

8.0 WATER

8.1 INTRODUCTION

This section of the Environmental Impact Assessment Report (EIAR) document has been prepared by DBFL Consulting Engineers, and addresses all natural water bodies including surface freshwater (streams, bogs, ponds, rivers and lakes), groundwater (shallow and deep) and where applicable estuarine waters and marine waters which may be effected by the proposed development. This chapter also addresses the issues of hydrogeology and the interaction between water bodies and the surface water drainage, foul water drainage, and water supply. This chapter was prepared by John Keogh, CEng, MIEI, PMP, PgDip, DipBs.

An updated Site Specific Flood Risk Assessment (SSFRA, Revision 'A') has been completed by DBFL Consulting Engineers and is included as a standalone report with this submission. A Hydraulic Analysis of the Bridge Design report has also been prepared. These reports have contributed to the contents of the EIAR, and the assessment below.

8.2 STUDY METHODOLOGY

The assessment of the potential impact of the proposed development on the water bodies was carried out according to the methodology specified by the EPA and the specific criteria set out in the Guidelines on Information to be Contained in an Environmental Impact Statement (EPA 2002 and 2017 Draft), EIA Directive 2014/EU/52, Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA 2003), Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003), Development Management Guidelines (DoEHLG, 2007) and Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessments (DoECLG, March 2013).

Information on surface water and water services was assembled from the following sources:

- Site Visit
- Site Investigation Report
- Geological Survey of Ireland (GSI) online maps and databases
- ECFRAMS Flood Mapping from OPW
- EPA online maps and databases
- Topographical Survey
- A SSFRA (Site Specific Flood Risk assessment, Revision 'A') prepared by DBFL Consulting Engineers
- A technical report entitled 'Hydraulic Analysis of Future Bridge for Phase 2', by DBFL Consulting Engineers
- Calculation sheets for foul and surface water drainage and watermains by DBFL Consulting Engineers
- Local authority record drawings

All drainage (surface and foul) and water supply will be provided in accordance with the requirements of Dun Laoghaire-Rathdown County Council and in particular with the following:-

- Greater Dublin Regional Code of Practice for Drainage Works
- Greater Dublin Strategic Drainage Study (GSDSDS)
- Planning System and Flood Risk Management Guidelines
- Building Regulations (Part H)

- Irish Water Standard Details and Codes of Practice for Water and Wastewater Infrastructure
- CIRIA SuDS manual C753 (2015).

This chapter also encompasses knowledge obtained from site visits, drainage and water services record information received from Irish Water, Local Authority and as-built information from Phase 1. Additionally, information from the EPA and GSI websites has been utilised. DBFL met with the DLRC Planners and Drainage personnel for pre-planning meetings and all comments have been incorporated into the proposed design.

8.3 THE EXISTING RECEIVING ENVIRONMENT

The site is currently undeveloped, however, some water infrastructure is being constructed in Phase 1 to service the Phase 2 lands.

The main freshwater watercourse within the vicinity of the proposed development site is the Ballyogan Stream which runs through the Eco Park (to be constructed as part of Phase 1) separating the Phase 1 site and the Phase 2 development lands. The Ballyogan stream drains the Carrickmines Valley and joins with the Loughlinstown Stream to become the Shanganagh River before discharging to Killiney Bay at Shanganagh.

Other surface water bodies in the vicinity of the proposed development lands comprise the following:

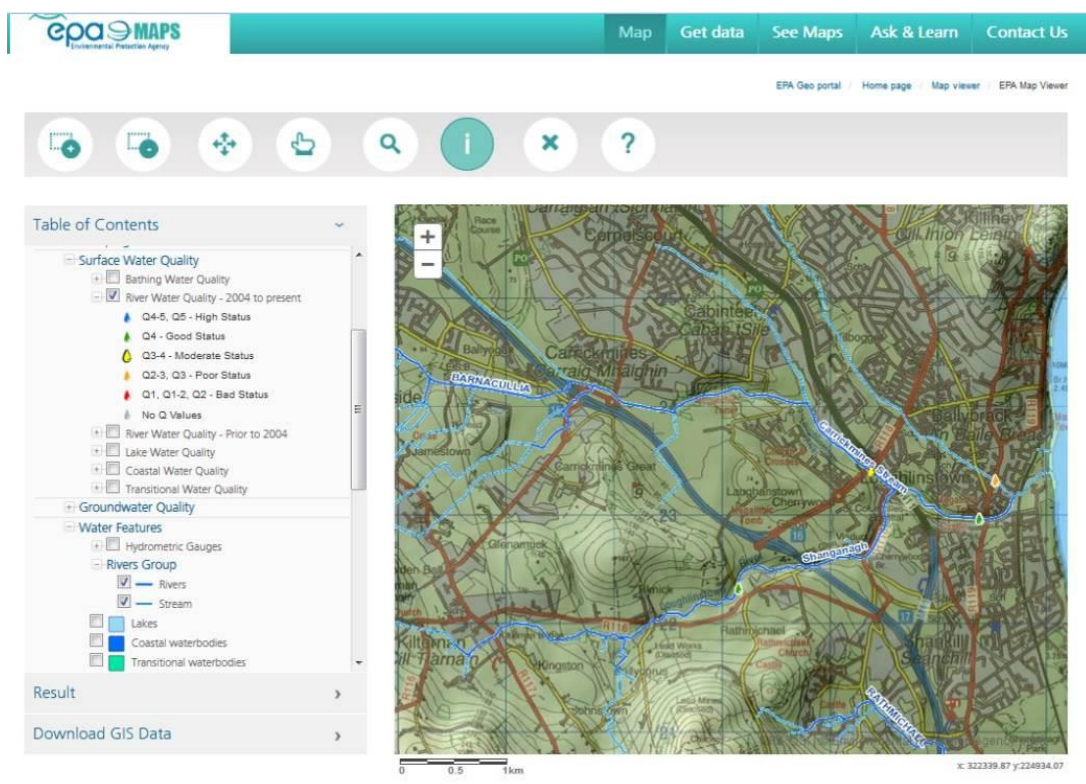
- Groundwater in the bedrock and quaternary geology beneath the site.
- Minor surface water drainage ditches and watercourses.
- There is an existing 375mm diameter foul sewer running south-west to north-east along the south-eastern boundary of the site. This sewer connects to a 525mm diameter sewer which runs in a south-easterly direction along the south side of the Ballyogan Stream.
- There is a 200mm diameter watermain being constructed in Larkfield Avenue as part of phase 1.

