appendix D.

4.12 Copies of the surface water calculations are included in Appendix E.

5.0 Foul Drainage

5.01 A 300mm combined sewer is located in Portobello Road to the north of the site. This sewer is approximately 1m in depth.

5.02 Foul water flows from the site are proposed to discharge to the public sewer with a disconnection manhole constructed at the site boundary. It is proposed for the service ramp area to discharge to the public combined sewer. This will need to be pumped upto the gravity outfall due to the levels of the combined sewer.

5.03 Scottish Water have confirmed to WSP Group, as part of the drainage strategy for the whole of the site, that foul water flows can discharge to the public combined sewer adjacent to the site.

5.04 The above is subject to a new connection application been submitted to Scottish Water which will be progressed as part of the detailed design.

5.05 A copy of the drainage layout is shown in Appendix C.

6.0 Summary and Recommendations

6.01 The risk of flooding to the development site can be deemed as low having considered all potential sources.

6.02 The proposed development will not exacerbate flooding elsewhere.

6.03 The use of infiltration techniques has been discounted due to the potential ground conditions.

6.04 Surface water flows are to be directed to the existing 300mm diameter public surface water sewer to the east of the site which ultimately discharges into the Figgate Burn.

6.05 Surface water flows from the Aldi site will be restricted to 2.5 litres per second with attenuation been provided on the site to accommodate storms upto the 1 in 200 year event in line with Edinburgh City Council requirements

6.06 Surface water run-off from the car park will receive two levels of treatment with the use of porous paving and granular stone sub base.

6.07 Foul water flows are to discharge to the existing public combined sewer located in Portobello Road.

Appendix A

Location Plan

Date	Revision	Checked	Rev.

consulting engineers

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Project	Portobello High Street Aldi Stores Ltd		
Title	Site Location Plan		
Scale 1:25,000 at A4	Drawn CB	Checked AC	Date Apr '14
Job No. 14517	Drawing No. Figure 1		Rev 0

Appendix B

Topographical Survey

portobello high street

portobello high street

portobello high street

access

access

exit

access

access

car sales area

car sales area

van sales area

office

car wash

valet bay

van hire yard

yard

yard

yard

van sales area

kwik fit depot

works

verden studios

garage premises

access

SS02
10.430

SS03
10.792

SS04
11.048

SS01
9.957

11.353

12.679

bus lane

bus stances

tarmac roadway

footpath (tarmac)

footpath (paving slabs)

stone wall / railing

brick retaining wall

brick upstand wall

drainage channel

concrete

canopy over

former fuel pump plinths

former petrol filling station

portacabin

portable storage container

timber screen fence ht 1.0m

timber screen fence ht 2.0m

overgrown young trees / bushes

no access to this area

single storey building

2 storey building

gravel chips

hardstanding/tarmac

grass

rough grass

bushes / fly tipped material

block paving

tarmac

parking

office/reception

SIGN

Revisions

0 10 20 30 40

Client
Aldi Stores Ltd.

Project Address
Portobello High Street, Edinburgh

Drawn SG
Checked by NM
Date 07.08.14
Scale 1:200 @A1

Project
Aldi Portobello

Drawing Title
Existing Site Plan [PLANNING]

Drawing Number
0058 - PL002

Revision
-

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Appendix C

Proposed Development

Plan

EXTENT OF ROAD WIDENING SHOWN DASHED

MARKINGS ASSOCIATED WITH NEW BUS STOP

ROAD WIDENED WITH NEW RIGHT TURN LANE AND NEW WHITE LINING TRAFFIC LANES

PORTOBELLO HIGH STREET

PHASES 2&3 - REFER TO OTHER DRAWINGS FOR INFORMATION

7no. 9m high "totems" to "public realm"

Patterned paving area in Conservation paving to demark "public realm"

Seating bench

Fall 1/40

Fall 1/90

Fall 1/60

Fall 1/50

Fall 1/75

Fall 1/36

Fall 1/21

Fall 1/3

+10.34 +10.63 +10.46 +10.915 +10.790 +10.665 +10.790 +10.393 +10.887 +11.088 +10.892

