Client: Lidl Ireland GmbH

Project: PROPOSED DEVELOPMENT OF NEW LIDL STORE AT MAIN STREET UPPER, NEWCASTLE, DUBLIN, CO. DUBLIN

Document Title: SERVICES DESIGN REPORT

PROJECT NO: 22058

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Client:	Lidl Ireland GmbH, Main Road, Tallaght, Dublin 24, D24 PW6K & Lidl RDC (Regional Distribution Centre), Robinstown (Levinge), Mullingar, Co. Westmeath, N91 P921
Project:	Permission for development at Main Street Upper, Newcastle, Co. Dublin, principally consisting of the construction of a Discount Foodstore Supermarket with ancillary off-licence sales. The proposed development comprises: 1) The construction of a single storey Discount Foodstore Supermarket with ancillary off-licence use (with mono-pitch roof and overall building height of c. 6.74m) measuring c. 2,167m^2 gross floor space with a net retail sales area of c. 1,410m^2; 2) Construction of a vehicular access point to Main Street Upper and associated works to carriageway and including partial removal of boundary wall / façade, modification of existing footpaths / public realm and associated and ancillary works including proposed entrance plaza area; 3) Demolition of part of an existing rear / southern single storey residential extension (and related alterations to remaining structure) of 'Kelly Estates' building. The original 'Kelly Estates' building (a protected structure - Eircode: D22 Y9H7) will not be modified; 4) Demolition of detached single storey accommodation / residential structure and ancillary wall / fence demolitions to rear of existing 'Kelly Estates' building; 5) Demolition of existing single storey (stable) building along Main Street and construction of single storey retail / café unit on an extended footprint measuring c. 118m^2 and associated alterations to existing Main Street boundary façade; 6) Renovation and change of use of existing (vacant) two storey vernacular townhouse structure to Main Street, and single storey extension to rear, for retail / commercial use (single level throughout) totalling c. 62m^2; 7) Repair and renewal of existing Western and Eastern 'burgage plot' tree and hedgerow site boundaries; and, 8) Provision of associated car parking, cycle parking (and staff cycle parking shelter), pedestrian access routes and (ramp and stair) structures (to / through the southern and western site boundaries to facilitate connections to potential future development), free standing and building mounted signage, free standing trolley bay cover / enclosure, refrigeration and air conditioning plant and equipment, roof mounted solar panels, public lighting, hard and soft landscaping, boundary treatments and divisions, retaining wall structures, drainage infrastructure and connections to services / utilities, electricity Substation and all other associated and ancillary development and works above and below ground level including within the curtilage of a protected structure.
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1 INSTRUCTION

In conjunction with the appointed multi-disciplinary design team, SDS (Structural Design Solutions) Ltd., Design Engineers, have been requested by Lidl Ireland GmbH, Main Street Upper, Newcastle, Co. Dublin, to prepare the "Services Design Report" for the proposed development on the site of the new Lidl Discount Foodstore Supermarket at Main Street Upper, Newcastle, Co. Dublin.

2 PROJECT DETAILS

Permission for development at Main Street Upper, Newcastle, Co. Dublin, principally consisting of the construction of a Discount Foodstore Supermarket with ancillary off-licence sales. The proposed development comprises:

1) The construction of a single storey Discount Foodstore Supermarket with ancillary off-licence use (with mono-pitch roof and overall building height of c. 6.74m) measuring c. 2,167m^2 gross floor space with a net retail sales area of c. 1,410m^2;

2) Construction of a vehicular access point to Main Street Upper and associated works to carriageway and including partial removal of boundary wall / façade, modification of existing footpaths / public realm and associated and ancillary works including proposed entrance plaza area;

3) Demolition of part of an existing rear / southern single storey residential extension (and related alterations to remaining structure) of 'Kelly Estates' building. The original 'Kelly Estates' building (a protected structure - Eircode: D22 Y9H7) will not be modified;

4) Demolition of detached single storey accommodation / residential structure and ancillary wall / fence demolitions to rear of existing 'Kelly Estates' building;

5) Demolition of existing single storey (stable) building along Main Street and construction of single storey retail / café unit on an extended footprint measuring c. 118m^2 and associated alterations to existing Main Street boundary façade;

