Waterman Moylan
Engineering Consultants

Flood Risk Assessment

Proposed Phase 3 of Aderrig Development
at Adamstown SDZ, Co. Dublin.

October 2022

Waterman Moylan Consulting Engineers Limited
Block S, East Point Business Park, Alfie Byrne Road, Dublin 3
www.watermangroup.com

Waterman Moylan
Engineering Consultants

Client Name:	Quintain Developments Ireland Limited
Document Reference:	22-023r.002 FRA Aderrig Phase 3
Project Number:	22-023

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1st	Oct. '22	J. Ulicna	K. Owen	I. Worrell

Comments

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1. Introduction

This **Flood Risk Assessment** (FRA) has been prepared by Waterman Moylan in support of the proposed Development of **Phase 3 of the Aderrig Tile (Development area 8)** located in the Adamstown Strategic Development Zone (**ASDZ**), Co. Dublin.

This FRA has been carried out in accordance with the Department of Housing and Local Government (DEHLG) and the Office of Public Works (OPW) document *"The Planning Process and Flood Risk Management Guidelines for Planning Authorities"* published in November 2009. This Assessment identifies and sets out possible mitigation measures against potential risks of flooding from various sources. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical error.

This report provides an assessment of the subject site for flood risk purposes only.

A plan illustrating the extent of the ASDZ can be seen in Figure 1-1 below.

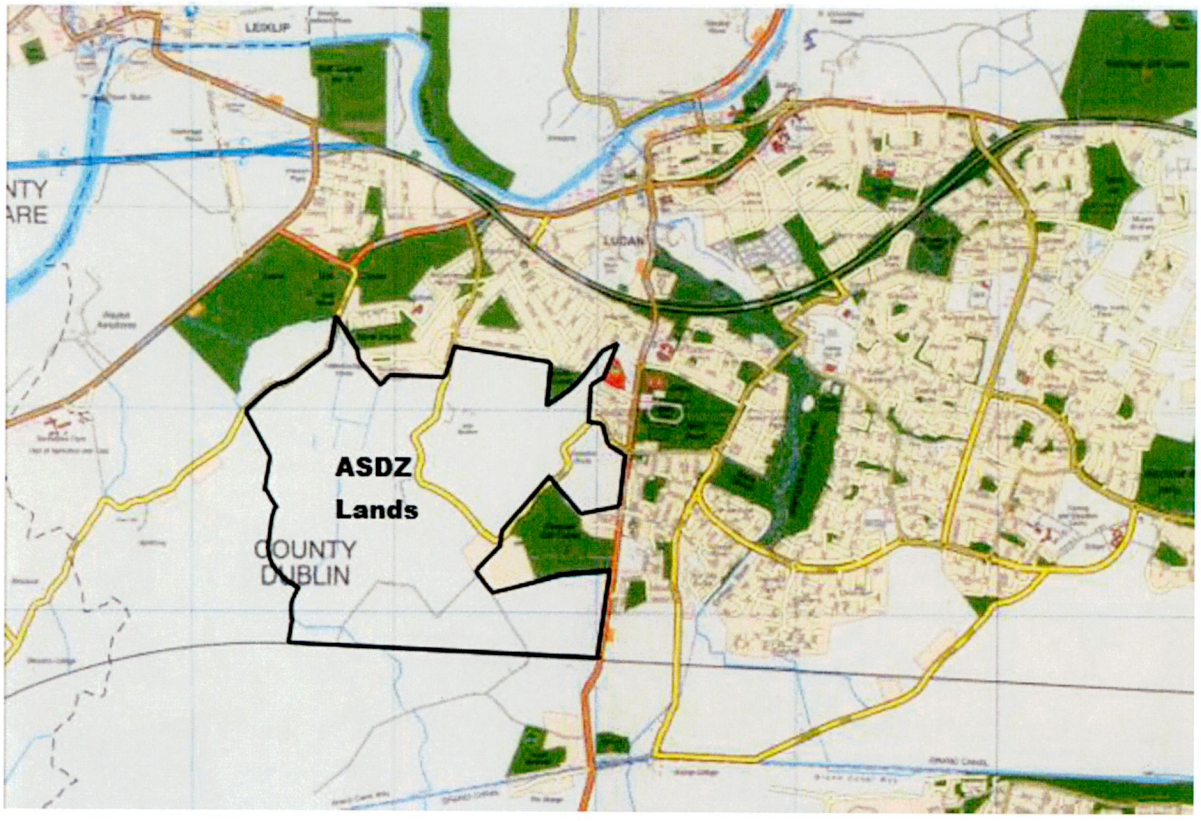

Figure 1-1: ASDZ Location Map

1.1 Site & Proposed Development Description

Quintain Developments Ireland Limited intend to apply for permission for development on 2 No. sites separated by the permitted Celbridge Link Road with a total area of 6.36 Ha in the townland of Aderrig, Adamstown, Lucan, Co. Dublin. The south-western site (5.39 Ha) is generally bound to the east by Celbridge Link Road, to the south and west by undeveloped land and an electrical substation and to the north by the Tubber Lane Development Area. The northern site (0.97 Ha) is generally bound to the east by the undeveloped Primary School site and Aderrig Park Avenue, to the south by Airlie Park Road West, to the west by Celbridge Link Road and the Tubber Lane Development Area and to the north by the Tubermaclugg Development Area.