8.3.2 Surface Water

Ballyogan Stream

The main freshwater watercourse within the vicinity of the proposed development site is the Ballyogan Stream which runs through the future Eco Park separating the Phase 1 site (currently under construction) and the Phase 2 future development lands. The Ballyogan stream drains the Carrickmines Valley and joins with the Loughlinstown Stream to become the Shanganagh River before discharging to Killiney Bay at Shanganagh. The EPA mapping refers to the Ballyogan Stream as the Barnaculla Stream. Figure 8.1 below, taken from EPA mapping outlines the river systems in the vicinity of the site.

Figure 8.1: River Systems in the Vicinity of the Site (from EPA Website)



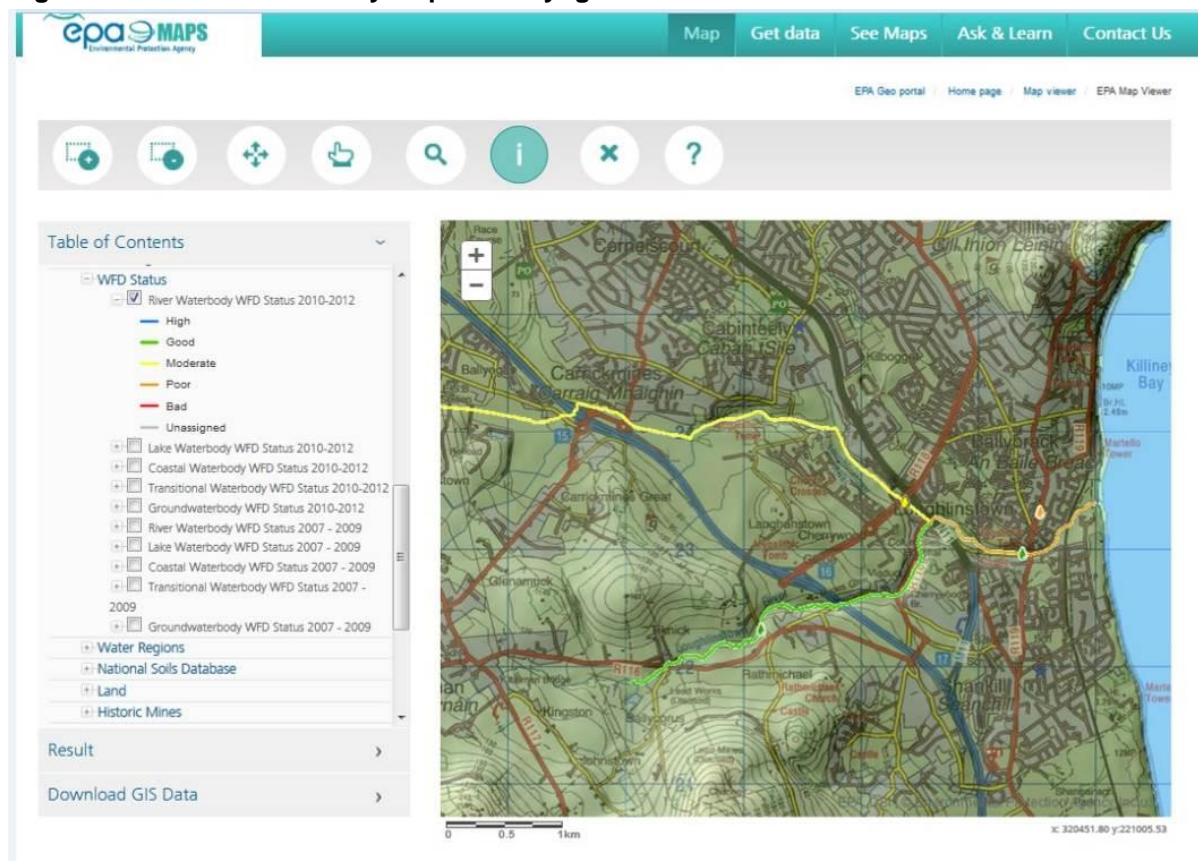
In total the Ballyogan Stream has a catchment area of 3.58km².

The proposed development site is within the Eastern River Basin District which is the Water Framework Directive designated catchment for this area.

Since 2000, water management in the EU has been directed by the Water Framework Directive (WFD). The key objective of the WFD is that all water bodies in a Member State achieve (or retain) 'good' status by 2015. In 2005, all water bodies were assessed and given a score based on the likelihood of them achieving this environmental objective.

The EPA uses the Q value system for assessing river water quality. This system describes the relationship between water quality and the macro invertebrate community in numerical terms. Q5 waters have high diversity of macro invertebrates and good water quality, while Q1 have little or no macro invertebrate diversity and bad water quality. Intermediate values, Q1-2, 2-3, 3-4 etc denote transitional conditions. The presence of pollution causes changes in flora and fauna of rivers. Well documented changes occur in the macro invertebrate community in the presence of organic pollution: sensitive species are progressively replaced by more tolerant forms as pollution increases. EPA sampling of watercourses dating from 2005 indicate that the Carrickmines Stream had a Q3-4 value immediately downstream of the subject site allocating it as a 'moderate' status. Refer to the water quality map, included as Figure 8.2 below.

Figure 8.2: EPA Water Quality Map for Ballyogan Stream



Information available from the EPA suggests that the Carrickmines River is “at risk of not achieving good water status” in terms of the WFD. The water quality within the designated water courses will be particularly affected by the quantity and quality of surface water run-off from the adjacent lands. Currently the lands are used for agriculture, with the primary activity being the grazing of cattle. This activity would encourage infiltration of precipitation therefore reducing run-off rates. Annual precipitation for this area is approximately 793mm (from Met Eireann website).

The OPW recently completed the Eastern Catchment Flood Risk and Management Study (ECFRAMS) which identifies flood zones, including those relating to the Ballyogan Stream. These flood zones are defined. The development site lies entirely within Flood Zone C i.e. where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

Other Watercourses

There is an open ditch system along the south-eastern boundary of the Phase 2 subject site which discharges to the Ballyogan Stream. It has been agreed with DLRCC (after submission of report 163056-rep-005) that this ditch serves as a land drain only and is not a watercourse. There is another ditch system traversing through the centre the Phase 2 lands which also discharges into the Ballyogan Stream, this ditch serves upstream lands (Stepaside Park) where there is an attenuated surface water outlet from the existing development.

Surface Water Sewers

There are no surface water sewers located with the Phase 2 site boundary.

8.3.3 Foul Sewers

Foul water drainage from the northern part of the development under consideration (Phase 2) would discharge to the existing 525mm diameter sewer adjacent to the Ballyogan Stream. Two southern catchments will drain to the existing 375mm diameter foul sewer along the south-eastern boundary of the site.