6) Renovation and change of use of existing (vacant) two storey vernacular townhouse structure to Main Street, and single storey extension to rear, for retail / commercial use (single level throughout) totalling c. 62m^2;

7) Repair and renewal of existing Western and Eastern 'burgage plot' tree and hedgerow site boundaries; and,

8) Provision of associated car parking, cycle parking (and staff cycle parking shelter), pedestrian access routes and (ramp and stair) structures (to / through the southern and western site boundaries to facilitate connections to potential future development), free standing and building mounted signage, free standing trolley bay cover / enclosure, refrigeration and air conditioning plant and equipment, roof mounted solar panels, public lighting, hard and soft landscaping, boundary treatments and divisions, retaining wall structures, drainage infrastructure and connections to services / utilities, electricity Substation and all other associated and ancillary development and works above and below ground level including within the curtilage of a protected structure

LOCATION, SIZE AND SCALE OF DEVELOPMENT

The application site is 1.04 hectares and is located on the site of the new Lidl Discount Foodstore at Main Street Upper, Newcastle, Dublin (see Figures 2.1 to 2.3 below). The site itself is bordered along the northern side with Kelly Estates, and along the eastern side with Choice Childcare Newcastle. St. Fintan's Church of Ireland is also located to the east of the site.

The existing site currently comprises a derelict single storey building, which is to be demolished, with a new single-storey Lidl store to be constructed on these grounds. The store is to have a mono-pitch roof and an overall floor space of 2,167m^2.

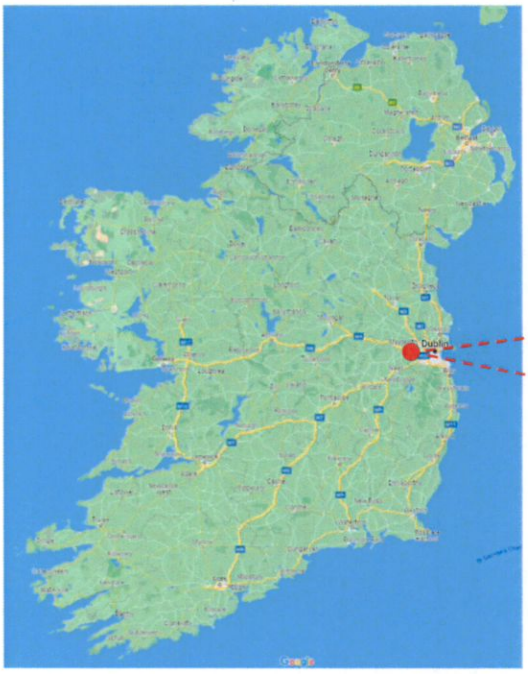

Figure 2.1 – Site Location *(image courtesy of Google Maps)*

Figure 2.2 – Site location in Newcastle, Co. Dublin

Figure 2.3 – Aerial image of the proposed development site *(image courtesy of Google Maps)*

3 LOCAL AUTHORITY

South Dublin County Council will be provided with the relevant drawings and the associated design calculations for the services proposed for this development for consideration.

4 SURFACE WATER

The following section outlines the hierarchy of options when considering the removal and disposal of surface water from site, before outlining a host of potential sustainable drainage system (SuDS) techniques considered when designing the surface water collection system for the proposed site.

4.1 HIERARCHY OF DISPOSAL

Generally, when designing a proposed surface water collection system, the philosophy of the design should be to prioritise the below methods of discharging surface water run off as much as reasonably practicable, from 1 (most desirable) to 4 (least desirable).

1. into the ground (infiltration),
2. To a surface waterbody,
3. To a surface water sewer, highway drain, or other drainage systems,
4. To a combined sewer.

4.1.1 INFILTRATION

Infiltration testing to BRE 365 was not carried out on site as a result of findings gathered from the Flood Risk Assessment carried out by JBA consulting. These findings, including the groundwater vulnerability on site, are discussed further in Section 4.4.

4.1.2 SURFACE WATERBODY

The nearest watercourse is not within close proximity of this site.

4.1.3 SURFACE WATER SEWER / COMBINED SEWER

Currently, there is an existing surface water system serving the proposed site crossing main street and discharging to the via public sewer to the north east of the site the SDCC service maps is available in this report in appendix E. The only hydrological feature on site being an existing dry ditch located along the western site boundary. The proposed surface water network is to be connected into the existing public surface water network running along the northern boundary of the site to the east. There is also no existing foul sewer network on site, with the proposed foul sewer network to be connected into an existing foul sewer network, also running just inside the northern site boundary.

