DONNACHADH O'BRIEN
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CERTAIN ASSETS OF DAWNHILL AND WINDHILL LIMITED

Lands at Kilbride, Arklow, Co. Wicklow

Infrastructure Design Report

(LRD Application Submission)

2432-DOB-XX-SI-RP-C-0001

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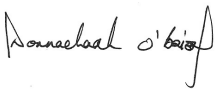
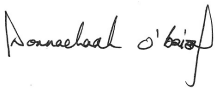
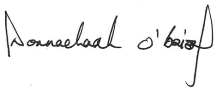
S2.P01	15.10.2024	Draft	Client, Design Team	1E	
S2.P02	25.10.2024	Issued for S32B	Wicklow County Council	3H 1E	
S2.P03	19.05.2025	Issued for Planning	Wicklow County Council	2H 1E	

1 Contents

1 Introduction

Donnachadh O'Brien & Associates Consulting Engineers Ltd. (DOBA) have been instructed by the Client, Certain Assets of Dawnhill and Windhill Limited, to prepare an Infrastructure Design Report to accompany a Planning Application to Wicklow County Council (WCC) for the proposed residential development in Kilbride, Arklow, Co. Wicklow consisting of 666 No. residential units with a mix of semidetached, detached, and terraced houses along with duplex apartments and apartments. The proposal will also deliver 3 no. retail units, 3 no. community/ medical units and 1 no. creche unit. The application also includes for a pedestrian and cycle boardwalk linking the site across the Marshlands and the Avoca River to tie into the proposed Greenway on the southern bank of the Avoca River.

The Phase 1 Masterplan strategy sets out a framework for the delivery of the first residential units on site with potential for sub phases based around the delivery of four Architectural Character Areas. This application forms part of the Phase 1 plan which will provide the first 750 residential units on site in a wide range of formats and sizes. Please note that the phase 1 masterplan includes 84 no units granted under planning reference 23756 - the remaining 666 no. Units forming the rest of phase 1 are proposed within this subject application.

2 Wicklow County Council LRD Opinion

On 18th December 2024, a Section 32D meeting was held with Wicklow County Council and an LRD Opinion was issued subsequent to the meeting, outlining certain matters that needed to be addressed in the relevant documentation to constitute a reasonable basis on which to make an application. Matters relate to the Engineering design of the site and, with reference to WCC's labelling in the LRD Opinion, are addressed in this report as follows:

<table>
<tr><th>Ref</th><th>WCC Opinion</th><th colspan="2">Applicant Response</th></tr>
<tr><td>C</td><td>Boardwalk/ Bridge
Further details are required in respect to the methodology of construction of the Boardwalk/ Bridge to ensure that the hydrology/ ecology of the marsh which is designated as a pNHA is protected</td><td colspan="2">DOB&A Greenway Boardwalk: Outline Construction Methodology Plan has been included as part of application (2432-DOB-XX-SI-RP-0100) co-ordinated with the CEMP prepared by Altemar Ltd and submitted with this application and also coordinated with the AWN Hydrological and Hydrogeological report also submitted with the application (257501.0051WR01)
Refer to section 11.7.2 of this report</td></tr>
<tr><td rowspan="5">D</td><td rowspan="5">Confirmation of timings of infrastructure works, outside of application that are required for the development
- Debris trap
- Foul sewer
- Public water upgrade</td><td colspan="2">Refer to Section 12 of this report detailing the phasing and timing of the proposed infrastructural works outside of the application boundary that are required for the development. Table 2 & Table 3 indicate the Outline Infrastructure/ Construction Phasing for the development.</td></tr>
<tr><td colspan="2">Phasing Summary</td></tr>
<tr><td>Junction Upgrades</td><td>Phase 1</td></tr>
<tr><td>Wastewater PWSA Sewer</td><td>Phase 1</td></tr>
<tr><td>Public Water Upgrades</td><td>Phase 1, 2 & 4</td></tr>
<tr><td>Debris Traps</td><td>Phase 3</td></tr>
<tr><td>J</td><td>Watercourse
Additional details to confirm the protection of the existing watercourse having regard to the provisions of the publication by Inland Fisheries Ireland Planning for Watercourses in the Urban Environment and Objective CPO 13.3 and CPO 17.26</td><td colspan="2">Protection of the watercourse has been provided. Refer to section 7.10 of this report</td></tr>
<tr><td>K</td><td>Surface Water
The inclusion, as far as reasonable possible, the nature-based surface water solutions in the surface water design</td><td colspan="2">Nature Based SuDS features have been incorporated insofar as is reasonably practicable and section 7 of this report and the accompanying surface water planning design drawings submitted with the application provide the relevant details</td></tr>
<tr><td>L</td><td>Flooding
Flood modelling to identify impact of bridging works on the Avoca River Flood Scheme</td><td colspan="2">A Site-Specific Flood Risk Assessment (SSFRA: 2432-DOB-XX-SI-RP-0005) and a Hydrological and Hydrogeological Report prepared by AWN (257501.0051WR01) are submitted with this application. Refer to section 8 of this report. For details regarding the identification of impacts of bridging works on the Avoca River Flood Scheme, Please refer to Section 7.2 of the</td></tr>
</table>

		SSFRA submitted with this application.
N	Full details of all retaining features and all remodelling works to the lands should be provided as part of the application details	Refer to section 6 of this report and site section drawings which detail of typical retaining features based on ground remodelling works
P	A CEMP is required and should include details to show that water quality in the Avoca River would be protected and the protection of Avoca Marsh will be undertaken during the course of construction.	DOB&A Outline Construction Methodology Plan (2432-DOB-XX-SI-RP-0004) and a Greenway Boardwalk: Outline Construction Methodology Plan (2432-DOB-XX-SI-RP-0100) have been submitted as part of this application. These reports have been fully coordinated with the AWN Hydrological and Hydrogeological report (257501.0051WR01) and the CEMP prepared by Altemar Ltd also submitted with the application. Refer to section 11.7.2 of this report

3 Existing Site

The site is located in the area of Kilbride on the northern side of the Avoca River in Arklow, Co. Wicklow. The site is bounded by open fields to the west and to the north by the Kilbride Industrial estate and Kilbride Road L-6179. The site slopes gently in a north/south direction towards the town marsh and Avoca River. The Pyramid of Arklow, a national monument, and its associated graveyard are located to the north west of the ownership area but outside of the subject site. The site is located adjacent to two sites which have received planning approval as follows:

- KWETB proposed school site (Planning Ref. 22/213) and shown green in figure 1 below
- 84 unit residential scheme, (submitted by the same client as this application) (ABP Ref. ABP-319604-24 & Wicklow Co. Co. Ref. 23/756) and shown in pink in figure 1 below

This planning submission for 666 units is part of an overall masterplan for the Kilbride lands that could provide up to 1500 residential units in the future along with all associated infrastructure. The infrastructural design of this planning application has taken account of the potential future development of the entire masterplan lands.

Figure 1: Application Lands outlined in Red

4 Proposed Development

Certain Assets of Dawnhill and Windhill Limited intend to apply for a 7-year planning permission for a Large Scale Residential Development at this site of c.25.07ha on “Lands at Kilbride”, Arklow, Co. Wicklow. The site is generally bounded by the town marsh to the south, M11 to the west, housing at Avondale Crescent/Murrell Drive and St Joseph’s School to the east and the Kilbride Industrial estate and Kilbride Road L-6179 to the north.

The proposed mixed use Large scale Residential Development will result in the demolition of an existing dwelling and 2 no. sheds/outbuildings and the construction of 666 no. residential units with a mix of semidetached and terraced houses along with duplex apartments and apartments. These will comprise 1, 2, 3 and 4 bed units. All residential units will have associated private open space facing north/ south/ east/ west. The proposal will also deliver a local centre containing 3 no. retail units, 3 no. community/ medical units and 1 no. creche unit.

A new road providing vehicular access is also proposed connecting to the north to Kilbride Road along with road improvements in the surrounding area. The development will also provide for landscaping, public open spaces and all associated site development works to enable the development including boundary treatments, attenuation storage area and other service provision including ESB works.

A significant part of the development will be the provision of a greenway pedestrian and cyclist boardwalk between the proposed development at Kilbride, across the Arklow marshlands and Avoca River connecting to the proposed Arklow to Shilelagh Greenway on the southern bank of the Avoca River. This Greenway starts adjacent to the public Cark Park in Arklow town centre. A River Walkway is being delivered by Wicklow County Council (WCC) as part of the Arklow Flood Relief Scheme and the Boardwalk will tie into the proposed levels of the River Walkway. There has been significant consultation and engagement between the applicant and Wicklow County Council prior to the application to co-ordinate the boardwalk design.

The proposed Boardwalk extends form the southern side of the residential development, through the internal cycle and pedestrian network of the residential development. The boardwalk is elevated and across the marshlands (approximately 650m) after which it crosses the Avoca River. Debris trap columns constructed in reinforced concrete are being provided by Wicklow County Council as part of the Avoca River Flood Relief scheme, and following extensive consultation with Wicklow County Council, the boardwalk will extend across the debris trap columns and will tie into the proposed levels of the Greenway on the southern side of the Avoca River. The Debris Trap piers and Greenway are approved works as part of WCC’s Arklow Flood Relief Scheme.

Figure 2: Proposed Development (Source: BKD Architects)

5 Kilbride Area Action Plan & Masterplan

The Arklow and Environs Local Area Plan (LAP) 2018-2024 provides the planning framework for development on the site masterplan and its relationship with the proposed KWETB school development and contribution to the wider Arklow area. The site of the proposed development falls within a large Mixed-Use zoning to the north of Arklow town and is part of the Kilbride Area Action Plan (AAP3), which is a c. 82 hectares parcel of land. The Applicant, during the planning design process, has liaised with the client of the adjacent school lands, KWETB, who have already received planning permission for an educational campus in line with the overall masterplan that comprises a residential development consisting of 1500 residential units, 3 no. creches, a local centre, 1,000 m2 of commercial development, the first phase of a future regional road for Arklow town, new roads connecting the site to the surrounding areas and a pedestrian / cycle path, a boardwalk link to Arklow through the town marshlands. (Refer to figure 3 below.) The roads infrastructure, surface water drainage, foul drainage and water supply arrangements for the proposed development have been fully coordinated with the KWETB and are described within this report and on the DOBA Engineering drawings submitted with this pre-application.

Figure 3 Draft masterplan of future residential development, including school site outlined in pink

6 Retaining Features and Ground Reprofiling

6.1 Ground Reprofiling

The existing greenfield site falls gently form north to south at an average gradient of 1 in 26. The road and house layout has been designed to comply with Building Regulation Part M requirements and this ensures that no roads in the scheme are greater than 1:21 gradient. The road and house levels have mirrored the natural topography of the site, and insofar as is reasonably practicable, the site design has for this application has resulted in the below overall cut and fill across the site.