A pre-application enquiry was made to Irish Water in Winter 2016 and a response was received from Irish Water in February 2017 stating that *“subject to a valid connection agreement being put in place, a proposed connection to the Irish Water network can be facilitated.”*

Refer to drawing no. 163056-3091, Rev 'A', in Appendix No. 8.1 for details of foul sewers.

8.3.4 Watermain

There is currently no water supply infrastructure within the subject site. There is an existing 300mm diameter public watermain located on Ballyogan Road. As part of the Phase 1 works, a new 200mm diameter watermain will be constructed along the main access road through Phase 1 to the location of the proposed bridge to be constructed over the Ballyogan Stream as part of the Phase 2 works.

A pre-application enquiry was made to Irish Water in Winter 2016 and a response was received from Irish Water in February 2017 stating that *“subject to a valid connection agreement being put in place, a proposed connection to the Irish Water network can be facilitated. In order to accommodate the proposed connection, works are required to link the 2 no. 300mm watermains on Ballyogan Road and the R117. A PRV will also be required at the location. Irish Water does not currently have any plans to carry out the works required to provide the necessary upgrade and capacity. Should you wish to have such upgrade works progressed, Irish Water may require you to provide a contribution of a relevant portion of the costs for the required upgrades, please contact Irish Water to discuss this further.”*

Refer to drawing no. 163056-3092, Rev 'A', in Appendix No. 8.1 for details of watermains.

8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

Consideration of the Characteristics of the Proposed Development allows for a projection of the 'level of impact' on any particular aspect of the proposed environment that could arise. For this chapter the potential impact on Water is discussed.

The proposed Phase 2 development under consideration involves the construction of 927 no. residential units (365 no. houses and 562 no. apartments), a childcare facility of 607 sq.m and 2 no. retail units each with a GFA of 85 sq.m and includes the associated section of the Clay Farm Loop Road from the bridged link with Phase 1 to the south western site boundary, associated internal roads, pedestrian and cycle paths, open space, and all associated site and infrastructural works. Vehicular access will be from the Ballyogan Road signal controlled junction through the completed Phase 1 lands and across a new bridge over the Ballyogan Stream linking Phase 1 and Phase 2. A potential vehicular connection is provided for to Cruagh Wood housing estate to the south.

The development of the Phase 2 lands includes a bridge linking the Phase 1 site and the Phase 2 development. This would be subject to a separate future planning application. The proposed bridge will span the full width of the flood plain, with both abutments located outside of the flood plain extents.

8.4.1 Surface Water

Characteristics of the proposed development that may impact on water bodies are outlined below:

- The Ballyogan Stream would require a new bridge crossing to link the Phase 2 subject site with the current development of Phase 1 lands. The construction of the bridge may impact on the water quality of the Ballyogan Stream and the bridge structure may cause a constraint to flood plain flows.
- The extent, density and character of the proposed developments within the application site including the density, location of open spaces etc. will affect run-off rates, water quality in adjacent watercourses, groundwater recharge ability and impact existing smaller surface water channels. To facilitate development it will be necessary to service the proposed development with physical infrastructure which will have the following characteristics.
- Surface water drainage for the Phase 2 lands will be designed in accordance with the Greater Dublin Strategic Drainage Study (GSDSDS). The development will be carried out using the “separate system” method of drainage i.e. separate foul drainage and surface water drainage systems. Surface water will be collected and discharged via a mixture of traditional and Sustainable Urban Drainage Systems (SuDS) to the Ballyogan Stream. SuDS features are incorporated into the design where possible.
- It will be necessary to provide surface water attenuation and storage for storm events up to 1% Annual Exceedance Probability (AEP).

The total surface water flow from the site will be restricted due to the fact that runoff from the site is to be attenuated to greenfield runoff rates, in accordance with the recommendations of the GSDSDS and Dun Laoghaire Rathdown County Council requirements. In addition, the ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’ will be adhered to.

Surface water runoff will be managed using a variety of SuDs features as recommended in the GSDSDS and in accordance with Dun Laoghaire Rathdown County Council’s development strategy. These SuDS features will include filter strips, filter drains, swales, bioretention areas, green roofs, detention basins, attenuation systems and petrol interceptors.

It is intended that the site will be divided into a number of different sub-catchments each with an underground attenuation system sized based on the contributing effective runoff area. A hydrobrake will be provided at each point to control discharge and mobilise storage within each system. Each attenuation system and hydrobrake control will work in series and the final combined discharge rate to the stream will be kept to the permissible discharge rate defined above. There will be two outlets from the site to the Ballyogan Stream to the north.

According to the GSDSDS, the method used for determining peak flow rates for small greenfield catchments is the UK ‘*Institute of Hydrology Report 124, Flood Estimation for Small Catchments*’. This method calculates $QBAR_{rural}$ which is the mean annual flood flow from a rural catchment.

Where long-term storage can be provided or is not necessary, surface water can be discharged at a higher value than $QBAR_{rural}$, this discharge rate ($QBAR_{growth}$) is dependent on the design return period and the corresponding growth factor from the GSDSDS Table 6.6. However, if long-term storage cannot be provided on-site the discharge rate from the site should be kept to $QBAR_{rural}$ or 2ls/ha.

As long-term storage can be provided for a sub-catchment of the site, this sub-catchment can discharge at a rate of $QBAR_{growth}$, the remaining area of the site will discharge to the downstream watercourse at $QBAR_{rural}$.

Permissible site discharge for the site has been determined as follows: -

Total Site Area (red-line boundary) = 20.222 Ha
Surface Water Catchment Area* = 17.950 Ha
Catchment draining through Long-term Storage = 3.82 Ha
Remaining catchment not draining through Long-term Storage = 14.13 Ha

Permissible Site Discharge Long-Term Storage Catchment = 49.7 l/s
Permissible Site Discharge Non-Long-Term Storage Catchment = 70.7 l/s
Total Site Permissible Site Discharge = 120.4 l/s

It should be noted that part of the site will not be developed and will therefore not need to be positively drained, i.e. the greenfield drainage regime will remain in place for post-development. Therefore, these areas of the total site boundary are excluded from surface water calculations.

Runoff from the site is controlled using a series of hydrobrake flow controls and storage is in the form of underground cellular attenuation systems (or similar approved), with an overground long-term storage basin provided in the north-east of the site.

It is intended that the site will be divided into a number of different sub-catchments each with an underground attenuation system sized based on the contributing effective runoff area. A hydrobrake will be provided at each point to control discharge and mobilise storage within each system. Each attenuation system and hydrobrake control will work in series and the final combined discharge rate to the stream will be kept to the permissible discharge rate defined above. There will be two outlets from the site to the Ballyogan Stream to the north.