This application is being made in accordance with the Adamstown Planning Scheme 2014 (as amended) and relates to a proposed development within the Aderrig Development Area of the Adamstown Strategic Development Zone.

The location of the proposed development, Aderrig Phase 3, within the ASDZ can be seen in Figure 1-2 below. The red line is only indicative for details please see the Architect's layout.

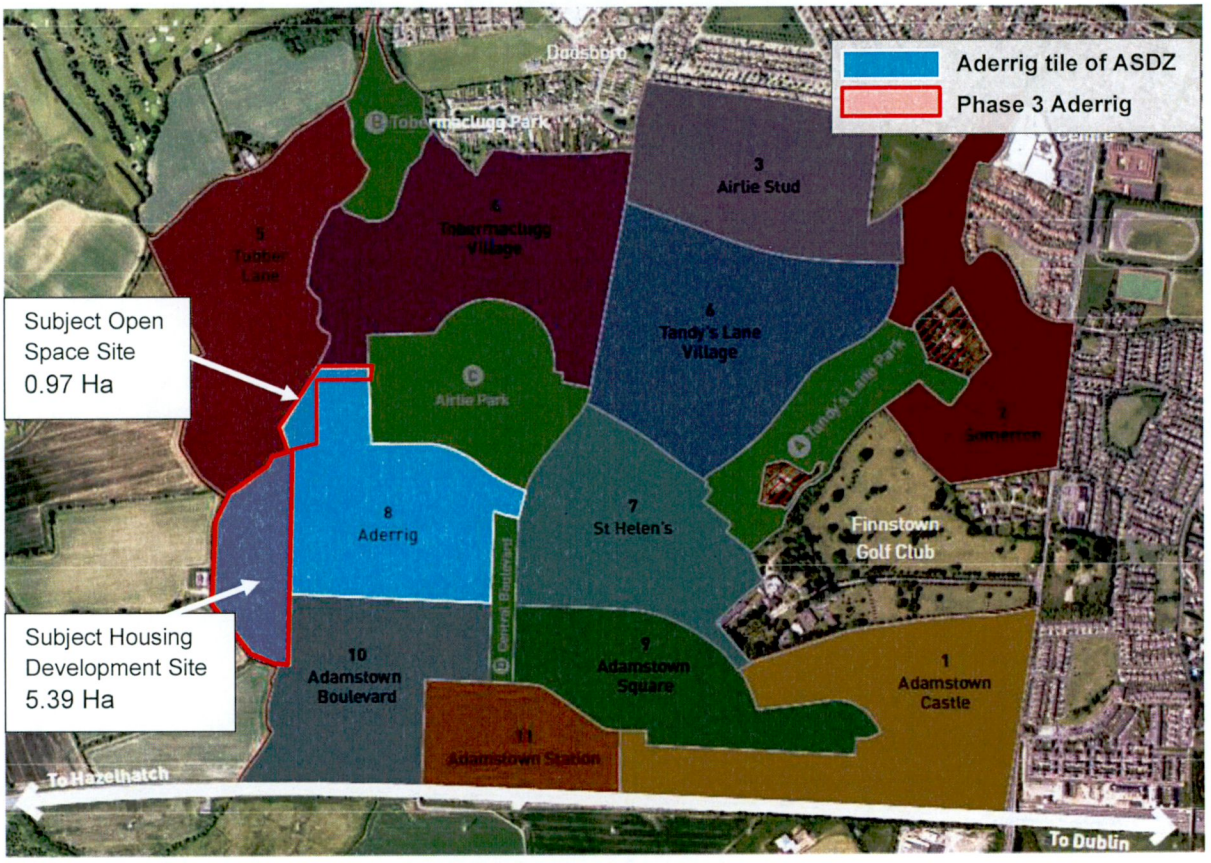

Figure 1-2: Location of Phase 3 Aderrig within the ASDZ

The housing development site generally slopes 1:40 from the south-southwest to the north-northeast with an overall elevation difference of approximately 8m. A maximum ground elevation of 59.67m OD Malin exists within the southern portion of the subject site. A minimum ground elevation of 51.46m OD Malin exists in the north.

The open space site generally slopes 1:55 from the south-southwest to the north-northeast with an overall elevation difference of approximately 3.2m. A maximum ground elevation of 50.82m OD Malin exists within the southern portion of the subject site. A minimum ground elevation of 47.60m OD Malin exists in the north.

The proposed development will principally consist of 207 No. residential units (64 No. 2-bed, 127 No. 3-bed and 16 No. 4-bed), ranging in height from 2 No. storeys to 4 No. storeys, comprising 75 No. houses (59 No. 3-bed and 16 No. 4-bed) and 132 No. duplexes (64 No. 2-bed and 68 No. 3-bed).