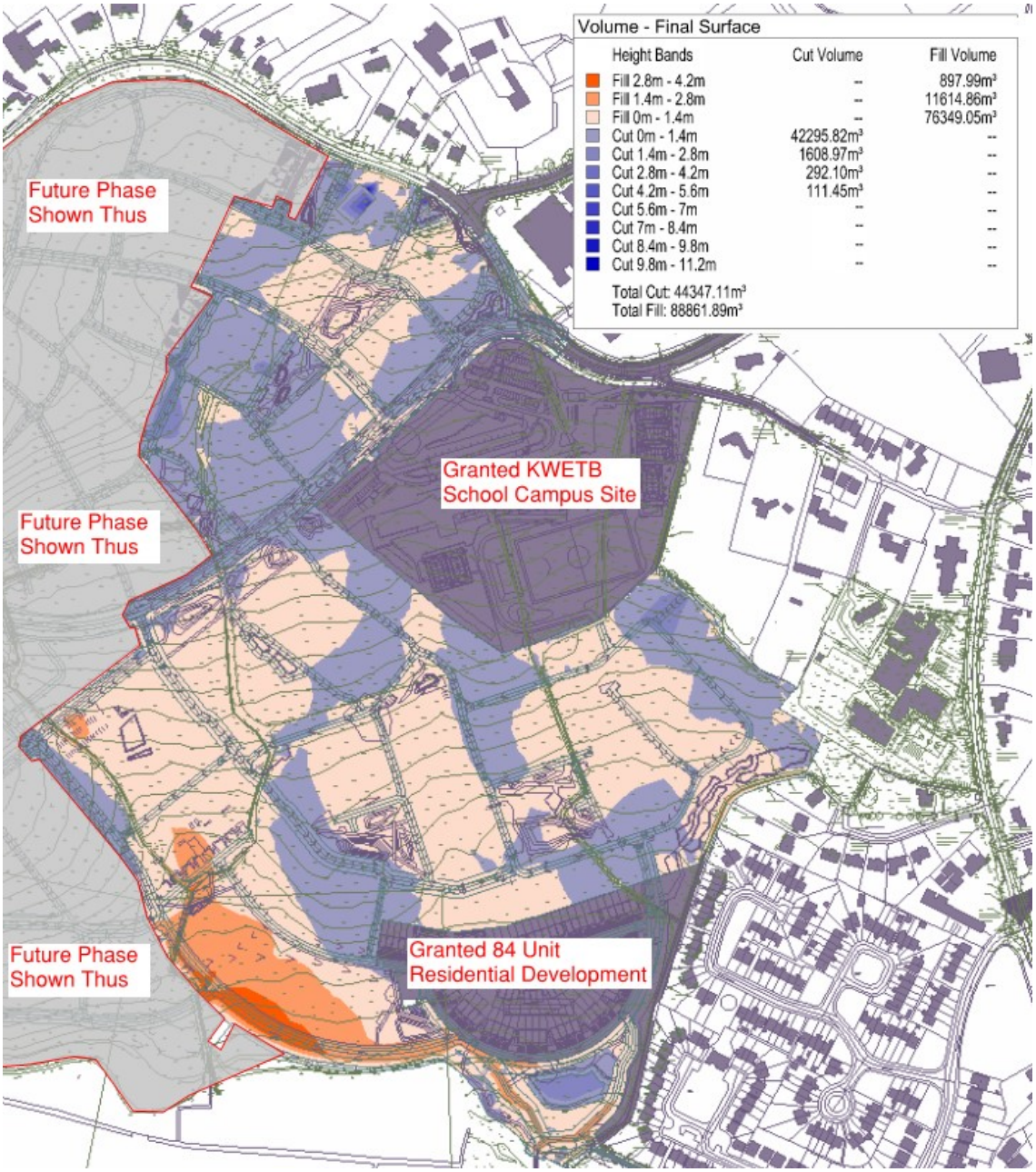


Figure 4: Site Isopath illustrating site areas subject to Cut & Fill

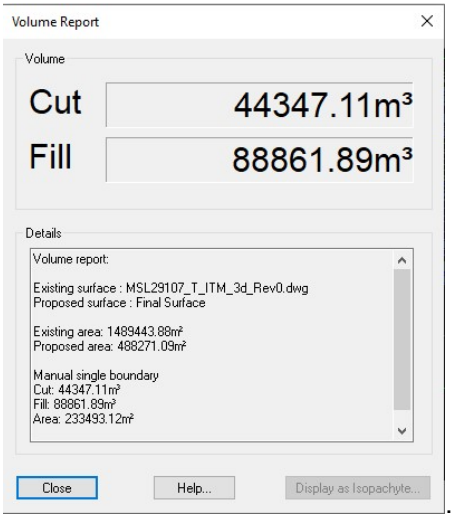


Figure 5: Extract from Volumetric Analysis illustrating Cut/ Fill volumes.

A volume of 88,861.89 cubic metres of fill material was calculated across the site to deliver the proposed development to final levels. 44,347.11m3 of this fill material will be provided by the cut material which has been calculated to final levels. The remaining fill material required for the site shall be supplemented by the material from dwelling unit foundation excavations, sewer / watermain excavations, and road excavations all to formation level and shall result in a balanced Cut/ Fill development.

The reuse of cut material on site for areas of fill shall be subject to suitability and shall be assessed in conjunction with the Outline Construction Management Plan prepared by Donnachadh O'Brien and Associates Consulting Engineers and submitted as part of this application (2432-DOB-XX-SI-RP-C-0004) and the Final Construction Management Plan prepared by the contractor following appointment,

6.2 Retaining Structures

The natural average gradient of the site results in certain back-to-back dwellings having a difference in floor level of between 1m and a maximum of 2.5m. This level difference will be treated locally through stepped landscaping in the rear gardens of the dwelling and the provision of some low retaining boundary walls. Figure 6 below illustrates the treatment of back-to-back gardens which contain a step of between 750mm to 2.65m in finished floor levels. Please refer to DOBA Engineering drawings **2432-DOB-XX-SI-DR-C-1850** & **C- 1860** for typical details of retaining structures throughout the proposed site.

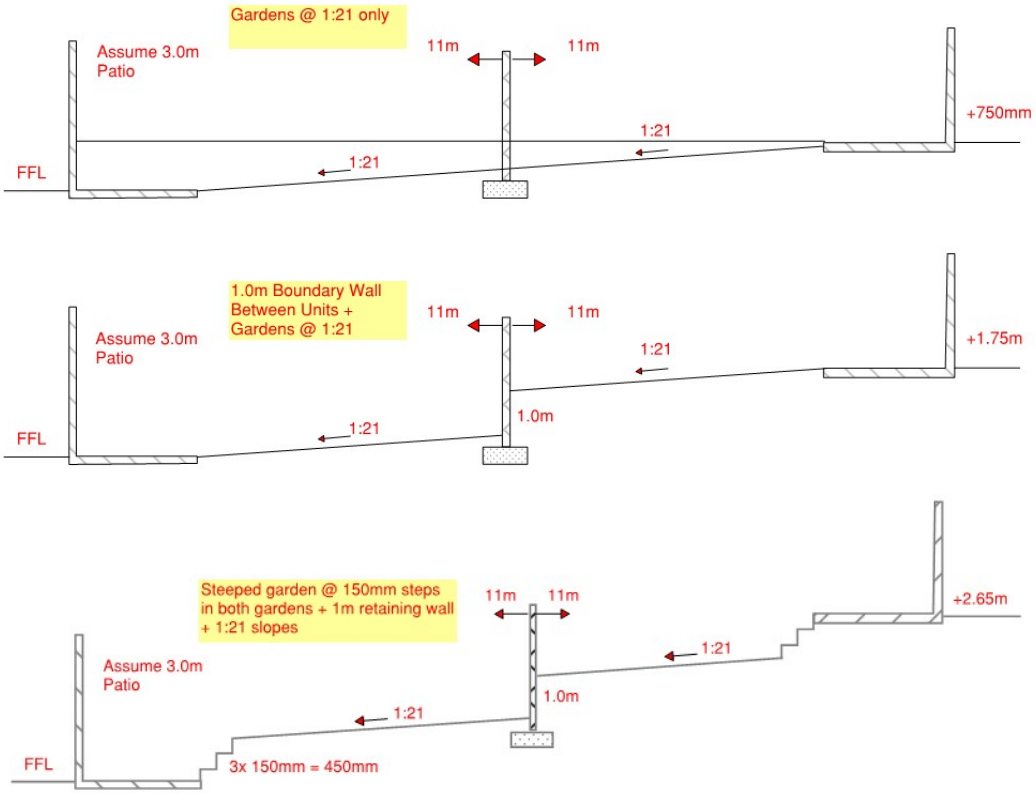


Figure 6: Typical details of adjacent back gardens for between 750mm and 2.65m difference in FFL

7 Surface Water

7.1 Wicklow County Development Plan 2022 - 2028

Objective 13.21 of the Wicklow County Development Plan 2022 – 2028 (WCC CDP) outlines the requirement for Sustainable Environmental Infrastructure to form part of any development and the requirement to integrate the principles of Sustainable urban Drainage Systems (SuDS) using best practice solutions. Objective 13.20 of the CDP also outlines the requirement for the provision of separated foul and surface water networks and the provision of treated surface water prior to discharge to an approved surface water system. This section of the Infrastructure Design Report outlines the surface water management proposals to meet the objectives set out in the CDP.

7.2 Existing Surface Water Drainage

There is no piped surface water network on site with run-off from the greenfield eventually discharging via overland flows and adjacent dry ditches to the Marsh area, located to the south of the proposed development. Figure 7 below shows the network of open watercourses that are in close proximity to the site.

Figure 7: Extract from EPA mapping showing exisyting watercourses adjacent to site

A full topographical survey of the site has been prepared. We have undertaken a review on site of the ditches and open watercourses adjacent to the site. Figure 8 below illustrates the extent of field boundaries which generally drain in a north to south direction and discharge to the marsh to the south which in turn discharges to the Avoca River. In all cases the ditches/field boundaries appear to be seasonally variable, are predominanyly dry and appear to convey overland water flows during winter and heavy rainfall events. From our review on site and assessment, and knowledge gained from site investigations they do not appear to be fed by springs or groundwater sources.