Each of the SuDS features will provide a volume of infiltration/evapotranspiration to cater for interception storage, as the GSDS requires that no run-off should directly pass to the receiving watercourse for rainfall depths of 5mm, therefore interception should be provided at source where practicable. In addition, the GSDS requires that a "treatment volume" be provided in a 'treatment train' in order to prevent any pollutants or sediments discharging into river systems. All run-off areas will pass through the required number of treatment stages prior to discharging to the downstream outfall.

As mentioned above, a bridge will be required to link the current phase 1 development and the future phase 2 development, a report addressing the '*Hydraulic Analysis of the Future Bridge for Phase 2*' was completed by DBFL Consulting Engineers and submitted as part of the phase 1 planning application documentation, it is included again as part of part of this subject site's current planning application. The hydraulic analysis estimates the open channel flow in the Ballyogan Stream and floodplain and demonstrates that there would be no impact on the channel capacity or flood storage.

All other development works will be located in Flood Zone C, i.e. outside the 0.1%AEP (1 in 1000 year) flood extents for the Ballyogan Stream.

8.4.4 Foul Sewers

It will be necessary to provide a suitably designed foul sewer network for the development lands. Foul effluent within the public system is ultimately transferred to Shanganagh Wastewater Treatment Plant for treatment and disposal.

Foul sewage within the site will be drained by a separate system. The site will be divided into a northern catchment, a southern catchment and an eastern catchment. The northern and eastern catchments will discharge by gravity into the existing 525mm diameter sewer adjacent to the Ballyogan Stream. The southern catchment will drain to the existing 375mm diameter foul sewer along the south-eastern boundary of the site.

Foul sewage in apartment blocks will be drained on separate systems via 150mm diameter pipes slung from the underside of basement roof slabs and adjacent to the basement walls. Service pipes from individual properties will project through ground floor slabs and connect into the slung drainage system which in turn will connect by gravity to the external drainage system.

The estimated peak flow from the development will be 30.5 l/s.

8.4.5 Watermains

It will be necessary to service the development with a reliable and safe water supply. A connection will be made to the 200mm diameter watermain currently being constructed along the main access road through Phase 1. This watermain will be extended across the proposed bridge to be constructed over the Ballyogan Stream as part of the Phase 2 works.

A new metered water main distribution network will be constructed for the individual dwellings and apartment blocks.

The estimated peak demand from the development will be 11.4 l/s with the average daily demand being 375.4 m³.

This daily consumption will be supplied from the existing 300mm diameter watermain on the Ballyogan Road. The new site watermain network will also adequately serve the firefighting requirements of the development.

8.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

The following provides an assessment of the potential impact on the water environment of the proposed development without mitigation measures being incorporated into the detailed design and construction phase. The mitigation measures and predicted impact of the proposed development are set out below in Section 8.7 and 8.8.

8.5.1 Surface water

Construction Phase

Construction of the proposed development will require the removal of a large part of the topsoil and extensive earthworks to facilitate the construction of the dwellings, infrastructure service provision, road construction, surface water storage systems etc. Given the extent of disturbance, there is potential for weathering and erosion of the surface soils from precipitation and run-off.

Surface water runoff from the construction phase may also contain increased silt levels or result in pollution from the construction processes. The discharge of these contaminants, such as concrete and cement, which are alkaline and corrosive, to the Ballyogan Stream has the potential to cause pollution. Accidental oil or fuel spillages or leaks from construction activities also have the potential to find their way into the adjacent water courses. Both increased silt and contaminant levels have the risk of reducing water quality in the adjoining water courses.

The exposure of the underlying sub-soil from topsoil stripping may also cause the rate and volume of the run-off to increase during construction until the topsoil and vegetation are replaced.

Construction of the phase 1 development may result in increasing silt levels in the water body and impacting on fisheries and riparian ecology which would be a short term negative impact. The Environmental Report of the Dún Laoghaire-Rathdown County Development Plan 2016-2022 SEA states that “The Carrickmines (Glenamuck) / Shanganagh system is a regionally important salmonid system. The Carrickmines system supports a resident population of Brown Trout and a migratory population of Sea trout.” Therefore, as set out in Section 8.7 below and in the Flora and Fauna chapter of the EIS adequate mitigation measures will be required to protect the stream from pollution during the construction phase.

The construction of the bridge linking Phase 1 and the future development of Phase 2 lands would be undertaken under the Phase 2 construction phase. This may result in increasing silt levels in the water body and impacting on fisheries and riparian ecology which would be a short term negative impact.

The potential impact from the construction phase on surface water is likely to be short term and moderate without mitigation measures in place.

Operational Phase

Adequate capacity exists in the Ballyogan Stream to cater for this development, given the fact that surface water runoff from the site would be attenuated and the discharge to the aforementioned stream would be controlled.

The completed development will result in a permanent change to the existing natural surface water processes on the current greenfield site. However, as a large proportion of runoff is routed through SuDS features these will have an attenuating effect which would reduce the rate of stormwater runoff for every rainfall event. Also, SuDS features would reduce the runoff volume through evaporation, transpiration, infiltration and depression storage of the water within each system. Therefore, runoff rates have been applied as follows:

- Roofs - Type 1 (Draining to traditional gullies) = 1.0
- Roofs - Type 2 (Draining to SUDS features) = 0.70
- Green Roofs (150mm filter bed depth) = 0.70
- Roads and Footpaths - Type 1 (Draining to gullies) = 0.80
- Roads and Footpaths - Type 2 (Draining to SUDS features) = 0.70
- Paved Areas = 0.80
- Permeable Paving = 0.50
- Bioretention Areas = 0.70
- Grassed Areas = 0.37 (soil type 3 - Flood Studies Report)
- Public Open Space = 0.37 (soil type 3 - Flood Studies Report)

Based on the development characteristics, layout and density, the average effective runoff coefficient from the site is approximately 0.55. Notwithstanding this, and based on the underlying ground conditions, groundwater recharge will be exploited in full by incorporating Sustainable Urban Drainage Systems (SUDS) systems to improve water quality, slow discharge runoff rates to mimic greenfield rates and provide natural storage as part of a managed surface water network.

Surface water run-off discharge rates from the development sites may be increased because of increase in impermeable surfaces, shorter flow paths through pipes and reduced roughness coefficient, however the implementation of SuDs features would aim to maintain runoff rates as close as possible to existing greenfield runoff rates.