4.2 SUSTAINABLE DRAINAGE

The following section outlines the potential SuDS techniques considered for the proposed site, with proposals such as green roofs, swales, and modular systems all being discussed herein.

4.2.1 RAINWATER HARVESTING

Rainwater harvesting (RWH) is the collection of rainwater runoff for use. Runoff can be collected from roofs and other impermeable areas, stored, treated (where required) and then used as a supply water for domestic, commercial and/or institutional properties. Rainwater harvesting will be disproportionate in terms of cost and function in regard to the proposed development features (Toilet, sinks etc.) Therefore, rainwater harvesting has been disregarded for this design.

4.2.2 GREEN ROOFS

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover, over a drainage layer. They are designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows. To assist in treating surface water at source, a green roof has been designed for the proposed Lidl Discount Foodstore, which will also provide an additional amount of surface water storage volume for the proposed development. Approximately 50% of the roof area will be designated as green, with the remaining area covered by photovoltaic panels.

4.2.3 SOAKAWAYS

Soakaways are square or circular excavations either filled with rubble or lined with brickwork, precast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be grouped and linked together to drain large areas including highways. The supporting structure and backfill can be substituted by modular geo-cellular units. Soakaways provide storm water attenuation, storm water treatment and groundwater recharge. Soakaways have been disregarded due to the encountered poor infiltration rates of the existing ground.

4.2.4 SWALES

Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate. They should promote low flow velocities to allow much of the suspended particulate load in the storm water runoff to settle out, thus providing effective pollutant removal. Due to the nature of the development, there is not sufficient space to incorporate a swale on this proposed site.

4.2.5 TREE PITS

Tree pits are beneficial for bioretention as they intercept precipitation, allow water to evaporate from relief surfaces, facilitate infiltration and groundwater recharge due to their root systems, provide shade, and provide further amenity and biodiversity benefits. Due to these aforementioned benefits, tree pits are provided within this design proposal.

4.2.6 PERVIOUS PAVEMENTS

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored between infiltration to the ground, reuse or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment. When permeable paving for car parking bays is used, the stone sub-base not only stores and slows down the rate of discharge, but also raises the water quality. It should not be used in the loading yard areas, due to the impact of the heavily loaded HGVs on the long-term durability of the pavement finish. Due to maintenance and the high cost involved, pervious pavements were initially discounted. However, in keeping with local policy, they have been adopted to treat the surface water run off at source and improve water quality.

4.2.7 GEO-CELLULAR / MODULAR SYSTEMS

Modular plastic geo-cellular systems with a high void ratio can be used to create a below ground storage structure. Modular tanks can be used for runoff attenuation but require silt trap protection and a suitable means of access for cleaning and inspection. A Geo-cellular system has been adopted on the proposed strategy. Water quality will be raised by providing a full retention interceptor prior to entry to the Geo-cellular storage structure.

4.2.8 PONDS / RAIN GARDENS / INFILTRATION BASINS

Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Runoff from each rain event is detained and treated in the pool. The retention time promotes removal of silt through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations. Rain gardens have been provided in numerous locations throughout the site, as indicated on drawing 22092-1025-PL9.

4.3 EXISTING SURFACE WATER SYSTEM

Currently, there is an existing surface water system serving the proposed site crossing main street and discharging to the via public sewer to the north east of the site the SDCC service maps is available in this report in appendix A.. The only other hydrological feature in the area is an existing dry ditch running from south to north along the western boundary. This ditch is culverted by an existing 300mm diameter pipe that is collecting runoff from an existing spring along the western boundary and the ditch to the south, discharging to the drain to the north west of the site along Main Street Upper. The spring will be retained along with the existing dry ditch, which is to be retained in its entirety. As mentioned previously, the existing spring and its connection to the culvert will be maintained within the proposed development.

