# CHAPTER 8

# Water

# 8.0 WATER

## 8.1 INTRODUCTION

This section of the Environmental Impact Assessment Report (EIAR) document has been prepared by DBFL Consulting Engineers and assesses and evaluates the impact of the proposed development on the Site's Water, Hydrogeology and Hydrology during the demolition, construction and operational phases. All natural water bodies including surface freshwater (streams, bogs, ponds, rivers and lakes), hydrogeological / groundwater (shallow and deep) and where applicable estuarine waters and marine waters which may be impacted by the proposed development are assessed. Interaction between the water bodies and the surface water drainage, foul water drainage, and water supply proposals are assessed.

A Flood Risk Assessment (SSFRA) has been completed by McCloy Consulting Engineers and is included as a standalone report with this application (Report Ref: M02182-01_DG01). This report has contributed to the contents of the EIAR, and the assessment below.

This chapter was prepared by Niall O' Hare BEng (Hons) MSc CEng MICE, MIEI and Kevin Sturgeon BEng (Hons) MSc CEng MIEI of DBFL Consulting Engineers.

Niall is an Associate and Chartered Engineer with 9 years experience post graduate and post 4 years in the design and planning of civil engineering deliverables of residential infrastructure projects includes, design drawings, specifications, design reports, Preliminary Construction and Environmental Management Plans, Site Specific Flood Risk Assessments and compiling Land and Soils Chapters for Environmental Impact Assessment Reports.

Kevin is a Director and Chartered Engineer with over 22 years' experience in Consulting Civil engineering design for both public and private sector projects. His expertise includes civil infrastructure design, planning and procurement for roads, drainage, site development, water main distribution & supply and flood analysis projects from feasibility stage through option appraisal, planning, detailed design, tender & procurement to final construction. Kevin has been with DBFL for over 15 years and during this time has played a key role in infrastructure design for a range of projects including road schemes, drainage upgrades, water-main improvement schemes, site development and flood analysis for a range of projects.

## 8.2 METHODOLOGY

### 8.2.1 Guidelines

The assessment of the potential impact of the proposed development on the water bodies was carried out in accordance with the methodology and the specific criteria set out in the following documents:

- EPA Guidelines on Information to be Contained in an Environmental Impact Statement (2022),
- 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).

### 8.2.2 Consultation

Information regarding the local surface water and hydrogeological environments was assembled from the following sources:

- Environmental Protection Agency (EPA) interactive mapping and water quality data;

- Ordnance survey Ireland (OSI) mapping;
- Geological Survey of Ireland (GSI) online mapping service;
- Topographical survey;
- Site inspection / walkover;
- Office of Public Works (OPW) National Flood Hazard Mapping & CFRAM Studies (Catchment Flood Risk and Management Studies);
- Kildare County Council record drawings;
- Ground Investigation Reports;
- Celbridge Local Area Plan 2017-2023.
- Greater Dublin Regional Code of Practice for Drainage Works;
- Greater Dublin Strategic Drainage Study (GDSDS);
- 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).
- Inland Fisheries Ireland Planning for Watercourses in the Urban Environment.

### 8.2.3 Desktop Study

This chapter encompasses knowledge obtained from site visits, drainage and water services record information received from Irish Water and the Local Authority. Additionally, information from the EPA and GSI websites has been utilised. DBFL met via online Microsoft Teams with the Kildare County Council Planners and Drainage personnel for pre-planning meetings and this has informed their approach to the proposed design. The content of the An Bord Pleanála Opinion has also been incorporated.

### 8.2.4 Assessment Methodology

Assessment of methodology was carried out as per the guidelines referenced above. Impacts are characterised using Table 3.3 of the EPA Guidelines on Information to be Contained in an Environmental Impact Statement (2022).

### 8.2.5 Application of Methodology

Application of methodology was carried out as per the guidelines referenced above.

### 8.2.6 Study Area

The proposed development is located at Dublin Road and Shinkeen Road, Celbridge Co. Kildare. The site area is approximately 13.4ha. The Hazelhatch Stream and Shinkeen Road bounds the site to the west and the Shinkeen Stream bisects the site. The Dublin Road is located to the north of the subject site. The site is within the River Liffey SC 090 catchment.