Greater run-off volumes generated by the impermeable surfaces will require stormwater storage within the site to provide protection against pluvial flooding events. Surface water attenuation storage will need to be incorporated into the design to safeguard against storms and associated flooding throughout the lifetime of the development. Refer to the 'Site Specific Flood Risk Assessment', (SSFRA, Rev 'A') prepared by DBFL.

The rate of discharge from the proposed development will not be greater than existing "Greenfield" runoff levels. Therefore, the development itself should pose no increased risk of pluvial flooding in the area. Best Management Practices will be incorporated into all surface water infrastructure / SuDS design within the proposed development site. The inclusion of a well-designed SuDS solutions for the proposed development site will further negate the risk of any pollution from normal activities within the development itself.

Road levels within the development site are set to ensure overland flooding is directed towards open spaces, the Ballyogan stream and adjacent ditch systems during storm events exceeding 0.1%AEP or for short duration, high intensity storms where runoff might fail to enter the drainage system. Proposed finished road

The bridge linking the proposed phase 1 development and the future phase 2 development could create constraints to stream floodplain flows. A separate standalone report by DBFL Consulting Engineers entitled '*Hydraulic Analysis of Future Bridge for Phase 2*' is included in this planning submission.

The aforementioned report the open channel flow in the Ballyogan stream and the flood plain using Manning's equation. The future bridge was then added to the existing cross-section and the flow at the future bridge location was calculated for the post-development case.

As the bridge will be supported on piers within the flood plain with adequate spacing between piers, it is not envisaged that the piers will restrict the flows of water from the flood plain returning to the stream channel following an extreme rainfall event.

The introduction of the future bridge between Phase 1 and Phase 2 would cause minimal decrease in flow and storage volume within the flood plain (0.1% AEP for draft ECFRAMS). While these decreases are considered to be negligible, it is proposed that the cross-sectional area through the bridge and channel will be increased by 0.5m^2 to match flows after installation of the bridge (and associated piers) to the existing flows before installation. With the introduction of the future bridge, the increase in cross-sectional area of flow will also lead to an overall increase of flood plain storage volume by 4.75m^3 .

The installation of the future Phase 2 bridge and the ancillary works to the channel are not considered to cause any negative impact of the Ballyogan Stream flow and flood plain storage.

There is no impact on the Ballyogan stream or floodplain flows and storage volume caused by the proposed development as all discharge from the site will be controlled to greenfield runoff rates, as is the current situation on the undeveloped site. Furthermore, through the introduction of Sustainable Drainage Systems throughout the site, the quality of surface water runoff to the stream will be maintained at or as close to greenfield standards as possible. The Phase 2 application is accompanied by a flood risk assessment which demonstrates no risk of flooding on site or increase of flood risk elsewhere as a result of the proposed development.

The potential impact from the operational phase on surface water is likely to be long term and low. The potential impact on water quality does not arise during the operation phase.

8.5.2 Foul Sewerage

Construction Phase

The installation of the foul sewers for the development will be conducted in parallel with the other services. This will mainly involve construction of pipes and manholes using trench excavation. The potential impact of the proposed development on the local foul sewerage network during the construction phase of the development would therefore be short term and minimal.

Operational Phase

The impact of the proposed development on the public foul sewerage system will be to increase the quantity of wastewater discharging to Shanganagh Wastewater Treatment Works for treatment and disposal. The estimated loading from completion and occupancy of the proposed Phase 2 development site would be approximately 500.6m³/day.

The development will add to the environmental and financial costs associated with treatment and disposal before final discharge at the WWTP.

There also exists a minor risk associated with the possibility of leakage from damaged foul sewers and drains within the development site. Any foul water leakage could result in minor contamination of groundwater in the area.

The potential impact from the operational phase of the development is therefore likely to be long term and minimal.

8.5.3 Water Supply

Construction Phase

Provision of a new water main distribution network would involve construction activities within the subject lands mainly involving trench excavations conducted in parallel with the other services. The potential impact on the local public water supply network would be short term and imperceptible.

Operational Phase

The total water consumption of the Phase 2 development will be approximately 375.4 cubic metres per day.

The impact of the operational phase of the proposed development on the public water supply is likely to be to increase the demand on the existing supply by approximately 375.4m³/day. As such additional water quantities would need to be treated at Dun Gaoithe Reservoir and supplied through the existing network to the site. This will require extra cost as well as increasing abstraction volumes from the existing source. The potential impact of the proposed development on the public water supply network is likely to be long term and minimal.

8.6 POTENTIAL CUMULATIVE IMPACTS

The other significant planned project in the area is the permitted development on the Phase 1 lands for 425 no. residential units, which was also subject to an environmental impact assessment, and a flood risk assessment. The Phase 2 application has assessed the cumulative impact of the proposed

development on the permitted Phase 1 project, for example in the SSFRA and Hydraulic Analysis of the Bridge, to ensure no adverse flood impacts arise.

A Construction and Environmental Management Plan will be put in place and complied with for both projects. Capacity of the surface water and foul sewer networks have been considered in the design of the Phase 2 development and capacity in the network has been confirmed by Irish Water and DLRCC. Water supply has also been considered and there is sufficient availability for the overall development. In terms of the permitted and proposed development the residual impact on water and hydrology on both construction and operation is anticipated to be Neutral in terms of quality and of imperceptible significance, once appropriate mitigation measures are put in place at the subject site.

However, provided sufficient mitigation measures are in place at each of the developing sites the overall impact on land and soils will be neutral. Having regard to the assessments undertaken, the capacity of the surrounding environment to accommodate development of the nature proposed, it is considered that the overall cumulative development in the area will have a moderate, long term impact on the water and hydrology of the area.

8.7 DO NOTHING IMPACT

In order to provide a qualitative and equitable assessment of the proposed development, this section considers the proposed development in the context of the likely impacts upon the receiving environment should the proposed development not take place.

If the proposed development does not proceed there would be no additional impact on the local water systems. The current rate of surface water run-off would continue to operate in its natural state. The only existing risk that would exist would arise from existing agricultural practices which may influence the run-off water quality and therefore the water quality within the Ballyogan Stream.

Fluvial flooding events would continue as they have historically in this area with the existing floodplain maintained for the 100 year (Zone 'A') and 1000 year (Zone 'B') floodplains.

Groundwater status would also remain unchanged if the existing agricultural land use continued.