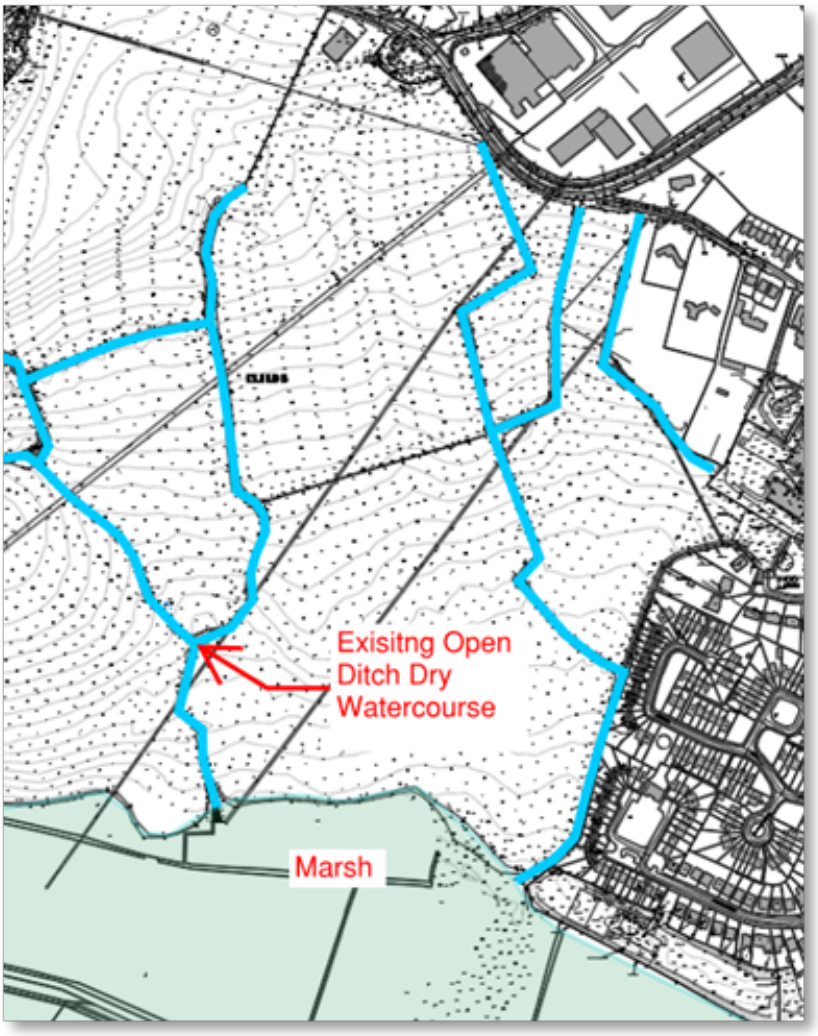


Figure 8: Extent of dry open ditches and field boundaries

7.3 Pre-Planning Consultations

The applicant engaged with Wicklow County Council regarding the proposed development during the S247 meeting on 15th May 2024, the Section 32B meeting 18th December 2024 and the LRD Opinion received on 21st January 2025. As part of the engagement with Wicklow County Council through the LRD staged process, consideration has been given to the below criteria as part of the development proposal: -

- Site investigations have been conducted across the site which demonstrate low permeability soils. These do not permit the discharge of surface water directly to the ground using infiltration techniques, and Soil Type 4 may be used in the calculation of Q_{bar} for the site
- Surface water is to be attenuated on site to facilitate a 1:100 Year plus 20% Climate Change event

- Attenuated surface water shall discharge to an existing watercourse, where eventually flows shall be conveyed to the Arklow Marsh area, which is a natural flood plain and also a proposed Natural Heritage Area (pNHA). (see figure 8 above)
- Surface water run-off shall be attenuated in above-ground retention basins where feasible with supplementary underground tanks and restricted using a flow control device
- Petrol interceptors shall be used to treat surface water prior to discharging to the watercourse
- Permeable paving shall be provided to the car parking bays with linear filter drains
- Treepits/ bio retention areas shall be used where possible to treat surface water and to provide additional surface water storage, minimising the extent of underground attenuation required.

7.4 Existing Ground Conditions

A Ground Investigation was carried out on site in August 2019 by IGSL (refer to **Appendix A**) and included the following: -

7.4.1 Boreholes and groundwater monitoring

6 no. cable percussion boreholes recorded topsoil overlying approx. 2.00m firm clay. Medium dense clay gravel was noted from 1.00m to 3.8m. Stiff brown sandy gravelly clay was then noted continuing to refusal depths of 7.30m and 8.10. Groundwater was not encountered in 3 of the 6 boreholes. In BH's 2, 3 and 5 the depth to groundwater was recorded as 1.12m, 1.45m and 5,22m respectively.

7.4.2 Trial Pits and BRE365 Infiltration tests

8 no. TPs recorded 400mm topsoil overlying soft to firm mottled grey brown gravelly SILT/ CLAY with strength increasing to firm/ stiff at 1.00m BEGL. No water strikes were encountered. BRE 365 percolation tests were undertaken in 6 trial pits and all results failed and no infiltration rates to ground were recorded in the firm to stiff upper clays. Therefore, discharge to ground as a SUDS measure is not feasible on the site.

7.4.3 In situ CBR by Plate Bearing Test

CBR values were determined at seven locations below the topsoil layer with an average CBR of 5% obtained at the initial load cycle. Therefore, 150mm of 6F2 caping material shall be provided to the formation level of all proposed roads.

7.4.4 BRE365 Tests

6 no. BRE365 tests were carried out with no fall in water level recorded in all locations, which are typical of boulder clay with extremely low permeability. No groundwater ingress was noted in the trial pits used for the BRE tests.

7.5 Proposed SuDS Strategy

7.5.1 Proposed Treatment Train

In line with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS), Sustainable Urban Drainage System (SuDS) and WCC CDP it is proposed to provide a treatment system aimed at enhancing the quality of surface water from the development which will be achieved by intercepting rainfall and other run off and treating the surface water prior to discharge to the adjacent watercourse. Following a review of the site layout and the ground conditions, the systems considered most appropriate are permeable/ porous surfaces and bio retention/ tree pits supplemented by rainwater harvesting, petrol interceptor, flow control devices, retention basins and underground attenuation. As noted above in section 7.4.2, BRE 365 percolation tests were undertaken in 6 trial pits and all results failed with zero infiltration rates to ground recorded in the firm to stiff upper clays. Therefore, discharge to ground as a SUDS measure and treatment train is unfortunately not feasible on this site.

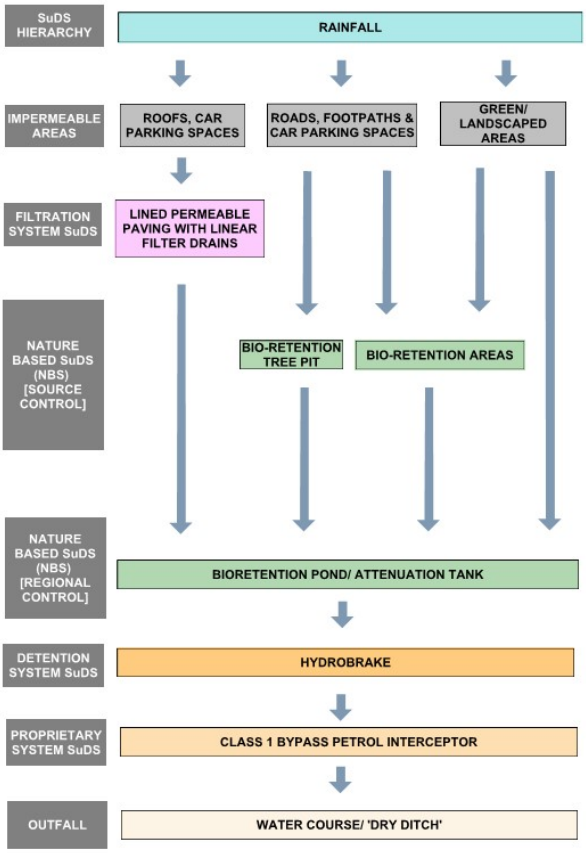


Figure 9 Proposed 2-Stage SuDS Strategy

7.6 Proposed SuDS Elements

7.6.1 Porous & Permeable paving

Porous and permeable paving shall be provided to all car parking hardstanding surfaces at ground level throughout the development. Permeable paving systems will reduce peak discharges into the drainage system and treat run-off by providing a 70-90% removal efficiency rate for hydrocarbons and 60-95% removal of suspended solids thereby improving the quality of water discharging. The base of the porous paving build-up shall also benefit from any available infiltration to ground. The porous paving shall be underlain by linear filter drains which shall provide a second treatment to the run-off preventing ingress of fine materials from the paved areas prior to discharge into the surface water drainage system.

7.6.2 Bioretention Systems & Tree Pits

Bioretention systems are landscaped and planted depressions that reduce run-off rates, provide infiltration where possible and treat pollution through the use of engineered soil and vegetation. Run-off collected by the system ponds temporarily on the surface and filters through the vegetation and underlying engineering filter medium. A drainage layer beneath the filter medium is wrapped in a geotextile to prevent the washing of fines from the filter medium to the drainage layer. The drainage layer is provided with a 150mm dia. perforated uPVC pipe which discharges to the adjacent surface water network. In addition, an overflow in the form of a standpipe is provided to direct flows to the downstream surface water network once the volume of the system has been exceeded.

7.6.3 Proprietary Surface Water Treatment System

Proposed Class 1 bypass petrol interceptors shall be incorporated into the drainage system to intercept run-off and improve the quality of surface water discharging into the receiving watercourse in compliance with best drainage practice and SuDS requirements. The interceptors shall serve to provide interception of run-off and deliver removal efficiency rates of up to 80% for suspended solids and hydrocarbons.

7.6.4 Retention Basins

The site will utilise bioretention basins as part of the nature-based SuDS strategy and to provide attenuation for surface water runoff from roof and paved areas up to and including the 1 in 100 year storm + 20% Climate Change event + 10% Urban Creep. The proposed basins shall contain water levels that will be designed to provide a minimum of 300mm freeboard to adjoining ground and road levels while also providing a minimum of 500mm freeboard to finished floor levels of all buildings on the site.

Basins will be vegetated and planted as part of a biodiverse landscaping solution which has been coordinated with the engineering solution with the project landscape consultant.

The total volume of surface water storage provided in the retention ponds/ basins across the proposed development for a 1:100 Year plus 20% Climate Change + 10% Urban Creep is 2,245m3.

The proposed retention pond/basin volumes have been designed to provide sufficient storage for the future development of the masterplan scheme.

7.6.5 Surface Water Attenuation

The development will utilise an underground attenuation tank consisting of a proprietary parabolic arched “Stormtech” or equivalent system lined with a woven impermeable geotextile liner. The discharge manhole of the attenuation tank or adjacent manholes shall be fitted with a flow control device in the form of a hydrobrake throughout the site discharging at a rate that complies with the GDSDS River Regime Protection criterion (173.91/s combined 2 No. Catchment discharge to the receiving watercourses to the east and south). A non-return valve shall be placed on the outfall manhole along with a high-level overflow for rainfall events exceeding a 1:100 storm + 20% Climate Change + 10% Urban Creep. Access to the attenuation tank shall be provided via manholes at each end which shall contain 500mm deep silt traps. A perforated distribution pipe shall be placed beneath the base of the tank which can be jetted and cleaned through ongoing maintenance. The total volume of surface water storage provided in the attenuation tanks across the proposed development for a 1:100 Year plus 20% Climate Change + 10% Urban Creep is 8,037m3. The proposed attenuation tank volumes have been designed to provide sufficient storage for the future development of the masterplan scheme.

7.7 Design of Proposed Sustainable Drainage System

The design of sustainable drainage systems, as per Chapter 6 of the Greater Dublin Strategic Drainage Study (GDSDS), is set out below and describes the performance of the proposed surface water drainage system when measured against the relevant GDSDS drainage criterion, namely

- Criterion 1 – River Quality Protection
- Criterion 2 – River Regime Protection
- Criterion 3 – Level of Service (flooding) for the Site
- Criterion 4 – River Flood Protection

The requirements of SuDS are typically addressed through the provision of

- Interception Storage
- Treatment Storage *(not required if interception storage is provided)*
- Attenuation Storage
- Long Term Storage *(not required if growth factors are not applied to Q_{bar} when designing attenuation storage)*

In accordance with WCC requirements, a climate change factor of 20% will be applied to the design of the surface water system.

