LANGAN

CONSULTING ENGINEERS

SUDS DESIGN REPORT

SANDYFORD CIVIC PARK, SANDYFORD, CO. DUBLIN

DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL C/O URBAN AGENCY

24208-RP-2101-FL01 | JANUARY 2026

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QUALITY CHECK SHEET

DOCUMENT TITLE: SuDS Design Report

PROJECT TITLE: Sandyford Civic Park, Sandyford, Co. Dublin

CLIENT: Dún Laoghaire-Rathdown County Council c/o Urban Agency

DOCUMENT REF: 24208-RP-2101-FL01

REVISION	DESCRIPTION	ISSUE DATE	PREPARED BY	CHECKED BY	APPROVED BY
DR01	Draft Issue	8th January 2026	KH	EOR	Mr. James Langan
DR02	Draft Issue	9th of January 2026	KH	EOR	Mr. James Langan
FL01	Final Issue	16th of February 2026	KH	EOR	Mr. James Langan

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Sandyford Business District (SBD) and Dún Laoghaire-Rathdown County Council (DLRCC) are collaborating to transform 0.96 hectares of existing commercial property in Sandyford, Co. Dublin into the new '*Sandyford Business District Civic Park*'. It is proposed to demolish a number of existing commercial buildings as part of the development. It is proposed now to seek consent via a Part 8 planning application.

Urban Agency has been appointed as the lead project designer of a multi-disciplinary team responsible for the delivery of the new Civic Park. Langan Consulting Engineers (LCE) are appointed by Urban Agency as the Urban Drainage Design Specialist (Sub Consultant) to design a Sustainable Drainage System (SuDS) for the proposed civic park. This report will support the planning application.

1.2 REPORT INTRODUCTION

This design report outlines LCE's SuDS design procedure.

SuDS is a way of managing rainfall that minimises the negative impacts on the quantity and quality of runoff whilst maximising the benefits of amenity and biodiversity for people and the environment as defined in the SuDS Manual C753 (2015) published by CIRIA.

The Greater Dublin Strategic Drainage Study (GDSDS) provides the following definitions for SuDS:

- *SuDS involve a change in our way of managing urban run-off from solely looking at volume control to an integrated multi-disciplinary approach which addresses water quality, water quantity, amenity and habitat (Vol 3 p.132)*
- *SuDS minimise the impacts of urban runoff by capturing runoff as close to source as possible and then releasing it slowly (Vol 3 p.133)*

1.3 SUSTAINABLE DRAINAGE DESIGN REPORT OBJECTIVES

The objectives of the SuDS Design Report are to:

- Outline how the SuDS design delivers the DLRCC's Scope of Services[1] and the aims of the Sandyford Urban Framework Plan (SUFP) 2022-2028.
- Describe how the system will operate.
- Explain the proposed maintenance regime.

1.4 SITE VISITS AND SURVEYS

The development lands were visited by LCE on the 26th of February 2025.

A topographical survey of the development lands was provided by Apex Surveys Ltd to LCE on the 11th of June 2025.

An underground utility survey of the development lands and surrounds was also provided by Apex Surveys Ltd to LCE on the 11th of June 2025.

[1] Dún Laoghaire-Rathdown County Council Community & Cultural Development Department Scope of Services for the Provision of Multi-Disciplinary Design Team Services – Landscape Architect Led with Sub-Consultants Consisting of; Civil & Structural Engineer, Urban Drainage Design Specialist, Electrical Engineer, Accessibility Consultant, Quantity Surveyor & PSDP for Sandyford Civic Park

1.5 ASSUMPTIONS

This report is based on the following assumptions:

- All development information is based on a data provided by Client.
- It is assumed all 3rd party information is current and accurate.
- All levels referred to in this report are relative to Ordnance Datum Malin Head (mOD) (Geoid: OSGM15).

1.6 ABBREVIATIONS AND DEFINITIONS

CIRIA	Construction Industry Research and Information Association
GDSDS	Greater Dublin Strategic Drainage Study
Geoid	A model of global mean sea level that is used to measure precise surface elevations
ITM	Irish Transverse Mercator
LCE	Langan Consulting Engineers Ltd.
mOD	Meters Ordnance Datum (Malin, unless otherwise noted)
OSGM15	A hybrid geoid covering all of the land areas and inshore waters of the Republic of Ireland, the Isle of Man, and the United Kingdom (see Geoid above).
SuDS	Sustainable Drainage Systems
DLRCC	Dún Laoghaire-Rathdown County Council
CDP	County Development Plan
SFRA	Strategic Flood Risk Assessment
SBD	Sandyford Business District
SUFP	Sandyford Urban Framework Plan
SI	Site Investigation

2 SITE CHARACTERISTICS

2.1 SITE DESCRIPTION

The proposed civic park is located in Sandyford, Dublin 18, west of Dún Laoghaire, Co. Dublin in the middle of a live business park. The Carmonhall Road runs along the northern border of the site. The Corrig Road is within the redline boundary and forms the east boundary of the proposed civic park as shown in Figure 2-1. The location of the proposed development lands is at ITM coordinates 719158,726681. Access to the site is provided via the Corrig Road.

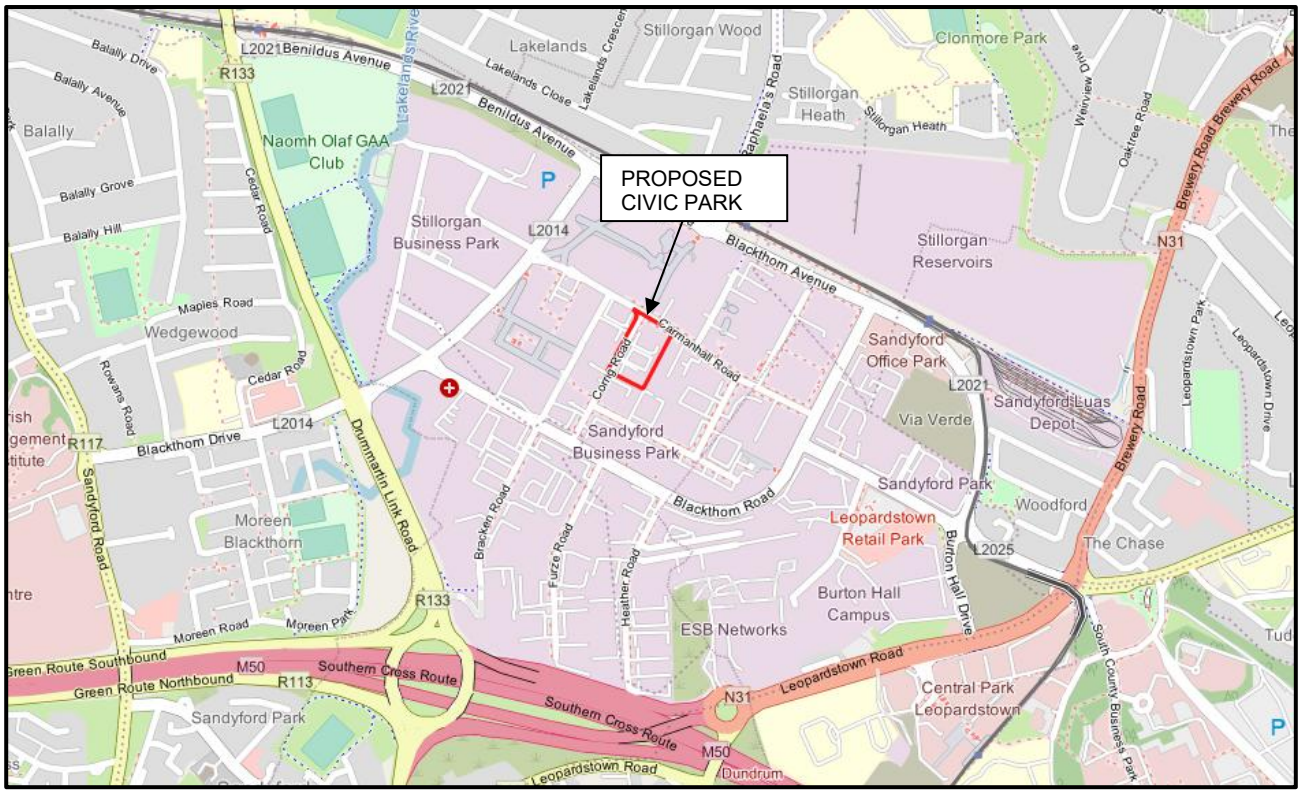

Figure 2-1 Site location (Open Street ArcGIS)

2.2 EXISTING LAND USE

The proposed civic park is currently occupied by three commercial buildings, as shown in Figure 2-2. According to the Sandyford Urban Framework Plan (SUFP) 2022–2028, the development lands are zoned as 'F - Open Space Zone', with the objective "*To preserve and provide for open space with ancillary active recreational amenities*."

Figure 2-2 Aerial image of the site

2.3 SITE TOPOGRAPHY

The existing ground levels of the development lands range from +84.4mOD to +88.9mOD generally falling from south to north.

2.4 PROPOSED DEVELOPMENT

This SuDS design is based on the proposed park layout provided by Urban Agency to LCE on the 16th of February 2026. The proposed park layout features a new topography which has multiple areas of grass mounds which are surrounded by pathways. Therefore, the topography is variable with ground levels in the range of +84.47mOD to +89.94mOD.

2.5 SITE GEOLOGY

2.5.1 GEOLOGICAL SURVEY OF IRELAND (GSI) BEDROCK MAPPING

The Geological Survey of Ireland (GSI) (1:100k) national bedrock mapping for the proposed development lands is shown in Figure 2-3. The site is underlain by “Pale grey fine to coarse-grained granite”.

Figure 2-3 GSI bedrock mapping

2.5.2 GSI AQUIFER AND KARST FEATURES MAPPING

The aquifer underlying the entire proposed development lands is classified as "*Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones".* No karst features are recorded in the area.

2.5.3 GSI SOILS MAPPING

The GSI soils mapping for the proposed development lands is shown in Figure 2-4.. The soils within the proposed development lands are classed as "*Tills derived from limestones*" and "*Till derived from granites*" and "*Bedrock outcrop or subcrop*".

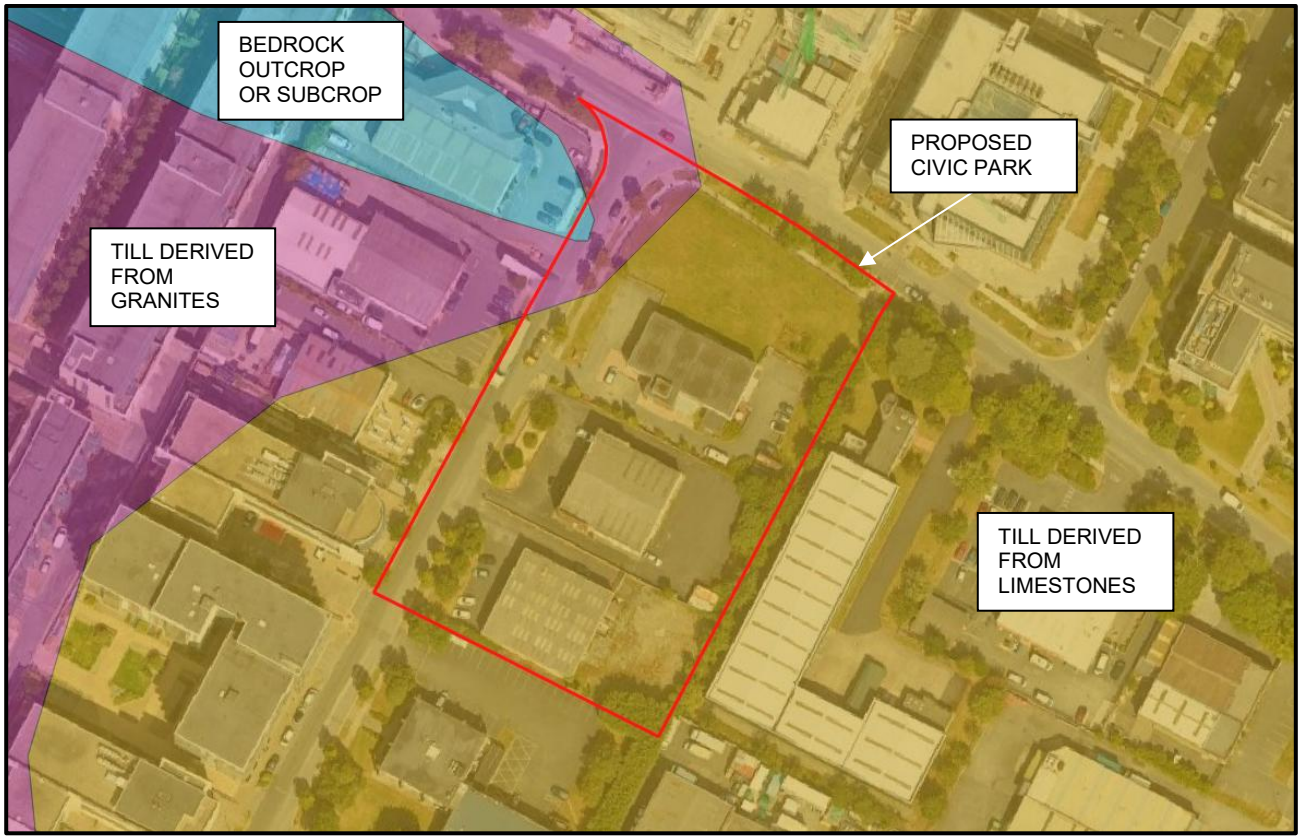

Figure 2-4 GSI soils mapping

2.5.4 SITE INVESTIGATION

IGSL Limited were appointed by LCE on behalf of DLR to carry out infiltration testing at the site. The SI report is shown in Appendix B.

The following text details the findings of the SI:

> "*The underlying soils were composed of firm to stiff brown sandy clay to a depth of 0.6 m BGL. Below this depth, the material graded to stiff (high strength) sandy gravelly clay with cobbles.*
>
> *Coarser material was met at a depth of 1.5 m BGL and had the appearance of residual soil (completely weathered bedrock). This material presented a very high resistance to excavation and was impenetrable below 1.7 m BGL.*
>
> *The pit sides remained stable and no water ingress was observed during the course of excavation operations.*
>
> *Soakaway testing was undertaken during the SI in accordance with BRE Digest 365[2]. The investigation found the rate of infiltration was too low to calculate due to the low permeability soils which are considered poor infiltration media. The findings specified that the site is unsuitable for the use of infiltration drainage systems*."

The report showed the existing soils have no infiltration characteristics at the test location. This design assumes the test is representative of the soils over the entire development lands.

This test result limits the potential SuDS solutions that can be adopted at this site.

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

2.6 SITE DRAINAGE

No hydraulic features are identified in the immediate vicinity of the proposed development lands. The closest hydraulic feature is the Carrickmines Stream which is located 0.35km to the southwest of the proposed civic park.

2.7 EXISTING STORMWATER NETWORK

A publicly available stormwater network drawing was received by LCE on the 13th of March 2025. There is an existing 375mm concrete pipe indicated as running beneath the Corrig Road. Invert levels suggest that the there is a northward flow in the pipe. This connects via manhole to an existing 750mm concrete pipe indicated as running beneath the Carmanhall Road. Invert levels suggest that there is a westward flow in the pipe.

A more detailed survey of the existing stormwater network was received by LCE on the 11th of June 2025. This survey confirms that there is a 375mm concrete pipe beneath the Corrig Road.