8.8 REMEDIAL AND MITIGATION MEASURES

Remedial and mitigation measures describe any corrective or mitigative measures that are either practicable or reasonable, having regard to the potential impacts discussed above. This includes avoidance, reduction and remedy measures as per the guidance set out in Section 4.7 of the Development Management Guidelines 2007 to reduce or eliminate any significant adverse impacts identified

Construction Phase

The following mitigation measures are proposed for the construction phase of the proposed development with reference to Water:

WT CONST 1: A detailed method statement would be prepared and agreed with the Local Authority prior to any works commencing on the bridge. The method statement would address how to mitigate the risk of contaminating watercourse and to mitigate against any temporary reduction in the flood plain storage due to the construction works.

WT CONST 2: Dewatering measures should only be employed where necessary.

WT CONST 3: Basement excavations should be kept to a minimum to reduce impacts to the groundwater. Undercroft/basement car parks are proposed for each of the apartment blocks to the north to minimise the impact of excavations and levels are set to work with existing ground levels as closely as possible. Two undercroft car parks are proposed under Blocks E8 and E9, which would involve less excavation works than the construction of full depth basement car parks in these locations.

WT CONST 4: In the event of groundwater being encountered during the construction phase, mitigation measures will include dewatering by pumping to an appropriate treatment facility prior to discharge. Other measures would include excluding contaminating materials such as fuels and hydrocarbons from sensitive parts of the site i.e. highly vulnerable groundwater areas.

WT CONST 5: Surface water storage systems will include 'soakaway' type systems where possible e.g. permeable paving, bioretention areas, swales etc to enable ground water recharge, thus replenishing the water table.

WT CONST 6: Mitigation measures should be put in place by the contractor in relation to storage of fuels and other materials and general maintenance of the site.

WT CONST 7: Surface water collecting in excavations should be directed to on-site settlement ponds, where silt removal will be facilitated prior to discharge to the further reduce the possibility of contaminants entering the local water system. Periodic testing of the surface water discharge might also be undertaken.

WT CONST 8: If concrete mixing is carried out on site, the mixing plant should be sited in a designated area with an impervious surface.

WT CONST 9: When it is necessary to store diesel or oil fuels on site, they should be stored in appropriate containers in bunded storage areas.

WT CONST 10: Any hazardous construction materials shall be stored appropriately;

WT CONST 11: Existing surface drainage channels within the lands that serve adjacent lands should be retained to prevent causing increased flooding impacts.

WT CONST 12: Ensure finished road levels direct overland flood water for rainfall events exceeding 1%AEP towards open space areas and the Ballyogan Stream and ensure runoff is retained within the site.

WT CONST 13: In order to reduce the risk of defective or leaking sewers, all new sewers should be laid in accordance with the relevant standards, pressure tested and CCTV surveyed to ascertain any possible defects.

WT CONST 14: There is a risk that ground water could become contaminated with lime from cement which subsequently finds its way into the local adjacent watercourses. The measures proposed to be put in place to mitigate any potential damage from the effluent of contaminated ground water would be to create an exclusion zone, as far as reasonably practicable, by the erection of a visible 1.0m high barrier along the watercourse. This will be formed by means of steel road pins, which will be used to support a PVC 'orange' barrier with warning signs appropriately fixed at regular intervals. The signs shall read 'NOTICE – NO DISCHARGE OF ANY KIND IS PERMITTED IN THIS VICINITY OR BEYOND THIS EXCLUSION ZONE'

WT CONST 15: Adjacent watercourses/groundwater need to be protected from sedimentation and erosion due to direct surface water runoff generated onsite during the construction phase. To prevent this from occurring surface water discharge from the site will be managed and controlled for the duration of the construction works until the permanently attenuated surface water drainage system of the proposed site is complete. A temporary positive drainage system shall be installed prior to the commencement of the construction works to collect surface water runoff by the site during construction. A Series of geotextile lined cascading, high level outfall, settling basins will be installed upstream of the agreed discharge point. This temporary surface water management facility will throttle runoff and allow suspended solids to be settled out and removed before being discharged in a control manner to the agreed outfall. All inlets to the cascading settling basins will be ripped to prevent scour and erosion in the vicinity of the inlet.

Operational Phase

The following mitigation measures are proposed for the operational phase of the proposed development with reference to water.

WT OPERAT 1: The design proposal for the bridge linking the proposed Phase 1 development and the future development of the Phase 2 lands, allows for an increase in the cross sectional area through the bridge by 0.5m² to accommodate the same pre and post-development flows. An outline of the pre and post development flows and bridge design are outlined in the standalone report by DBFL Consulting Engineers entitled '*Hydraulic Analysis of Future Bridge for Phase 2*'.

WT OPERAT 2: Stormwater storage structures and drainage systems should incorporate infiltration to promote the potential for ground water recharge.

WT OPERAT 3: A properly designed surface water system incorporating SuDS and designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) would minimise the overall impact of the development on the existing environment.

WT OPERAT 4: Surface water discharge rates should be limited to existing Greenfield run-off rates to prevent increased flood risk.

WT OPERAT 5: Ensure that the recommendations and mitigation measures outlined in the Site Specific Flood Risk Assessment (SSFRA) by DBFL, are implemented in full.

WT OPERAT 6: All surface water ditches within the development site should be left open where possible. Where ditch systems cross proposed roads, they will be culverted.

WT OPERAT 7: Regular inspection of the hydro-brake, gullies and petrol interceptor will be required to prevent contamination and increased runoff from the site.

WT OPERAT 8: It is envisaged that the development would take place and be occupied over a reasonable time period, and therefore the downstream foul sewerage system (foul sewer network and wastewater treatment facility) would be gradually loaded.

WT OPERAT 9: No remedial works would be required to the existing foul sewerage system after the introduction of development generated flows.

WT OPERAT 10: Water conservation methods such as the use of low flush toilets and grey water reuse should be incorporated into dwellings to reduce water volumes and related treatment and abstraction costs of the development.

8.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

The proposed development of the Phase 2 subject site will result in an increase of impermeable areas by approximately 8.75ha (with an effective runoff area of 6.5ha). There will be no increase in runoff rate as post-development rates will match greenfield values through the use of SuDS and attenuation storage.

The proposed development of the Phase 2 subject site will result in an increase in foul loading on the public sewerage system of 500.6m³/day.

The proposed development of the Phase 2 subject site will result in an increase in water demand on the public water supply system of 375.4m³/day.

8.10 MONITORING

All drainage works will be approved by Dun Laoghaire Rathdown County Council, Sanitary Services Division, and will be carried out in accordance with the GDR COP (Greater Dublin Regional Code of Practice for Drainage Works).

8.10.1 Hydrogeology

Although no specific monitoring will be required as part of the proposed development it is envisaged that EPA Monitoring will continue in the area through the life of the development.