## 8.3 EXISTING RECEIVING ENVIRONMENT (BASELINE SCENARIO)

### 8.3.1 Topography & Land Use

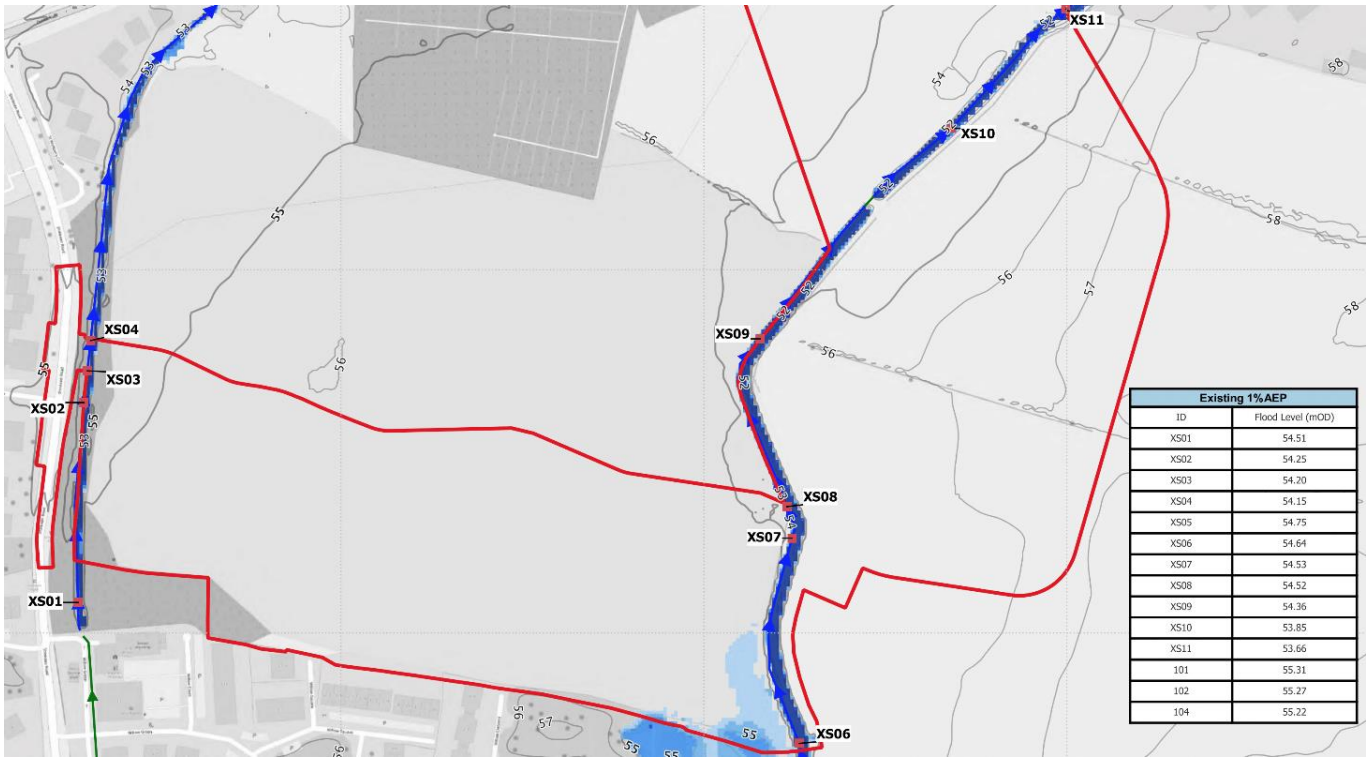
The subject lands are predominately flat in character with a gentle slope from the central spine of the site to the watercourses on the eastern and western sides. The site is bisected by the Shinkeen Stream to the west of the development and there is a further stream known as the Hazelhatch Watercourse to the east. The character of the Shinkeen Watercourse consists of circa 3-4m deep banks with relatively low water level depths. The depth of the banks of this stream is a fundamental aspect to the flood zoning in this area and thus these levels will not be adjusted or interfered as part of the new development.

From the central spines of each sub-site the lands falls from towards its West and Eastern boundary edges at gradients ranging from 1/200 to 1/350, and the site falls from the Southern boundary to the Northern boundary at gradients ranging from 1/150 to 1/240 within sub-site B.

Within BH04 Made Ground was found four meters below ground level under the subsoil layer. The made ground was found to be consisting of gravelly cobbles with concrete. These made ground is located within the flood plain within Site A and therefore will not be disturbed during construction

### 8.3.2 Existing Surface Water Features & Hydrology

The site is within the Liffey catchment area with both the Hazelhatch and Shinkeen Watercourses transversing the site. Figure 8.1 and Figure 8.2 below illustrates the present day levels for the 1% and 0.1% AEP flood levels taken from the site specific flood risk assessment (SSFRA) and reference should be made to this document




| Existing 1%AEP | |
|---|---|
| ID | Flood Level (mOD) |
| XS01 | 54.51 |
| XS02 | 54.25 |
| XS03 | 54.20 |
| XS04 | 54.15 |
| XS05 | 54.75 |
| XS06 | 54.64 |
| XS07 | 54.53 |
| XS08 | 54.52 |
| XS09 | 54.36 |
| XS10 | 53.85 |
| XS11 | 53.66 |
| 101 | 55.31 |
| 102 | 55.27 |
| 104 | 55.22 |