All existing network details are included in Appendix C.

2.8 HISTORIC MAPPING

2.8.1 6 INCH ORDINANCE SURVEY MAP FIRST EDITION COLOUR (1837-1842)

The 6 Inch First Edition Colour (1837-1842) mapping for the proposed development lands was investigated.

No historical features were identified within the proposed development lands as shown in Figure 2-5.

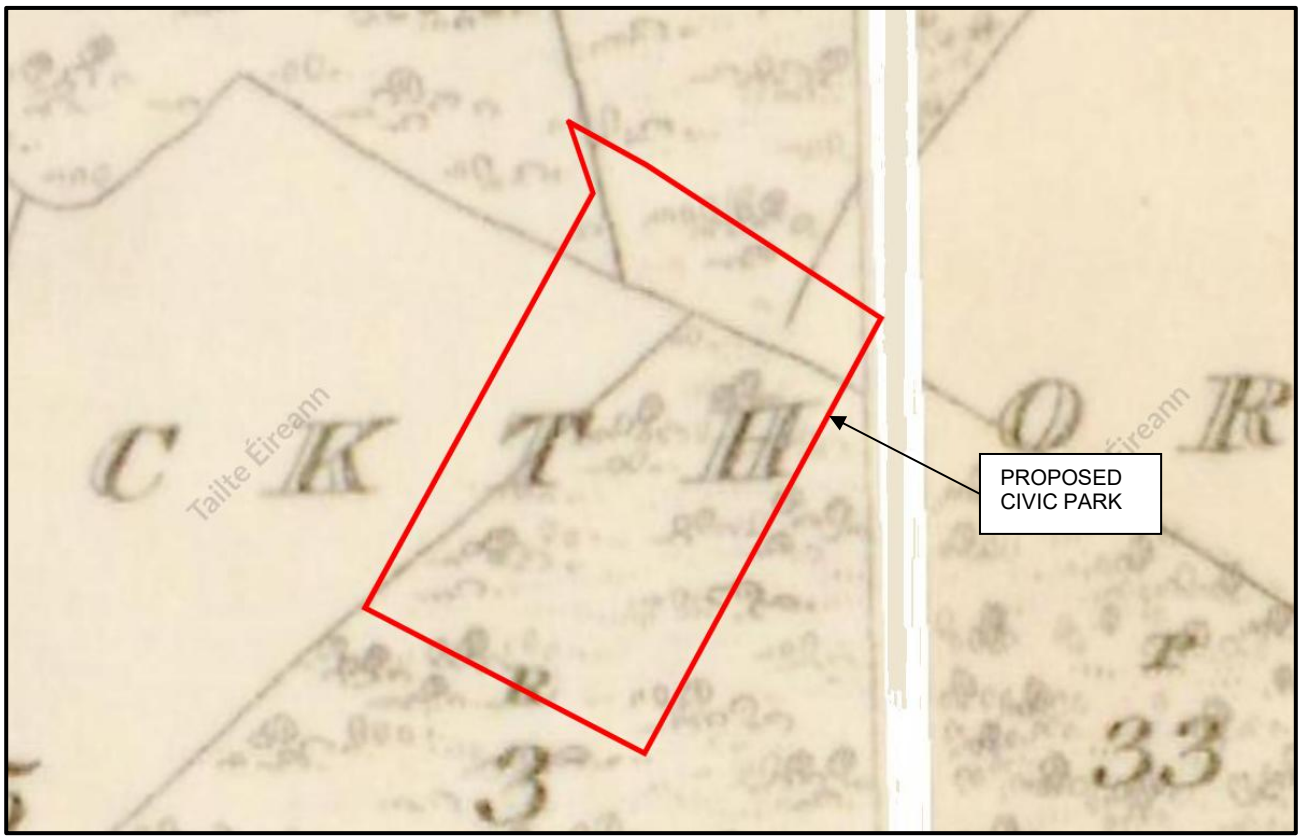

Figure 2-5 6 Inch Ordinance Survey Map First Edition (1837-1842) of proposed civic park

2.8.2 25 INCH ORDINANCE SURVEY MAP (1888-1913)

The 25 Inch Ordinance Survey (1888-1913) mapping for the proposed development lands was investigated. There is conclusive evidence of a minor drain/ditch running along the northern boundary of the proposed development lands as shown in Figure 2-6. This drain/ditch is not visible on any OS mapping since then. LCE expect the feature was removed/ became redundant during the Business Park development 40 years ago.

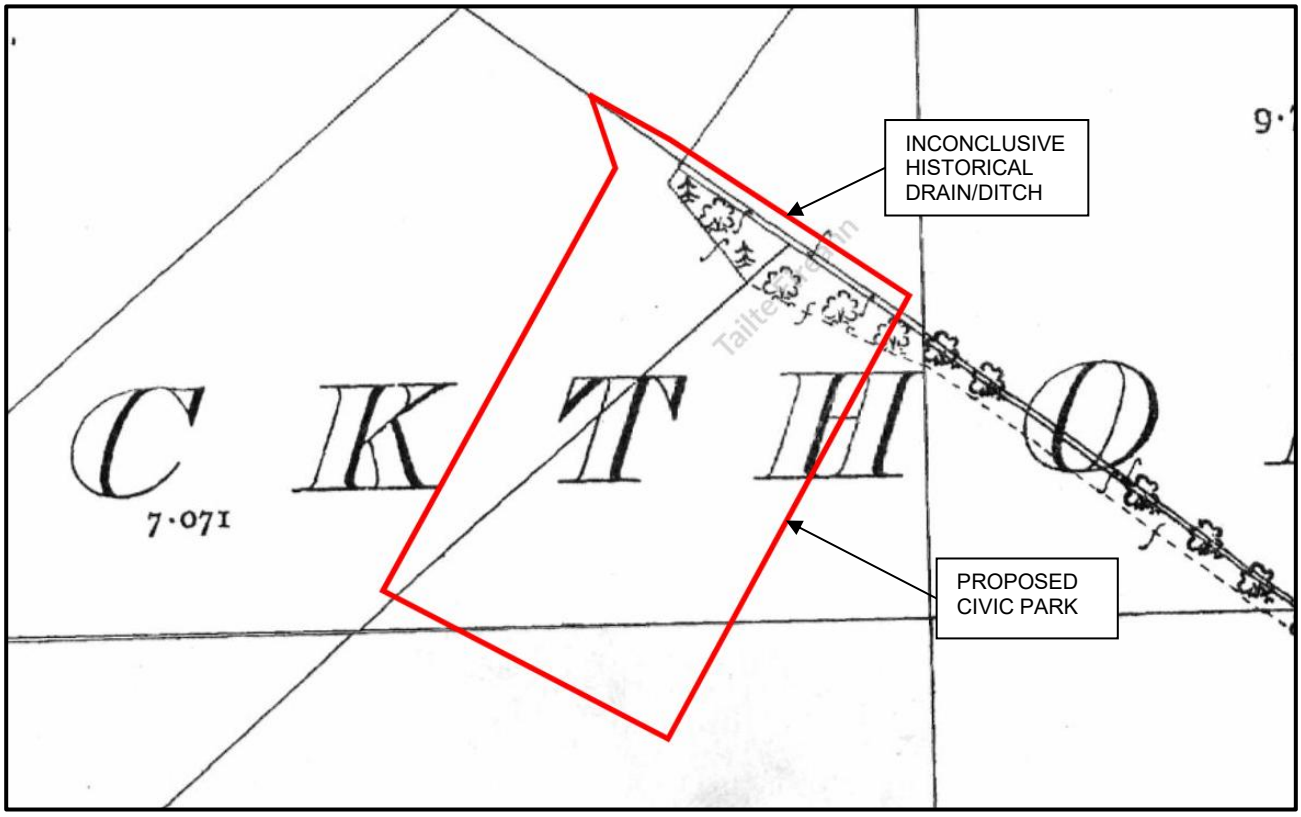

Figure 2-6 25 Inch Ordinance Survey (1888-1913) of proposed civic park

2.9 SITE CONSTRAINTS

The constraints which will inform the development of the SuDS design is presented in Table 2-1.

Table 2-1 Site constraints

Attribute	Description	Dataset Confidence Rating Low (L), Medium (M), High (H)	Influence on SuDS design
Flooding	There is a pluvial flood risk highlighted in the northwest of the proposed civic park in the DLRCC County Development Plan 2022-2028 Strategic Flood Risk Assessment (SFRA). See Appendix D.	L	This reinforces the objective of the SuDS design to retain stormwater in this area.
Existing stormwater infrastructure	There is existing public drainage infrastructure in the vicinity of the proposed development site.	H	The SuDS design will have a clear outfall point. It will connect into an existing stormwater pipe that is 375mm in diameter. The design will result in lesser volumes of stormwater run off during extreme weather events.
Utilities	There is existing utility services in the vicinity of the proposed development lands	H	The SuDS design will be design so that new drainage features will not clash any existing utilities.
Topography	There is a natural slope across the site falling from north to south.	H	The SuDs design will utilise the existing topography, draining stormwater in the same direction and with an attenuation tank along the southern boundary.
Land use existing and proposed	The majority of the existing site is either roofed or paved. All new pavement areas will be permeable, 2 buildings will be removed and replaced with green areas.	H	SuDS design will achieve a maximum run off rate of 2 l/s.
Size of site	0.96 hectares.	H	All SuDS features will be localised in scale.

3 SUSTAINABLE URBAN DRAINAGE DESIGN STRATEGY

3.1 DESIGN APPROACH

The SuDS design approach sets out the proposed strategy for managing rainfall runoff within the development, ensuring that flood risk is not increased either on-site or elsewhere, while also delivering wider benefits for water quality, amenity, and biodiversity.

The SuDS design approach follows the guidance in the CIRIA SuDS Manual and can be summarised as follows:

- Identify existing and altered flow routes.
- Determine suitable discharge mechanisms for site drainage.
- Establish a management system and define an appropriate number of sub-catchments to enable effective collections, treatment, storage, and conveyance of runoff across the site.
- Select SuDS components that align with the proposed landscape character.

Note that this report outlines the preliminary stage of design.

3.2 EXISTING FLOW ROUTE ANALYSIS

The existing stormwater network has been assessed. The existing flow route for the site is illustrated in Figure 3-1.

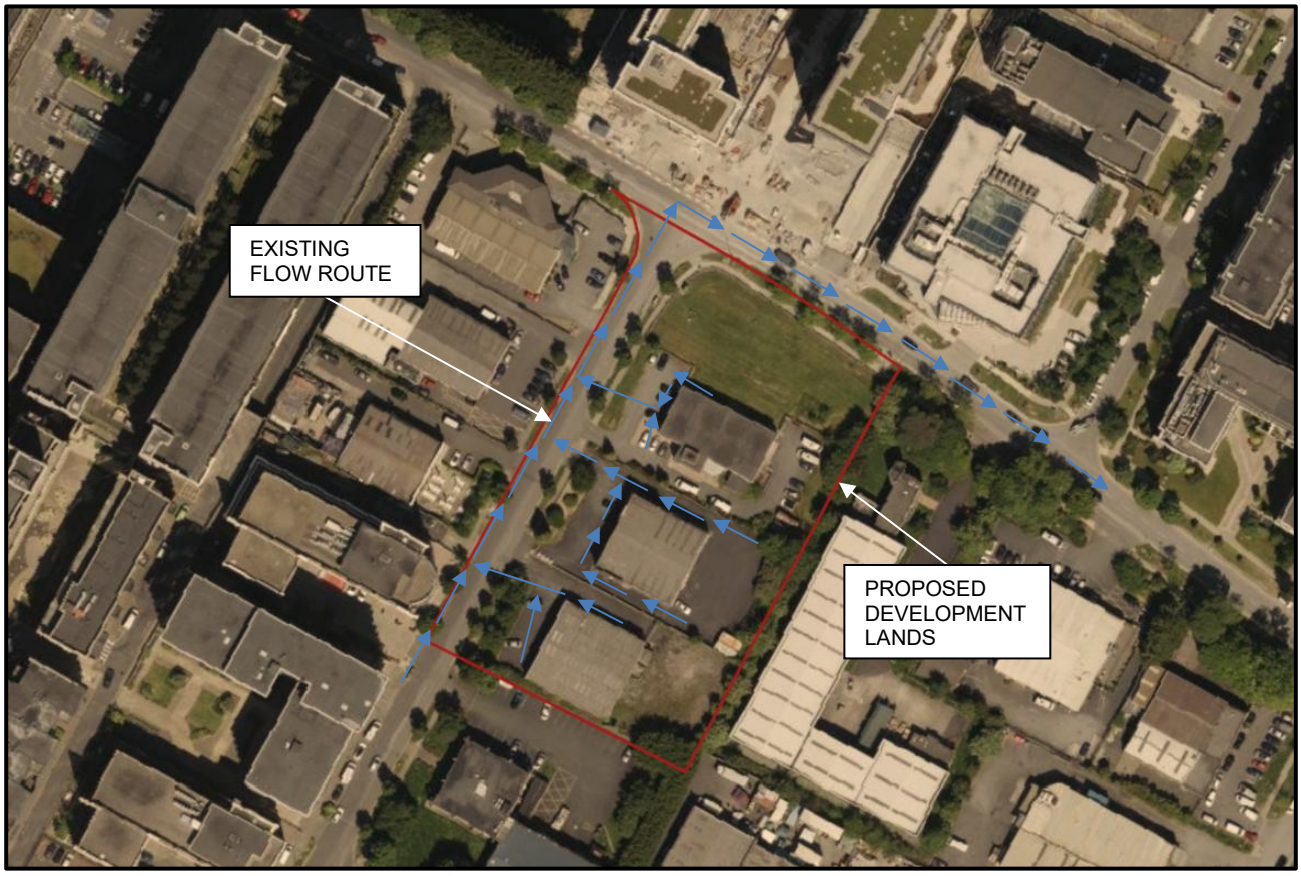

Figure 3-1 Existing stormwater flow routes

3.3 PROPOSED FLOW ROUTE ANALYSIS

The development proposes to revise the existing flow route marginally. The proposed flow route has been assessed, based on the proposed civic park layout drawing included in Appendix A. The modified flow route for the site is illustrated in Figure 3-2.

Figure 3-2 Proposed new stormwater flow routes

3.4 DRAINAGE HIERARCHY

The mechanism that runoff is disposed from the site is designed in accordance with the following hierarchy of discharge:

- Re-use – Where opportunities arise for rainfall harvesting within the proposed development, these should be maximised.
- Infiltration – Infiltration of stormwater to ground is not considered an option here, as per onsite BRE 365 test results received.
- Watercourse – There are no natural watercourses in the vicinity of the site to which the proposed SuDs design can outfall to, therefore this option is not considered here.
- Surface Water Sewer – The existing stormwater from the proposed development site is serviced by a public stormwater network. The SuDS design will discharge to the same services.

For the purposes of this outline SuDS design, following the drainage hierarchy outlined above, the stormwater pipe beneath the Corrig Road is taken as the preferred point of discharge. In the absence of re-use, sufficient infiltration potential or presence of a local watercourse, the stormwater water drainage pipe is the only viable means of drainage.

3.5 PROPOSED SUDS COMPONENTS

In accordance with the DLRCC CDP 2022-2028 Section 10.2.2.6 Policy Objective EI6: Sustainable Drainage Systems, the proposal must demonstrate that it meets the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) policies in relation to Sustainable Drainage Systems (SuDS). The design must incorporate SuDS measures appropriate to the scale of the proposed development such as soakpits, permeable paving, rainwater harvesting, rain gardens, etc. that minimise flows to the public drainage system and maximises local infiltration potential. All SuDS measures must be designed in accordance with the relevant industry standards and the recommendations of The SuDS Manual (CIRIA C753).