The development will also include: vehicular junctions to access the development from Celbridge Link Road (2 No.) and Adamstown Way (3 No.); internal road, cycle and footpath network; 314 No. car parking spaces; cycle parking; bin storage areas; public, communal and private open space areas, with balconies and terraces facing all aspects; hard and soft landscaped areas; boundary treatments; public lighting; 2 No. sub-stations; and all associated site and development works above and below ground.

The development will include all associated infrastructure to serve the development, which includes a network of foul, surface water drains/ SuDS measures, as well as road infrastructure and watermain infrastructure.

The site is located in the Tobermaclugg Tributary surface water catchment area of the ASDZ lands. According to the ASDZ Planning Scheme 2014, Ref. No. 2.5.5, the catchment drains to a large surface water outfall (2.4m ø stormwater pipe) and 5000m^3 attenuation pond to the north-east of Lucan Golf Course on the Backstown/Tobermaclugg Stream. Dry weather and normal flows will continue to discharge into the outfall. As a result, no attenuation is required for this development. Further details are outlined in the Engineer Assessment Report that accompanies this planning submission.

1.2 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Ground Water – flooding from springs / raised ground water
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective.

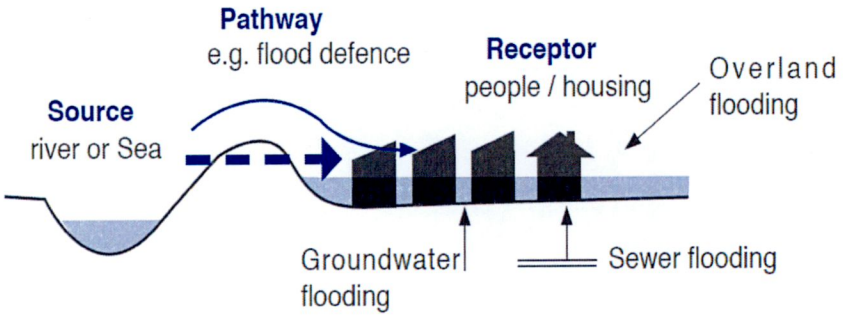

Figure 1-3: Source-Pathway-Receptor S-P-R Model

The aim of a flood risk assessment is to combine these components and map or describe the risks on a spatial scale, to analyze the consequences of each scenario.

1.3 Assessing the Overall Flood Risk

The overall risk of flooding to a development shall be determined by way of a 3x3 Risk Matrix, considering the likelihood of a flooding event occurring within a development and the consequences of such flooding.

1.3.1 Assessing Likelihood

The likelihood of flooding falls into the categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Table 1-1: OPW Guidelines for Assessing Likelihood

Likelihood	Low	Moderate	High
Tidal	Probability < 0.1%	0.5% > probability > 0.1%	Probability > 0.5%
Fluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%
Pluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%

Note: Probability denotes likelihood of occurrence in a given year.

For ground water flooding and flooding from human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

1.3.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and

professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate and high.

1.3.3 Assessing Risk

Based on the determined 'likelihood' and 'consequence' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

Table 1-2: 3x3 Risk Matrix

		CONSEQUENCE		
LIKELIHOOD		LOW	MODERATE	HIGH
	LOW	Extremely Low Risk	Low Risk	Moderate Risk
	MODERATE	Low Risk	Moderate Risk	High Risk
	HIGH	Moderate Risk	High Risk	Extremely High Risk

1.3.4 Flood Risk Management

After a risk has been assessed, flood risk management is the next stage. Flood risk management aims to minimize the risks to people, properties and the environment arising from flooding.

1.3.5 Residual Risk

The residual risk is the risk which remains after all risk avoidance, substitution and mitigation measures have been implemented.

2. Tidal – Irish Sea

2.1 Sources

Tidal Flooding is caused by elevated sea levels or overtopping by wave action. The Irish Sea is approximately 18 km east of the subject site. The proposed site has natural ground elevations ranging from 47.60 m to 59.67 m OD Malin, the construction levels of the site shall be built within this range.

The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95 m OD Malin.

The lowest possible level of the proposed site is therefore 44.65m above the highest tide recorded in the Dublin Coastal area.

2.2 Pathway

Given that the site is located 18 km west inland from the Irish Sea, the site levels exceed the highest ever recorded or projected tide in the area, and that there is no coastal flooding indicated on the OPW map, the risk from tidal flooding is considered **EXTREMELY LOW** and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

Fluvial flooding is caused by rivers, watercourses or ditches overflowing. The subject site is located within the Tobermaclugg Tributary catchment area. The old Tobermaclugg Stream (which has been reflected as a water feature in the SDZ 2014 Planning Scheme) flowing within the Phase 1 Aderrig site, from south to north, along the Phase 1 western boundary.

The original Stream has been undergrounded in a network of 1350mm Ø pipes with a 450mm Ø pipe that brings a restricted flow (approximately 100l/s) to the surface to now feed the proposed water feature through the SDZ in accordance with the Planning scheme. These networks are within the Aderrig Phase 1 boundary.