7.7.1 River Quality Protection

7.7.1.1 Objective

Interception storage of at least 5mm, and preferably 10mm, of rainfall where run-off to the receiving water can be prevented.

7.7.1.2 Proposal

The 10mm rainfall event on site will be intercepted without discharging to the public system. For the purpose of the SuDS calculations, the relevant areas outlined in **table 1** below in m^2 apply.

Table 1 Summary of drained areas

Area Description	Area (m^2)
Roofs	49,789
Hardstanding (internal site)	111,011

The required interception storage volume to accommodate the 10mm rainfall event is therefore 160,800 x 0.01 = 1608m^3

A summary of the interception volumes provided is as follows:-

- 200mm of stone build up beneath the parabolic arched attenuation tank
    - 7,352m2 x 0.2 x 0.4 = 588.16m^3

- 200mm of stone build up beneath the permeable paving (below invert of distribution pipes)
    - 16,650m2 x 0.2 x 0.4 = 1,332.00m^3

The total provided interception storage is 1920.00m^3, while the total required interception storage is 1608m^3, therefore, the provision of interception storage volume exceeds the minimum required on the site for the 10mm event and complies with the requirements of GDSDS and the River Quality Projection objective.

7.7.2 Level of Service (flooding) for the Site

7.7.2.1 Objectives

3.1 *No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical.*

3.2 *No internal property flooding. Planned flood routing and temporary flood storage accommodation on site for short high intensity storms. Site critical duration events.*

3.3 *No internal property flooding. Floor levels at least 500mm above Maximum River level and adjacent on-site storage retention.*

3.4 *No flooding of adjacent urban areas. Overland flooding managed within the development.*

7.7.2.2 Proposal

Engineering calculations included in **Appendix B** demonstrate that no pluvial out-of-manhole flooding of the proposed development's surface network occurs for storms up to and including a 1 in 100 Year plus 20% Climate Change event + 10% Urban Creep. Therefore, no flooding of the site, internal properties or adjacent urban area occurs as a result of the proposed development's surface water network. Pipe sizes and gradients have been designed to achieve minimum self-cleansing velocities as per the requirements of the Building Regulations Part 'H'.

7.7.3 River Flood Protection

7.7.3.1 Objectives

4.1 Long-term floodwater accommodated on site for development runoff volume is in excess of the Greenfield volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme flood events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.

4.2 Infiltration storage provided equal in volume to long term storage and usually designed to operate for all events.

4.3 Maximum discharge rate of Q_{bar} or 2 l/s/Ha, whichever is the greater, for all attenuation storage where separate long-term storage cannot be provided.

7.7.3.2 Proposals

A maximum discharge rate Q_{bar} of 173.91 l/s (Eastern Catchment- 108.08l/s, Western Catchment – 65.83l/s) for attenuation storage has been adopted as long-term storage cannot be provided.

7.8 Proposed Piped Surface Water Network Design Parameters

The surface water piped network and associated attenuation design calculations have been prepared using Infodrainage Network Design Computer software by Autodesk and are included in **Appendix B** of this report. The proposed surface water network has also been designed to account for flows from the future masterplan development. The proposed surface water drainage system has been designed in accordance with I.S. EN 12056: 2000 'Gravity Drainage Systems inside Buildings', I.S. EN 752: 2017 'Drain & Sewer Systems outside Buildings', 'The Greater Dublin Region Code of Practice for Drainage Works', the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS) and the Building Regulations Technical Guidance Document Part H applying the following parameters.

Surface water drainage design method	Modified Rational Method
Storm Return period (years)	1 in 5 year
Flooding Period	Up to and including a 1 in 100 Year + 20% CC
M5-60 rainfall depth (mm)	20.00
Ratio, r	0.273
Allowance for Climate Change (%)	20
Allowance for Urban Creep (%)	10
Minimum self-cleansing velocity (m/s)	0.75
Pipe roughness (mm)	0.6
Run-off coefficients	
External hardstanding	80%
Roofs	95%
Green/ Open Space	30%
Gardens	10%

Refer to **DOBA Engineering drawing C-0200, C-0210, C-0220, C-0230, C-0240, C-0250,** relating the proposed development's surface water drainage network.

7.9 Proposed Surface Water Attenuation

7.9.1 Proposed Retention Basins

The site will utilise bioretention basins as part of the nature-based SuDS strategy and to provide attenuation for surface water runoff from roof and paved areas where feasible. The proposed basins shall contain water levels that will be designed to provide a minimum of 300mm freeboard to adjoining ground and road levels while also providing a minimum of 500mm freeboard to finished floor levels of all buildings on the site. The proposed retention basins shall provide storage volume of approximately

2,245m^3 and has been designed to store run-off up to and including a 1:100 year+ 20% Climate Change event + 10% Urban Creep.

Basins will be vegetated and planted as part of a biodiverse landscaping solution which has been coordinated with the engineering solution with the project landscape consultant. Bioretention ponds with wetland edges will be provided to both attenuate and treat surface water and provide an element of aquatic vegetation which will enhance the existing vegetation within the site. Retention basins are located in areas of green space where proposed landscaped levels can be suited to maximise utilisation and where there has been significant surface water treatment in the upstream network through treepits, bioretention areas, permeable paving and filtration measures incorporated around the development buildings and hardstanding. Dense wetland vegetation around the perimeter will promote the adhesion of contaminants, aerobic decomposition and will help to manage sediments and prevent resuspension.

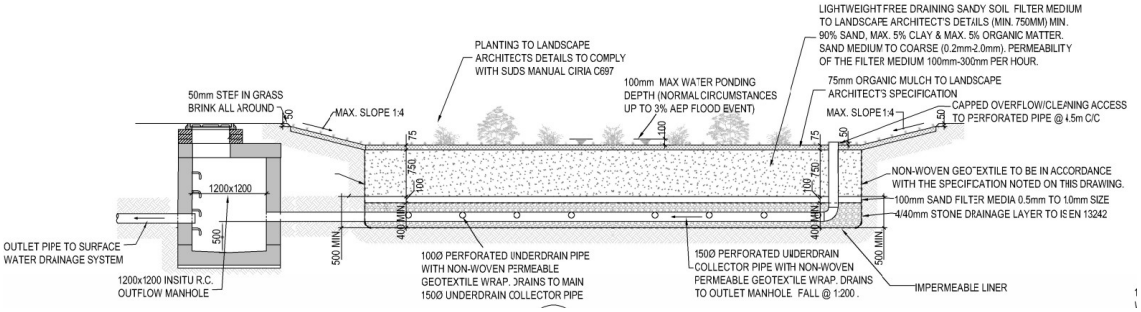


Figure 10: Typical Retention basin detail (refer to Drawing **2432-DOB-XX-SI-DR-C-0270**)

7.9.2 Residual Underground Attenuation

Due to the sloping nature of the site, and the poor infiltration rates that would allow infiltration to ground, some residual underground Surface water attenuation storage is requited to be provided throughout the site consisting of Stormtech or Equivalent parabolic arched chambers surrounded with void stone and has been designed to store run-off up to an including a 1:30 Year + 20% Climate Change event + 10% Urban Creep throughout the site (1 in 100 year event + 20% Climate Change event + 10% Urban Creep in some areas where Retention Ponds are not feasible), As highlighted in DOBA Engineering drawings **C-0200, C-0210, C-0220, C-0230, C-0240, C-0250.** A number of attenuation tanks shall be located beneath Retention basins which will be connected hydraulically to increase storage in the areas where basins are located. The total volume of surface water storage provided in the attenuation tanks across the proposed development for a 1:100 Year plus 20% Climate Change + 10% Urban Creep is 8,037m3. The proposed attenuation tank volumes have been designed to provide sufficient storage for the future development of the masterplan scheme.

The location of the tank and details are illustrated on **C-0200, C-0210, C-0220, C-0230, C-0240, C-0250, C-0270 and C-1200** respectively.

7.10 Proposed Riparian Buffers

With the development located adjacent to the discharging watercourse to the east, consideration has been given in the site layout to the protection of wildlife and the reduction of impacts on the existing riparian environment along the watercourse.

As part of the pervious approved application for 84 units) (ABP Ref. ABP-319604-24 & Wicklow Co. Co. Ref. 23/756), DOB&A liaised with Matthew Carroll, Environmental Officer in Inland Fisheries Ireland regarding the buffer from the adjacent watercourse along the eastern boundary. Although this feature is identified as a 'watercourse' on EPA mapping, it is a field boundary ditch that is seasonally variable and occasionally dry. As part of the above approved application a minimum buffer of 5.0m was considered appropriate by Inland Fisheries given the nature of this particular watercourse.

Notwithstanding the previous advice above from Inland Fisheries, the site layout and design for this application has been developed to consider a buffer from the watercourse in accordance with the Wicklow County Development Plan Objective CPO 13.1 and CPO 17.26 to protect the watercourse and associated wildlife by the integration of riparian buffers of 25.0m, free from development.

CPO13.3 To minimise alterations or interference with river / stream beds, banks and channels, except for reasons of overriding public health and safety (e.g. to reduce risk of flooding); a buffer of generally 25m along watercourses should be provided (or other width, as determined by the Planning Authority having particular regard to *'Planning for Watercourses in the Urban Environment'* by Inland Fisheries Ireland for urban locations) free from inappropriate development, with undeveloped riparian vegetation strips, wetlands and floodplains generally being retained in as natural a state as possible.

CPO 17.26 Protect rivers, streams and other water courses by avoiding interference with river / stream beds, banks and channels and maintaining a core riparian buffer zone of generally 25m along watercourses (or other width, as determined by the Planning Authority having particular regard to 'Planning for Watercourses in the Urban Environment' by Inland Fisheries Ireland for urban locations) free from inappropriate development, with

Figure 11 Extract from WCC CDP Objectives relating to Riparian Buffers

The site layout and design has generally followed the Inland Fisheries Ireland's guidance documents 'Planning for Watercourses in the Urban Environment' and a 25.0m riparian buffer along the watercourse has been provided in accordance with CPO13.3 to protect and enhance the riparian environment to the adjacent watercourse. The measures that are being taken to ensure appropriate protection of the riparian zones include the following:

- Streamside zone of 10m left intact and undisturbed with existing hedgerows, trees, and stream vegetation. Vegetation enhancement will be provided with native marginal and emergent vegetation where required.

- The remainder of the 25m riparian buffer will be maintained and landscaped appropriately with native plants and vegetation

We would refer you to the Landscape drawings submitted with this application for full details of this improved riparian buffer.