The SuDS components that form the surface water design approach are presented in Table 3-1.

Table 3-1 SuDS Features Options Table

SuDS Measures	Measures to be considered on this site	Reason for selecting/ Not selecting
Source Control		
Swales	Y	Swales help mitigate the heat-island effect by slowing runoff and reducing peak discharge.
Tree Pits	Y	Tree pits provide long-term sustainable drainage and amenity value and are appropriate to a civic park.
Rainwater butts	Y	Rainwater butts offer short-term stormwater storage; however, these depend heavily on user engagement, have limited capacity, and may lead to algae, odour, or insect issues if not properly maintained.
Rainwater harvesting	N	Rainwater harvesting enables water reuse (potentially for a site water feature), but this is costly, complex to manage, and requires significant treatment before any potable use. Water demand to be confirmed.
Soakaways	N	Soakaways are effective for managing overflows from other SuDS components, but these rely on favourable soil infiltration. These are unsuitable in areas with high groundwater, shallow bedrock, or ground-condition constraints.
Infiltration trenches	N	Infiltration trenches effectively manage overflow and these are suitable along the historical drainage channel on the northern boundary. These require minimal maintenance when well designed, can be integrated below permeable pavements, and the site provides adequate linear space.
Permeable pavement	Y	Permeable pavement will be installed across parking and hardstanding areas, and this will maximise local infiltration and reduce surface runoff.
Grasscrete	Y	Grasscrete supports infiltration for parking and hardstanding, although this may introduce accessibility challenges.
Block Paving	Y	Block paving provides a permeable, visually appealing surface for parking and hardstanding, and this allows individual blocks to be replaced if damaged.
Porous Asphalt	Y	Porous asphalt supports infiltration across paved areas in accordance with DLR design objectives. This reduces surface runoff and integrates well with vehicular and pedestrian routes.

Green roofs	N	Green roofs slow and attenuate roof-level runoff, reducing reliance on infiltration features. This may be difficult to maintain due to working-at-height requirements.
Filter strips	N	Filter strips slow and disperse surface runoff, reducing erosion, lowering peak flows, and protecting downstream drainage infrastructure.
Bio-retention systems/raingardens	Y	Bio-retention systems/raingardens can be designed to accommodate storm events, enhance biodiversity, and improve site amenity and streetscape quality.
Blue Roofs	N	Blue roofs could offer roof-level storage, but this presents significant maintenance challenges due to restricted access.
Filter Drains	N	Filter drains convey and infiltrate stormwater efficiently and these can distribute flows to other SuDS features when appropriately designed.
Site Control		
Detention Basins	Y	Detention basins are excluded due to safety considerations. Basins if adopted, will be designed with depths of less than 0.3m.
Regional Basins	N	The project has a relatively small footprint, so there's no capacity to enhance regional design.
Regional Control		
Ponds	N	The project has a relatively small footprint, so there's no capacity to enhance regional design. Ponds are not proposed for this development and generate a health and safety risk. This a localised project.
Wetlands	N	The project has a relatively small footprint, so there's no capacity to enhance regional design. Wetlands are not proposed for this development.
Other		
Hydrocarbon Interceptor	Y	A hydrocarbon interceptor required where permeable pavements are used by vehicles to mitigate contamination risks.
Attenuation Tank	Y	Attenuation tanks provide controlled stormwater storage and this is necessary due to the site's stringent runoff-rate requirements.
Oversized pipes	Y	Oversized pipes will be adopted in this design to provide additional storage and help reduce the runoff rate.

3.6 WATER QUANTITY

Adequate attenuation must be implemented to prevent unexpected flooding on the site, safeguard future buildings, and avoid increasing flood risk in other areas. With inadequate soil infiltration on-site, there will be a heavy reliance of attenuation structures in the SuDS design.

3.6.1 CLIMATE CHANGE

Climate change allowances are applied in accordance with the OPW 'General Map User Guidance Notes' available on floodinfo.ie. For hydraulic calculations supporting the outline design proposal, a 20% increase in extreme rainfall depths (Mid-Range Future Scenario, MRFS) has been adopted.

3.6.2 STORMWATER RUNOFF RATES

There are no SuDs features in the existing stormwater drainage networks. A hydraulic stormwater model for each of the 3 existing commercial properties was prepared in MicroDrainage. Existing flow rates of 55.3, 68.8 & 70.3 l/s were estimated consecutively for the properties, in the order north to south. The total existing run-off rate is therefore 194 l/s.

The proposed surface water drainage has been designed in accordance with the criteria established by GDSDS Stormwater Management Policy as follows:

- Criterion 1.1: Interception storage is provided through vegetated and soil based SuDS which will generate losses in runoff for the majority of runoff events. The losses generated will achieve this criterion.
- Criterion 1.2: N/A
- Criterion 2.1: Table 3-2 identified the flow rate acceptable, which is demonstrated by the hydraulic calculations (MicroDrainage) provided in Appendix E.
- Criterion 2.2: All flows retained to QBar for the 1 in 100 year rainfall event.
- Criterion 3.1: Compliance demonstrated by the hydraulic calculations provided.
- Criterion 3.2: Compliance demonstrated by the proposed layout. Detailed design site levels will ensure that any exceedance flow will cascade from the SuDS component to the next.
- Criterion 3.3: Highest proposed water level proposed in main storage basin is 84.5mOD. An exceedance flow path is situated between storage location and basin which will route flows away from the properties. Therefore, properties are not directly connected to peak storage level.
- Criterion 3.4: Compliance demonstrated by drawing and calculations provided in Appendix E.
- Criteria 4.1, 4.2 and 4.3: Table 3-2 and calculations in Appendix E demonstrate compliance with Criterion 4.3 in lieu of 4.1 and 4.2.

Table 3-2 below shows the existing and proposed stormwater run-off rates for this development.

Table 3-2 Project Design Run-off Rates (l/s)

Catchment Ref	Existing Stormwater Run-off Rate	Proposed Stormwater Run-off Rate 1% AEP (1 in 100) incl. 20% CC
Sandyford Civic Park	194	2

The proposed development will have a significantly reduced stormwater runoff rate than the existing stormwater runoff rate.

3.6.3 STORAGE OF RUNOFF AND DISCHARGE LOCATION

Runoff is attenuated throughout the site as it passes through or is stored in SuDS components which have been chosen to collect, convey and store water based on site and hydraulic requirements.

In line with GDSDS requirements, attenuation storage was sized for the 1% AEP (with allowance for climate change) critical rainfall event while the 1-year and 100-year events to the rates shown above. It is proposed to construct an underground stormwater attenuation tank with a volume, are provided in Table 3-3.

Table 3-3 Attenuation Storage Volume

Return Period	Attenuation Volume (m^3)
1% AEP (1 in 100 year) + CC	368

3.6.4 DESIGNING FOR EXCEEDANCE

Site levels and landscaping have been designed to route exceedance flows away from buildings. Overland flow routes are defined using road corridors. Detail design will set levels from individual SuDS components top ensure that flows are controlled and routed across the site in a predictable manner.

3.7 WATER QUALITY

3.7.1 WATER QUALITY REQUIREMENTS

Proposals for the site will comprise residential development and therefore considered to be low risk. Treatment provision is summarised as follows:

- Roof only runoff – removal of solids. All roofed areas will pass through at least one stage of treatment.
- Roads used for vehicular movement. The SuDS design developed makes provision for collection of runoffs through a range of techniques namely, SuDS tree planters, shallow basins, bioretention channels. Where proposed site levels will allow, SuDS components are connected in series. Flows pass into a (site control) basin prior to final discharge.

Analysis of the effectiveness of chosen SuDS components to achieve water quality criteria follows the 'simple index approach' described in the CIRIA C753 SuDS Manual chapter 29.

3.7.2 SIMPLE INDEX APPROACH

The simple index approach assigns a risk index to areas of development dependent on their land use to represent the level of pollution that is typically generated and therefore must be 'treated' within SuDS components to meet water quality standards.

Table 3-4 Risk Indices

Land Use	Pollution Hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
New Building Roof	Very Low	0.2	0.2	0.05
Low traffic roads, pedestrian routes	Low	0.5	0.4	0.4

As per the simple index approach, each SuDS component is assigned a 'mitigation index' relative to the three primary sources of pollution listed above: TSS, metals, and hydrocarbons. Mitigation indices are added together and water quality criteria are met if the mitigation index is greater than the risk index.

Secondary/further stages in the treatment train are assigned treatment indices greater than the risk indices for both types of development on site so water quality requirement is deemed to have been met. It is noted that tree pits will act similarly to bioretention so have been included a single component for a conservative water quality assessment.

Table 3-5 Mitigation Indices

SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Bioretention Channel/ Tree Pit	0.8	0.8	0.8
Detention Basin	0.25	0.25	0.3
Total	1.05	1.05	1.1

3.8 AMENITY AND BIODIVERSITY

Biodiversity is to be considered in the SuDS design process with the creation of blue / green infrastructure to provide habitat and connectivity linkages within the proposed development. The SuDS components are spread across the site as a series of 'nodes' (shallow basins and trees/tree pits) and 'links' (bioretention channels and linear basins).

The SuDS strategy retains water at or near the surface. In particular.

- The creation of habitats within the SuDS corridor will assist in meeting DLRCC CDP objectives.
- The basins can be used for recreation and public open space which support objectives in the DLRCC CDP which encourages the provision of accessible parks, open spaces and recreational facilities alongside the sustainably managing water within the site.

3.9 MAINTENANCE AND MANAGEMENT

The proposed maintenance plan for the SuDS components on site is outlined in Table 4-1 along with the party who is anticipated to be responsible for maintain of each type of component.

Table 3-6 Management and Maintenance Plan of SuDS Features

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required action	Typical frequency
Permeable Paving	Facility Operator	Regular maintenance	Brushing (standard cosmetic sweep over whole surface)	Once a year after leaf fall or reduced frequency as required
		Occasional maintenance	Removal of weeds or management using glyphosate or other suitable weed killer.	As required - once a year on less frequently used pavements
		Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
			Remediate any landscaping which has been raised to within 50 mm of the level of the paving	As required
			Rehabilitation of surface and upper sub-structure by remedial sweeping	Every 10 to 15 years or as required (if performance is reduced due to significant clogging)
		Monitoring	Initial inspection	Monthly for three months after installation
			Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Every 3 months, 48h after large storms in firsts six months
			Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
			Monitor inspection chambers	Annually
Tree Pits	Facility Operator	Regular maintenance	Remove litter and debris	Monthly (or as required)
			Manage other vegetation and remove nuisance plants	Monthly (or as required)
			Inspect inlets and outlets	Inspect monthly

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required action	Typical frequency
Tree Pits	Facility Operator	Occasional maintenance	Check tree health and manage tree appropriately	Annually
			Remove all silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
			Water	As required (in periods of drought)
		Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Half yearly
Bioretention	Facility Operator	Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underlain to determine if maintained is necessary	Quarterly
			Check operation of underdrains by inspection of flows after rain	Annually
			Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
			Inspect inlets and outlets for blockages	Quarterly
		Regularly maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons).
			Replace any plants, to maintain planting density	As required
			Remove sediment, litter and debris build-up from around inlets.	Quarterly top biannually

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required action	Typical frequency
Bioretention	Facility Operator	Occasional maintenance	Infill any holes or scour in the filter medium improve erosion protection if required	As required
			Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium, and replacing mulch	As required
		Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years
Basin	Facility Operator	Regular Inspections	Remove litter and debris	Monthly
			Cut grass - for spillways and access routes	Monthly (during growing season or as required)
			Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season or as required)
			Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
			Inspect inlets and outlets for blockages, and clear if required	Monthly
			Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
			Inspect inlets and facility surface for silt accumulation, Establish appropriate silt removal frequencies.	Monthly (for first year) then annually or as required.
			Check any mechanical devices (none currently proposed).	Annually

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required action	Typical frequency
Basin	Facility Operator	Regular Inspections	Tidy all dead growth before start growing season	Annually
			Remove sediments from inlets and outlets	Annually (or as required)
			Manage plans (where specific planting regime is adopted)	Annually
		Occasional maintenance	Reseed areas of poor vegetation growth	As required
			Prune and trim any trees and remove cuttings	Every 2 years, or as required
			Remove sediment from inlets, outlets and main basin when required.	Every 5 years, or as required (likely to be minimal requirements as upstream source control is provided)
		Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
			Realignment of rip rap	As required
			Repair / rehabilitation of inlets and outlets	As required
			Relevel uneven surfaces and reinstate design levels	As required
Open ditch	Facility Operator	Regular maintenance	Remove litter and debris	Monthly, or as required

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required action	Typical frequency
Open ditch	Facility Operator	Regular maintenance	Cut grass – to retain grass height within specified design range	Monthly (during growing season) or as required
			Manage other vegetation and remove nuisance plants	Monthly at start, then as required.
			Inspect inlets, outlets for blockages, and clear if required	Monthly
			Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half year.
			Inspect inlets and bed for silt accumulations, establish site removal frequencies.	Half yearly.
		Occasional maintenance	Reseed areas of poor vegetation growth. After plant types to better suit conditions if required.	As required / if bare soil is exposed over 10% of swale treatment area
		Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
			Re-level uneven surfaces and reinstate design levels	As required
			Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required

4 STORMWATER DESIGN

4.1 INTRODUCTION

4.2 DESIGN PARAMETERS

The design parameters used for the basis of this stormwater drainage design are outlined in Table 4-1 below.

Table 4-1 Stormwater drainage design parameters

Parameters	Values
Rainfall run-off calculation	The Modified Rational Method
Max Greenfield Runoff	2 l/s/ha
M5-60	17.9
Ratio 'R'	0.27
Max. Rainfall	50mm/hr
Global Time Entry	5 minutes
Max. Time of Concentration	30 minutes
PIMP (%)	100%
Volumetric Run-Off Co-efficient, Cv	0.75
Routing Coefficient, Cr	1.3
Soil Infiltration Rate	0 m/min
Min. Flow Velocity	1 m/s
Max. Flow Velocity	3 m/s
Min Gradient: Main Drainage Services Local Storm at buildings Internal Drainage in buildings All slot/ drainage channels	 As per MH Schedule on Design Drawings 1:100 Falls As per Architects Details As per Architects Details/ Landscape Architect
Pipe Roughness (mm)	0.60
Min Pipe Cover	1.2m under trafficked areas, 1m elsewhere (0.5m for cellular storage)
Design sewer flooding design criteria for standing water Surface Water Design Criteria. Network Design	3-year Return Period (GDSDS)3 30-year Return Period (GDSDS) 100-year Return Period (GDSDS)
Climate change	20% extra added flow rate; and or 10% extra added to rainfall

[3] Greater Dublin Strategic Drainage Study, Volume 2

4.3 PIPE AND MANHOLE NUMBERING

The manhole numbers (prefix- S)/ drainage nodes (prefix-DN) define the structure of the drainage network. These are labelled such that labels in the direction of flow are typically in increasing order. S01, S02, DN01, DN02 etc. is used for storm sewers located inside the site boundary of this development.

4.4 STORMWATER DESIGN PROCEDURE

The proposed stormwater drainage network was designed using Micro Drainage software which is based on the Wallingford Tables and the Modified Rational Method of storm flow modelling. The design procedure complies with the specifications set out in the "Recommendations for Site Development Works for Housing Areas" as issued by the Department of the Environment, Heritage and Local Government.