**Figure 8.1: Present Day 1% AEP flood extend levels. Source SSFRA**

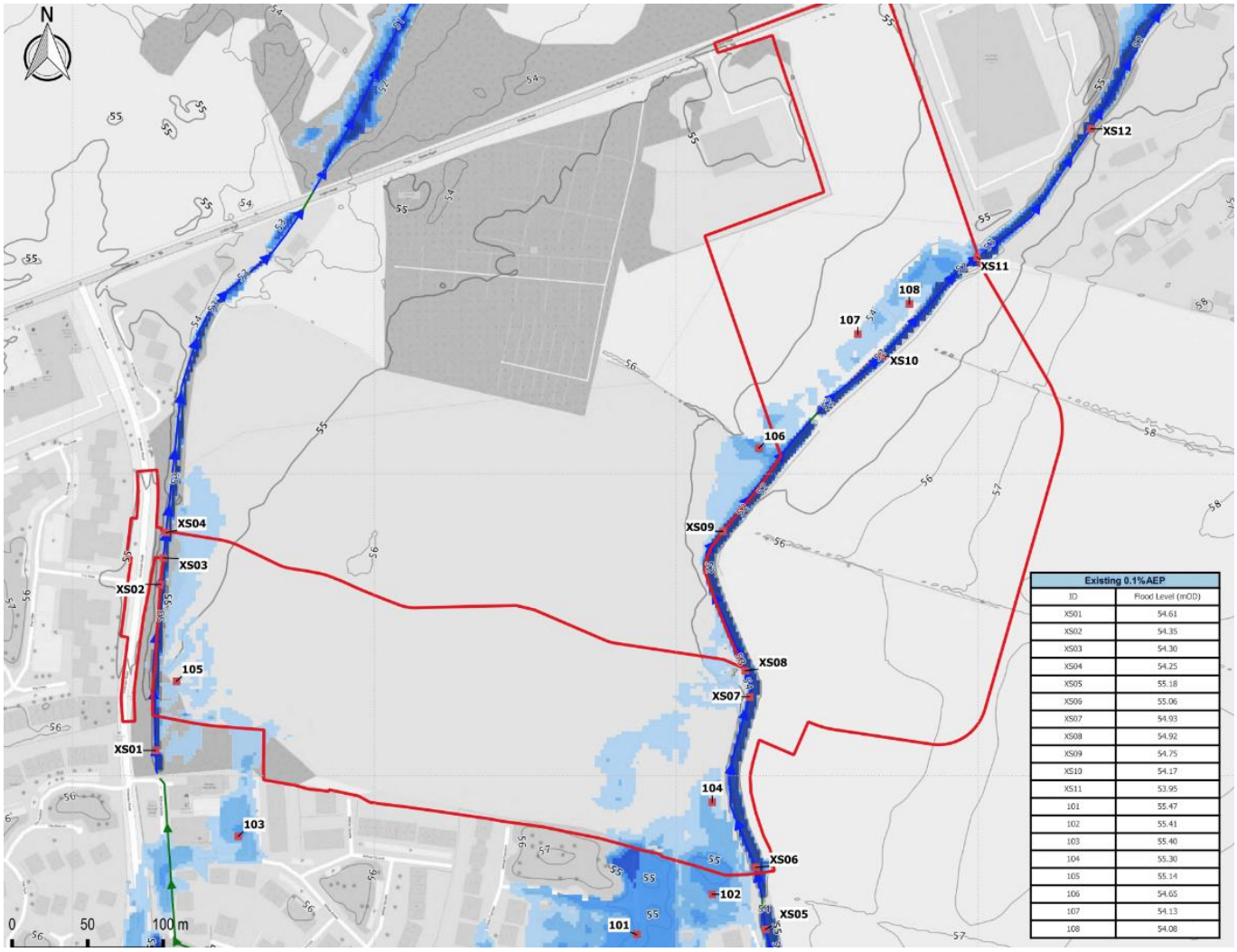



**Figure 8.2: Present Day 0.1% AEP flood extend levels. Source SSFRA**

In terms of development areas in zones where probability of flooding from rivers is highest, there are no areas of flooding within the vicinity of housing units and are all where the probability of flooding from rivers is low (less than 0.1% AEP or 1 in 1000 for the rivers).

No evidence of flooding or marsh areas are shown within any developed areas within the site based on the latest flood maps received for the development.

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

- The Skinkeen Stream bisecting the site from the southern boundary to the northern boundary.
- The Hazlehatch Stream which transverses the western boundary of the site from Southern to the Northern Boundary and joins the River Liffey downstream of the development

The character of the Shinkeen Watercourse is a very deep watercourse with circa 3-4m deep banks. The depth of this stream is a fundamental aspect to the flood zoning in this area and thus these levels will not be adjusted as part of the new development.

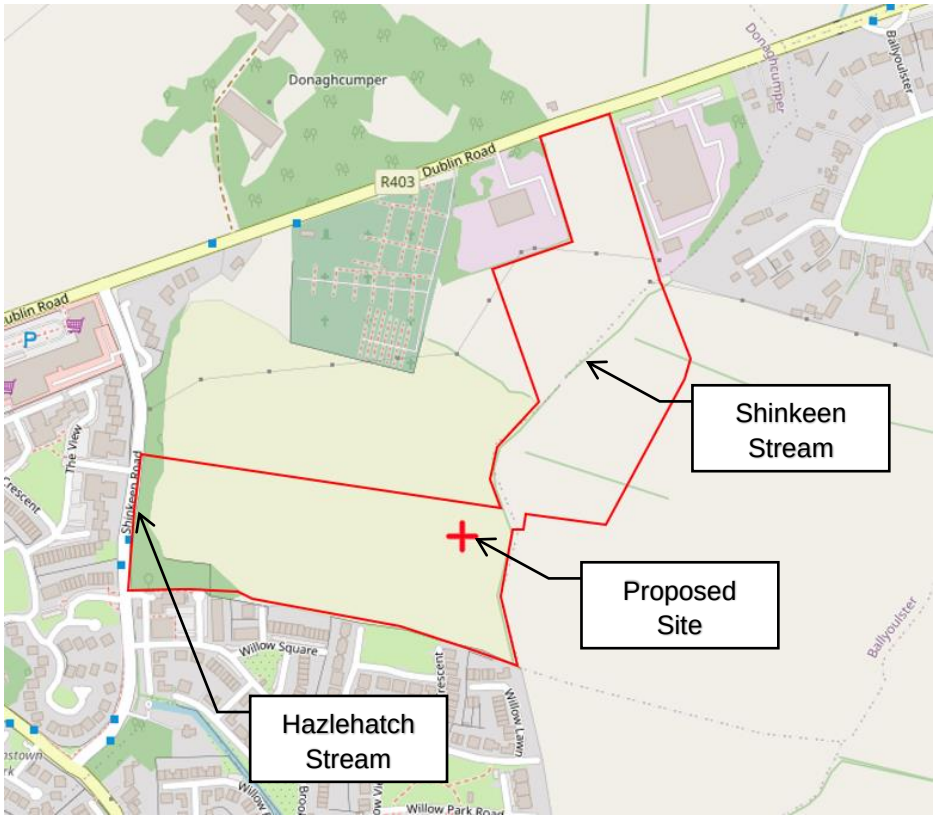



**Figure 8.3 – Extract from EPA mapping**

### 8.3.3 River Water Quality

The EU Water Framework Directive (WFD) seeks to restore and protect water quality. The *"Celbridge Local Area Plan – 2017-2023"* (LAP) describes the system of protecting and restoring water quality through the River Basin Management Plans (RBMPs). Celbridge is located with the Eastern River Basin District. This water management unit contains the River Liffey water bodies. The status of the surface water ranges from Bad to Moderate and the objective is to restore and protect. The Shinkeen nor Hazelhatch watercourse have not been identified as being continually monitored and therefore no data exists in terms of water quality for these.