Post sign subject to separate advertising consent

Tarmac road surface

S/S bollards

Timber knee rail

7000

+10.907 +10.707 +10.712 +10.541 +10.414 +10.398 +10.243

New service road, white lined along extent

CAR PARKING
94 total

Permeable block paving parking bay with white blocks to mark out bays

6500 6500 9100

+11.306 +11.106 +11.111 +10.783 +10.553 +10.523 +10.160 +10.370 +10.243 +10.070

White painted crossing point

8000 9795

+11.106 +10.975 +11.80 +11.125 +10.596 +10.355 +10.593 +10.831 +11.070

Pedestrian grade tarmac

Conservation paving to fore front

Extent of canopy

Main entrance

FFL +10.370

Trolley park

Cycle stand

Area for public art to be agreed with LPA

+10.29 +10.17 +10.18 +10.16 +10.37 +10.22 +10.22 +10.50 +10.22 +10.63 +11.67 +12.44 +10.22 +12.80 +10.27 +10.22 +12.00 +12.16 +9.07 +9.71

Sales Area - 1245m²
FFL - 10.370

55000 22800 7000

600 RW 1200 RW

Fences

Refrigeration cage / plant sitting on concrete plinth with galvanised steel mesh fence and mesh access gates

Loading bay with brushed concrete surface laid to falls

Land sloped at 1:3 maximum from footpath

1.8m close boarded timber fence

0 10 20 30 40

Revisions

A	Site boundary line and parking amended.	20.08.14	SG
B	Public art wall and annotation added	28.08.14	NM
C	Phasing noted.	09.09.14	NM
D	Generally updated and issued for approval.	11.09.14	NM
E	Planting updated in line with comments.	17.11.14	NM
F	Public realm updated in line with comments.	24.11.14	NM
G	Additional landscaping added.	03.12.14	NM

Car Parking:

Standard Bays	(2.5-2.7x5.0m)	= 81
Accessible	(3.7x6.2m)	= 5
Parent & Child	(3.0x5.0m)	= 8
Total		= 94

Key Areas:

Aldi Sales Area	= 1,254m² / 13,497ft²
GEFA	= 1,764m² / 18,987ft²

Client: Aldi Stores Ltd.

Project Address: Baileyfield

Project: Aldi Portobello

Drawing Title: Phase 1 Proposed Retail Use Proposed Site Plan [FOR APPROVAL]