4.5 HYDROBRAKE AND ATTENUATION SYSTEM DESIGN

All storm-water will be attenuated using a flow control device. Runoff from the development is limited to 2 l/s/ha using a Hydro-brake device that has an orifice size not less than 50mm in diameter, [product reference; MD-SHE-0064-2000-1200-2000] in accordance with industry standards, or similar approved product by approved manufacturer. The proposed product is included in Appendix E of this report.

An attenuation tank was designed using Micro Drainage software. The overall attenuation requirement for the project will be provided by both the proposed SuDS features and an attenuation tank. The attenuation tank is to comprise of Wavin Aquacell, [product reference: 6LB250 / 4064832], [Size= 57.5m(long) x 5.0m(wide) x 0.8m(high)], or similar approved product by approved manufacturer. The proposed attenuation product is included in Appendix E of this report.

4.6 DESIGN OUTPUTS

Please see the following proposed storm water drainage services design drawings.

- Proposed Stormwater Layout. 24208-DG-2101l/s
-
- TII stormwater infrastructure details.

5 REFERENCES

1. Eurocode with the associated Irish National Annex
2. CIRIA guidance
3. Recommendations for Site Development Works
4. Wallingford guidance
5. NRA/TII and DMRB Drainage guidance
6. BS EN 752:2017
7. Greater Dublin Strategic Drainage Study, Volume 2
8. Building Research Establishment (BRE) Digest 365 1991
9. Recommendations for Site Development Works for Housing Areas" as issued by the Department of the Environment, Heritage and Local Government. Oct 1998.

DISCLAIMER

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APPENDIX A
PROPOSED CIVIC PARK SITE LAYOUT

A3

PROPOSED SITE LAYOUT
SCALE 1:500

NOTES:

1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. ALL COORDINATES ARE IN METERS AND RELATE TO ITM (IRISH TRANSVERSE MERCATOR) UNLESS OTHERWISE NOTED.
3. ALL LEVELS IN METERS ARE RELATIVE TO ORDNANCE DATUM MALIN HEAD (OSGM15).
4. DO NOT SCALE FROM DRAWINGS, USE FIGURED DIMENSIONS ONLY.
   ALL DIMENSIONS SHALL BE CONFIRMED ON SITE.
5. DRAWINGS ARE FOR THE PURPOSES OUTLINED IN THE TITLE BOX ONLY.
6. DRAWINGS ARE BASED ON SITE SURVEY INFORMATION AND OSI VECTOR MAPPING.
7. SITE LOCATION REFERENCE X=719170; Y=726722 (ITM)

LEGEND:

PROJECT SITE BOUNDARY

FINAL

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND REPORTS.

DATE	REV	BY	CHK	DESCRIPTION
16/02/26	FL01	KH	JL	FINAL ISSUE

REVISION HISTORY

dlr Comhairle Contae County Council

LANGAN CONSULTING ENGINEERS CIVIL | STRUCTURAL | MARINE

PROJECT TITLE:	SANDYFORD CIVIC PARK	DATE:	DEC 2025
AT :	SANDYFORD DUBLIN	DWG No:	1100
CLIENT:	DÚN LAOGHAIRE-RATHDOWN CC	SCALE:	1:500 @ A3
JOB NUMBER:	24208	DRAWING BY:	KH
DRAWING TITLE:	EXISTING SITE LAYOUT	CHECKED BY:	JL
		REVISION:	FL01

APPENDIX B
BRE 365 SOIL INFILTRATION TEST REPORT

IGSL Limited

Langan Consulting Engineers
Dun Laoghaire Rathdown County Council

Sandyford Civic Park
Dublin 18

Infiltration Test Report

Report No. 26343

December 2025

Report

M7 Business Park
Naas
Co. Kildare
Ireland

T: +353 (45) 846176
E: info @igsl.ie
W: www.igsl.ie

Project: Sandyford Civic Park

Project No. 26343

Revision	**Date**	**Title**		
Rev 0	17/12/2025	Infiltration Test Report		
	Copies	Document Format	Prepared By	Reviewed By
		PDF	Brian Green Chartered Engineer	David Green Chartered Engineer
	To	Langan		
Revision	**Date**	**Title**		
Rev 0				
	Copies	Document Format	Prepared By	Copies
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			

TABLE OF CONTENTS

FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). A new National Annex for use in the Republic of Ireland is currently in circulation for comment and will be adopted in the near future. In the meantime, the following Irish (IS) and European Standards or Norms are referenced:

- IS EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- IS EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- IS EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- IS EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- IS EN ISO 14689-1:2004 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting
Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points.

This report has been prepared for Langan Consulting Engineers and the information should not be used without prior written permission. The recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

In-Situ Testing

Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Retention of Samples

Samples shall be retained for a period of 60 days following approval of the final factual report, as detailed in the Scope of Works.

1.0 Introduction

Future development of a site at the proposed Sandyford Civic Park will require a system for the dispersal of storm water. IGSL Limited were appointed by Langan Consulting Engineers on behalf of Dun Laoghaire Rathdown County Council to perform infiltration testing at the site.

The site location is shown in Figure 1.

Figure 1 – Site Location

This report presents the results of infiltration testing and a record of the ground conditions encountered in the infiltration test pit.

2.0 Subsoil Conditions

The test pit intercepted a Tarmacadam surfacing overlying granular fill (sub base granular fill) to a depth of 0.3 metres below existing ground level (m BGL).

The underlying soils were composed of firm to stiff brown sandy clay to a depth of 0.6 m BGL. Below this depth, the material graded to stiff (high strength) sandy gravelly clay with cobbles.

Coarser material was met at a depth of 1.5 m BGL and had the appearance of residual soil (completely weathered bedrock). This material presented a very high resistance to excavation and was impenetrable below 1.7 m BGL.

The pit sides remained stable and no water ingress was observed during the course of excavation operations.

The test pit record and photographs are presented in Appendix 1 and the pit location is shown on the as-surveyed site plan in Appendix 3.

3.0 Infiltration Testing

The infiltration testing was performed in accordance with BRE Digest 365 ‘Soakaway Design’. The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second.

In accordance with the Digest, water is poured into the test pit, and records taken of the fall in water level against time. This procedure is typically carried out 3 times.

During the first monitoring stage of 90 minutes, the fall in water was negligible (20 mm) and no measurable fall was recorded during the final 50 minutes. No further stages of testing were considered necessary or practical.

4.0 Principles of Soakaway Design

Soakaways are generally designed in accordance with "BRE Digest 365 - Design of soakaways". The digest suggests that a soakaway should be designed to accommodate the immediate storm-water run-off and permit infiltration into the surrounding ground sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm.

The required soakaway capacity is obtained by calculating the inflow and outflow for a range of storm durations and choosing the storm period which gives the maximum storage requirement. Rainfall statistics are obtained from Met Eireann and calculations are usually carried out for a 30-year return period. However, the local authority may stipulate a storm return period which takes into account climate change.

5.0 Conclusions

The infiltration test indicated very low or negligible infiltration rate for the subsoils, which is to be expected, given the dominance of clay in the test pit.

Coarser material was encountered towards the base of the pit, and this would typically be more favourable in terms of soakage. However, if the obstructing material at the base of the pit proves to be the horizon of predominately unfractured (intact) bedrock, then this could explain the absence of soakage through the pit base.

The infiltration test has shown that conventional soakaway systems will not function adequately in this location due to very low / negligible infiltration. Instead, it will be necessary to discharge storm water to an existing surface water system, using attenuation techniques to regulate the flow.

Appendix 1

Test Pit Record and Photographs

TRIAL PIT RECORD

REPORT NUMBER 26343

CONTRACT	Sandyford Civic Park	**TRIAL PIT NO.**	**TP/SA01**
		SHEET	Sheet 1 of 1
LOGGED BY	DM	**CO-ORDINATES**	719,168.57 E 726,690.30 N
		DATE STARTED	04/12/2025
		DATE COMPLETED	04/12/2025
CLIENT	Dun Laoghaire-Rathdown Co. Co.	**GROUND LEVEL (m)**	87.51
ENGINEER	Langan Consulting Engineers	**EXCAVATION METHOD**	ZAXIS 26U

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TARMACADAM		0.07	87.44						
Cl. 804 type material (Hardcore)		0.30	87.21						
Firm to stiff brown sandy CLAY		0.60	86.91						
Stiff brown slightly sandy gravelly CLAY with a medium cobble content. Gravel is subangular fine to medium. Cobbles are subangular to subrounded.					AA179095	B	0.80-0.90		
Medium dense light brown sandy angular fine to coarse GRAVEL.		1.50	86.01						
		1.70	85.81		AA179096	B	1.60-1.70		
End of Trial Pit at 1.70m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
CAT cable detector used to scan dig footprint ahead of breaking ground. Service drawings consulted ahead of setting out location.

IGSL TP LOG 26343.GPJ IGSL.GDT 4/12/25

Project Number: 26343

Sandyford Civic Park – Infiltration Test Photographs

TP/SA01

Photo 1/5

Photo 2/5

Project Number: 26343

Sandyford Civic Park – Infiltration Test Photographs

Photo 3/5

Photo 4/5

Project Number: 26343

Sandyford Civic Park – Infiltration Test Photographs

Photo 5/5

Appendix 2

Infiltration Records

Soakaway Design f -value from field tests IGSL

Contract: Sandyford Civic Park Contract No. 26343
Test No. SA01
Engineer DM
Date: 04/12/2025

Summary of ground conditions

from	to	Description	Ground water
0.00	0.07	Tarmacadam	
0.07	0.30	Cl. 804 type material	
0.30	0.60	Firm to stiff brown sandy CLAY	DRY
0.60	1.50	Stiff brown slightly sandy gravelly CLAY with a medium cobble content.	
1.50	1.70	Medium dense light brown sandy angular fine to coarse GRAVEL	

Notes: For all trial pit information, see TP/SA01 log.

Field Data

Depth to Water (m)	Elapsed Time (min)
1.000	0.00
1.000	1.00
1.000	2.00
1.000	3.00
1.000	4.00
1.000	5.00
1.000	6.00
1.000	7.00
1.000	8.00
1.000	9.00
1.000	10.00
1.000	12.00
1.000	14.00
1.000	16.00
1.000	18.00
1.010	20.00
1.010	25.00
1.010	30.00
1.020	40.00
1.020	50.00
1.020	60.00
1.020	70.00
1.020	80.00
1.020	90.00

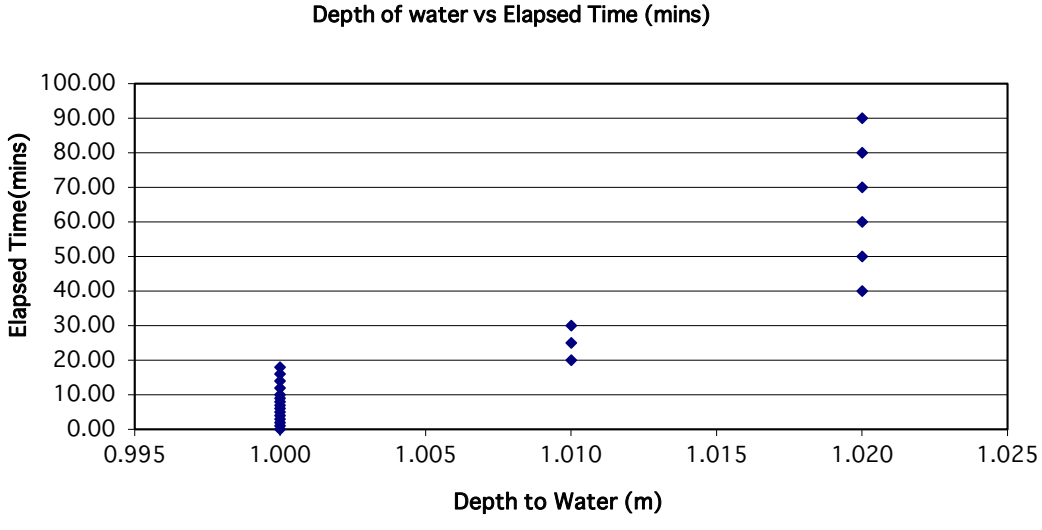
Field Test

Depth of Pit (D)	1.70	m
Width of Pit (B)	0.43	m
Length of Pit (L)	1.60	m
Initial depth to Water =	1.00	m
Final depth to water =	1.020	m
Elapsed time (mins)=	90.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.688	m2
*Av. side area of permeable stratum over test perio	2.8014	m2
Total Exposed area =	3.4894	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

No fall in water after 40 mins



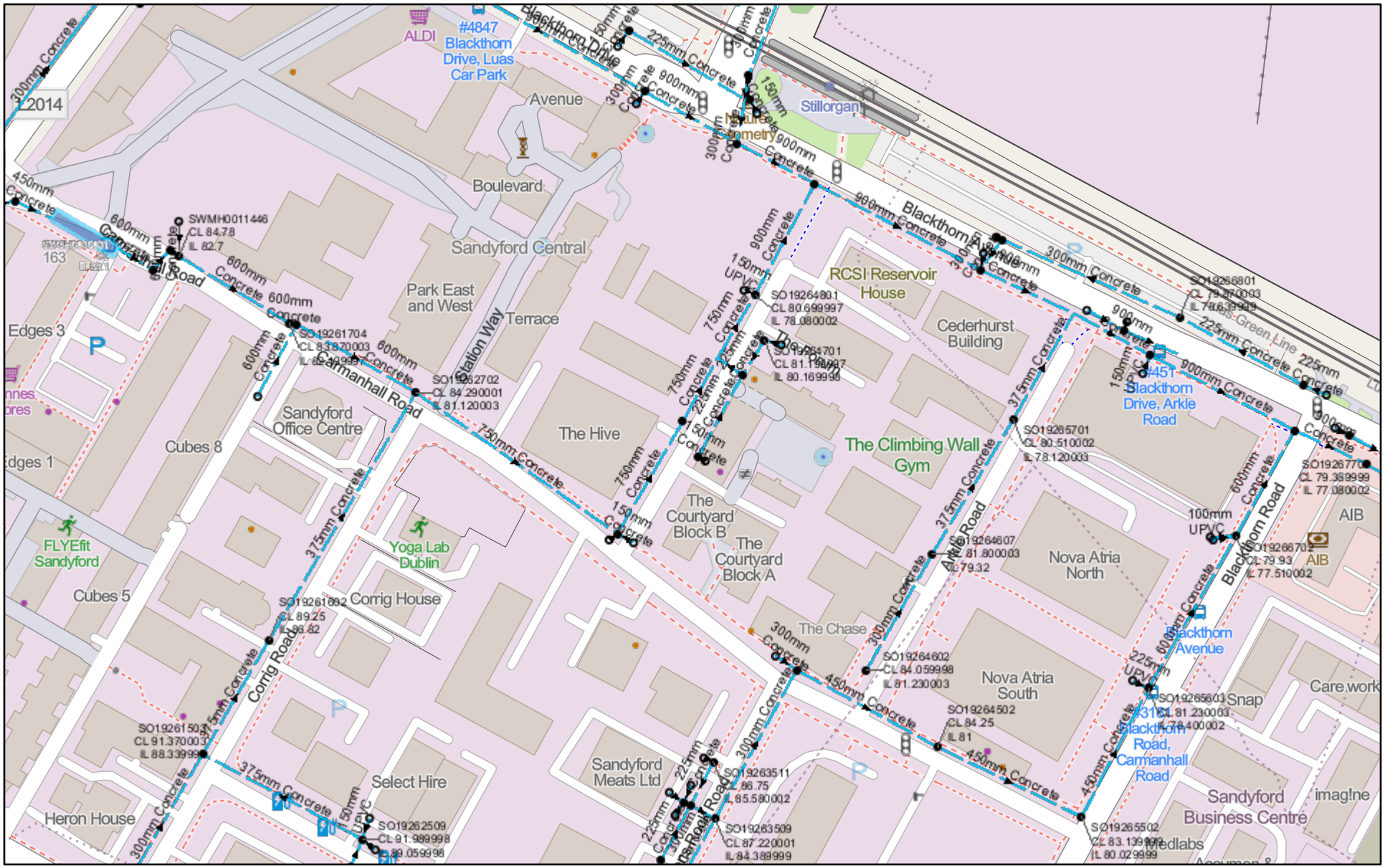
Appendix 3

As-Surveyed Site Plan

APPENDIX C
EXISTING UTILIITIES DRAWING


26343 - Sandyford Civic Park
Exploratory Holes Location Plan
Legend
Infiltration Test
BRE01
Google Earth
30 m
N