4.4 PROPOSED SURFACE WATER COLLECTION SYSTEM

The proposal for this development is to provide a new surface water collection network, collecting surface water run-off through roof gutters/downpipes and a network of permeable (pervious) tarmac areas, rainwater gardens, gullies, and stockholm tree pits located around the site to the design levels proposed for the finished car park layout. Please see drawing no. 22058-1025-PL9 for details of the proposed collection network. These rainwater gardens and permeable tarmac areas are both to incorporate a 550mm deep clean stone sub-base with a 30% void ratio, along with a 225mm perforated pipe wrapped in permeable geotextile membrane, which is laid within this sub-base. A green roof, equipped with a DSE 40

drainage and protection layer, is also to be included on the roof of the proposed Lidl Discount Foodstore, which will have a surface area of approximately 1,047m^{2}and a subsequent storage volume of 14m^3. All surface water collected from areas accessible to vehicle traffic will be cleansed by an inline Bypass Fuel/Oil Separator. At car park level, surface water will be initially collected by the aforementioned rainwater gardens and permeable tarmac areas, providing 22m^2 and 365m^2 of storage volume respectively, before subsequently being routed to and held in the proposed attenuation tank, providing a storage volume of 102m^3. In total, all SuDS features on site equate to a cumulative storage volume of 503m^3.The outflow from the site will be limited by a HydroBrake, restricting the surface water discharge from the site to a flow of 2.06l/s. See below for a more detailed description of the attenuation systems and outflow control from this site. The surface water collection network will be constructed in accordance with the following:

- BS EN 752:2008 – Drain & Sewer Systems Outside Buildings;
- Building Regulations - TGD Part H – Drainage and Wastewater Disposal,
- Newcastle LAP and SDCC County Development Plan 2022-2028,
- SDCC SuDS Explanatory Design Evaluation Guide.

The SuDS design has been developed in collaboration with Austen Associates, landscape architects targeting a green space factor of a least 0.5. Austen Associates drawings and reports should be read in conjunction with this report.

OUTFLOW FROM SITE

In the Flood Risk Assessment carried out by JBA Consulting, the associated groundwater vulnerability is classified as 'Extreme' for the proposed site which indicates a significant risk to the groundwater under the site and a bedrock depth of between 0m and 3m. The groundwater vulnerability for the additional land to the south is classified as 'High', which indicates a high risk to the groundwater under the site and a bedrock depth of between 3m and 5m. These classifications are based on relevant hydrogeological characteristics of the underlying geological materials. This consequently makes infiltration unviable for the surface water treatment of the proposed development, therefore making controlled discharge and storage the proposed option.

The outflow from the site will be limited to the pre-development greenfield runoff rate of 2.00 l/s/ha. This practice is in accordance GDSDS requirements and SDCC SuDS Explanatory Design and Evaluation Guide. As the site area is 1.04 ha, the outflow from the site will be restricted to 2.06 l/s. A HydroBrake Optimum by Hydro International (or similar equivalent) will be provided within the last manhole within the site to limit the outflow as above. Subsequently, the discharge from this development is proposed via the existing surface water pipeline running along the northern boundary of the site, illustrated on drawing 22058-1025-PL9.

SURFACE WATER ATTENUATION SYSTEM

An attenuation tank, a green roof, permeable tarmac areas, and rainwater gardens have been designed to provide storage for the surface water generated during a 1 in 100-year rainfall event. The rainfall generated by such an event will be increased by an allowance of 20% to cater for predicted climate change due to global warming. The required storage volume of the cumulative surface water attenuation system has been calculated as 503m^3. This will be divided between the permeable surface (rainwater gardens and

permeable tarmac areas) subbase, providing a storage volume of 387m^3, the green roof, which provides a storage capacity of 14m^3, and the attenuation tank, providing 102m^3 of storage. Please refer to Appendix A for surface water attenuation design calculations.

SUDS ELEMENTS PROPOSED

In accordance with the SDCC SuDS Explanatory, Design and Evaluation guide, the following are proposed:

- Green Roof
  - The proposed green roof will assist significantly in treating surface water at source.
- Rain Garden
  - The proposed rain gardens shall promote biodiversity.
- Permeable Tarmac
  - The proposed permeable surfacing and clean stone subbase will assist with water quality
- Attenuation Tank
  - The proposed attenuation storage shall assist with water quantity.

5 FOUL EFFLUENT

The following section comprises a brief description of the existing foul sewer system situated on the proposed site, before discussing the design of the proposed foul sewer system.