7.11 Proposed Culvert

As part of the development, it is proposed to provide greenway infrastructure to improve pedestrian and cycle access from the site to Arklow Town and adjoining existing developments (refer to section 11.7 of this report). This connection requires a crossing of the existing eastern watercourse and will be constructed in accordance with OPW Section 50 consent and requirements. There are currently no significant flows conveyed within this watercourse with the watercourse being considered largely a 'dry ditch'. The proposed culverting of the watercourse is proposed with a 900 mm diameter pipe capable of accommodating approximately 1.4m^3/sec flow and this is sufficient to convey discharging greenfield flows from the site along with any minimal overland flows from while allowing for normal blockage analysis

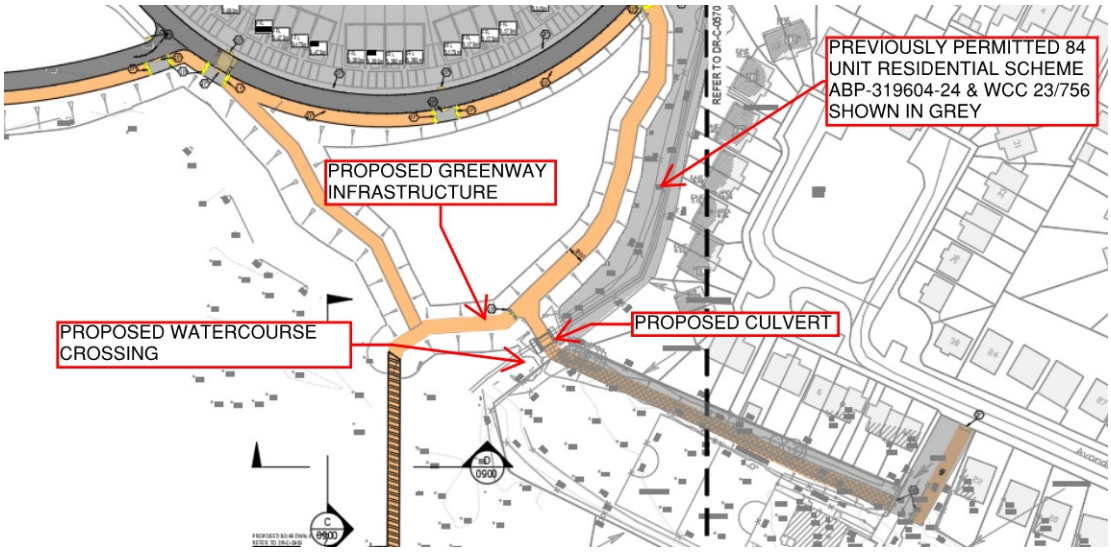


Figure 12 Proposed Culvert Crossing to accommodate Greenway Infrastructure

Figure 13 and 14 below are extracts from DOBA Engineering Drawing 2432-DOB-XX-SI-RP-C-1210, illustrating the proposed culvert details and the proposed 900mm diameter pipe to convey flows.

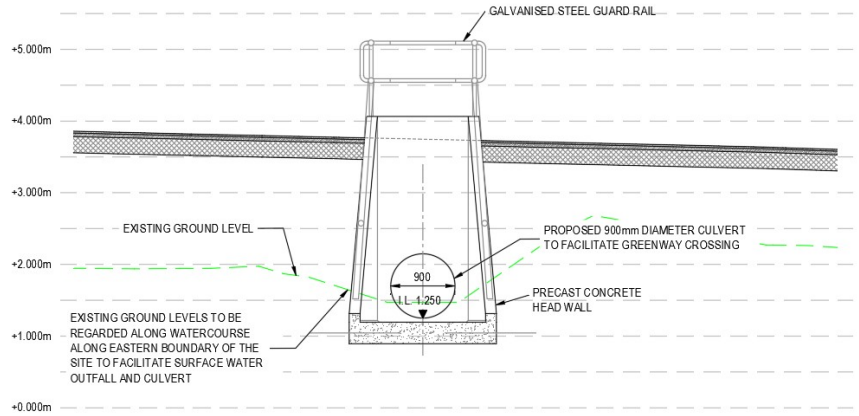


Figure 13 Proposed Cross section of Culvert Crossing to accommodate Greenway Infrastructure (Refer to DOBA Engineering drawing **2432-DOB-XX-SI-RP-C-1210**)

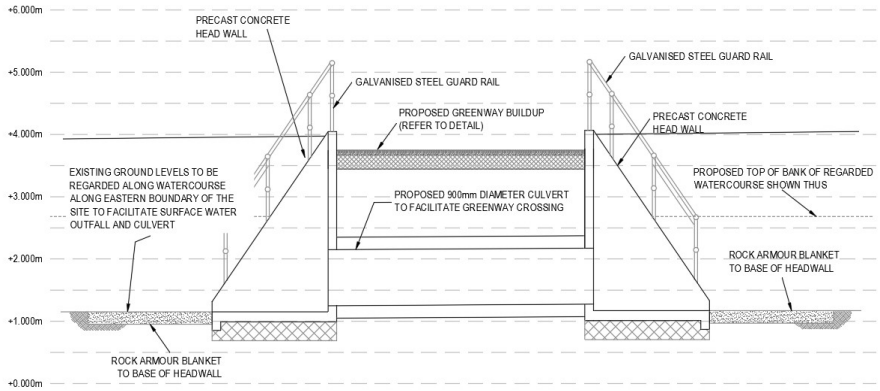


Figure 14 Proposed Long section of Culvert Crossing to accommodate Greenway Infrastructure (Refer to DOBA Engineering drawing **2432-DOB-XX-SI-RP-C-1210**)

8 Flooding

Donnachadh O'Brien & Associates have prepared a site-specific flood risk assessment **2432-DOB-XX-SI-RP-C-0005** for the proposed site and masterplan development. This SSFRA has been submitted to Wicklow County Council as part of this LRD Application Submission, and has demonstrated that the proposed subject site identified as vulnerable is located in a Flood Zone C and is not at risk of flooding.

All existing information has been reviewed regarding the flood risk in the area and the Avoca Flood Relief Scheme flood risk mapping is considered to have the most up to date and reliable estimates of extreme water levels. This 0.1% AEP (1:1000-year event) event with a predicted flood level of 3.24m OD Malin has been used for the assessment of the site.

The proposed development is classified as Highly Vulnerable by the Planning System and Flood Risk Management Guidelines. The lowest proposed Finished Floor (6.865 m OD Malin) and Road (5.250 m OD Malin) Levels within the development are substantially above the predicted 0.1% AEP water levels, in accordance with the recommendations of the Planning System and Flood Risk Management Guidelines.

The proposed greenway and associated embankments located within the flood zone to the south of the site (Considered Water Compatible aspect of the site) have been calculated to displace approximately 1825m3 of flood volume during the 1:1000-year event. It is proposed to provide compensatory storage in the southern greenspace (located in Flood Zone C) to account for any displaced volume lost to the greenway embankments. An area of approximately 1046m2 has been identified as being suitable to regrade the ground 1.35m lower than existing to 1.89mOD to allow for lost flood volume to be catered for. Section 7.1 of the SSFRA outlines the justification test for the minimal portion of embankments/ landscaping/ Amenity Open Space located within Flood Zone A/ B which are also considered water compatible, which concludes that the proposals outlined do not increase the risk of flooding on the subject site or adjacent developments.

Figure 15 below is an extract from DOBA Engineering Drawing 2432-DOB-XX-SI-RP-C-1210, illustrating the location and extent of the proposed compensatory storge which is indicated outside the extent of flood volume which occurs during the 1:1000 year flood event.

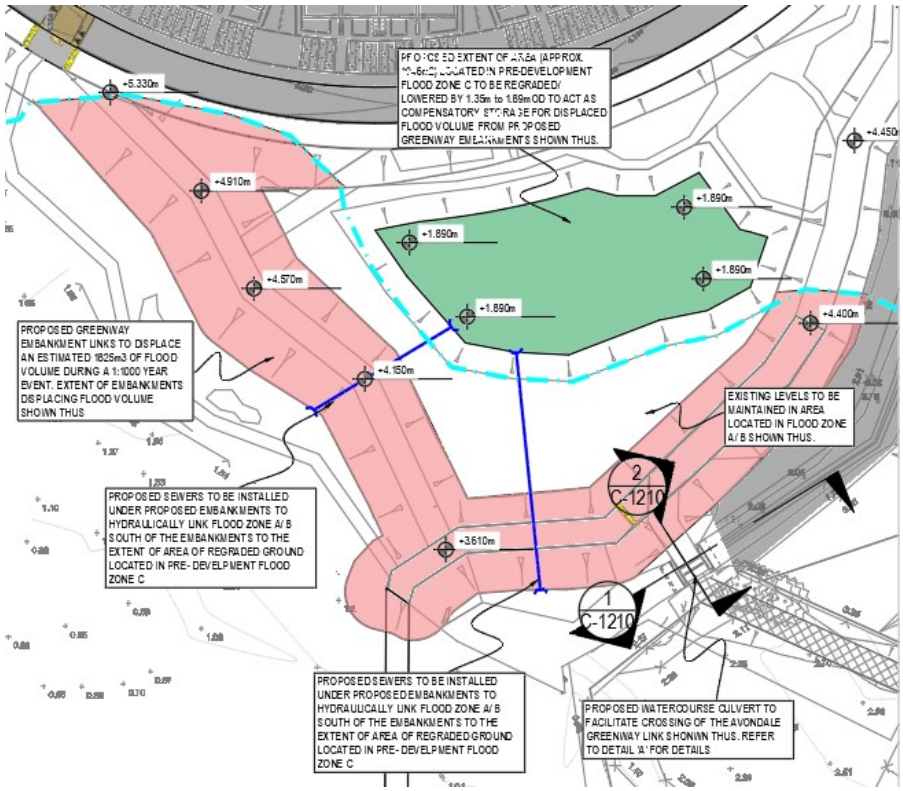


Figure 15 Proposed Compensatory Storage to the south of the site (Refer to DOBA Engineering drawing **2432-DOB-XX-SI-RP-C-1210**)

Flood modelling has been undertaken by the OPW as part of the Avoca Flood Relief scheme which identified that the 1 in 100 year flood level was +3.03mOD at the Avoca River. The applicant has liaised and coordinated the proposals for the Avoca crossing with Wicklow County Council, OPW and the Design Team of the Debris Traps and have agreed that the deck level of the Boardwalk crossing shall be set at +4.00mOD over the Avoca River. The level of the underside of the boardwalk structure/ Top of the granted OPW debris traps is approximately 3.73mOD, providing a freeboard of 700mm to the 1 in 100 year flood level. Therefore, the proposed boardwalk crossing is at low risk of flooding.

9 Wastewater Drainage

9.1 Uisce Eireann Consultation

9.1.1 Uisce Eireann Confirmation of Feasibility

DOB&A has liaised with Uisce Eireann regarding the wastewater for the masterplan development along with this phase for which this LRD Application Submission relates to. The client is in possession of a Uisce Eireann Confirmation of Feasibility (CoF). The received CoF has stated that a connection to the Uisce Eireann infrastructure is '*Feasible Subject to upgrades'.* The upgrades advised by Uisce Eireann relate to sewer upgrades to the southeast of the site as a result of a Project Works Services Agreement (PWSA) which the client has previously entered into with Uisce Eireann and described in Section 9.1.2 below. The advised upgrade works are outlined fully in the CoF which has been included in **Appendix D** of this LRD Application Submission Infrastructure Design Report.