Drawn: SG Checked by: NM

Date: 21.08.14 Scale: 1:200 @A1

Drawing Number: 0058 - PL003 Revision: G

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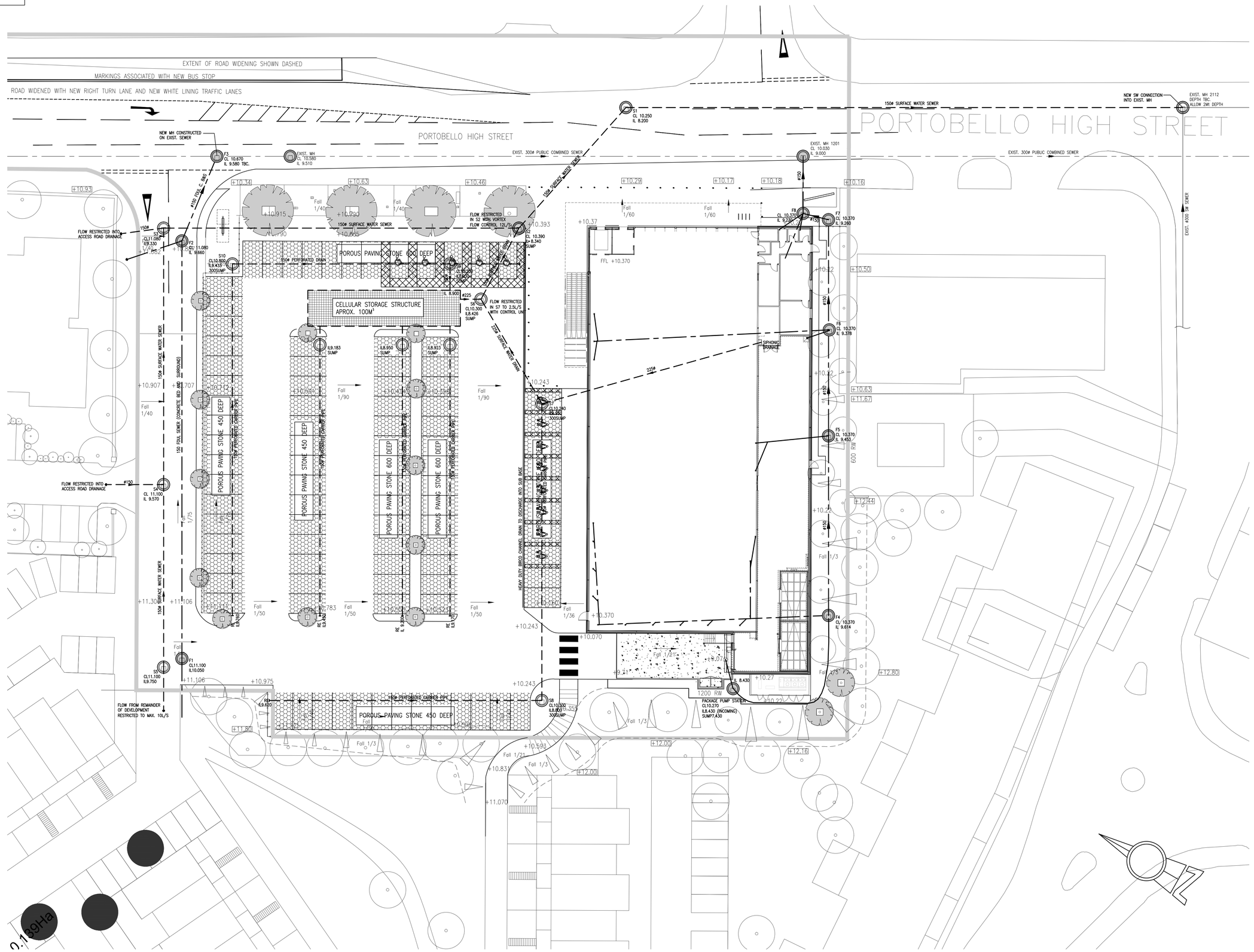
Appendix D

Proposed Drainage

Layout Plan

A1



DRAINAGE LAYOUT

1:250

DO NOT SCALE.

Only PDF/DWF Issues of this drawing are controlled. All other formats (eg. DWG AutoCAD FILES) are UN-controlled and are used at your own risk.

Contractors should refer to the residual risks contained in the CDM Pre Construction Information before carrying out any site operations and should not issue parts of this drawing without including the CDM notes and references. This information will include details of the SIGNIFICANT risks which 3E have considered beyond that which a competent contractor should be aware.