The **CFRAM** fluvial flood extent map for the Lucan to Chapelizod Extents (E09LUC_EXFCS_F0_02) dated October 2016, shown in Figure 3-1 below, **incorrectly** indicates that flooding events occur in and around the Phase 1 and 2 Aderrig development sites. This map is outdated and does not depict the current fluvial flood extent accurately as previous explained to SDCC Drainage and reviewed on site.

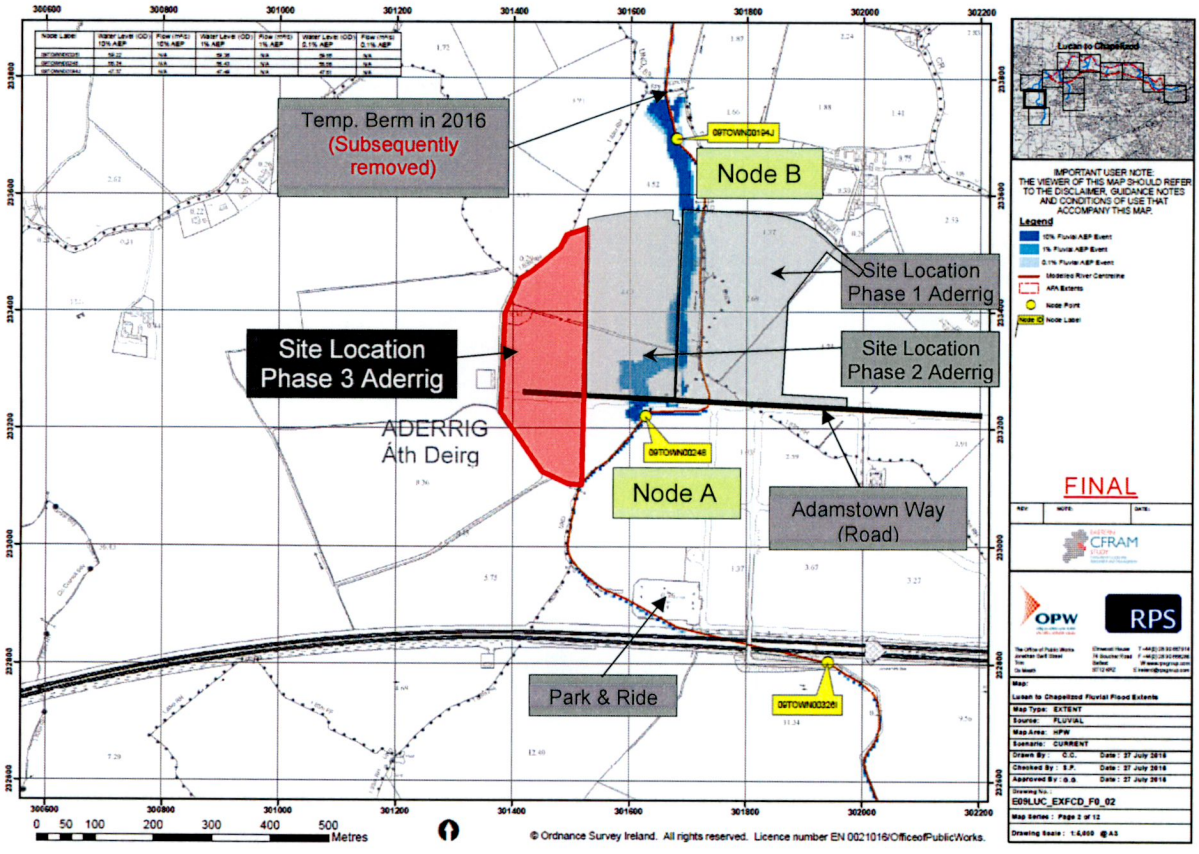

Figure 3-1: **Outdated** CFRAM 2016 Fluvial Flood Map (E09LUC_EXFCS_F0_02)

The Aderrig Phase 3 site is reflected as being outside the of the 0.1% AEP (1in1000 year) flood event, i.e. in Flood Zone C, where the probability of flooding from rivers and the sea is low as defined in section 2.23 of DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management published in November 2009.

At Node A in Figure 3-1:-

Fluvial flooding does not collect at Node A, south of the site, as an old ditch network alignment previous located here no longer exists, but rather, is carried via underground culverts installed to the east of this location. The diverted stream system currently flows through a 450mmØ culvert and an adjacent 1350mmØ culvert between the Station Road and Adamstown Way, with the 450mmØ and the 1350mmØ designed to accommodate fluvial flows. A separate 1200mm/1500mm dia surface water pipe network has been designed and constructed to accommodate all hardstanding & road drainage flows within the ASDZ. **No flooding occurs here currently.**

At Node B in Figure 3-1:-

Fluvial flooding does not collect at Node B, north of the site. During construction under a separate project between the years of 2006-2009, a **temporary works berm was installed** as a protection measure to facilitate other ASDZ works to the north (e.g. Tobermaclugg Pump Station and other drainage works). The berm has now since been removed which was located in the now Cairn Homes Compound for the Shackleton works under construction in the ASDZ.