Untitled map



2/28/2025

1:4,460

0 0.02 0.04 0.09 mi

0 0.04 0.07 0.14 km

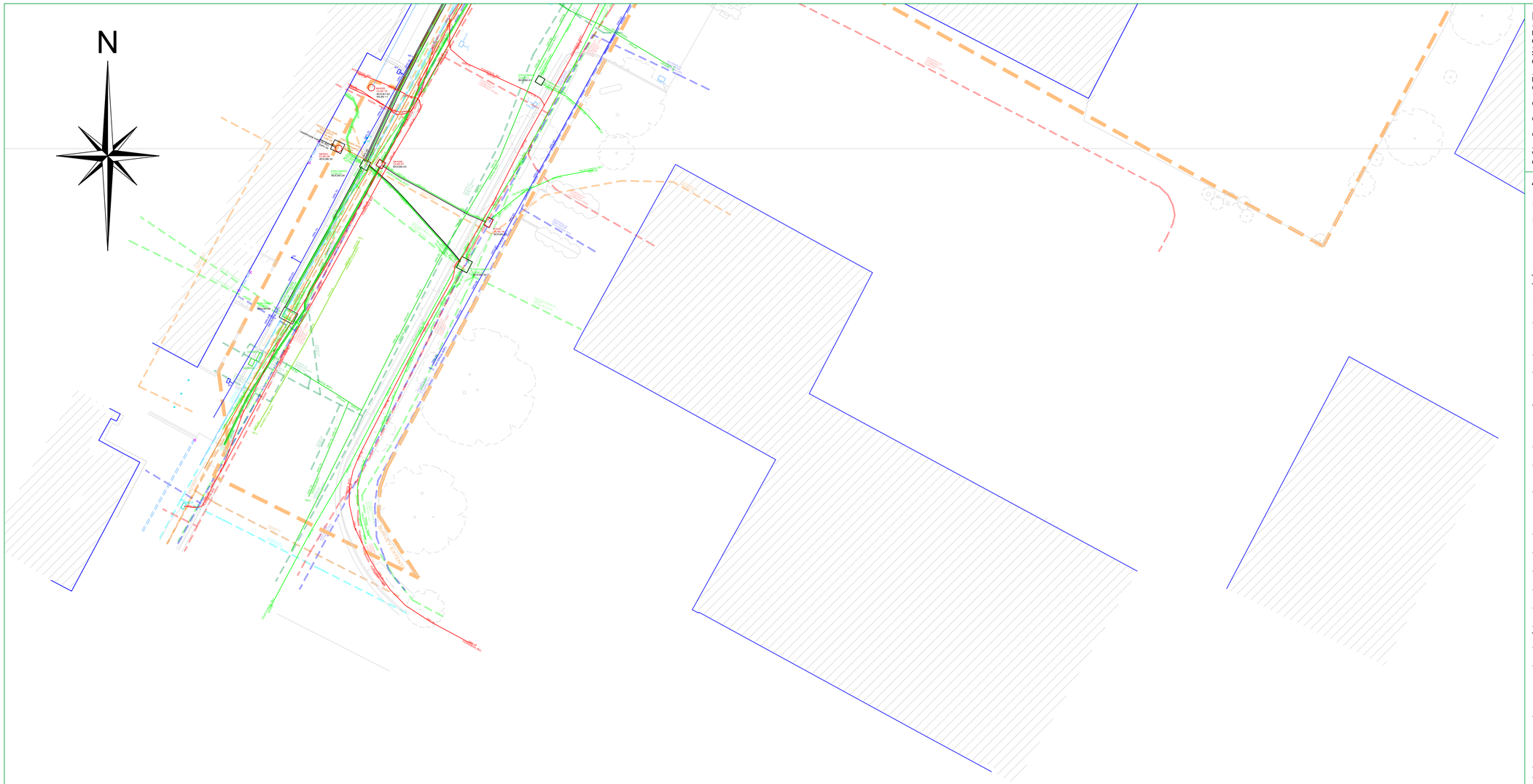
Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Culverts
Storm Clean Outs
Storm Weirs
Storm Open Drains
Storm Detention Areas
Storm chambers



PAS 128: 2014 (Quality of Survey Level Outputs):

DESKTOP UTILITY RECORDS SEARCH	
QL-D	Drafted from utility records
SITE RECONNAISSANCE	
QL-C	Location Demonstrated by visual reference to street furniture or evidence of previous streetworks, ie - reinstatement scars
DETECTION	
QL-B4	A segment of utility suspected to exist but has not been detected by a geophysical technique
QL-B3	Horizontal location only of the utility detected by one of the geophysical techniques used
QL-B2	Horizontal and vertical location of the utility detected by one of the geophysical techniques used
QL-B1	Horizontal and vertical location of the utility detected by multiple geophysical techniques
VERIFICATION	
QL-A	Horizontal and vertical location of the top and/or bottom of the utility

Apex Surveys Ltd. Disclaimer - Utility Survey

The interpretative nature and the non-intrusive, indirect and non-destructive survey methods must be taken into account when considering the results of the surveys. Therefore Apex Surveys, while using appropriate practice to execute, interpret and present the data, gives no guarantees that all underground utilities and underground structures will be located and mapped. Furthermore, Apex Surveys cannot guarantee the accuracy of the utility depths annotated on the survey drawings.
Apex Survey shall not be liable for any omissions or inaccuracies in the survey which arise due to the limitations of the service. No liability shall attach to Apex Surveys, in any circumstances, howsoever arising, in respect of any consequential loss or damages suffered by the Client.

The following is a non-exhaustive list of the limitations of utility surveys:

The Survey aims to map existing utilities subsurface utilities and provide information with respect to pipe size, material type and drainage connectivity. However utility surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub-surface features.

- Depth of Utility: The depth and size of a utility affect the signal response and the degree with which a utility can be located.
  Due to attenuation of the radar signal with depth, resolution is restricted, hence making identification of utilities more difficult with increasing depth.
- Size of Utility: The smaller the diameter of a utility the more difficult it is to locate. This difficulty increases with depth.
- Ground Conditions: The depth penetration and quality of the data depends on the ground conditions of the site. GPR Surveying works best within high resistivity material. Clay overburden can impair GPR Surveying. Poor data may be a result of areas with high conductivity.
- Utility Congestion: Where different utilities converge together into a service corridor or cross paths it becomes difficult to isolate a specific utility and to map its route. The reflected signal will display a single response to multiple utilities. Therefore multiple utilities may appear to be a single utility. Where similar services run on close proximity, separation may be impossible.
- Signal Jumping: Signal from surrounding services may 'jump' to a highly conductive line masking its true identity.
- Shadowing: (of deeper utilities by shallower objects) Shallow utilities will mask the existence of deeper utilities where they are in close proximity. Also, high reflective materials close to the surface i.e rebar may hide deeper anomalies.
- Surface Obstructions: The GPR system relies on a relatively flat and even surface on which to perform radar passes. If ground obstructions such as vehicles, organic material (long grass, scrub) or undulating ground surface are present then the acquired data will be of lower resolution and in some cases not viable.
- Loss of signal: It is not always possible to trace the entire length of each underground service.
- Connections between manholes: Connections between manhole chambers are assumed to be straight.
- Non-metallic objects: Nonmetallic objects are amongst the most difficult to trace therefore successful tracing of non-metallic pipes/ utilities may be limited.
- Fiber Optic Cables: Fiber optic cables may not be possible to locate except where laid with a built in tracer wire or similar conductor system.
- Defective / flooded manholes or pipework: It may not be possible to establish connections between flooded or defective manholes or pipework.
- Acute bends in pipework: It may not be possible to trace a pipe past an acute bend.

Accuracy estimates:

- Locational accuracy is determined by referring to the manufacturers guidelines for the detector used.
- In ideal conditions the spatial accuracies for the underground utilities may be +/- 5% for Radiodetection and +/- 10% of depth for the GPR to 2.5m deep. However variations within the subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- Plan accuracies of + or - 150mm may be achieved but this figure will depend on the depth of service below ground level. However variations within the subsurface subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- DP represents distance from the surface level to the top of the service/ target
- Where technically possible, depth indications will be given. These along with plan positions should be used for guidance only and wherever critical accuracy is required these should be confirmed by the client by undertaking trial excavations or similar.

Record Drawing Information

- Services which have been untraceable are shown from records where possible or available. These lines are annotated as "Taken From Records" or "From Records".
- Existing record information showing underground services is often incomplete and with unknown accuracies therefore it should be regarded as indicative only.
- Where Apex Surveys issue a utility drawing, this should be read in conjunction with all available public or private utility records.
- Apex Surveys endeavor to add relevant Public Utility record information onto the final drawing. However, we would recommend that direct contact is made with the asset owner or statutory undertaker.
- We shall not be held responsible for the accuracy, or otherwise, of the location of a service, as issued by the utility provider and therefore shown as "Taken for Records" on the drawing.

The following have been excluded from the survey:

- Location of individual service feeds to properties or buildings as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of works, survey cost and also cause possible disruption to occupants.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services.
- Small diameter cables less than 20mm diameter or pipes less than 40mm diameter.
- Above ground services unless specifically requested.
- Lifting manholes which require longer than 10 minutes effort using standard heavy duty apparatus.

All works carried out be Apex Surveys conforms to the guidelines set out by The Survey Association (TSA) and PAS:128 Standard for utility mapping

1

APEX SURVEYS

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info@apexsurveys.ie
00353 1 691 0156

STREET FURNITURE :

BOLLARDS	BD +
BUS STOP	BS •
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP •
TELEPHONE POLE	TP •
EARTHING ROD	ER +
LAMP POST	LP •
MARKER POST	MKR +
SIGN POST	SIGN
TRAFFIC LIGHT	TL •
TELEPHONE BOX	TB
POST	POST +
POST BOX	POST BOX
ROADSIGN	RS - RS
BORE HOLE	BH +
TRIAL PIT	TPIT +

SERVICES :

AIR VALVE	AV
ARMSTRONG JUNCTION	AJ
CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
ELECTRICAL CABLE PIT	ECP
ESAT COVER	ESAT
ESB COVER	ESB
ESB JUNCTION BOX	ESB BOX
FIRE HYDRANT	FH
GAS VALVE	GV
GULLY	G
INSPECTION COVER	IC
MANHOLE	MH
SEPTIC TANK	SEPTIC
SLUICE VALVE	SV •

STOPCOCK	ST •
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT •
WATER METER	WM +

LEVELS :

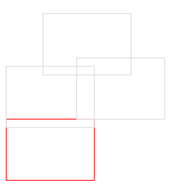
BED LEVEL	+BED101.50
FLOOR LEVEL	+FL101.50
INVERT LEVEL	+IL101.50
ROAD LEVEL	+101.50
SOFFIT LEVEL	+SL101.50
SPOT LEVEL	+101.50
TOP OF WALL LEVEL	+TOW101.50
WATER LEVEL	+WL101.50
SURVEY CONTROL STATION	

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
CCTV	CCTV
IRRIGATION PIPE	IRRIGATION
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

BOTTOM OF CHAMBER	BOC	DOWNPIPE	DP	START OF RUN	SOR
CAST-IRON	C/I	EARTHENWARE	E/W	UNABLE TO OPEN	UTO
CONCRETE	CONC	NO FURTHER TRACE	NFT	UNABLE TO TRACE	UTT
DIAMETER	DIA	OFFSITE	O/S		

SHEET LAYOUT :



PLAN PRODUCED BY:

APEX SURVEYS

CONTACT INFORMATION:

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CLIENT:

Urban Agency

PROJECT:

Sandyford Civic Park Survey

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	DD/MM	Original Drawing

SCALE : 1/200 A1

DATE : 04/06/2025

DRG No: 7092

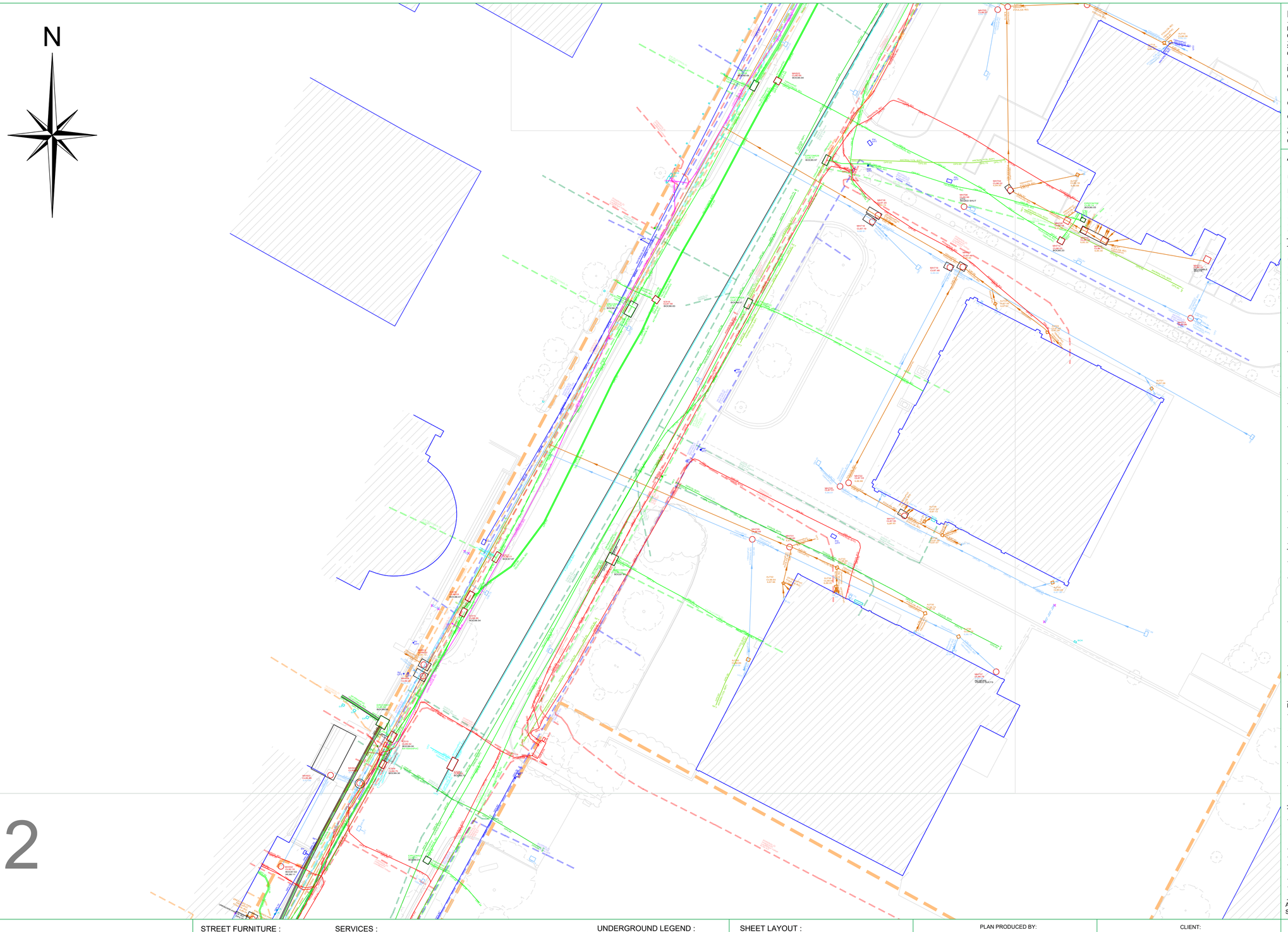
DESCRIPTION : 2D Utilities

SURVEYED BY : D.I., G.F.