NOTES

1. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE WATER SERVICES ASSOCIATION "SEWERS FOR SCOTLAND" - 2ND EDITION AND ADOPTING WATER AUTHORITY/SEWERAGE AGENCY REQUIREMENTS AND SPECIFICATIONS.
2. ALL PRIVATE DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS 2002 EDITION.
3. CONTRACTOR TO ESTABLISH POSITION SIZE AND DEPTH OF ALL EXISTING SEWERS AND SERVICES PRIOR TO COMMENCEMENT ON SITE.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT, AND TEMPORARY AND PERMANENT DIVERSION WORKS, AS NECESSARY TO ALL EXISTING SERVICES.
5. THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
6. THE CONTRACTOR SHALL ALLOW FOR KEEPING SEWER TRENCHES AND EXCAVATIONS AS DRY AS PRACTICABLE BY PUMPING FROM TEMPORARY SUMPS AND DEWATERING AS APPROPRIATE. THE POINT AND METHOD OF DISCHARGE TO BE AGREED WITH THE DRAINAGE AUTHORITY.
7. PIPES UP TO AND INCLUDING 300mmø TO BE UNPLASTICISED PVC. PIPES 375mmø AND GREATER TO BE CONCRETE CLASS H.
8. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS 4027, UNLESS AGREED OTHERWISE WITH THE ADOPTING AUTHORITY.
10. PRECAST CONCRETE PRODUCTS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS 5911 AND BE KITEMARKED. CONCRETE PIPES TO BE CLASS H UNLESS NOTED OTHERWISE.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124, HAVE MINIMUM 675 x 675 CLEAR OPENINGS WITH 150 DEEP FRAMES UNLESS OTHERWISE SPECIFIED. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITHOUT CUSHION INSERTS AND BE KITEMARKED. LOAD CLASS D400 IN VEHICULAR TRAFFICKED AREAS AND LOAD CLASS B125 IN FOOTWAYS AND PEDESTRIAN AREAS.
12. GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124 AND BE OF A NON-ROCKING DESIGN WITH CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 FOR ROADS REGULARLY CARRYING FAST MOVING HEAVY VEHICLES. CLASS C250 TO BE USED IN LESSER TRAFFICKED AREAS eg. ESTATE ROADS, CUL-DE-SACS, RESIDENTIAL CAR PARKING AREAS ETC.
13. CLASS Z BEDDING DETAIL SHALL BE PROVIDED WHERE COVER TO THE PIPE BARREL IS LESS THAN 1.2M IN VEHICULAR TRAFFICKED AREAS AND 0.9M ELSEWHERE, TO ALL ROAD GULLY CONNECTIONS AND WITHIN AREAS OF DEEP ROOTING VEGETATION.
14. WHERE CLASS Z TRENCH BEDDING DETAIL IS USED, THE CONCRETE BED AND SURROUND SHALL BE DISCONTINUED AT EACH PIPE JOINT OVER THE FULL CROSS SECTION BY MEANS OF A SHAPED COMPRESSIBLE FILLER.
15. SELECTED BACKFILL MATERIAL SHALL CONSIST OF UNIFORM MATERIAL FREE FROM STONES LARGER THAN 40mm, CLAY LUMPS LARGER THAN 75mm, TREE ROOTS, ORGANIC MATTER AND FROZEN SOIL. SELECTED BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL.
16. GENERAL BACKFILL MATERIAL TO BE FREE FROM STONES LARGER THAN 40mm. GENERAL BACKFILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm THICKNESS AND EACH LAYER COMPACTED BY HAND. NO MECHANICAL COMPACTION OF FILL MATERIAL SHALL BE PERMITTED WITHIN 300mm ABOVE THE CROWN/BARREL OF THE PIPE.
17. BACKFILLING AND REINSTATEMENT TO TRENCHES IN PUBLIC HIGHWAYS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE ADOPTING AUTHORITY, OR, IN THE ABSENCE OF SUCH, IN ACCORDANCE WITH THE REQUIREMENTS OF "THE STREET WORKS REGULATIONS 1992" AND RELEVANT PROVISIONS OF H.A.U.C. "SPECIFICATION FOR THE REINSTATEMENT OF OPENINGS IN HIGHWAYS" JUNE 1992, BOTH UNDER SECTION 71 OF THE NEW ROADS AND STREET WORKS ACT 1991.
18. BACKFILL TO DRAINAGE TRENCHES IN HARD PAVED AREAS SHALL BE G.S.B. TYPE 1.
19. ALL ROAD GULLIES ARE TO BE TRAPPED GULLIES.
20. ALL GULLY LEADS TO BE 150mm DIAMETER.
21. ALL REDUNDANT EXISTING DRAINAGE TO BE GRUBBED UP OR GROUTED, ANY EXISTING LIVE DRAINAGE SHOULD BE REPORTED TO THE ENGINEER AND RECONNECTED.
22. ALL ROAD GULLIES & LEADS TO BE CLEARED OF DEBRIS UPON COMPLETION OF WORKS
22. NY EXISTING DRAINAGE WHICH BECOMES UNDER TRAFFICKED AREAS IN THE NEW SCHEME SHOULD BE SUBJECT TO THE FOLLOWING REMEDIALS/REVISIONS. WHERE DEPTH OF COVER IS LESS THAN 1200MM, THE EXISTING PIPEWORK SHALL BE EXPOSED & SURROUNDED WITH 150MM CONCRETE AS CLASS "Z" BEDDING. WHERE THE EXISTING MANHOLE COVER & FRAME IS NOT AS MANHOLE DETAIL A OR B, OR TO BS497 GRADE A, OR EN124 CLASS D, THEN IT SHOULD BE CHANGED FOR SUCH.
23. THE CONTRACTOR MUST ENSURE THAT ANY OF THE EXISTING DRAINAGE WHICH IS LIVE IS KEPT CLEAR OF DEBRIS AND SHOULD ALLOW FOR JETTING THROUGH THE NEW & EXISTING DRAINAGE UPON COMPLETION.
24. CONTRACTOR TO TAKE MEASURES TO PROTECT HIS OPERATIVES WITH RESPECT TO THE PRESENCE OF GAS IN SEWER TRENCHES AND MANHOLES THROUGH THE USE OF GAS MONITORING EQUIPMENT AND BREATHING APPARATUS AS REQUIRED.
25. CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.