It is proposed to carry out baseline water quality monitoring of the Ballyogan Stream prior to the construction stage to ascertain the current Q value of the watercourse. Monitoring of the watercourse would also be carried out during the construction phase of the works ascertain of there is any negative impact on water quality due to the construction works.

8.10.2 Surface Water

The surface water system will be monitored by way of observation of any flooding events if such occur and the establishment of a proper maintenance programme for all sewers / drains / SuDS elements etc.

8.10.3 Foul Sewerage

No specific monitoring measures are required.

8.10.4 Water Supply

On-going water usage within the proposed development will be monitored by bulk water meters at the connections to the public mains and individual dwelling meters where appropriate. The network will be developed as a district metered area (DMA) subject to the requirements of the local authorities. Water usage will be continually monitored to avoid waste, leakage etc. All watermains will be constructed in accordance with Irish Water's Code of Practice for water infrastructure.

8.11 REINSTATEMENT

8.11.1 Hydrogeology

No specific reinstatement measures are required.

8.11.2 Surface Water

It is not envisaged that there will any works in the public lands or roads as all surface water drainage for the development will be constructed within boundaries of the Phase 1 and Phase 2 sites with outfalls to the Ballyogan Stream. However, if it should be required, normal post construction reinstatement of sewer trenches etc., will be completed as part of the proposed development. Where such works arise, all existing roads will be reinstated in accordance with Dun Laoghaire Rathdown County Council's Road Maintenance Specification 2014.

8.11.3 Foul Sewers

It is not envisaged that there will any works in the public lands or roads as all foul water drainage for the development will be constructed within boundaries of the Phase 1 and Phase 2 sites. However, if it should be required, normal post construction reinstatement of sewer trenches will be completed as part of the proposed development. Where such works arise, all existing roads will be reinstated in accordance with Dun Laoghaire Rathdown County Council's Road Maintenance Specification 2014.

8.11.4 Water Supply

It is not envisaged that there will any works in the public lands or roads as all watermain infrastructure for the development will be constructed within boundaries of the Phase 1 and Phase 2 sites. However, if it should be required, normal post construction reinstatement of watermain trenches will be completed as part of the proposed development. Where such works arise, all existing roads will be reinstated in accordance with Dun Laoghaire Rathdown County Council's Road Maintenance Specification 2014.

8.12 INTERACTIONS

There is an interaction between the provision of surface water for the proposed development drainage and the flood potential of the Ballyogan Stream. Mitigation measures identified in the Site Specific Flood Risk Assessment (SSFRA) by DBFL Consulting Engineers will ensure there is no adverse effect from the proposed works. This report is submitted as a standalone report as part of this planning submission.

There is an obvious and directly proportional interaction between foul drainage and water supply in that the former will closely replicate the later in volumetric terms.

8.13 DIFFICULTIES ENCOUNTERED IN COMPILING

No particular difficulties were encountered in completing this section.

8.14 REFERENCES

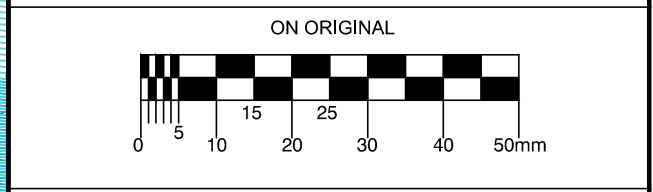
Environmental Report Of The Dún Laoghaire-Rathdown County Development Plan 2016-2022 SEA
EPA Website
GSI Website
Met Eireann Website
Foul and Surface water design calculations By DBFL
Site Specific Flood Risk Assessment, Revision 'A' By DBFL
HYDRAULIC ANALYSIS OF FUTURE BRIDGE FOR PHASE 2', BY DBFL.