SHEET: 1 of 4

PROCESSED BY : J.P.

CHECKED BY : A.B.



2

PAS 128: 2014 (Quality of Survey Level Outputs):

DESKTOP UTILITY RECORDS SEARCH	
QL-D	Drafted from utility records
SITE RECONNAISSANCE	
QL-C	Location Demonstrated by visual reference to street furniture or evidence of previous streetworks, ie - reinstatement scars
DETECTION	
QL-B4	A segment of utility suspected to exist but has not been detected by a geophysical technique
QL-B3	Horizontal location only of the utility detected by one of the geophysical techniques used
QL-B2	Horizontal and vertical location of the utility detected by one of the geophysical techniques used
QL-B1	Horizontal and vertical location of the utility detected by multiple geophysical techniques
VERIFICATION	
QL-A	Horizontal and vertical location of the top and/or bottom of the utility

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  Due to attenuation of the radar signal with depth, resolution is restricted, hence making identification of utilities more difficult with increasing depth.
- Size of Utility: The smaller the diameter of a utility the more difficult it is to locate. This difficulty increases with depth.
- Ground Conditions: The depth penetration and quality of the data depends on the ground conditions of the site. GPR Surveying works best within high resistivity material. Clay overburden can impair GPR Surveying. Poor data may be a result of areas with high conductivity.
- Utility Congestion: Where different utilities converge together into a service corridor or cross paths it becomes difficult to isolate a specific utility and to map its route. The reflected signal will display a single response to multiple utilities. Therefore multiple utilities may appear to be a single utility. Where similar services run on close proximity, separation may be impossible.
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Accuracy estimates:

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00353 1 691 0156

STREET FURNITURE :

BOLLARDS	BD +
BUS STOP	BS +
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP •
TELEPHONE POLE	TP •
EARTHING ROD	ER +
LAMP POST	LP •
MARKER POST	MKR +
SIGN POST	SIGN
TRAFFIC LIGHT	TL •
TELEPHONE BOX	TB
POST	POST •
POST BOX	POST BOX
ROADSIGN	RS - RS
BORE HOLE	BH +
TRIAL PIT	TPIT +

SERVICES :

AIR VALVE	AV
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CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
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CAST-IRON	C/I
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DIAMETER	DIA
DOWNPIPE	DP
EARTHENWARE	E/W
NO FURTHER TRACE	NFT
OFFSITE	O/S

STOPCOCK	ST •
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT •
WATER METER	WM +

LEVELS :

BED LEVEL	+ BED101.50
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INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	

START OF RUN	SOR
UNABLE TO OPEN	UTO
UNABLE TO TRACE	UTT

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
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FOUL SEWER	FOUL
COMBINED SEWER	COMB
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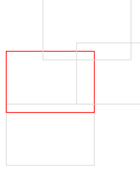
O/HEAD TELECOM	OT

SHEET LAYOUT :



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PROJECT:

Sandyford Civic Park Survey

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	DD/MM	Original Drawing

SCALE : 1/200 A1

DATE : 04/06/2025

DRG No: 7092

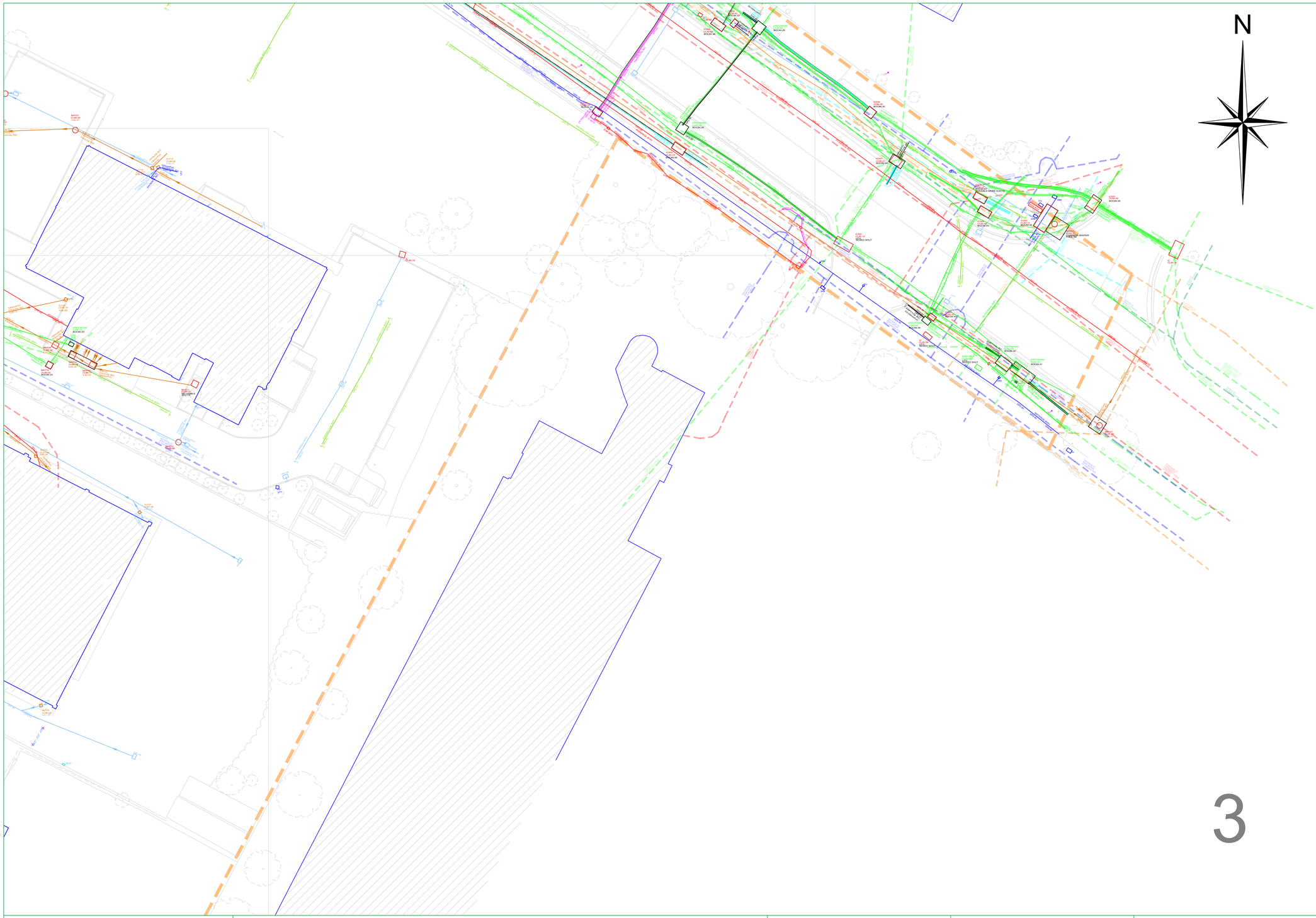
SHEET: 2 of 4

DESCRIPTION : 2D Utilities

SURVEYED BY : D.I., G.F.

PROCESSED BY : J.P.

CHECKED BY : A.B.



N

3

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QL-A	Horizontal and vertical location of the top and/or bottom of the utility

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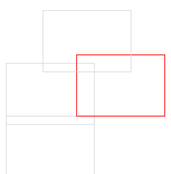

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REVISIONS:

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SCALE : 1/200 A1

DATE : 04/06/2025

DRG No: 7092

SHEET: 3 of 4

DESCRIPTION : 2D Utilities
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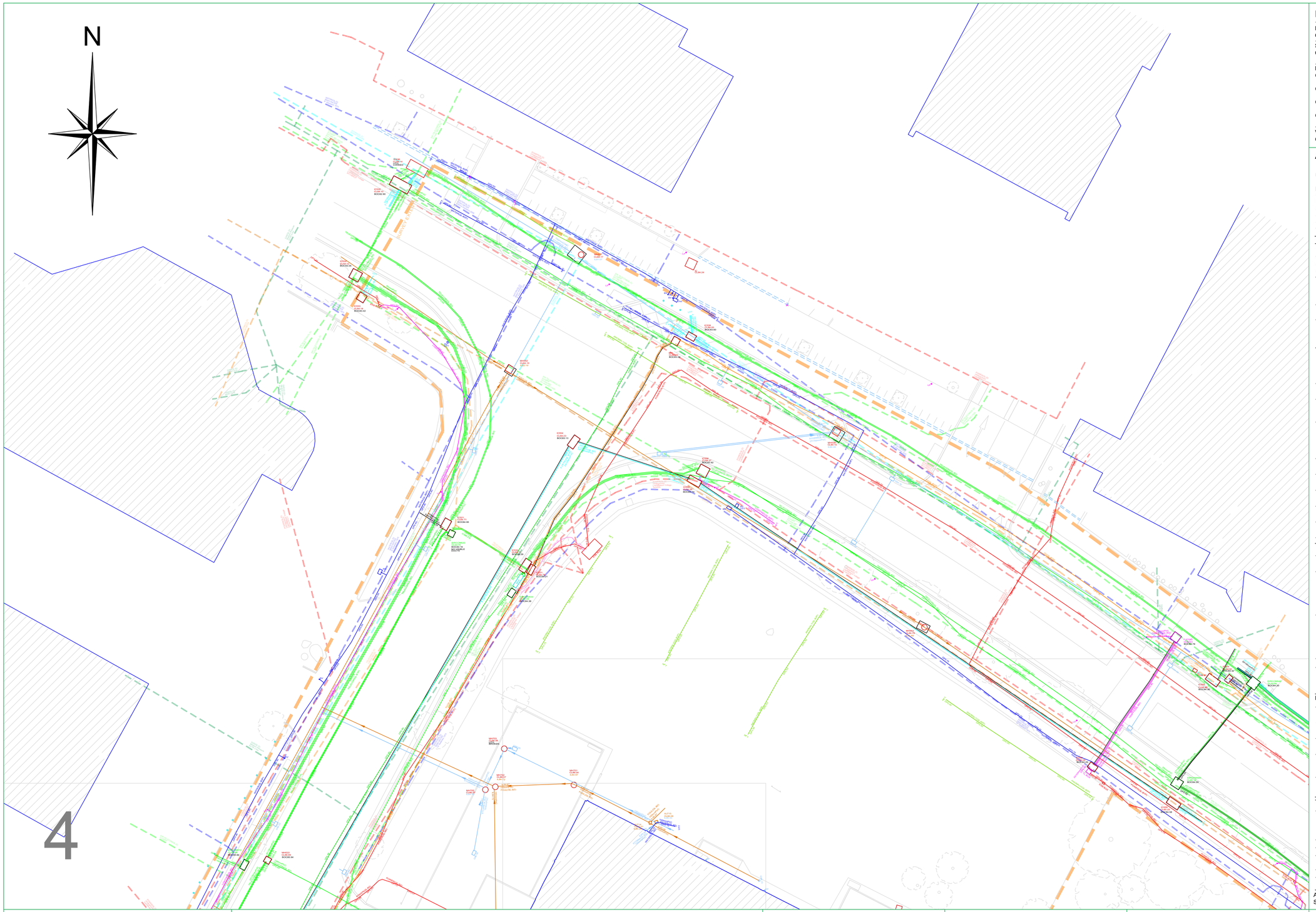

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- Where technically possible, depth indications will be given. These along with plan positions should be used for guidance only and wherever critical accuracy is required these should be confirmed by the client by undertaking trial excavations or similar.

Record Drawing Information

- Services which have been untraceable are shown from records where possible or available. These lines are annotated as "Taken From Records" or "From Records".
- Existing record information showing underground services is often incomplete and with unknown accuracies therefore it should be regarded as indicative only.
- Where Apex Surveys issue a utility drawing, this should be read in conjunction with all available public or private utility records.
- Apex Surveys endeavor to add relevant Public Utility record information onto the final drawing. However, we would recommend that direct contact is made with the asset owner or statutory undertaker.
- We shall not be held responsible for the accuracy, or otherwise, of the location of a service, as issued by the utility provider and therefore shown as "Taken for Records" on the drawing.

The following have been excluded from the survey:

- Location of individual service feeds to properties or buildings as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of works, survey cost and also cause possible disruption to occupants.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services.
- Small diameter cables less than 20mm diameter or pipes less than 40mm diameter.
- Above ground services unless specifically requested.
- Lifting manholes which require longer than 10 minutes effort using standard heavy duty apparatus.

All works carried out be Apex Surveys conforms to the guidelines set out by The Survey Association (TSA) and PAS:128 Standard for utility mapping

APEX SURVEYS

www.apexsurveys.ie
info@apexsurveys.ie
00353 1 691 0156

STREET FURNITURE :

BOLLARDS	BD •
BUS STOP	BS •
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP •
TELEPHONE POLE	TP •
EARTHING ROD	ER +
LAMP POST	LP •
MARKER POST	MKR +
SIGN POST	SIGN
TRAFFIC LIGHT	TL •
TELEPHONE BOX	TB
POST	POST •
POST BOX	POST BOX
ROADSIGN	RS - RS
BORE HOLE	BH +
TRIAL PIT	TPIT +

SERVICES :

AIR VALVE	AV
ARMSTRONG JUNCTION	AJ
CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
ELECTRICAL CABLE PIT	ECP
ESAT COVER	ESAT
ESB COVER	ESB
ESB JUNCTION BOX	ESB BOX
FIRE HYDRANT	FH
GAS VALVE	GV
GULLY	G
INSPECTION COVER	IC
MANHOLE	MH
SEPTIC TANK	SEPTIC
SLUICE VALVE	SV •

STOPCOCK	ST •
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT •
WATER METER	WM +

LEVELS :

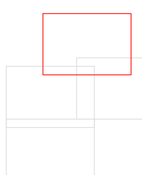
BED LEVEL	+ BED101.50
FLOOR LEVEL	+ FL101.50
INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	

BOTTOM OF CHAMBER	BOC	DOWNPIPE	DP	START OF RUN	SOR
CAST-IRON	C/I	EARTHENWARE	E/W	UNABLE TO OPEN	UTO
CONCRETE	CONC	NO FURTHER TRACE	NFT	UNABLE TO TRACE	UTT
DIAMETER	DIA	OFFSITE	O/S		

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
CCTV	CCTV
IRRIGATION PIPE	IRRIGATION
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

SHEET LAYOUT :



PLAN PRODUCED BY:

APEX SURVEYS

CONTACT INFORMATION:

Apex Surveys
Unit 78 Dunboyne Business Park
Dunboyne, Co. Meath, Ireland
www.apexsurveys.ie
info@apexsurveys.ie
00353 1 691 0156

CLIENT:

Urban Agency

PROJECT:

Sandyford Civic Park Survey

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	DD/MM	Original Drawing

SCALE :	1/200 A1
DRG No:	7092
SHEET:	4 of 4
DATE :	04/06/2025
DESCRIPTION :	2D Utilities
SURVEYED BY :	D.I., G.F.
PROCESSED BY :	J.P.
CHECKED BY :	A.B.