KEY

- Proposed surface water drainage
- Proposed surface water manhole
- Proposed foul water drainage.
- Proposed foul water manhole
- RG Gully.
- OU Outlet sump from Birco Channel

Date	Revisions	Drawn	Rev.
18/02/15	PRELIMINARY ISSUE	DA	P1

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Client: Aldi Stores Ltd [Bathgate]

Project: Aldi (New Build)
Portobello Road Edingburgh

Title: Drainage Layout Plan

Scale	Drawn	Checked	Date
1:250	DA	MP	18/02/15

Drawing Status: Preliminary

Job No.	Drawing No.	Revision
14517	C1000	P1

Appendix E
Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	12.500	Minimum Backdrop Height (m)	0.000
Ratio R	0.250	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	100	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.160	4-8	0.483

Total Area Contributing (ha) = 0.643

Total Pipe Volume (m³) = 10.329

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	49.000	0.327	149.8	0.023	3.00	0.0	0.600	o	150	
1.001	30.000	0.500	60.0	0.028	0.00	0.0	0.600	o	150	
1.002	4.000	0.040	100.0	0.000	0.00	0.0	0.600	o	150	
2.000	30.000	0.200	150.0	0.054	3.00	0.0	0.600	o	150	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	38.57	4.00	9.760	0.023	0.0	0.0	0.0	0.82	14.5	2.4
1.001	37.44	4.38	9.433	0.051	0.0	0.0	0.0	1.30	23.0	5.2
1.002	37.25	4.45	8.933	0.051	0.0	0.0	0.0	1.00	17.8	5.2
2.000	39.81	3.61	9.430	0.054	0.0	0.0	0.0	0.82	14.5	5.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
3.000	40.000	0.267	149.8	0.053	3.00	0.0	0.600	o	150	
4.000	40.000	0.267	149.8	0.023	3.00	0.0	0.600	o	150	
5.000	37.000	0.740	50.0	0.063	3.00	0.0	0.600	o	150	
5.001	40.000	0.267	149.8	0.079	0.00	0.0	0.600	o	225	
5.002	14.000	0.093	150.5	0.170	0.00	0.0	0.600	o	225	
1.003	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	300	
1.004	11.000	0.073	150.7	0.000	0.00	0.0	0.600	o	150	
6.000	30.000	0.200	150.0	0.075	3.00	0.0	0.600	o	150	
6.001	35.000	0.233	150.2	0.056	0.00	0.0	0.600	o	150	
6.002	48.000	0.320	150.0	0.019	0.00	0.0	0.600	o	150	
1.005	22.000	0.147	149.7	0.000	0.00	0.0	0.600	o	150	
1.006	75.000	0.500	150.0	0.000	0.00	0.0	0.600	o	150	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	39.15	3.81	9.200	0.053	0.0	0.0	0.0	0.82	14.5	5.6
4.000	39.15	3.81	9.170	0.023	0.0	0.0	0.0	0.82	14.5	2.4
5.000	40.42	3.43	9.620	0.063	0.0	0.0	0.0	1.43	25.2	6.9
5.001	38.39	4.06	8.805	0.142	0.0	0.0	0.0	1.07	42.4	14.8
5.002	37.74	4.28	8.538	0.312	0.0	0.0	0.0	1.06	42.3	31.9
1.003	37.14	4.49	8.370	0.493	0.0	0.0	0.0	1.28	90.6	49.6
1.004	36.53	4.71	8.350	0.493	0.0	0.0	0.0	0.82	14.4«	49.6
6.000	39.81	3.61	9.700	0.075	0.0	0.0	0.0	0.82	14.5	8.1
6.001	37.60	4.32	9.500	0.131	0.0	0.0	0.0	0.82	14.4	13.3
6.002	35.03	5.30	9.267	0.150	0.0	0.0	0.0	0.82	14.5	14.2
1.005	34.00	5.75	8.277	0.643	0.0	0.0	0.0	0.82	14.5«	59.2
1.006	30.99	7.28	8.130	0.643	0.0	0.0	0.0	0.82	14.5«	59.2