5.1 EXISTING FOUL SEWER SYSTEM

The existing foul sewer service is to be removed and a new foul sewer pipeline is proposed to be provided to service the facilities in the proposed new store. There is an existing public foul sewer located in the access road to the store that the new foul sewer will connect to again.

5.2 PROPOSED FOUL SEWER SYSTEM

A new foul sewer system will be constructed within the site in accordance with the following:

- BS EN 752:2008 – Drain & Sewer Systems Outside Buildings,
- Building Regulations - TGD Part H – Drainage and Wastewater Disposal.

The effluent generated by the proposed building is outlined in the following table:

Table 3: Recommended Wastewater Loading Rate

Building	Type	Loading[1] (l/day)	No.	Avg. Flow (l/s)[2]	Peak Flow[4] (l/s)
Cafe	Staff	60	3	0.0042	0.0252
	Visitor	15	100[3]	0.0347	0.2082
Retail Unit	Staff	60	3	0.0042	0.0252
	Visitor	15	50[3]	0.0174	0.1044
Licensed Discount Food Store	Staff	60	8[5]	0.0111	0.067
	Visitor	15	250[3]	0.0868	0.521
TOTAL FLOW				**0.1584**	**0.951**

[1] Based on EPA's Treatment Systems for Small Communities, Business, Leisure Centres and Hotels –

[2] Food Store and Retail Units are open 12 hours day, so average flow is spread over 12 hours.

[3] Based on 25% of Visitors per day. Store/Retail Unit open 12 hours day.

[4] Peak flow = 6 times average flow.

[5] Number of staff on duty at any one time. Total staff to be 20-25.

The overall daily wastewater loading is 6843 litres/day or 6.843m^3/day. The proposed foul sewer system will be connected to an existing foul sewer network within the site. A new connection will be made to the existing public foul sewer along the adjacent public road along the northern boundary of the application site.

6 WATERMAINS

The proposed development will be connected to the existing public watermain along the adjacent public road along the northern boundary of the application site. Allowing for a drinking water requirement of 2 l/day/person and the wastewater daily loading of 6.843m^3/day, the proposed development will require in the order of 6.903m^3 of potable water per day. The proposed connection for the new store will be made in accordance with Irish Water Standard Details for Non-Mechanical Meter Chamber (40mm to 250mm in diameter): Ref. STD-W-26-Rev 03. Please refer to drawing 22058-1026-PL5 for the location and details of the proposed new watermains network and fire hydrants proposed for this new site layout.

7 EXISTING SERVICES

All existing foul sewer, surface water pipeline, gullies and watermains have been identified on site and are shown on the topographic survey. All existing services will be removed from the site and the proposed new systems will be provided.

8 SUMMARY AND CONCLUSIONS

Surface Water

The proposed surface water network on site will be served by a bypass fuel/oil separator, a green roof, permeable tarmac and rainwater gardens throughout the site, both incorporating a clean stone subbase with 30% void ratio (non-infiltration), and an attenuation tank. The provision of an attenuation tank and subbase storage with HydroBrake flow control device will restrict the outflow from the site to the equivalent of 2.06 l/s. This proposed design achieves compliance with all aforementioned regulations whilst considering the constraints of the site.

Foul Water

The wastewater loading from the site will be 6.843m^3 day, with a peak flow of 0.951 l/s.

Watermains

The volume of water required by the proposed development will be 6.903m^3 day.