APPENDIX D
STRATEGIC FLOOD RISK ASSESSMENT REPORT

Mapping Notes

1. The lines of the Road Proposals shown are diagrammatic only and may be subject to change.
2. Wave Overtopping layer is relevant to the following maps only: Map No's. 2, 3, 4, 7, 10 & 14 unless noted otherwise.
3. These flood maps contain Land Use Zonings & Flooding information only. Please refer to the Land Use Zoning maps for more detailed land use objectives.

Flood Zone Map

COMHAIRLE CHONTAE DHÚN LAOGHAIRE-RÁTH AN DÚIN

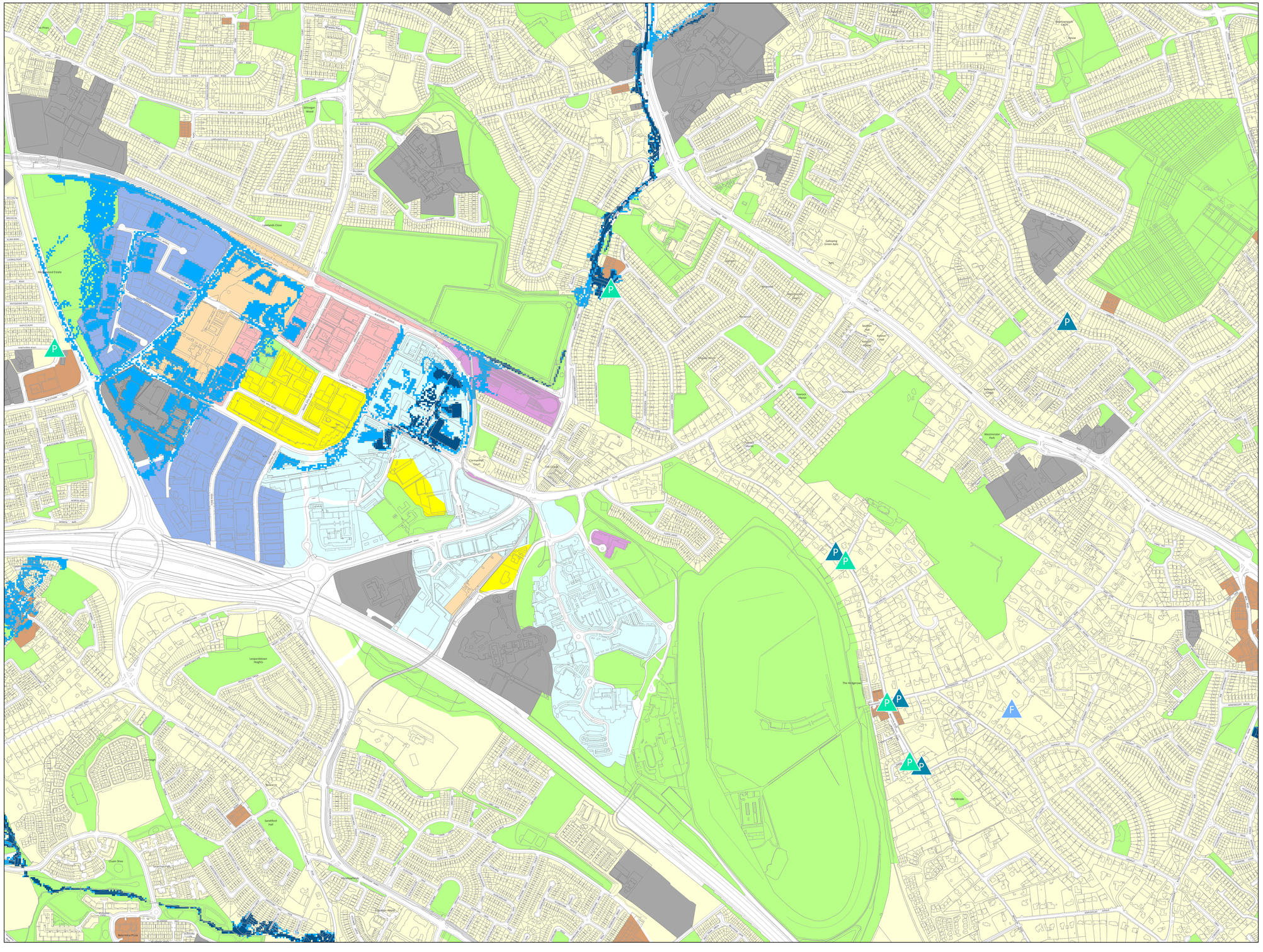
DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL

COUNTY DEVELOPMENT PLAN 2022-2028

Adopted March 2022

dlr Comhairle Contae County Council

INDEX



Land Use Zonings

Objective A	To provide residential development and improve residential amenity while protecting the existing residential amenities.
Objective A1	To provide for new residential communities and Sustainable Neighbourhood Infrastructure in accordance with approved local area plans.
Objective A2	To provide for the creation of sustainable residential neighbourhoods and preserve and protect residential amenity.
Objective B	To protect and improve rural amenity and to provide for the development of agriculture.
Objective DC	To protect, provide for and-or improve mixed-use district centre facilities.
Objective E	To provide for economic development and employment.
Objective F	To preserve and provide for open space with ancillary active recreational amenities.
Objective G	To protect and improve high amenity areas.
Objective GB	To protect and enhance the open nature of lands between urban areas.
Objective LIW	To improve and provide for low density warehousing/light industrial warehousing uses
Objective MIC	To consolidate and complete the development of the mixed use inner core to enhance and reinforce sustainable development.
Objective MOC	To provide for a mix of uses which complements the inner core, but with less retail and residential and more emphasis on employment and services.
Objective MTC	To protect, provide for and-or improve major town centre facilities.
Objective NC	To protect, provide for and-or improve mixed-use neighbourhood centre facilities.
Objective OE	To provide for office and enterprise development.
Objective TLI	To facilitate, support and enhance the development of third level education institutions.
Objective W	To provide for waterfront development and harbour related uses.
Objective SNI	To protect, improve and encourage the provision of sustainable neighbourhood infrastructure

Areas of Flood Risk Concern

- Fluvial - Surface Water
- Pluvial - Surface Water
- Pluvial - Foul
- Flood Zone A
- Flood Zone B
- Wave Overtopping
- County Boundary

Metres

0 50 100 200 300 400 500

Director of Planning: M Henchy
Senior Planner: L McGauran

APPENDIX E
PROPOSED SUDS SITE LAYOUT DESIGN

A3

PROPOSED STORMWATER NETWORK DETAILS

Manhole Name	Cover Level (m)	MH Depth (m)	Pipe Out PN	Pipes In Invert Level (m)	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In Diameter (mm)	Pipes In Backdrop (mm)
S1	89.200	1.623	S1.000		87.577	225		
S2	88.700	1.481	S1.001	87.219	87.219	225	225	
S3	88.700	3.300	S1.002	85.400	85.400	375	225	
S4	86.100	2.900	S1.003	84.491	83.200	375	375	1291
S5	85.300	2.924	S1.004	82.676	82.376	375	375	300
S6	85.300	3.228	S1.005	82.072	82.072	375	375	
S7	85.300	3.260	S1.006	82.040	82.040	375	375	
ExMH	85.300	3.359		81.941	OUTFALL		375	

PROPOSED SuDS SITE LAYOUT
SCALE 1:500

NOTES:

1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. ALL COORDINATES ARE IN METERS AND RELATE TO ITM (IRISH TRANSVERSE MERCATOR) UNLESS OTHERWISE NOTED.
3. ALL LEVELS IN METERS ARE RELATIVE TO ORDNANCE DATUM MALIN HEAD (OSGM15).
4. DO NOT SCALE FROM DRAWINGS, USE FIGURED DIMENSIONS ONLY. ALL DIMENSIONS SHALL BE CONFIRMED ON SITE.
5. DRAWINGS ARE FOR THE PURPOSES OUTLINED IN THE TITLE BOX ONLY.
6. DRAWINGS ARE BASED ON SITE SURVEY INFORMATION AND OSI VECTOR MAPPING AND SITE LAYOUT RECEIVED FROM URBAN AGENCY ON THE 18/12/25.
7. SITE LOCATION REFERENCE X=719170; Y=726722 (ITM)
8. ALL TREES/BUSHES TO BE FOUNDED UPON TREE PITS

LEGEND:

- PROPOSED PLANNING BOUNDARY
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- PROPOSED STORM FILTER DRAIN
- PROPOSED STORM LINEAR DRAINAGE (HOLD)
- PROPOSED PERMEABLE PAVING (HOLD)
- PROPOSED STORM SERVICE CONNECTION
- PROPOSED STORM MANHOLE
- HB — PROPOSED HYDRO BRAKE
- HYDROCARBON BYPASS INTERCEPTOR (HOLD)
- RG — PROPOSED ROAD GULLY
- PROPOSED ATTENUATION/INFILTRATION TANK
- PROPOSED STORM INSPECTION CHAMBER

FINAL

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND REPORTS.

DATE	REV	BY	CHK	DESCRIPTION
16/02/26	FL01	KH	JL	FINAL ISSUE
09/01/26	DR02	KH	JL	DRAFT ISSUE
08/01/26	DR01	KH	JL	DRAFT ISSUE

REVISION HISTORY

dlr Comhairle Contae County Council

LANGAN CONSULTING ENGINEERS CIVIL | STRUCTURAL | MARINE

PROJECT TITLE:	SANDYFORD CIVIC PARK	DATE:	JAN 2026
AT :	SANDYFORD DUBLIN	DWG No:	2101
CLIENT:	DÚN LAOGHAIRE-RATHDOWN CC	SCALE:	1:500 @ A3
JOB NUMBER:	24208	DRAWING BY:	KH
DRAWING TITLE:	PROPOSED SuDS SITE LAYOUT	CHECKED BY:	JL
		REVISION:	FL01

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Full JL

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	21.454	0.358	59.9	0.039	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	28.745	1.819	15.8	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	54.558	0.909	60.0	0.291	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.003	31.420	0.524	60.0	0.014	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	27.401	0.304	90.0	0.200	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	5.736	0.032	180.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	17.780	0.099	180.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

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)
S1.000	50.00	5.21	87.577	0.039	0.0	0.0	0.0	1.69	67.3	5.3
S1.001	50.00	5.36	87.219	0.087	0.0	0.0	0.0	3.31	131.5	11.8
S1.002	50.00	5.74	85.400	0.379	0.0	0.0	0.0	2.34	258.7	51.3
S1.003	49.84	5.97	83.200	0.393	0.0	0.0	0.0	2.34	258.8	53.0
S1.004	49.03	6.21	82.376	0.593	0.0	0.0	0.0	1.91	211.0	78.8
S1.005	48.80	6.28	82.072	0.593	0.0	0.0	0.0	1.35	148.8	78.8
S1.006	48.10	6.50	82.040	0.593	0.0	0.0	0.0	1.35	148.8	78.8

Free Flowing Outfall Details for Full JL

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SExMH	85.300	81.941	81.880	0	0

Simulation Criteria for Full JL

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	Scotland and Ireland
Return Period (years)	2	M5-60 (mm)	17.000

Synthetic Rainfall Details

Ratio R	0.300	Cv (Winter)	0.840
Profile Type	Summer	Storm Duration (mins)	30
Cv (Summer)	0.750		

Online Controls for Full JL

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.006, Volume (m³): 5.2

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	82.040
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0
Flush-Flo™	0.282	1.8
Kick-Flo®	0.573	1.4
Mean Flow over Head Range	-	1.6

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	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.3	7.500	4.7
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	5.0
0.500	1.6	2.000	2.5	5.000	3.9	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.4		

Storage Structures for Full JL

Cellular Storage Manhole: S7, DS/PN: S1.006

Invert Level (m) 82.311 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	460.0	0.0	0.801	0.0	0.0
0.800	460.0	0.0			

Summary of Critical Results by Maximum Level (Rank 1) for Full JL

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	1
Number of Online Controls	1	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 0.289
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.700	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	200.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

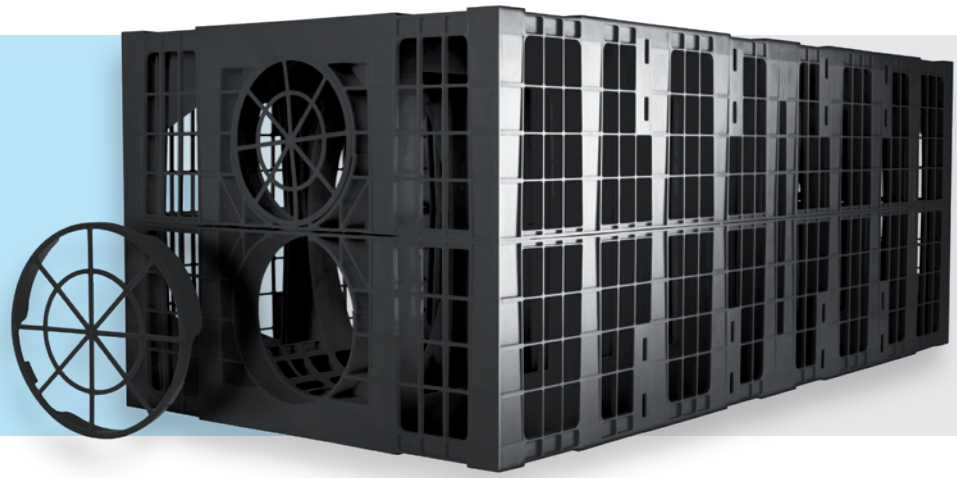
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+20%					87.655
S1.001	S2	15 Winter	100	+20%					87.303
S1.002	S3	15 Winter	100	+20%					85.625
S1.003	S4	15 Winter	100	+20%					83.546
S1.004	S5	15 Winter	100	+20%	30/15 Summer				83.276
S1.005	S6	1440 Winter	100	+20%	1/180 Winter				83.107
S1.006	S7	1440 Winter	100	+20%	1/60 Winter				83.107

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.147	0.000	0.26		15.7	OK	
S1.001	S2	-0.141	0.000	0.30		36.2	OK	
S1.002	S3	-0.150	0.000	0.67		160.7	OK	
S1.003	S4	-0.029	0.000	0.71		163.9	OK	
S1.004	S5	0.525	0.000	1.27		234.7	SURCHARGED	
S1.005	S6	0.660	0.000	0.15		14.5	SURCHARGED	
S1.006	S7	0.692	0.000	0.02		1.9	SURCHARGED	

Product Datasheet

AquaCell Plus-R



Product description

AquaCell Plus-R has been designed primarily for use in applications where inspectability is required, and is suitable for use in all applications from landscaped areas to heavily trafficked areas.