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	2112	9.700	7.630	0.000	1200	0

Online Controls for Storm

Crown Vortex Valve® Manhole: 6, DS/PN: 1.004, Volume (m³): 2.4

Design Head (m) 1.650 Vortex Valve® Type R1 SW Only Invert Level (m) 8.350
Design Flow (l/s) 2.5 Diameter (mm) 57

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	2.1	3.000	3.3	7.000	5.1
0.200	0.9	1.400	2.3	3.500	3.6	7.500	5.3
0.300	1.1	1.600	2.4	4.000	3.8	8.000	5.4
0.400	1.2	1.800	2.6	4.500	4.1	8.500	5.6
0.500	1.4	2.000	2.7	5.000	4.3	9.000	5.8
0.600	1.5	2.200	2.9	5.500	4.5	9.500	5.9
0.800	1.7	2.400	3.0	6.000	4.7		
1.000	1.9	2.600	3.1	6.500	4.9		

Crown Vortex Valve® Manhole: 2, DS/PN: 1.005, Volume (m³): 4.7

Design Head (m) 1.800 Vortex Valve® Type R3 SW Only Invert Level (m) 8.277
Design Flow (l/s) 12.8 Diameter (mm) 94

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	10.4	3.000	16.5	7.000	25.2
0.200	4.3	1.400	11.3	3.500	17.8	7.500	26.1
0.300	5.2	1.600	12.1	4.000	19.1	8.000	27.0
0.400	6.0	1.800	12.8	4.500	20.2	8.500	27.8
0.500	6.7	2.000	13.5	5.000	21.3	9.000	28.6
0.600	7.4	2.200	14.1	5.500	22.3	9.500	29.4
0.800	8.5	2.400	14.8	6.000	23.3		
1.000	9.5	2.600	15.4	6.500	24.3		

Storage Structures for Storm

Porous Car Park Manhole: 11, DS/PN: 1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	46.0
Max Percolation (l/s)	63.9	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	10.170	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: 10, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	39.0
Max Percolation (l/s)	54.2	Slope (1:X)	90.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.540	Cap Volume Depth (m)	0.600

Porous Car Park Manhole: RE2, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	38.0
Max Percolation (l/s)	52.8	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.945	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: RE3, DS/PN: 3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	38.0
Max Percolation (l/s)	52.8	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.700	Cap Volume Depth (m)	0.600

Porous Car Park Manhole: RE4, DS/PN: 4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	38.0
Max Percolation (l/s)	52.8	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.650	Cap Volume Depth (m)	0.600

Porous Car Park Manhole: 9, DS/PN: 5.001

Infiltration Coefficient Base (m/hr)	0.00000	Max Percolation (l/s)	48.6
Membrane Percolation (mm/hr)	1000	Safety Factor	2.0