- **Wastewater Connection**

  Feasible Subject to upgrades
  - A concept design report, relating to this site via a Project Works Services Ageement (PWSA), outlined a preferred wastewater discharge solution for this site.

Figure 16 Extract from UE CoF

9.1.2 Arklow PWSA Network Upgrade

As part of the site's masterplan, the client and Uisce Eireann have recently entered into an agreement to carry out a Project Works Services Agreement (PWSA) which has informed the client and Uisce Eireann of the most feasible and preferable long-term solution for the disposal of wastewater from the site following the construction of the masterplan development and the Arklow WWTP *(UE Reference: Arklow PWSA Network Upgrade- Project Number: 10046933)*. Uisce Eireann issued an update on the PWSA in June 2022. Asset Planning have reviewed a number of options for the permanent long-term solution and have concluded that:

- A preferred route for the gravity sewer from the development lands to the tie into the interceptor sewer has been identified. A survey scoping report has been prepared and issued for review. The surveys proposed will inform the concept design.

Figure 17 Extract from UE June 2022 update report on PWSA.

An extract showing the extent of the upgrade works by Uisce Eireann is indicated in figure 18 below. The complete suite of drawings developed as part of the proposed upgrade works are included in **Appendix G** As part of this LRD Application Submission, It is proposed to discharge Wastewater to the Uisce Eireann Uisce Eireann Infrastructure, details of which shall be agreed with UE and will comply with the Confirmation of Feasibility.

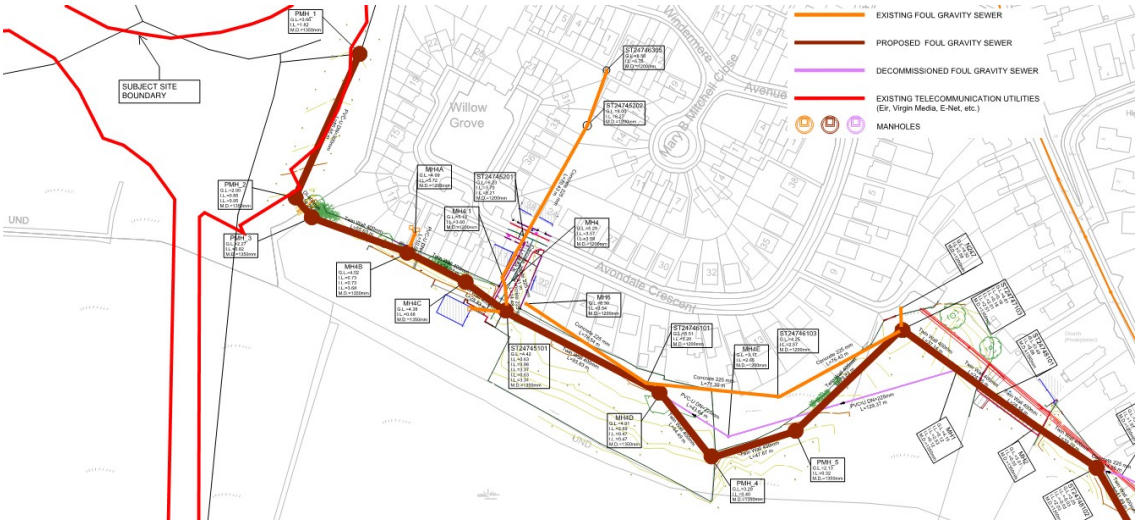


Figure 18 Extract from UE PWSA Upgrade Works. (Full Suite of Drawings have been included in Appendix G)

9.2 Proposed Wastewater Drainage Solution

The following sections describes the proposed Wastewater drainage solutions within the site following confirmation of the identified route to discharge Wastewater flows from the site. Wastewater flows generated from the proposed development shall be conveyed to the south with Wastewater infrastructure constructed fully coordinated with the proposed upgrade works before discharging to the upgraded UE wastewater infrastructure and Arklow WWTP. The details of the discharge to UE infrastructure shall be agreed with UE and shall comply with the received Confirmation of Feasibility and Statement of Design Acceptance, which has been received form UE and is also included in **Appendix E.**

Refer to **DOBA Engineering drawing C-0300, C-0310, C-0320, C-0330, C-0340 and C-0350** relating the proposed development's wastewater drainage network.

9.3 Proposed Wastewater Drainage Network Design

The proposed Wastewater network will collect effluent from the new development via a local piped network (refer to **DOBA Engineering Calculations** in **Appendix F**) and discharge to the south east of the site as described in section 9.2 above and as illustrated on **DOBA Engineering drawing C-0300, C-0310, C-0320, C-0330, C-0340 and C-0350** submitted with this LRD Application Submission. The Wastewater sewer network has been designed in accordance with the principles and methods set out in Irish Water's Code of Practice for Wastewater Infrastructure IW-CDS-5030-03 (Revision 2 – July 2020), IS EN 752 Drain & Sewer Systems outside Buildings, IS EN 12056 Gravity Drainage Systems inside Buildings and the Building Regulations Technical Guidance Document Part H Drainage & Wastewater. The proposed gradients and pipe sizes have been designed to cater for the flows from the future masterplan development, including the granted 84 unit scheme to the south of the site (ABP Ref. ABP-319604-24 & WCC Ref. 23/756). All gradient, pipe sizes, separation distance

and offsets have been set out in accordance with the Uisce Eireann 'Code of Practice for Wastewater Infrastructure- Connections and Developer Services- IW-CDS-5030-03' and the Uisce Eireann 'Water Infrastructure Standard Details- Connections and Developer Services- IW-CDS-5030-01'. The estimated peak foul loading generated by the proposed development's Dry Weather Flow is estimated at 3.90 l/s while the Design Foul Flow of 6DWF is 23.4 l/s.

10 Water Supply

10.1 Existing Water Supply

The Uisce Eireann (UE) record drawings indicate the presence of the following:

- A 315mm High-Performance Polyethylene (HPPE) watermain to the east of the site on the R772;
- A 6' Asbestos main along Monument Lane;
- A 50mm uPVC main along the existing L6179 road

Figure 19 Existing Water Supply Infrastructure.

10.1.1 Uisce Eireann Consultation

The client has liaised with Uisce Eireann regarding the Water Supply for the masterplan development along with this phase for which this LRD Application Submission relates to. The client is in possession of a Uisce Eireann Confirmation of Feasibility (CoF). The received CoF has stated that a connection to the Uisce Eireann infrastructure is '*Feasible Subject to upgrades'.* The advised upgrade works are outlined fully in the CoF which has been included in **Appendix D** of this LRD Application Infrastructure Design Report.

10.2 Proposed Water Supply

The proposed development as part of this LRD Application Submission shall be served by a 300mm dia HDPE watermain which shall connect/ extend from an upgraded 300mm dia. HDPE along Monument Lane as part of the Uisce Eireann upgrade Works and will be delivered by others. This proposed 300mm dia ID watermain has been designed to account for the future masterplan development and has also been fully coordinated with the granted school campus development.

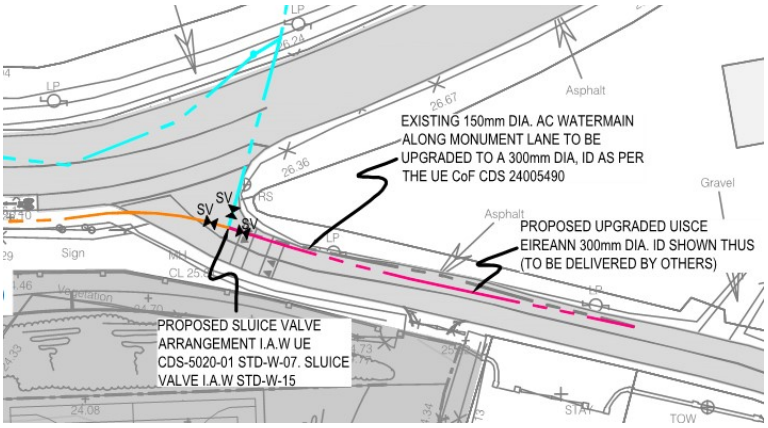


Figure 20 Proposed Connection point at upgraded 300mm dia. ID UE infrastructure.

As part of this initial development, the estimated **peak hour water demand** generated is **25.25 l/s** as demonstrated in below. The watermain layout and connections, valves, hydrants, meters etc. are designed in accordance with Irish Water's Code of Practice for Water Infrastructure IW-CDS-5020-03 (Revision 2 – July 2020) / Standard Details and the Department of the Environment's Building Regulations "Technical Guidance Document Part B Fire Safety". Hydrants will be provided on the loop main in accordance with Part B of the Building Regulations and the Fire Safety Certificate's Requirements. Sluice valves will be provided at appropriate locations to facilitate isolation and purging of the system. The proposed watermains are illustrated on **DOBA Engineering drawing C-0400, C-0410, C-0420, C-0430, C-0440, C-0470 and C-0471**.

RESIDENTIAL Proposed Water Demand Phase 1								
Use Type	**No. of Units**	**Occupancy Rate (persons/ dwelling)**	**Popualtion (P)**	**Per Capita Cosumption (l/ person/day)**	**Average daily domestic demand (l/ day)**	**Average daily domestic demand (l/ sec)**	**Average day/ peak week demand (l/sec)**	**Peak hour water demand (l/sec)**
Residential	750	2.7	2025	150	303750	3.52	4.39	21.97
						Peak hour water demand (l/s)		**21.97**

COMMERICAL Proposed Water Demand Phase								
Use Type	**Floor Area (m^2)**	**Occupancy Rate (persons/m^2)**	**Population (P)**	**Per Capita Cosumption (l/ person/day)**	**Average daily domestic demand (l/ day)**	**Average daily domestic demand (l/ sec)**	**Average day/ peak week demand (l/sec)**	**Peak hour water demand (l/sec)**
Creche	1095	8	137	60	8213	0.10	0.12	0.59
Health	790	25	32	350	11060	0.13	0.16	0.80
Retail	450	7.5	60	30	1800	0.02	0.03	0.13
							Peak hour water demand (l/s)	**1.52**

Figure 21 Proposed Water Demand

11 Roads Infrastructure

11.1 Existing Road Access to site

The existing site, is accessed to the north by a public road (L6179) which connects to Beech Road and the Dublin road (R772) north east of the site. Monument Lane adjoins the L6179 at the north-east corner of the site and provides an existing pedestrian and cycle link back to the town in addition to providing local vehicular access to existing dwellings; through access to the Dublin Road is for pedestrians and cyclists only. Existing Vehicular access to the site from the town and surrounding area is via the L6179 road only.

As part of an existing approved educational development at Kilbride, KWETB have been granted permission for a school campus (Planning Ref. 22/213). This development incorporates a new road access and improvements to the L6197, outlined in red in figure 22 below. The design and layout of this residential application has fully incorporated the approved road work approved under the granted permission.