As this berm was left in place post construction in 2008, the historical ditch/Stream pathway was unable to flow through this location and ponding occurred. As a result of continued ponding, the fluvial flows flooded the surrounding low-lying areas which can be seen in the flood maps.

This barrier/temporary works berm has since been removed and the natural overland flow path of the historic agricultural stream reinstated without obstructions. **No flooding occurs here currently.**

3.2 Pathway

The Stream centreline depicted in the flood map (Figure 3-1), **no longer exists** as the Stream was diverted as part of the ASDZ design strategy. Furthermore, the Stream connecting to this segment from further southeast, which is culverted under the railway line within a 900mm/1500mmØ pipes, was diverted to the new Stream centreline and thus has an updated flow path.

Taking the following into account:

1. The historical stormwater system and capacity for catering to higher fluvial flows has been substantially upsized post publication of the flood maps referenced above;
2. The installation of a 450mmØ and 1350mmØ culvert was completed;
3. The historical agricultural ditches carrying the majority of the fluvial flows have been diverted (and upsized) through newly designed systems **resulting in little to no flow through Node A in the current scenario;**

The risk from fluvial flooding is considered **EXTREMELY LOW** and no fluvial flood mitigation measures need to be implemented.

4. Pluvial

4.1 Source

Pluvial flooding is from heavy rainfall and is often referred to as flooding from surface water. Surface water flooding can occur as a result of overland flow or ponding during periods of extreme prolonged rainfall.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways and subsequent receptors:

Table 4-1: Pathways & Receptors

	Pathway	Receptor
1	Surcharging of the existing drainage system within the site.	Proposed development – residential dwellings and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site.	Proposed development – residential dwellings and roads
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding.	Downstream lands and roads – proposed downstream dwellings and roads
4	Overland flooding from surrounding areas flowing onto the subject site.	Proposed development – residential dwellings and roads
5	Overland flooding from the subject site flowing onto surrounding areas.	Downstream lands and roads – proposed downstream dwellings and roads

Note the risk of pluvial flooding for each of the pathways discussed below has been assessed by referencing the Risk Matrix in Section 1.3 of this report.

4.3 Overview – Existing Surface Water Drainage

The site is located in the Tobermaclugg Tributary surface water catchment area of the ASDZ. According to the ASDZ Planning Scheme 2014 Amendment, Ref. No. 2.5.5, most of the SDZ (65%), within the Western Catchment of the ASDZ, is drained to a large surface water outfall and attenuation pond to the **northeast of Lucan Golf Course** on the Backstown/Tobermaclugg Stream. The Aderrig Development Tile falls within this Surface Water Catchment.

There is an existing 750mm Ø surface water drainage sewer in Adamstown Way traversing southern portion of the subject site. It drains east before it turns north into an existing 1200mm Ø sewer along the eastern boundary of Aderrig Phase 2. To the north of Aderrig Phase 1, an existing 900mm Ø pipe drains in a westerly direction and connects into the 1200mm Ø sewer in the northwest corner of Aderrig Phase 1, the surface water pipeline increases to a 1500mm Ø at this position, draining north

Also, there is an existing 375mm Ø surface water drainage sewer at the eastern boundary of the subject site in the Celbridge Link Road. This sewer drains north before it drains east into the East

West Avenue Road sewer connecting into the 1500mm Ø sewer at the northeaster corner of Aderrig Phase 2 development then draining north.

Further downstream, the surface water pipeline increases in size to a 2100mm Ø pipe where the undergrounded Tobermaclugg Water Feature pipe joins into the network. The historical Tobermaclugg Stream is primarily culverted north of this point (via 2100/2400mm ø pipes) next to Tubber Lane Road and then through the Lucan Golf Course.

The undergrounded Tobermaclugg Stream pipe location (2100mm Ø pipe) can be seen in the north west corner of the below figure. The Lucan Golf Course and attenuation pond are further downstream (northwards) of this position.

Figure 4-1 below shows a plan view of the Lucan Golf Course and surrounding landmarks. Attenuation for the Western Catchment of the ASDZ (65% of ASDZ) collects at the attenuation area shown indicatively below, with a size of 5000m³. In accordance with the ASDZ Surface Water Strategy, Phase 3 Aderrig will attenuate all surface water drainage to this attenuation pond.

Refer to Appendix A for the Waterman Moylan Drawing 17-113-SK121B showing the 3 no. ASDZ surface water Catchments and overall surface water infrastructure.