### 8.3.4 Regional Hydrogeology

In accordance with the Water Framework Directive (2000/60/EC) it is necessary to understand the groundwater vulnerability of the site, which is defined as the tendency and likelihood for general contaminants to reach the water table after introduction at the ground surface. The GSI vulnerability mapping guidelines are as per GSI (www.gsi.ie) Groundwater vulnerability classifications are based on the type and thickness of subsoils and the presence of karst features.

The groundwater vulnerability for the study areas is displayed in Figure 8.4. GSI interactive mapping classifies the site's groundwater vulnerability as "*moderate*" for the majority of the site with western and Northern boundaries deemed "*high*" and along the Hazelhatch stream as "*extreme*". The underlying aquifers are classified as "*Locally important aquifer – Bedrock which is moderately productive only in local zones*". Site investigations indicate that the vulnerability classification of the aquifer will be lower where substantial overburden is present and provides protection to the bedrock.

Within the study area the groundwater vulnerability ranges from Moderate to extreme where bedrock or sub-crop is close to the surface. Areas of extreme groundwater vulnerability are located in western boundary of the subject site along the Shinkeen Stream.

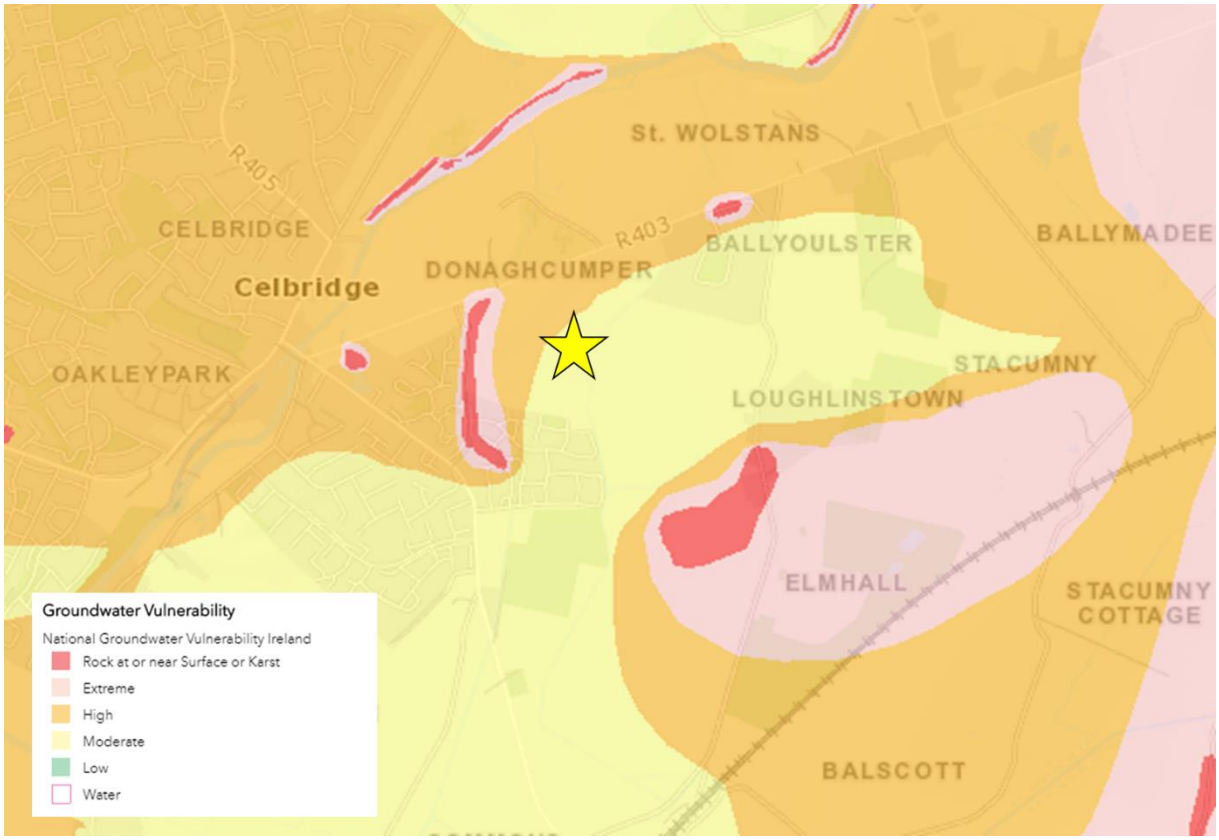



**Figure 8.4: Groundwater Vulnerability *Source epa.ie***

### 8.3.5 Site Hydrology and Groundwater

The *"Celbridge Local Area Plan – 2017-2023"* (LAP) lands including the subject site are located in the River Liffey catchment (LIFFEY_SC_090) which is within the Eastern River Basin District (ERBD) and is a nationally important salmonid system. The Shinkeen Stream and Hazelhatch Stream are the water features in the area. Both streams are tributary of the River Liffey which flows west to east through the northern section of the plan area.

### 8.3.6 Flooding and Flood Risk

Figure 5.1 of the SFRA for Celbridge LAP includes a map (prepared by RPS Consulting Engineers see Appendix 3) outlining flood risk to LAP lands in accordance with '*The Planning System & Flood Risk Management Guidelines'*. This map identified the land abounding the Shinkeen stream as being potential areas of flood risk for 100 year and 1,000 year return events.