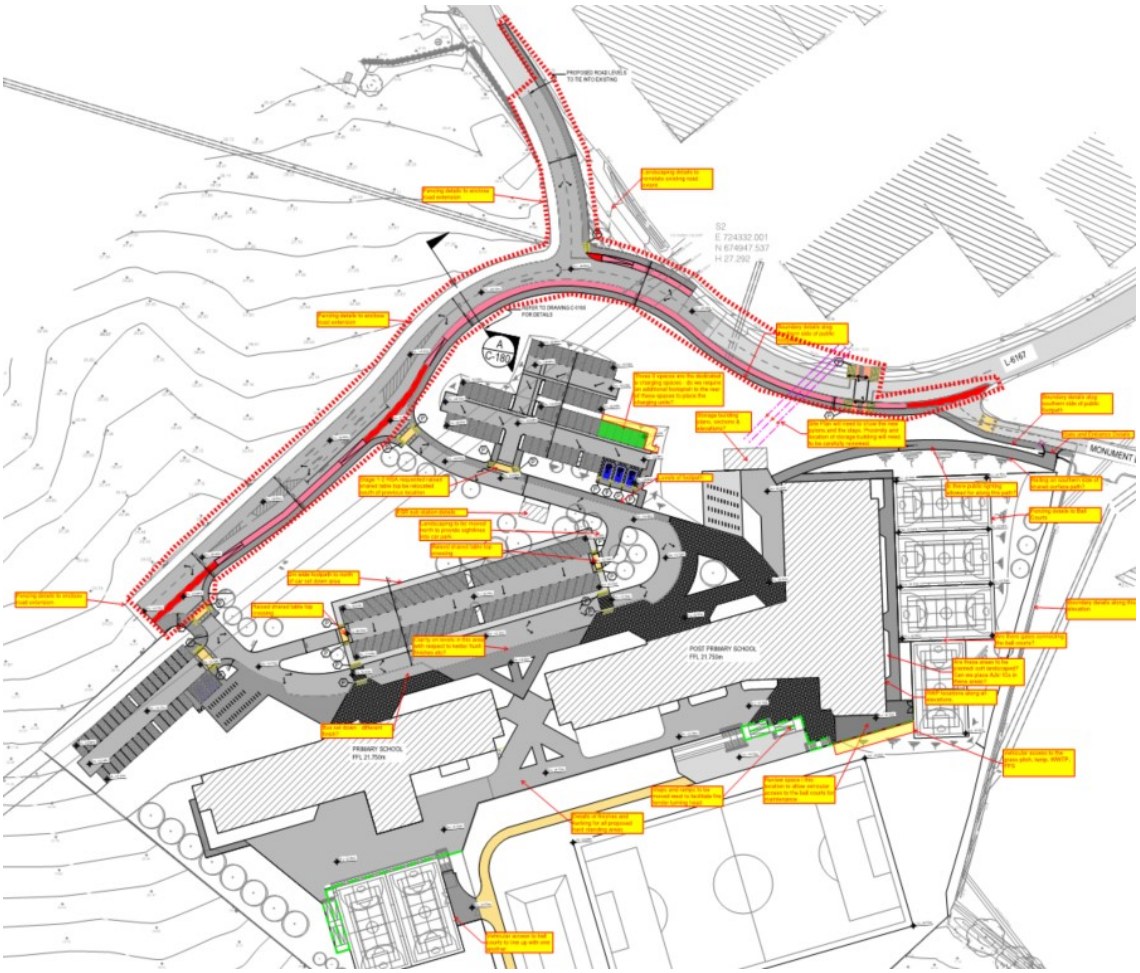


Figure 22: Approved educational development at Kilbride, KWETB (Planning Ref. 22/213).

11.2 Future Road Infrastructure

The Arklow and Environs Local Area Plan (LAP) 2018-2024 provides the planning framework for the proposed development, the future masterplan development, the school campus site, and the relationship and contribution to the wider region. The site falls within a large Mixed-Use zoning to the north of Arklow town and is part of the Kilbride Area Action Plan (AAP3) which is a c. 82 hectares parcel of land. The overall masterplan comprises of a residential development consisting of 1500 residential units, creches, a local neighbourhood centre. The Masterplan also provides for the first phase of a future regional road for Arklow town, new roads connecting the site to the surrounding areas and a pedestrian/cycle greenway link through Avondale Crescent to the south east of the proposed lands, (refer to figure 23 below), which has been approved as part of the applicants 84 unit scheme (ABP Ref. ABP-319604-24 & Wicklow Co. Co. Ref. 23/756). The future connectivity of the site also includes the marsh boardwalk to the south of the site linking across the Avoca River to the south bank riverwalk.

Figure 23 Draft masterplan of future residential development with school site outlined in pink

DOB&A has developed a hierarchy of roads for the masterplan area which has been discussed with Wicklow County Council, and is illustrated in figure 24 below. The design of the proposed road and Vulnerable Road User (VRU) infrastructure for the proposed development has adhered to the hierarchy of roads. The portion of new road to be constructed to the north of the development, which also serves the proposed school campus development, has been fully coordinated with the KWETB along with all associated underground services.

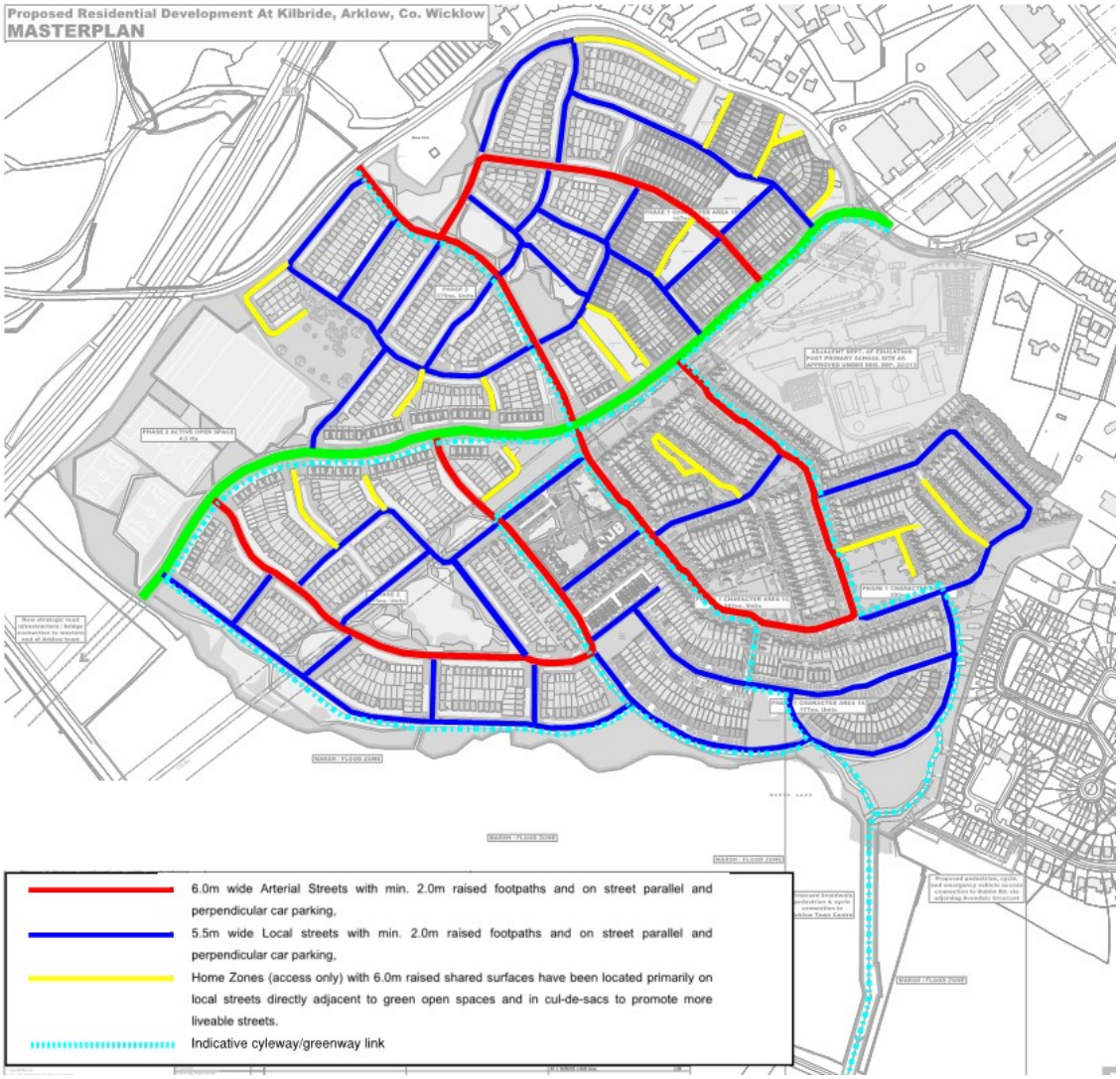


Figure 24 Roads hierarchy for Masterplan (incorporating the subject site of this application)

11.3 Proposed Internal Road and VRU Infrastructure

The following section of this report describes the attributes of the proposed internal road and VRU infrastructure associated with the development as illustrated in figure 25 below.

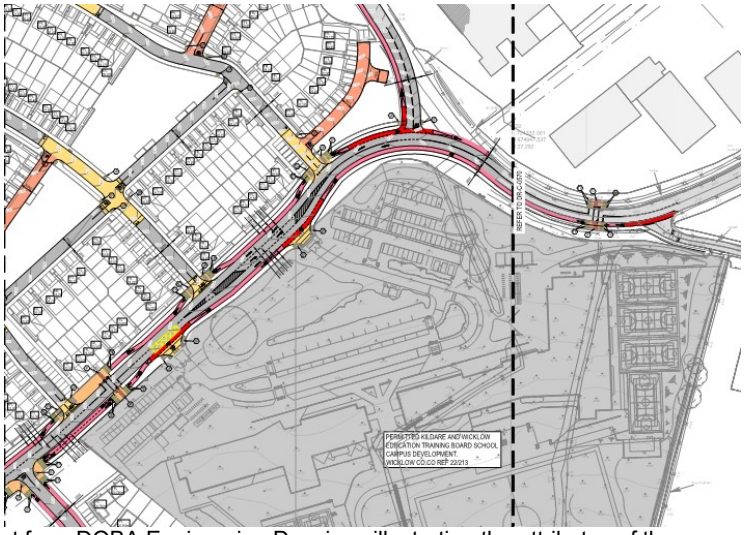


Figure 25: Extract from DOBA Engineering Drawings illustrating the attributes of the proposed development

- Provision of main Link Road running from North East to South which will also serve the proposed school campus development and has been fully coordinated with KWETB. The school design includes the provision of a right-hand turning lane and separate access and egress locations.
- Realignment of the L-6179 Road to facilitate the proposed road hierarchy, resulting in a proposed junction. (Refer to Section 11.5)
- Provision of 2.0m wide cycle paths (On road and raised)
- Provision of 2.0m grass verge along main link road
- Provision of 2.0m wide footpath for pedestrian access
- Raised table tops provided throughout site for traffic calming and to promote slower speeds around the development.
- Home Zone areas were provided adjacent to housing, where the road shall be a shared surface for traffic and cyclists.
- Provision of a toucan crossing to the north of the site and further south along the main link road to allow for pedestrian access to the development from the L-6179.
- Extension of proposed cycle path to the L-6179 and footpath to Monument Ln for increased VRU safety, (Refer to Section 11.6.1)
- Provision of junction upgrade works at the L-6179 Beech Road and the R772 junctions to cater for the anticipated traffic flows and to improve VRU safety.
- Provision of Boardwalk in a North-South direction to allow VRU permeability from the site and improve access to Arklow Town Centre (Refer to Section 11.7.2).