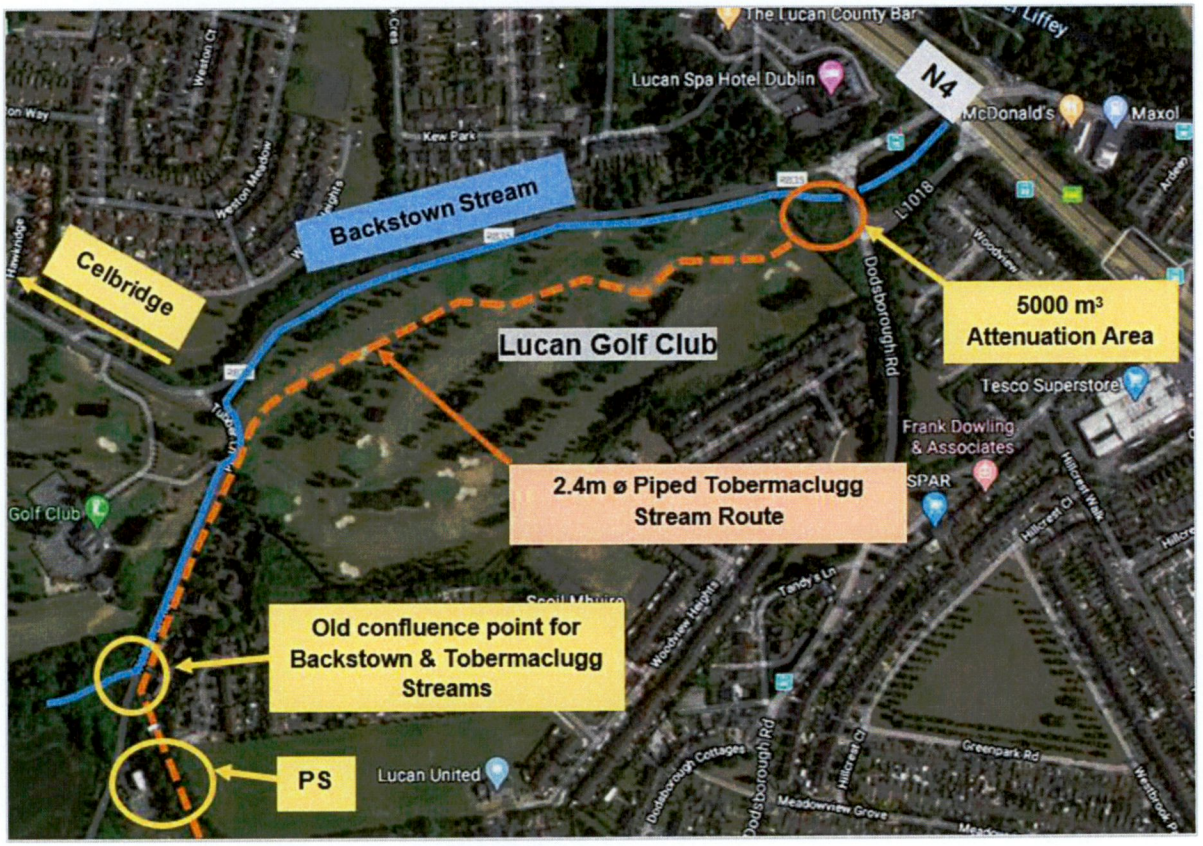

Figure 4-1: Location of 5000m³ attenuation pond.

4.4 Surcharging of the Existing On-Site Drainage System

4.4.1 Likelihood

As the site is currently an open field with no existing on-site drainage system, there is highly unlikely that a flooding event could occur due to surcharge.

4.5 Surcharging from the Existing Surrounding Drainage System

4.5.1 Likelihood

The existing surrounding drainage system has been sized to accommodate a 1in100-year storm event for surface water. Therefore, it is considered that there is a **MODERATE** likelihood of flooding as a result of surcharging from the existing surrounding drainage system.

4.5.2 Consequences

The consequence of flooding from surcharging of the existing surrounding drainage system, will be minor damage to landscaped areas and surrounding roads infrastructure. The consequences of a pluvial flood event are therefore assessed to be **MODERATE**.

4.5.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a moderate likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is assessed to be **MODERATE**.

4.5.4 Flood Risk Management

Given that the flood risk from surcharging the existing surrounding drainage system is considered as **MODERATE**, mitigation measures are required.

These will include flood routing through the development and raised finished floor levels relative to the adjoining roads and ensuring no localised low points within the roads exist. Where possible, the proposed FFL's are at least 150mm above the adjacent road levels with all thresholds falling away from the units to eliminate flood risk.

4.5.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be **LOW**.

4.6 Surface Water Discharge from the Subject Site

4.6.1 Likelihood

Due to the increase in hard standing area as a result of the proposed development, there is an increase in likelihood of surface water discharge from the site leading to consequential increased run off within the subject site and downstream of the site.

As a result of the surrounding development cutting off and diverting the surface water runoff from the lands south of the ASDZ and then undergrounding the bulk of the original Stream flow through the ASDZ the likelihood of flooding from surface water discharge from the subject site is considered **LOW** as there is a separate surface water networking of pipes design for 1in100 year flood event flows into which the proposed Phase 3 development will connect into.

4.6.2 Consequences

In an event of surface water discharging from the subject site the consequence of flooding would result in flood damage to surrounding roads and landscaped areas. The consequences of such flooding are assessed to be **MODERATE** to **HIGH**.

4.6.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a low likelihood and the moderate to high consequences of flooding the development and downstream of the development due to discharging of surface water from the site, the resultant risk is considered to be **LOW** to **MODERATE** and flood risk management will be required to be implemented.

4.6.4 Flood Risk Management

Appropriate SuDS devices such as water butts, swales and bio-retention tree pits shall be implemented on site where possible. This will ensure surface water discharging from the development can be reduced in volume and velocity and substantially lowering the surface water discharge.