In November 2021 DBFL were made aware of updated flood maps if the Hazelhatch area and as such were informed that these maps should be referenced in relation to the proposed development. As such the LAP flood risk mapping has been superseded by the HAZELHATCH CURRENT FLUVIAL FLOOD EXTENT, which indicates increased flooding along the western boundary of the Shinkeen stream. In accordance with *the 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities'* (2009), a site specific flood risk assessment (SSFRA) has been carried out by McCloy Consulting Engineers for the subject site and is included as a standalone report. McCloy Consulting Engineers developed a new model based on the topographical survey data of the site and would now be considered most accurate. Reference should be made to SSFRA Report Ref: M02182-01_DG01.

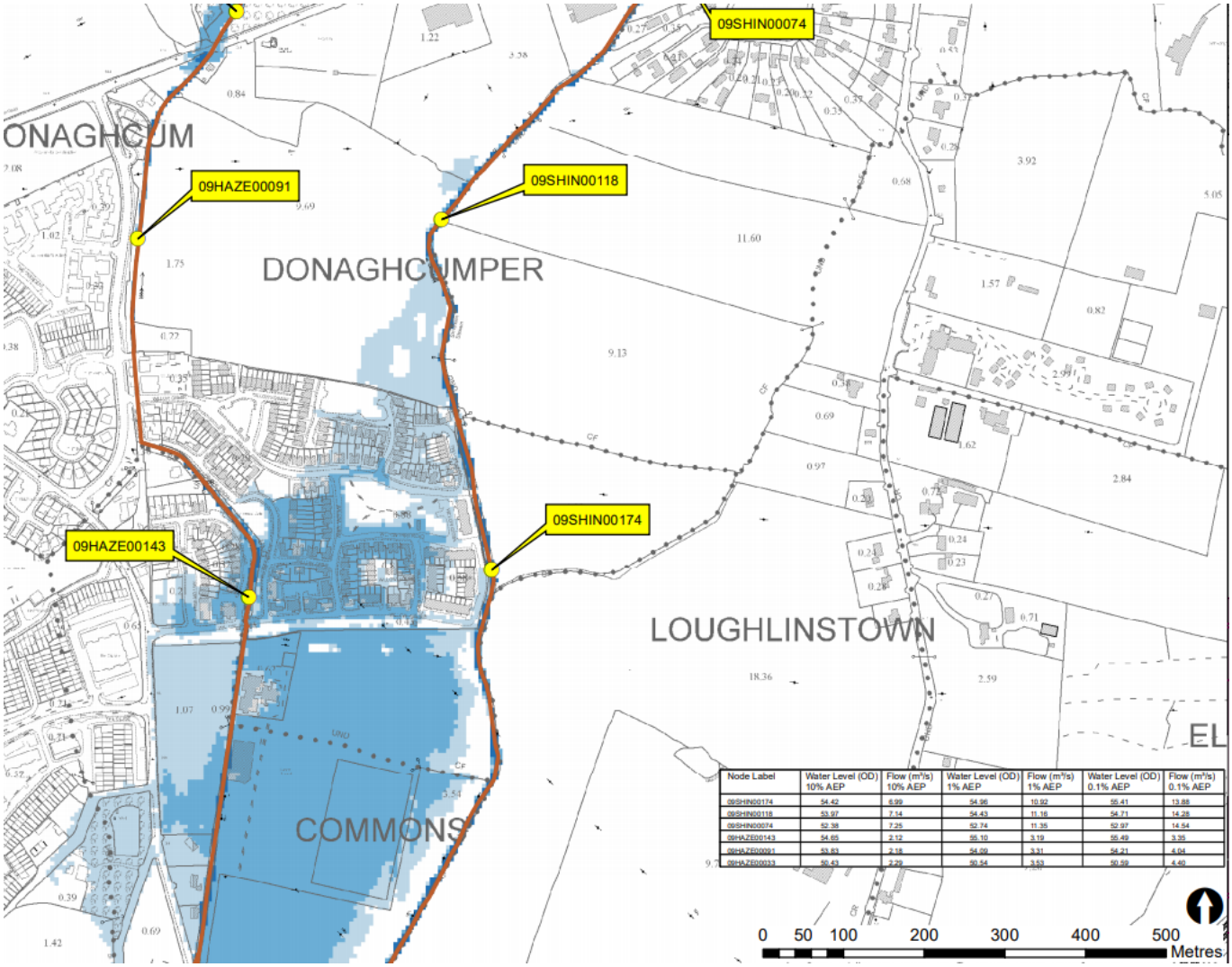



**Figure 8.5 – Extract from Hazelhatch Current Fluvial Flood Extent (RPS).**

## 8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The Ballyoulster SHD Phase 1 development comprises the construction of 344 units totaling 54 no. 1 beds, 30 no. 2 beds, 210 no. 3 beds and 50 no. 4 beds), a childcare facility with a GFA of c. 369 sq.m, public and communal open space, landscaping, car and cycle parking spaces, provision of an access road from Dublin Road and Shinkeen Road, associated vehicular accesses, internal roads, pedestrian and cycle paths, bin storage, pumping station and all associated site and infrastructural works as well as associated road infrastructure and open space. Please refer to Chapter 2.0 (Description of Development and Alternatives) for a detailed site and development description.

Further information regarding the proposed infrastructure elements of the proposed development are detailed in the separate “Infrastructure Design Report”, document reference 180221-DBFL-XX-XX-RP-C-0002 by DBFL Consulting Engineers.

It is anticipated that the main development characteristics impacting water, hydrogeology and hydrology comprise the following:

- General construction activities across most of the site.
- Installation of sub surface utilities.
- Installation of additional stormwater storage.
- Installation of SUDS features.

- Changes to ground levels across the site to facilitate final development levels.

### 8.4.1 Topography & Land Use

The proposed development area sits above the flood plain level. The proposed development is designed to follow the existing ground profile where possible. The proposed apartments finished floor levels are designed with existing levels in mind and relationships with boundaries such as the Dublin Road and Shinkeen Road. Finished floor levels to properties are set over and above minimum freeboard requirements.