Porous Car Park Manhole: 9, DS/PN: 5.001

Porosity	0.30	Slope (1:X)	50.0
Invert Level (m)	9.703	Depression Storage (mm)	5
Width (m)	5.0	Evaporation (mm/day)	3
Length (m)	35.0	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: 8, DS/PN: 5.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	29.0
Max Percolation (l/s)	40.3	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.420	Cap Volume Depth (m)	0.600

Cellular Storage Manhole: 7, DS/PN: 1.003

Invert Level (m)	8.370	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.801	0.0	0.0
0.800	100.0	0.0			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	8
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.250
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	12.400	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	30, 100, 200
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	1440 Winter	30	0%	100/240 Winter				
1.001	1440 Winter	30	0%	30/180 Winter				
1.002	1440 Winter	30	0%	30/120 Summer				
2.000	1440 Winter	30	0%	30/180 Winter				
3.000	1440 Winter	30	0%	30/120 Winter				
4.000	1440 Winter	30	0%	30/120 Winter				
5.000	960 Winter	30	0%	30/360 Winter				
5.001	1440 Winter	30	0%	30/60 Winter				
5.002	1440 Winter	30	0%	30/15 Summer				
1.003	1440 Winter	30	0%	30/15 Summer				
1.004	1440 Winter	30	0%	30/15 Summer				
6.000	15 Winter	30	0%	30/15 Summer				
6.001	15 Winter	30	0%	30/15 Summer				
6.002	30 Winter	30	0%	30/15 Summer				
1.005	30 Winter	30	0%	30/15 Summer				
1.006	30 Winter	30	0%					

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	RE1	9.855	-0.055	0.000	0.02	0.0	0.3	OK
1.001	11	9.855	0.272	0.000	0.03	0.0	0.7	SURCHARGED
1.002	10	9.855	0.772	0.000	0.12	0.0	1.4	SURCHARGED
2.000	RE2	9.881	0.301	0.000	0.06	0.0	0.8	SURCHARGED
3.000	RE3	9.851	0.501	0.000	0.05	0.0	0.8	SURCHARGED
4.000	RE4	9.849	0.529	0.000	0.03	0.0	0.5	SURCHARGED
5.000	RE	9.866	0.096	0.000	0.05	0.0	1.2	SURCHARGED
5.001	9	9.864	0.834	0.000	0.05	0.0	1.9	SURCHARGED
5.002	8	9.865	1.102	0.000	0.11	0.0	4.1	SURCHARGED
1.003	7	9.941	1.271	0.000	0.11	0.0	5.5	SURCHARGED
1.004	6	9.963	1.463	0.000	0.18	0.0	2.3	SURCHARGED
6.000	5	10.057	0.207	0.000	0.85	0.0	11.8	SURCHARGED
6.001	4	9.969	0.319	0.000	1.25	0.0	17.5	SURCHARGED
6.002	3	9.750	0.333	0.000	1.08	0.0	15.2	SURCHARGED
1.005	2	9.530	1.103	0.000	0.77	0.0	10.5	SURCHARGED
1.006	1	8.226	-0.054	0.000	0.73	0.0	10.4	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	8
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.250
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	12.400	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	30, 100, 200
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	1440 Winter	100	0%	100/240 Winter				
1.001	1440 Winter	100	0%	30/180 Winter				
1.002	1440 Winter	100	0%	30/120 Summer				
2.000	1440 Winter	100	0%	30/180 Winter				
3.000	1440 Winter	100	0%	30/120 Winter				
4.000	1440 Winter	100	0%	30/120 Winter				
5.000	1440 Winter	100	0%	30/360 Winter				
5.001	1440 Winter	100	0%	30/60 Winter				
5.002	1440 Winter	100	0%	30/15 Summer				
1.003	1440 Winter	100	0%	30/15 Summer				
1.004	1440 Winter	100	0%	30/15 Summer				
6.000	30 Winter	100	0%	30/15 Summer				
6.001	30 Winter	100	0%	30/15 Summer				
6.002	30 Winter	100	0%	30/15 Summer				
1.005	30 Winter	100	0%	30/15 Summer				
1.006	30 Winter	100	0%					