Refer to Waterman Moylan drawing 22-023-P211 for the overland flood routing map for the subject site.

Given the overall flood routing and extent of green spaces with ASDZ, the flood risk of surface water discharge from the subject site is **LOW**.

4.6.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be **LOW**.

4.7 Overland Flooding from Surrounding Areas

4.7.1 Likelihood

The existing and proposed surrounding road network to the east, south and west flood routes along the roads bounding the site, meeting at a central flow path at the northwest corner of the site. Refer to Appendix A which depicts the overall flood routing for the ASDZ.

A natural surface flood route through the site will be preserved. The likelihood of flooding from surface water discharge from surrounding areas is considered **MODERATE**.

Furthermore, according to the historical flooding map produced by the OPW's online National Flood hazard Mapping database no floods have been recorded within or surrounding the site. A map showing all flood events within proximity of the subject site is provided below in Figure 4-2 below.

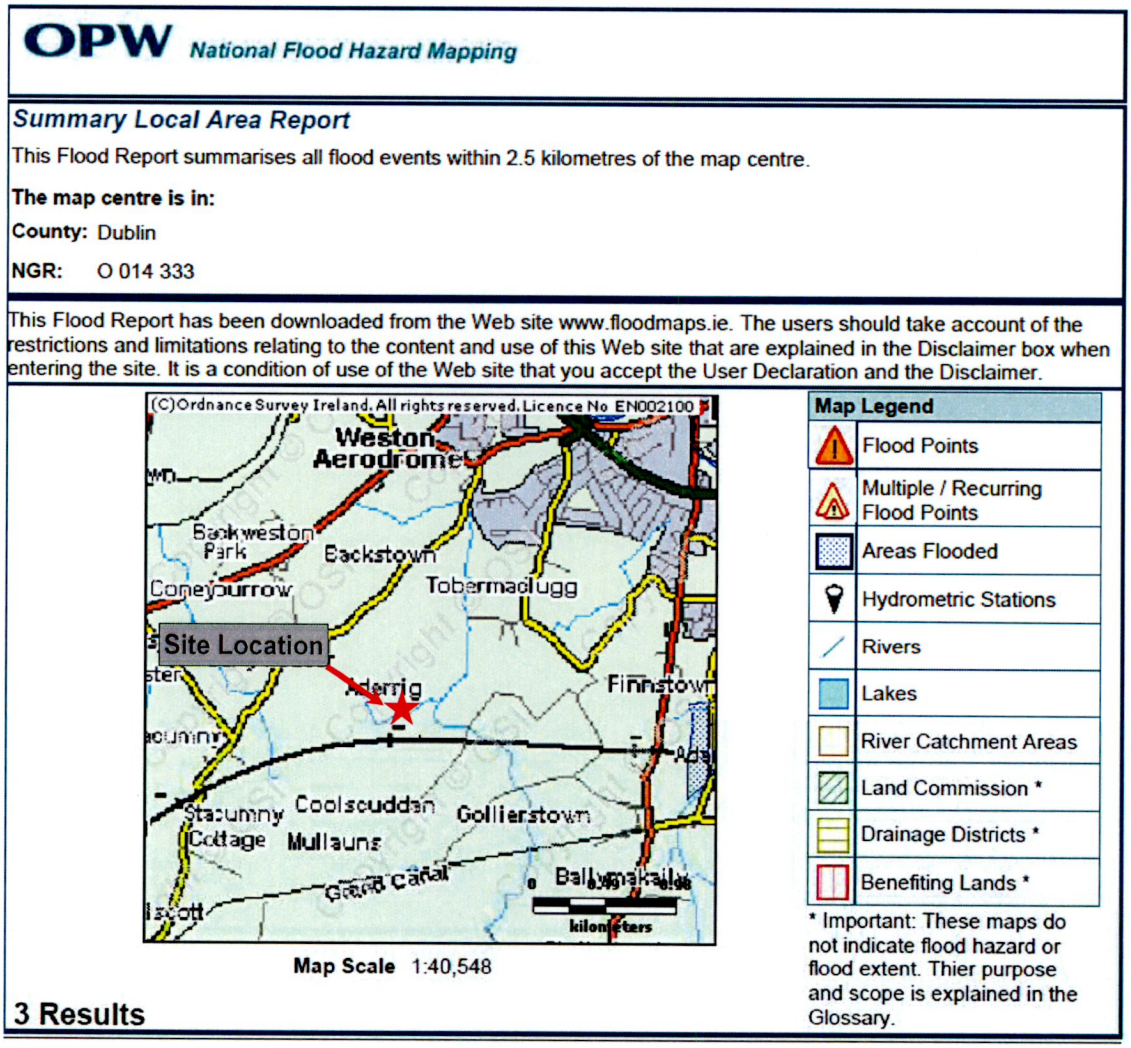

Figure 4-2: OPW National Flood Hazard Mapping

4.7.2 Consequence

The consequence of overland flooding from the surrounding area would result in moderate damage to roads, landscaped area and dwellings. The consequences of this flooding event are therefore assessed to be **MODERATE**.