### 8.4.2 Regional Hydrogeology

The integration of SUDs features with traditional drainage methods, is a strategy of both the LAP and the County Development Plan. SUDs features encourage groundwater recharge where possible and replicate natural drainage systems. SUDs features proposed for the subject site include swales/bio-retention areas, and tree pits as well as green roofs.

### 8.4.3 Site Hydrology and Groundwater

The proposed development is designed to limit surface water runoff from the site to the greenfield runoff rate and to store flows exceeding this in a combination linear detention basins, swales and ponds. No underground tanks (geo-cellular or otherwise) are proposed for the entirety of the development. For storms exceeding a 100-year event, the development has been designed to provide overland flood routes along streets and roads direct flood water away from apartments, basements and to open space areas.

The total allowable surface water runoff for the subject site has been calculated as 28.02/s and the storage volume required to accommodate runoff from a 1%AEP (Annual Event Probability) is calculated using Microdrainage software as approximately 4364m3. Refer to DBFL report number 108221-DBFL-XX-XX-RP-C-0002, “Infrastructure Design Report”, for detailed calculations of the allowable outflow from the site and the storage requirements.

The proposed surface water drainage network, attenuation storage and site levels are designed to accommodate a 100- year storm event (including an allowance for climate change comprising a 20% increase in rainfall figures, as required in the GDSDS (Greater Dublin Strategic Drainage Study)). Proposed finished floor levels of all dwellings are set over and above 500mm above the estimated 1 in 100-year return period storage level, as required in the GDSDS. A number of Soakaway tests carried out by IGSL in November 2021 indicate that infiltration is low and this has been taken into consideration in the design. Refer to Ground Investigation Report by IGSL Ltd included with application (see Appendix B of the Infrastructure Design Report). However, a number of SUDs features are incorporated into the surface water design providing a facility to intercept and filter pollutants in conjunction with providing conveyance, attenuation and limiting surface water runoff flows.

### 8.4.4 Flooding and Flood Risk

The SSFRA carried out by McCloy Consultant Engineers, document no M02182-01_DG01, assesses the proposed development in the context of the ‘*Planning System and Flood Risk Management Guidelines’*. This report is included as a standalone report.

Following the Site Specific Flood Risk Assessment, it has been determined that much of the site is in Flood Zone C with areas adjoining watercourses in Flood Zones A and B. The proposed development is within low risk Flood Zone C and are considered appropriate as defined by the Guidelines.

## 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 and the Shinkeen and Hazelhatch Watercourses 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 8.6 and 8.7.

### 8.5.1 Construction Phase

Construction of the proposed development will require the removal of a large part of the topsoil and to facilitate the construction of the residential units, 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, Hazelhatch and Shinkeen 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.

Excavation of soil and sub-soil layers may reduce the ability of the lands to recharge groundwater. The surface water runoff will be collected and positively discharged from the development to both Shinkeen and Hazelhatch Stream which in turn flows to the River Liffey. It is likely that this activity would have a slight, adverse, permanent, residual, impact on groundwater.

The development will require a new surface water drainage network including overland attenuation storage features to accommodate surface water runoff from the development. Due to the poor infiltration rates on the site, discharges to the ground would be limited, with the majority of surface water collected on site, positively drained to the Shinkeen and Hazelhatch streams via an attenuated outlet. Surface water collected on site would also be lost through evaporation. It is likely that this activity will have a slight, adverse, permanent, residual, impact on the existing watercourses.

Surface water runoff during the construction phase may contain increased silt levels (e.g. runoff across areas stripped of topsoil) or become polluted by construction activities. This has the potential to result in increased silt and pollutant levels into existing nearby watercourses. In the absence of mitigation, it is likely that this activity would have a slight, adverse, temporary, residual impact on the watercourses.

Heavy rain fall or a high level of ground water could produce ponding in open trenches. Discharge of this rainwater pumped from excavations to existing streams could compromise the capacity of the stream and as such cause flooding. This impact may be characterised as a likely, moderate, temporary, adverse impact. The consequence of this will increase the flow within the existing stream and hence potentially cause flooding.

Discharge of wash water from concrete trucks and discharge of vehicle wheel wash water has the potential to contaminate the groundwater. This impact may be characterised as a temporary, short term, moderate impact. It is likely that this activity would have a temporary, adverse, slight, adverse, impact on groundwater and local watercourses within the area.

### 8.5.2 Operational Phase

Potential operational phase impacts are noted below:

- Increased impermeable surface area will reduce local groundwater recharge and potentially increase surface water runoff and flooding downstream. It is likely that this activity would have a slight, permanent, adverse, impact on groundwater and the local watercourses.
- Accidental hydrocarbon leaks and subsequent discharge into piped surface water drainage network (e.g. along roads and in driveway areas). The likely impact may be characterised as imperceptible, temporary and adverse.
- Contamination risks arising from development use / leaking pipes / contaminated surface water runoff. The likely adverse impact arising from this activity may be characterised as imperceptible and temporary.

### 8.5.3 Risks to Human Health

A potential risk to human health from water, hydrology and hydrogeology can be linked to the potential for contamination of the potable water supply. The ground water and supply network would present possible pathways. The risk is considered below.

Groundwater Supply

As noted above the underlying receiving groundwater is a locally important aquifer which is moderately productive in local zones. The risk to the contamination of this water supply source from surface water run-off from the development during construction and operation is considered to be low given infiltration results obtained as part of the site investigation undertaken by Ground Investigations Ireland.

Network Supply

As noted above surface water outflow from the site ultimately discharges to the Shinkeen and Hazelhatch Watercourses. If surface water is not adequately treated and managed in accordance with the GDSDS it has the potential to impact human health as the watercourses are tributaries to the River Liffey.