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	RE1	10.030	0.120	0.000	0.03	0.0	0.4	SURCHARGED
1.001	11	10.030	0.447	0.000	0.04	0.0	0.9	SURCHARGED
1.002	10	10.029	0.946	0.000	0.12	0.0	1.4	FLOOD RISK
2.000	RE2	10.028	0.448	0.000	0.08	0.0	1.1	SURCHARGED
3.000	RE3	10.026	0.676	0.000	0.07	0.0	0.9	SURCHARGED
4.000	RE4	10.024	0.704	0.000	0.05	0.0	0.7	SURCHARGED
5.000	RE	10.042	0.272	0.000	0.05	0.0	1.1	SURCHARGED
5.001	9	10.040	1.010	0.000	0.05	0.0	2.2	FLOOD RISK
5.002	8	10.041	1.278	0.000	0.13	0.0	4.8	FLOOD RISK
1.003	7	10.121	1.451	0.000	0.11	0.0	5.4	FLOOD RISK
1.004	6	10.142	1.642	0.000	0.19	0.0	2.5	FLOOD RISK
6.000	5	10.396	0.546	0.000	0.78	0.0	10.9	SURCHARGED
6.001	4	10.346	0.696	0.000	1.24	0.0	17.2	SURCHARGED
6.002	3	10.167	0.750	0.000	1.23	0.0	17.3	SURCHARGED
1.005	2	9.879	1.452	0.000	0.86	0.0	11.8	SURCHARGED
1.006	1	8.235	-0.045	0.000	0.82	0.0	11.7	OK

200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	8
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.250
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	12.400	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	30, 100, 200
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	1440 Winter	200	0%	100/240 Winter				
1.001	1440 Winter	200	0%	30/180 Winter				
1.002	1440 Winter	200	0%	30/120 Summer				
2.000	1440 Winter	200	0%	30/180 Winter				
3.000	1440 Winter	200	0%	30/120 Winter				
4.000	1440 Winter	200	0%	30/120 Winter				
5.000	1440 Winter	200	0%	30/360 Winter				
5.001	1440 Winter	200	0%	30/60 Winter				
5.002	1440 Winter	200	0%	30/15 Summer				
1.003	1440 Winter	200	0%	30/15 Summer				
1.004	1440 Winter	200	0%	30/15 Summer				
6.000	30 Winter	200	0%	30/15 Summer				
6.001	30 Winter	200	0%	30/15 Summer				
6.002	30 Winter	200	0%	30/15 Summer				
1.005	30 Winter	200	0%	30/15 Summer				
1.006	30 Winter	200	0%					

200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	RE1	10.142	0.232	0.000	0.03	0.0	0.5	SURCHARGED
1.001	11	10.142	0.559	0.000	0.04	0.0	0.9	SURCHARGED
1.002	10	10.141	1.058	0.000	0.12	0.0	1.5	FLOOD RISK
2.000	RE2	10.139	0.559	0.000	0.09	0.0	1.2	SURCHARGED
3.000	RE3	10.139	0.789	0.000	0.07	0.0	1.0	SURCHARGED
4.000	RE4	10.137	0.817	0.000	0.05	0.0	0.7	SURCHARGED
5.000	RE	10.151	0.381	0.000	0.05	0.0	1.2	SURCHARGED
5.001	9	10.149	1.119	0.000	0.06	0.0	2.3	FLOOD RISK
5.002	8	10.173	1.410	0.000	0.13	0.0	5.0	FLOOD RISK
1.003	7	10.227	1.557	0.000	0.10	0.0	5.1	FLOOD RISK
1.004	6	10.248	1.748	0.000	0.20	0.0	2.5	FLOOD RISK
6.000	5	10.733	0.883	0.000	0.80	0.0	11.1	SURCHARGED
6.001	4	10.676	1.026	0.000	1.30	0.0	18.1	SURCHARGED
6.002	3	10.463	1.046	0.000	1.31	0.0	18.5	SURCHARGED
1.005	2	10.125	1.698	0.000	0.93	0.0	12.7	FLOOD RISK
1.006	1	8.240	-0.040	0.000	0.88	0.0	12.6	OK