4.7.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a moderate likelihood and the moderate consequences of overland flooding from surrounding areas, the resultant risk is **MODERATE** and flood risk management will be required to be implemented.

4.7.4 Flood Risk Management

Raised finished floor levels, the elimination of localised cut off low points on the designed roads and overland flood routing have been adopted to mitigate the potential risk of flooding.

Refer to Waterman Moylan drawing 22-023-P211 for the proposed developments flood routing.

4.7.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be **LOW**.

4.8 Overland Flooding from the Subject Site

4.8.1 Likelihood

Due to the increase in hard standing area as a result of the proposed development, there is an increase in likelihood of overland flooding from the site leading to flooding within the subject site and downstream of the site.

However, considering the overall ASDZ flood routing, there is a decrease in the likelihood of surface water discharging from the site that could lead to downstream flooding. Therefore, the likelihood of overland flooding from the subject site is considered **LOW**.

4.8.2 Consequence

The consequence of surface water discharging from the subject site would be damage to the surrounding roads and landscaped areas. Therefore, the consequence of such flooding is assessed to be **MODERATE**.

4.8.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a low likelihood and the moderate consequences of overland flooding from the subject site, the resultant risk is **LOW**.

4.8.4 Flood Risk Management

Given that the flood risk of overland flooding from the subject site is **LOW**, no further flood risk management measures are deemed necessary.

5. Ground Water

5.1 Source

During periods of prolonged rainfall, the groundwater can seep to above ground level.

5.2 Pathway

During periods of prolonged rainfall there is a possibility that the groundwater level could rise. This may result in ground water seeping above the ground surface.

5.3 Receptor

The receptors would be the proposed open spaces.

5.4 Likelihood

The SFRA for South Dublin County Council Development Plan 2022 to 2028 found no particular karst or other ground water systems within the catchment for South Dublin County Council (ref paragraph 2.2.4 SFRA). However, it is possible for ground water to rise and cause potential flooding on site during prolonged wet periods. Therefore, the likelihood of ground water flooding occurring at the proposed development is assessed to be **LOW**.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the landscaping areas. Therefore, the consequences of ground water flooding occurring at the proposed development is assessed to be **LOW**.

5.6 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event of a low likelihood with low consequences, it is deemed that the risk from ground water flooding on the proposed development is **LOW**.

5.7 Flood Risk Management

Given that the flood risk of overland flooding from the subject site is **LOW**, no further flood risk management measures are deemed necessary.

6. Human / Mechanical Errors

6.1 Source

The existing surrounding surface water sewer network is the source of possible flooding if the system were to block.

6.2 Pathway

If the proposed drainage system blocks this could lead to possible flooding within the open spaces, landscaped areas and roads.

6.3 Receptor

The receptors are the landscape areas, and roads.

6.4 Likelihood

There is a **MODERATE** likelihood of flooding on the subject site if the surface water network was to block.

6.5 Consequence

The surface water network would surcharge and overflow through manhole lids on roads and landscape area. It is therefore assessed that the consequences of such flooding are **MODERATE**.

6.6 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event of a moderate likelihood with low consequences, it is deemed that the risk of overland flooding from human/mechanical error flooding on the proposed development is **MODERATE**.

6.7 Flood Risk Management

Regular inspection of the proposed and existing drainage network will reduce the risk of overland flooding from human/mechanical error.

Raised finished floor levels, appropriate adjacent road levels, no isolated low points and overland flood routing have been adopted to mitigate the potential risk of flooding.

Refer to Waterman Moylan drawing 22-023-P211 for the flood routing map pertaining to Aderrig Phase 3.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a **LOW** residual risk of overland flooding from human/mechanical error.

7. Conclusions and Recommendations

The Aderrig Phase 3 site is outside the of the 0.1% AEP (1in1000 year) flood event, i.e. in Flood Zone C.

The subject site has been analysed for risks from tidal flooding, fluvial flooding, pluvial flooding, groundwater and drainage system failures due to human error or mechanical system failure.

Table 7-1 below presents the various residual flood risks involved. As the flood risk from all sources can be mitigated, with all residual risk seen as low, the proposed development is considered acceptable in terms of flood risk.

Table 7-1: Summary of the Flood Risks from each flooding type

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	None	Proposed Development	n/a	n/a	n/a	none	**n/a**
Fluvial	None	Proposed Development	n/a	n/a	n/a	none	**n/a**
Pluvial	Private and Public Drainage Network	Proposed Development	Low to Moderate	Moderate to High	Moderate	SuDS measures, flood routing, raised FFL's	**LOW**
Ground Water	Ground	Proposed Development	Low	Low	Low	n/a	**LOW**
Human / Mechanical Error	Drainage network	Proposed Development	Moderate	Moderate	Moderate	Maintenance of sewer system, flood routing, raised FFLs	**LOW**

APPENDICES

A. **Drawing 17-113-SK121B ~ ASDZ Surface Water Infrastructure & Overall Flood Routing**

UK and Ireland Office Locations