APPENDIX 8.1- DBFL DRAWINGS

Kilgobbin Cottage

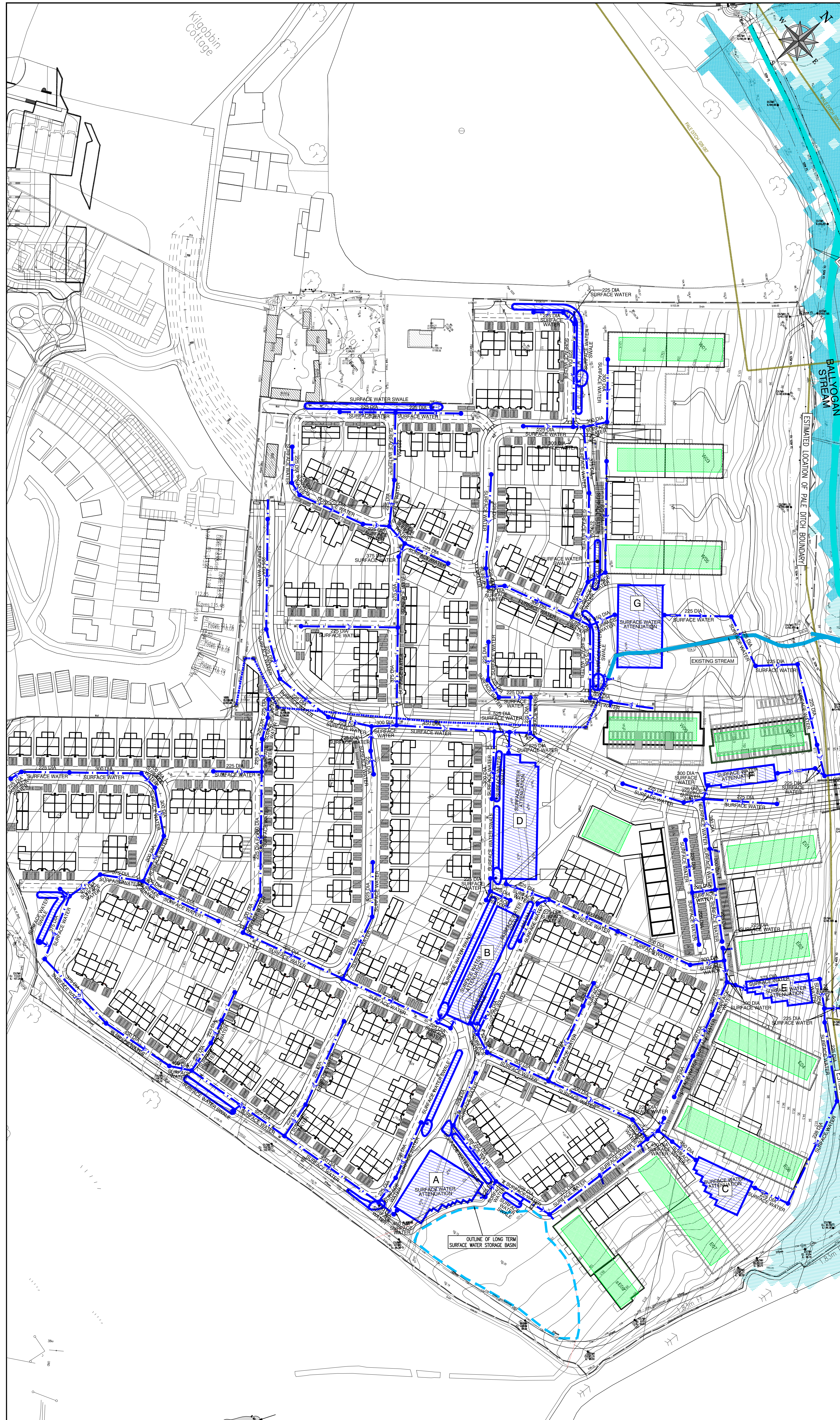


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1. ALL DIMENSIONS AND LEVELS IN METRES, EXCEPT IF NOTED OTHERWISE.
2. ALL LEVELS TO MALIN HEAD DATUM.
3. CO-ORDINATE SYSTEM IS: IRISH TRANSVERSE MERCATOR.
4. ZONE A & ZONE B IDENTIFIED BY OPW ECFRMS MAPPING.
5. FLOOD ZONES AS DEFINED IN THE PLANNING SYSTEM & FLOOD RISK MANAGEMENT GUIDELINES FOR PLANNING AUTHORITIES.

- LEGEND:
- PROPOSED SURFACE WATER SEWER
 - PROPOSED SURFACE WATER ATTENUATION
 - EXISTING SURFACE WATER SEWER
 - FFL 94.35
 - 1:100 YEAR FLOOD EXTENT [ZONE A] (POST-DEVELOPMENT SCENARIO)
 - 1:1000 YEAR FLOOD EXTENT [ZONE B] (POST-DEVELOPMENT SCENARIO)
 - PHASE 2 BOUNDARY (CURRENT APPLICATION)



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DESIGNED	KPS	PREPARED	SLM	
DATE	SEPT 2017	CHECKED	JBK	

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PROJECT
RESIDENTIAL DEVELOPMENT AT CLAY FARM, BALLYOGAN ROAD, DUBLIN 18, PHASE 2

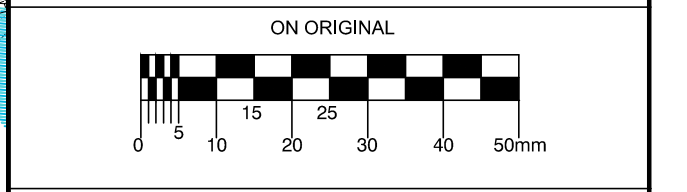
DRG. TITLE
SCHEMATIC SURFACE WATER LAYOUT PLAN

ARCHITECT
O'MAHONY PIKE ARCHITECTS

SCALE: 1:1000 @A1 FILE REF: 163056-3090
 DRG. NO. 163056-3090



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5. FLOOD ZONES AS DEFINED IN THE PLANNING SYSTEM & FLOOD RISK MANAGEMENT GUIDELINES FOR PLANNING AUTHORITIES.

- LEGEND:
- PROPOSED FOUL SEWER
 - EXISTING FOUL SEWER
 - FFL 94.35 FINISHED FLOOR LEVEL
 - 1:1000 YEAR FLOOD EXTENT [ZONE A] (POST-DEVELOPMENT SCENARIO)
 - 1:1000 YEAR FLOOD EXTENT [ZONE B] (POST-DEVELOPMENT SCENARIO)
 - PHASE 1 BOUNDARY (CURRENT APPLICATION)
 - PHASE 2 BOUNDARY (FUTURE APPLICATION)

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DESIGNED	KPS	PREPARED	SLM	
DATE	SEPT 2017	CHECKED	JBK	

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PROJECT
RESIDENTIAL DEVELOPMENT AT CLAY FARM, BALLYOGAN ROAD, DUBLIN 18, PHASE 2

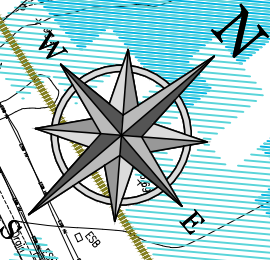
DRG. TITLE
SCHEMATIC FOUL SEWER LAYOUT PLAN

ARCHITECT
O'MAHONY PIKE ARCHITECTS

SCALE 1:1000 @A1 FILE REF. 163056-3090

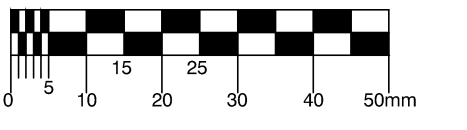
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Kilgobbin Cottage



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ON ORIGINAL



1. ALL DIMENSION AND LEVELS IN METRES, EXCEPT IF NOTED OTHERWISE.
2. ALL LEVELS TO MALIN HEAD DATUM.
3. CO-ORDINATE SYSTEM IS: IRISH TRANSVERSE MERCATOR.
4. LEVELS AND POSITIONS OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
5. EXISTING FOUL & SURFACE WATER DRAINS & CONNECTIONS & WATER SUPPLY TO BE PRESERVED & UTILISED WHERE POSSIBLE.
6. WATERMAIN TO BE PE TO IRISH WATER STANDARDS.
7. COVER TO WATERMAIN TO BE 750mm UNDER FOOTPATHS AND 900mm UNDER ROADS.
8. ANCHOR BLOCKS TO BE POSITIONED AT DEAD ENDS, TEES, BENDS AND AT EACH SIDE OF THE HYDRANTS AND VALVES.

LEGEND:

- PROPOSED WATERMAIN
- EXISTING WATERMAIN
- FFL 94.35 FINISHED FLOOR LEVEL
- 1:100 YEAR FLOOD EXTENT [ZONE A] (POST-DEVELOPMENT SCENARIO)
- 1:1000 YEAR FLOOD EXTENT [ZONE B] (POST-DEVELOPMENT SCENARIO)
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PROJECT
**RESIDENTIAL DEVELOPMENT
 AT CLAY FARM, BALLYOGAN
 ROAD, DUBLIN 18,
 PHASE 2**

DRG. TITLE
**SCHEMATIC WATERMAIN
 LAYOUT PLAN**

ARCHITECT
O'MAHONY PIKE ARCHITECTS

SCALE 1:1000 @A1 FILE REF. 163056-3090

DRG. NO. **163056-3092**