9 APPENDIX A – SURFACE WATER ATTENUATION DESIGN

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

Half Drain Time : 2167 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 Summer	7.746	0.246	0.0	1.9	1.9	128.8	O K
30 min Summer	7.837	0.337	0.0	1.9	1.9	175.9	O K
60 min Summer	7.929	0.429	0.0	1.9	1.9	223.9	O K
120 min Summer	8.028	0.528	0.0	1.9	1.9	275.7	O K
180 min Summer	8.087	0.587	0.0	1.9	1.9	306.8	O K
240 min Summer	8.130	0.630	0.0	1.9	1.9	329.4	O K
360 min Summer	8.190	0.690	0.0	1.9	1.9	360.3	O K
480 min Summer	8.229	0.729	0.0	2.0	2.0	381.0	O K
600 min Summer	8.257	0.757	0.0	2.0	2.0	395.7	O K
720 min Summer	8.278	0.778	0.0	2.0	2.0	406.3	O K
960 min Summer	8.303	0.803	0.0	2.0	2.0	419.6	O K
1440 min Summer	8.319	0.819	0.0	2.0	2.0	427.7	O K
2160 min Summer	8.306	0.806	0.0	2.0	2.0	420.9	O K
2880 min Summer	8.293	0.793	0.0	2.0	2.0	414.5	O K
15 min Winter	7.777	0.277	0.0	1.9	1.9	144.6	O K
30 min Winter	7.878	0.378	0.0	1.9	1.9	197.6	O K
60 min Winter	7.982	0.482	0.0	1.9	1.9	251.9	O K
120 min Winter	8.094	0.594	0.0	1.9	1.9	310.6	O K
180 min Winter	8.163	0.663	0.0	1.9	1.9	346.4	O K
240 min Winter	8.213	0.713	0.0	1.9	1.9	372.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	89.992	0.0	131.3	27
30 min Summer	61.591	0.0	146.6	41
60 min Summer	39.558	0.0	231.1	72
120 min Summer	24.745	0.0	289.3	130
180 min Summer	18.646	0.0	294.5	190
240 min Summer	15.231	0.0	294.7	250
360 min Summer	11.417	0.0	297.1	368
480 min Summer	9.294	0.0	301.3	488
600 min Summer	7.918	0.0	306.8	606
720 min Summer	6.945	0.0	311.7	726
960 min Summer	5.644	0.0	318.7	964
1440 min Summer	4.212	0.0	326.3	1440
2160 min Summer	3.143	0.0	623.2	1864
2880 min Summer	2.551	0.0	616.0	2252
15 min Winter	89.992	0.0	147.1	27
30 min Winter	61.591	0.0	143.3	41
60 min Winter	39.558	0.0	258.9	70
120 min Winter	24.745	0.0	294.5	128
180 min Winter	18.646	0.0	295.1	186
240 min Winter	15.231	0.0	297.3	246

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
360 min Winter	8.283	0.783	0.0	2.0	2.0	409.0	O K
480 min Winter	8.331	0.831	0.0	2.0	2.0	433.9	O K
600 min Winter	8.365	0.865	0.0	2.1	2.1	452.1	O K
720 min Winter	8.392	0.892	0.0	2.1	2.1	465.8	O K
960 min Winter	8.427	0.927	0.0	2.1	2.1	484.5	O K
1440 min Winter	8.460	0.960	0.0	2.1	2.1	501.6	O K
2160 min Winter	8.461	0.961	0.0	2.1	2.1	502.3	O K
2880 min Winter	8.438	0.938	0.0	2.1	2.1	490.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	11.417	0.0	304.6	362
480 min Winter	9.294	0.0	312.9	480
600 min Winter	7.918	0.0	319.1	596
720 min Winter	6.945	0.0	323.9	712
960 min Winter	5.644	0.0	330.3	942
1440 min Winter	4.212	0.0	336.0	1392
2160 min Winter	3.143	0.0	634.8	2036
2880 min Winter	2.551	0.0	640.3	2364

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)	16.800	Shortest Storm (mins)	15
Ratio R	0.292	Longest Storm (mins)	2880
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.780

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.260	4	8	0.260	8	12	0.260

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 7.500 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	550.0	0.0	1.001	0.0	0.0
1.000	550.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0066-2100-1200-2100
Design Head (m)	1.200
Design Flow (l/s)	2.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	7.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.1
Flush-Flo™	0.288	1.9
Kick-Flo®	0.587	1.5
Mean Flow over Head Range	-	1.7

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)
0.100	1.6	1.200	2.1	3.000	3.2	7.000	4.7
0.200	1.8	1.400	2.2	3.500	3.4	7.500	4.9
0.300	1.9	1.600	2.4	4.000	3.6	8.000	5.0
0.400	1.8	1.800	2.5	4.500	3.9	8.500	5.2
0.500	1.7	2.000	2.6	5.000	4.0	9.000	5.3
0.600	1.5	2.200	2.8	5.500	4.2	9.500	5.5
0.800	1.7	2.400	2.9	6.000	4.4		
1.000	1.9	2.600	3.0	6.500	4.6		