### 8.5.4 "Do-Nothing" Scenario

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 current state.

Fluvial flooding events would continue as they have in this area within the existing floodplains.

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

## 8.6 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

### 8.6.1 Incorporated Design Mitigation

Mitigation incorporated into the scheme design are as follows:

- Areas for vegetation removal will have surveys to identify any otter holts or other wildlife habitats that would need re-locating prior to construction.
- Piling operation and excavated material to be contained to ensure excavated material (from piling or earthworks) does not enter watercourse.
- Any in-situ concrete work to be lined and areas bunded (where possible) to stop any accidental spillage entering the watercourse.
- Design of site services / drainage works are in accordance with the relevant design guidance.
- Appropriately designed site services / drainage / sewers will protect the water, hydrogeology and hydrology from risk of contamination arising from the development such as light liquids separator or SuDS treatment train. Features such as green roofs, bio-retention areas, filter strips, bio-swales and open-bottom attenuation are proposed to intercept pollutants and promote groundwater recharge where possible. A bypass separator is proposed prior to any surface water discharging to the Shinkeen and Hazelhatch outlets.
- Design and layout of the scheme is aimed at maximising SuDS features and protecting the Hazelhatch and Shinkeen watercourse in accordance with guidance from Inland Fisheries Ireland on the Planning for Watercourses in the Urban Environment.
- Surface water drainage for the development has been designed in accordance with the GDSDS to avoid risk to Human health.

### 8.6.2 Construction Phase Mitigation

To minimise the impact of the construction phase on the water environment it is recommended that mitigation measures included in Section 8.6.1 and the Preliminary CEMP will be implemented as part of a Site-Specific Construction and Environmental Management Plan, as per below.

**WATER CONST 1: Construction and Environment Management Plan**

General site works:

- It is recommended that best practice construction methods and practices complying with relevant legislation to avoid or reduce the risk of contamination of watercourses or groundwater in accordance with section 8.6.1 and the CEMP.
- It is recommended that a Site Specific Construction and Environment Management Plan be developed and implemented during the construction phase. Site inductions to include reference to the procedures and best practice as outlined in the PCEMP, prepared by DBFL Consulting Engineers, submitted with the SHD application.
- Measures to be implemented to capture and treat sediment laden surface water runoff especially from basement excavations and stripped land (e.g. sediment tanks, surface water inlet protection and earth bunding adjacent to open drainage ditches).
- Weather conditions and seasonal weather variations will also be taken account of when planning stripping of topsoil and excavations, with an objective of minimizing soil erosion.
- The extent of sub-soil and topsoil stripping to be minimised to reduce the rate and volume of the run-off during construction until the topsoil and vegetation are replaced.
- Concrete batching will take place off site or in a designed area with an impermeable surface.
- Concrete wash down and wash out of concrete trucks will take place on-site into an appropriate washout facility.
- Discharge from any vehicle wheel wash areas is to be directed to on-site settlement tanks.
- Oil and fuel stored on site for construction should be stored in designated areas. These areas shall be bunded and should be located away from surface water drainage and features.
- Refuelling and servicing of construction machinery to take place in a designated hardstanding area, remote from surface water inlets (when it is not possible to carry out such activities off-site).
- Any hazardous materials to be stored within secondary containment designed to retain at least 110% of the storage contents - to prevent the accidental release (fuels, paints, cleaning agents, etc.) with bunds for oil/diesel storage tanks.
- Spill kits will be kept in designated areas for re-fuelling of construction machinery.
- Dewatering measures will only be employed where necessary.

### 8.6.3 Operational Phase

Operational phase mitigation measures are noted below:

**WATER OPERA 1: Scheme Design and Maintenance**

- The design of proposed site levels (roads, FFL etc.) has been carried out to replicate existing surface contours, break lines etc. and therefore replicating existing overland flow paths, and not concentrating additional surface water flow in a particular location.
- Surface water runoff from the site will be attenuated to the greenfield runoff rate as recommended in the Greater Dublin Strategic Drainage Study (GDSDS). Surface water discharge rates will be controlled by a Hydrobrake flow control device, with underground attenuation tanks, swales and detention basins provided to store runoff from a 1 in 100 year return period event. SUDs features are implemented in the surface water drainage network to reduce the rate of runoff form hard standing area sand to improve the quality of surface water runoff. For detailed information refer to DBFL Report number 180221-DBFL-XX-XX-RP-C-0002, “Infrastructure Design Report”.
- Surface water runoff from the development will be collected by an appropriately designed system with contaminants removed prior to discharge i.e. petrol interceptor.

- A regular maintenance and inspection programme of the flow control devices, attenuation storage facilities, gullies and petrol interceptor will be required during the Operational Phase to ensure the proper working of the development's networks and discharges.
- Waste generated by the everyday operation of the development should be securely stored within designated collection areas with positive drainage collection systems to collect potential runoff.
- Operational waste should be removed from site using licenced waste management contractors.

## 8.7 PREDICTED IMPACT FOLLOWING MITIGATION (RESIDUAL IMPACT)

The predicted residual impact of the construction and operation activities following implementation of the mitigation measures above is summarised below.

- As surface water drainage design has been carried out in accordance with the GDSDS, and SUDS methodologies are being implemented as part of a treatment train approach, there are no predicted impacts on the water and hydrogeological environment arising from the operational phase.
- Implementation of the measures outlined in Section 8.6 will ensure that the potential impacts of the development on soils and the geological environment are minimised during the construction phase and that any residual impacts will be short term and imperceptible.
- Residual impacts from earthworks haulage and the risk of contamination of groundwater are deemed to be of minor risk. The residual impacts for a residential development, and open space are deemed to be imperceptible post construction (during the operational phase).