Technical specification

Product code / SAP code	6LB250 / 4064832	**Void ratio**	95%
Colour	Black	**Material**	Recycled PP
Dimensions	1m x 0.5m x 0.4m	**Vertical loading**	70.2 tonnes/m^2 (702 kN/m^2)
Weight	12.7kg	**Lateral loading**	15.1 tonnes/m^2 (151 kN/m^2)
Storage volume	190 litres		

Maximum installation depths

Typical soil type	**Maximum depth of installation – to base of units (m)[1]**				
	Soil weight kN/m^3	**Angle of internal friction φ (degrees)[2, 3]**	**Landscaped areas**	**Vehicle mass <9 tonnes[4, 5]**	**Vehicle mass <44 tonnes**
Over consolidated stiff clay	20	24	4.67	4.42	4.17
Silty sandy clay	19	26	5.03	4.78	4.53
Loose sand and gravel	18	30	5.86	5.61	5.36
Medium dense sand and gravel	19	34	6.87	6.62	6.37
Dense sand and gravel	20	38	7.82	7.57	7.30

Minimum cover depths

	Landscaped areas	**Car parks with vehicle mass <3 tonnes[5]**	**Car parks with vehicle mass <9 tonnes**	**Car parks with vehicle mass <12 tonnes**	**Low speed roads with vehicle mass <60 tonnes**
Minimum cover depth (m)	0.30	0.50	0.69	0.81	1.30

1. Without groundwater present below base of units – AquaCell Plus-R may be used where groundwater is present, contact Wavin for technical advice.
2. Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.
3. The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
4. Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
5. This category should be used when considering landscaped areas that may be trafficked by ride on mowers.

Assumptions made:

- Ground surface is horizontal
- Shear planes or other weaknesses are not present within the structure of the soil

Wavin Ireland Ltd | Balbriggan | Co Dublin | K32 K840
Tel 01 8020200 | **Email** info.ie@wavin.com | **Website** www.wavin.ie

June 2021

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS
FOR PEACE OF MIND

Kingspan

Klargester

60 YEARS OF
Expertise &
1955–2015 Innovation

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

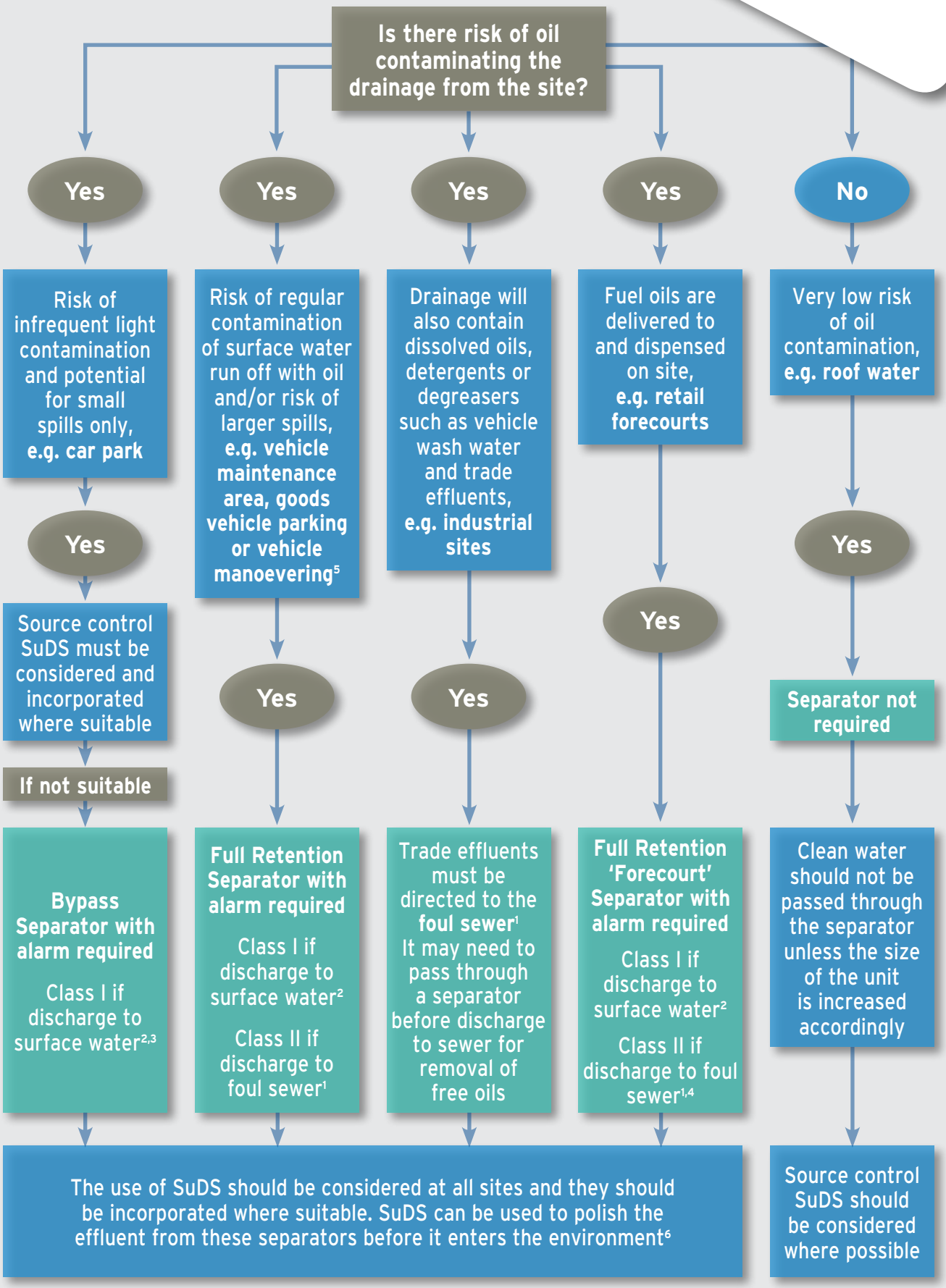
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

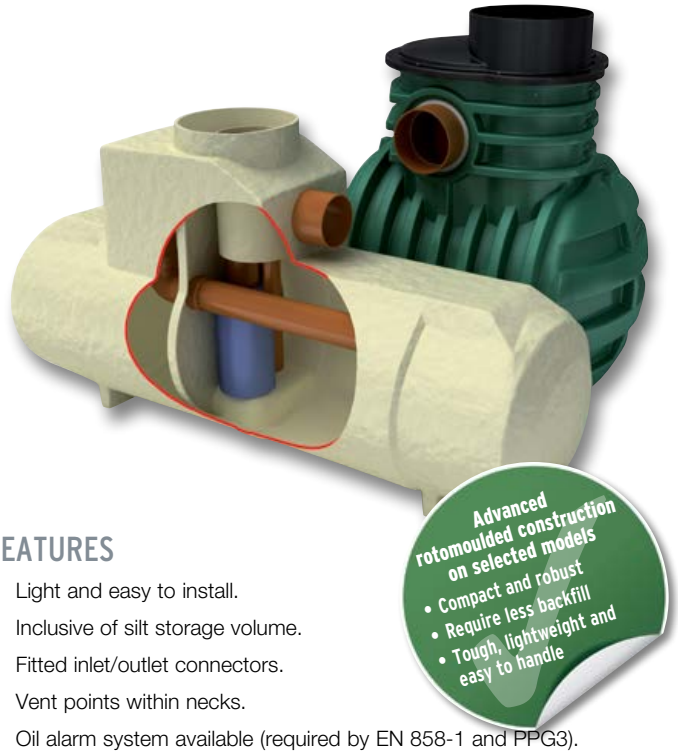
For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Kingspan Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.
2 You must seek prior permission from the relevant environmental body before you decide which separator to install.
3 In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.
4 In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.
5 Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.
6 In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.

Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction GRP chamber construction * Some units have more than one access shaft – diameter of largest shown.

Full Retention NSF RANGE

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Kingspan Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

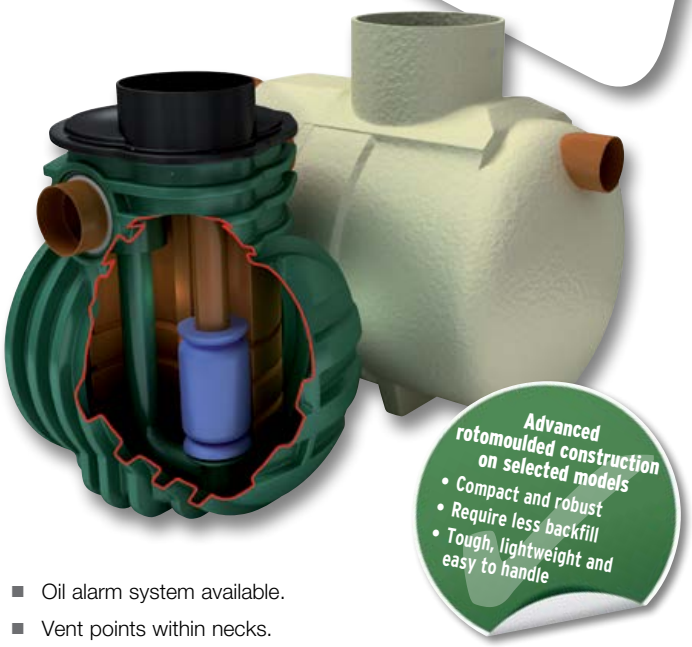
Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Automatic closure device.
- Oil storage volume.
- Coalescer (Class I units only).

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.



- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size full retention separator, the following information is needed:-

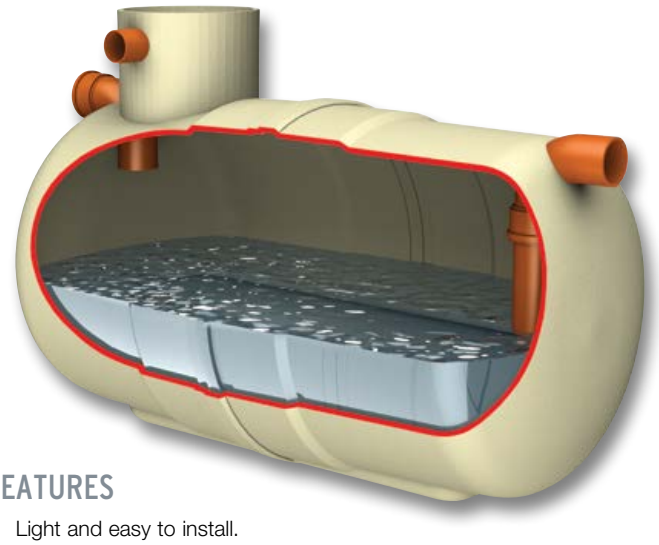
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m^2) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction GRP chamber construction

Washdown & Silt



APPLICATION

This unit can be used in areas such as car wash and other cleaning facilities that discharge directly into a foul drain, which feeds to a municipal treatment facility.

If emulsifiers are present the discharge must not be allowed to enter an NS Class I or Class II unit.

- Car wash.
- Tool hire depots.
- Truck cleansing.
- Construction compounds cleansing points.

PERFORMANCE

Such wash down facilities must not be allowed to discharge directly into surface water but must be directed to a foul connection leading to a municipal treatment works as they utilise emulsifiers, soaps and detergents, which can dissolve and disperse the oils.

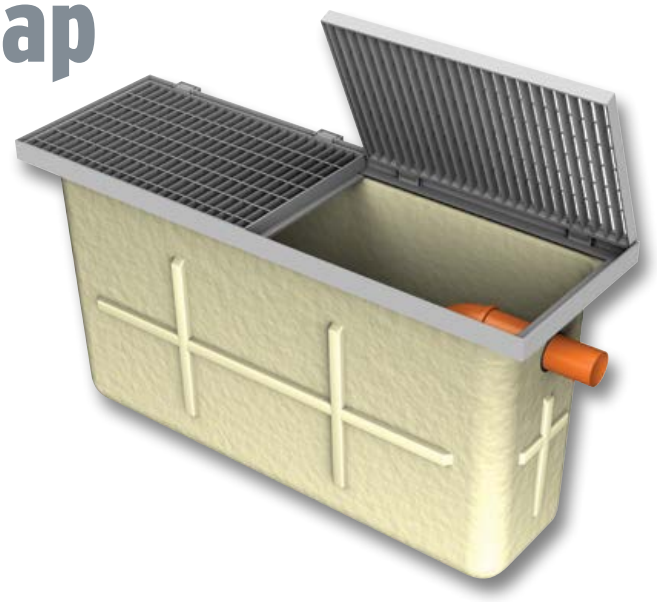
FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

SIZES AND SPECIFICATIONS

REF.	TOTAL CAPACITY (litres)	MAX. REC. SILT	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)	APPROX EMPTY (kg)
W1/010	1000	500	3	1123	1225	460	1150	1100	50	500	160	60
W1/020	2000	1000	5	2074	1225	460	1150	1100	50	500	160	120
W1/030	3000	1500	8	2952	1225	460	1150	1100	50	500	160	150
W1/040	4000	2000	11	3898	1225	460	1150	1100	50	500	160	180
W1/060	6000	3000	16	4530	1440	600	1360	1310	50	500	160	320
W1/080	8000	4000	22	3200	2020	600	2005	1955	50	500	160	585
W1/100	10000	5000	27	3915	2020	600	2005	1955	50	500	160	680
W1/120	12000	6000	33	4640	2020	600	2005	1955	50	500	160	770
W1/150	15000	7500	41	5435	2075	600	1940	1890	50	500	160	965
W1/190	19000	9500	52	6865	2075	600	1940	1890	50	500	160	1200

Car Wash Silt Trap



APPLICATION

Car Wash silt trap is designed for use before a separator in car wash applications to ensure effective silt removal.

FEATURES

- FACTA Class B covers.
- Light and easy to install.
- Maintenance from ground level.

Forecourt

APPLICATION

The forecourt separator is designed for installation in petrol filling station forecourts and similar applications. The function of the separator is to intercept hydrocarbon pollutants such as petroleum and oil and prevent their entry to the drainage system, thus protecting the environment against hydrocarbon contaminated surface water run-off and gross spillage.

PERFORMANCE

Operation ensures that the flow cannot exit the unit without first passing through the coalescer assembly.

In normal operation, the forecourt separator has sufficient capacity to provide storage for separated pollutants within the main chamber, but is also able to contain up to 7,600 litres of pollutant arising from the spillage of a fuel delivery tanker compartment on the petrol forecourt. The separator has been designed to ensure that oil cannot exit the separator in the event of a major spillage, subsequently the separator should be emptied immediately.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- Class I and Class II design.
- Oil storage volume.
- Coalescer (Class I unit only).
- Automatic closure device.
- Oil alarm system available.

INSTALLATION

The unit should be installed on a suitable concrete base slab and surrounded with concrete or pea gravel backfill. See sales drawing for installation.

If the separator is to be installed within a trafficked area, then a suitable cover slab must be designed to ensure that loads are not transmitted to the unit.

The separator should be installed and vented in accordance with Health and Safety Guidance Note HS(G)41 for filling stations, subject to Local Authority requirements.

SIZES AND SPECIFICATIONS

ENVIROCEPTOR CLASS	TOTAL CAP. (litres)	DRAINAGE AREA (m^2)	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STD. FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STD. PIPEWORK (mm)	EMPTY WEIGHT (kg)
I	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
II	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
I	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500
II	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500

Alarm Systems

British European Standard EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 requires that all separators are to be fitted with an oil level alarm system and that it should be installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying.

- Easily fitted to existing tanks.
- Excellent operational range.
- Visual and audible alarm.
- Additional telemetry option.

PROFESSIONAL INSTALLERS

Kingspan Klargester Accredited Installers
Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.

Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
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Issue No. 21: September 2015