### 8.7.1 Impact on Climate

The surface water drainage network, attenuation storage and site levels are designed to accommodate a 100-year storm event (provision for 20% climate change included). Floor levels of houses are set above the 100-year flood levels by a minimum of 0.5m. For storms in excess of 100 years, the development has been designed to provide overland flood routes along the various development roads towards the surface water drainage outfalls and existing roads. Floor levels are also set well above finished floor and basement vent levels as outlined in the Site Specific Flood Risk Assessment which forms part of this application. This overland flood route also reduces the development's vulnerability to climate change.

### 8.7.2 Impact on Human Health

Risks to human health include the accidental spills/ leaks of hydrocarbons/ oils entering the groundwater/surface water or potable water system. This impact following mitigation measures outlined in section 8.6 will result in a imperceptible impact to human health.

## 8.8 WORST CASE SCENARIO

Worst case scenarios envisioned are extreme occurrences of the potential impacts identified above in conjunction with failure of mitigation measures including:

- Significant contamination event.
- Flooding due to extreme event or unsuitable drainage measures.

Given the scale of the site, low risk flood zoning and relatively standard nature of the works involved the likelihood of a "worst case" event is extremely low.

### 8.8.1 Construction Phase

Implementation of the measures outlined in Section 8.6.2 will ensure that the potential impacts of the proposed development on water and the hydrogeological environment do not occur during the construction phase and that any residual impacts will be short term.

### 8.8.2 Operational Phase

As surface water drainage design has been carried out in accordance with the GDSDS, and SuDS methodologies are being implemented as part of a treatment train approach, there are no predicted residual impacts on the water and hydrogeological environment arising from the operational phase.

## 8.9 MONITORING

Construction phase monitoring relates to the good maintenance of mitigation measures outlined above in section 8.6 including the project specific Construction Environmental Management Plan (CEMP). It is recommended that any monitoring of any hazardous material stored on-site be carried out in accordance with the CEMP. It is recommended that a dust management/monitoring programme be implemented during the construction phase of the development in accordance with the CEMP.

### 8.9.1 Monitoring measures – construction

Proposed monitoring during the construction phase in relation to the water, hydrogeological and hydrological environment are as follows:

- Contractors will be recommended to adhere to the CEMP.
- Construction monitoring of the works (e.g. inspection of services and SuDS installation and backfill, stability of excavations etc.).
- Inspection of fuel / oil storage areas.
- Monitoring cleanliness of adjacent road network, implementation of dust suppression and provision of vehicle wheel wash facilities.
- Monitoring of contractor's stockpile management (e.g. protection of excavated material to be reused as fill; protection of soils from contamination for removal from site)
- Monitoring sediment control measures (sediment retention tanks, surface water inlet protection etc.)

### 8.9.2 Monitoring measures – operational phase

Proposed monitoring during the operational phase in relation to the water and hydrogeological environment are as follows:

- The taking in charge of the water infrastructure will ensure the system is regularly inspected and maintained.
- The performance of all SuDS features will be monitored by the relevant authorities during the life of the development.
- Monitoring of the installed hydrobrake, interceptor and gullies will be required to prevent contamination and increased runoff from the site.
- Although no specific monitoring will be required as part of the proposed development, it is envisaged that EPA Monitoring of the water quality of the water bodies will continue in the area through the life of the development.

## 8.10 CUMULATIVE IMPACTS

The proposed 3 no. bridge crossings have all been assessed by hydraulic modelling and detailed engineering design to verify that they can accommodate the required flows and do not impact flood risk or worsen the flood risk situation downstream impacting adjacent lands. A Section 50 approval from the OPW will be obtained in accordance with the Arterial Drainage Act 1945 for the three number bridge crossings prior to any construction. The stream banks shall be replanted, and riparian zones maintained.

The proposed surface water drainage infrastructure has been designed in accordance with the relevant guidelines. Any other future development in the vicinity of the site would have to be similarly designed in relation to permitted

surface water discharge, surface water attenuation and SuDS, therefore, no potential cumulative impacts are anticipated in relation to surface water and flooding.

Overall, the impact on the hydrological and hydrogeological environment as a result of the wider developments in the area are considered to be long-term and imperceptible. Each project currently permitted or under construction is subject to EIA and/or planning conditions which include appropriate mitigation measures to minimise impacts. Provided mitigation measures are in place at each of the developments, the overall impact is expected to be neutral.

Given the scale of the proposed residential development, and the capacity of the surrounding environment to accommodate a development of this nature, it is not likely to give rise to any significant effects cumulatively or, in combination with other surrounding, permitted, planned and existing development in the area.

There are no predicted cumulative impacts arising from the construction or operational phase.

## 8.11 INTERACTIONS

The most significant interactions with water and hydrology is between land, soils, geology and hydrogeology population and human health and air quality. Due to the inter-relationship between groundwater and surface water the discussed impacts are considered applicable to Chapter 7 (Land and Soils). The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all surface and groundwater legislative limits and therefore the predicted impact is short-term, negative and imperceptible with respect to the construction phase and long-term, neutral and imperceptible with respect to the operational phase.

## 8.12 DIFFICULTIES ENCOUNTERED

No particular difficulties were encountered in completing this section.

## 8.13 REFERENCES


- Environmental Protection Agency (EPA), 2000, EPA Geo Portal, Available at http://gis.epa.ie/,
- Office of Public Works (OPW), 2000, Flood and Erosion Mapping, Available at http://www.opw.ie/en/flood-risk-management/floodanderosionmapping/,
- Flooding.ie, 2009, The planning System and Flood Risk Management, Available at About - OPW Flood Risk Management (floodinfo.ie)
- Greater Dublin Regional Code of Practice for Drainage Works, Version Draft 6.0
- Celbridge LAP 2017-2022