11.3.1 Quality Audit

A sitewide quality Audit has been conducted by Traffico and has been submitted as part of this application. The Quality audit assessed the site for factors including the safety for vehicular road users, vulnerable road users and VRU permeability though the site. Where appropriate the road safety Auditor suggested amendments to aspects of the site which were incorporated to the layout. Appendix I contains the signed feedback approval form from all parties accepting all feedback and/ or amendments from the road safety auditors Quality Audit.

11.4 Proposed Cycle Network

The proposed network for the Phase 1 development has been designed in conjunction with the proposed masterplan development. As outlined in section 11.3, The development shall provide a series of 2.0m wide both on road and off-road cycle paths which extend sufficiently around the development to maximise permeability.

The proposed cycle paths include the extension of a partly constructed cycle path along the L-6179 towards the Beech Rd junction as seen in figure 26 below.

All cycle paths; including the future masterplan, provide connectivity toward the Greenway Boardwalk to the south of the site improving increased access and safety to Arklow Town Centre.

The proposed cycle path arrangement allows for the connection of the previously granted greenway link along the south of Avondale Crescent and the Marshland Sports club, allowing the permeability and extending the usability of the Greenway Boardwalk to the local residents of Avondale Crescent, Ticknock and the surrounding areas

A sitewide quality Audit has been conducted by Traffico and has been submitted as part of this application. Appendix I contains the signed feedback approval form from al parties accepting all feedback from the Quality Audit.

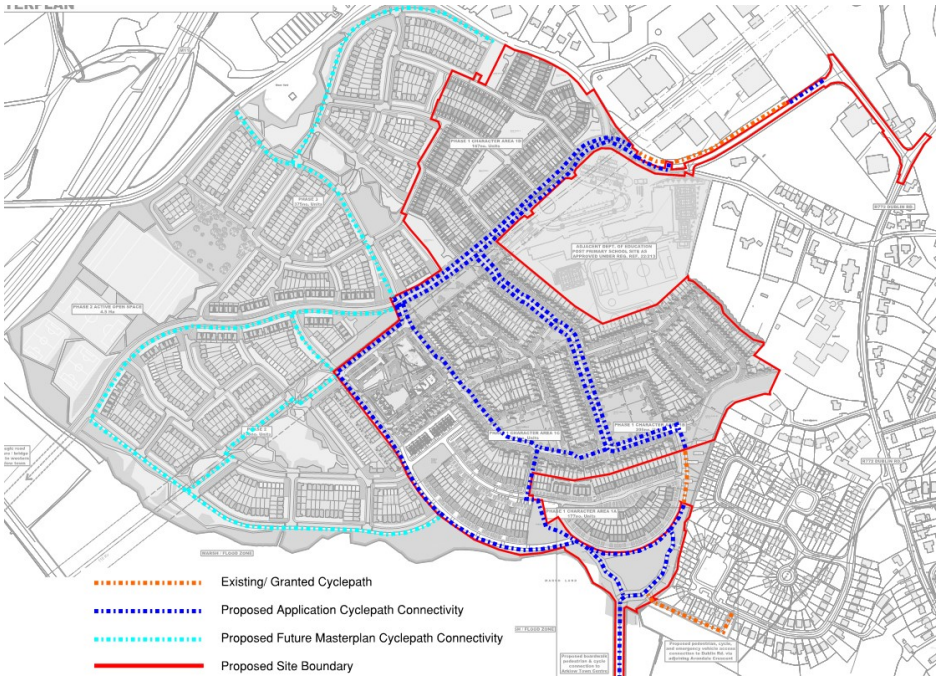


Figure 26 Proposed Cycle Network Connectivity for Proposed Development and Future Phasing

11.5 L-6179 Road Realignment

As part of the development, It is proposed to realign the existing L-6179 road to the north of the site creating a junction onto the main access road to the site. This road realignment is proposed to facilitate the proposed Road Hierarchy as per Section 11.2 and to increase pedestrian and VRU road safety in and around the area and in particular, students walking and cycling to and from the proposed school campus by significantly reducing speeds by bringing vehicles to a stop at the junction.

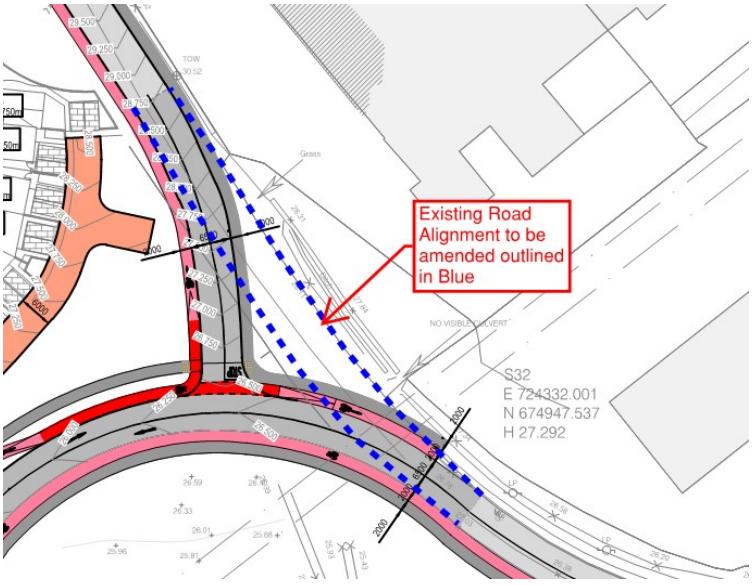


Figure 27 Extract from DOBA Engineering drawing C-0500 indicating proposed junction and road realignment of the L-6179

11.6 Proposed External Junction Upgrades

As part of the submitted proposals for the development, assessments of the predicted traffic volume and movements were completed by Systra Group and have been submitted with this LRD Application Submission. The conducted analysis concluded that the current arrangement of the Beech Road Junctions to the East of the site were required to be upgraded to cater for the predicted traffic movements from the proposed development.

11.6.1 L-6179- Beech Road Junction

As part of the development, it is proposed to extend the existing footpath and cycle path on the northern edge of the L-6179 toward the junction and provide a crossing point to the southern infrastructure to improve safety on the VRU infrastructure. Figure 28 below indicates the existing and proposed junction arrangements of the L-6179- Beech Road Junction. Please refer to DOBA Engineering drawing **C-0600 and C-0610** for the full details of the proposed arrangement.

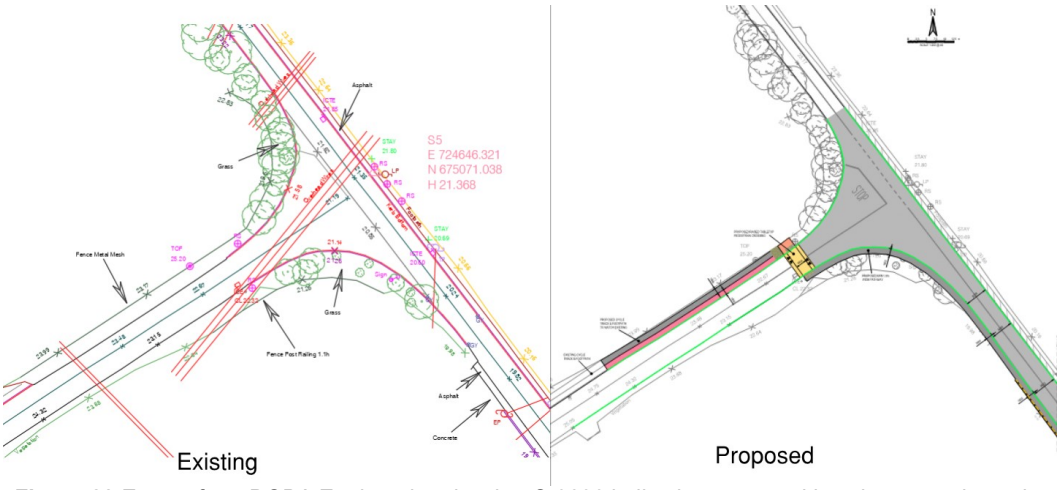


Figure 28 Extract from DOBA Engineering drawing C-0600 indicating proposed junction upgrade works

11.6.2 Beech Road- R772 Junction

As part of the development, to cater for the proposed residential development, it is proposed to incorporate a left- and right-hand signalised turning lane onto the R772. The proposed arrangement will allow for sufficient queuing lengths to and from the proposed development. To improve VRU safety, it is also proposed to reduce corner radii as a traffic calming measure and to reduce speeds. Please refer to DOBA Engineering drawing **C-0600 and C-0610** for the full details of the proposed arrangement.

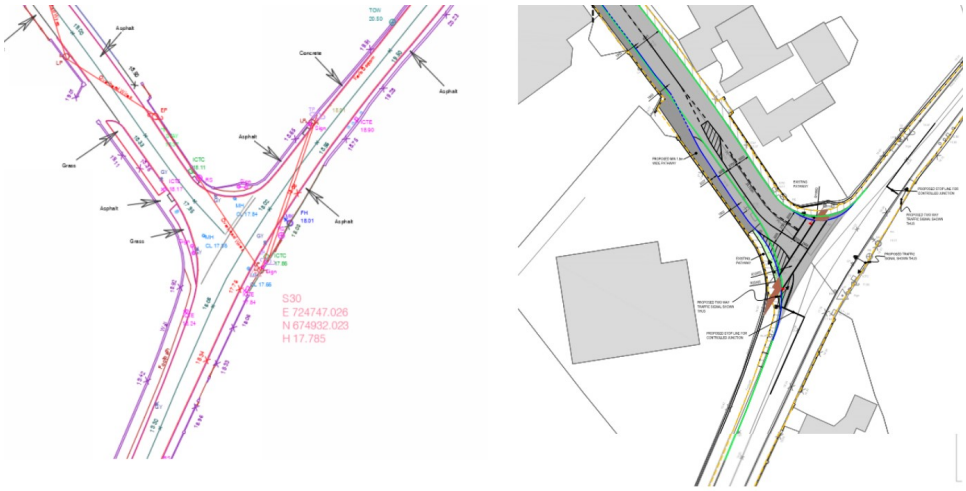


Figure 29 Extract from DOBA Engineering drawing C-0600 indicating proposed junction upgrade works

A sitewide quality Audit has been conducted by Traffico and has been submitted as part of this application. Appendix I contains the signed feedback approval form from al parties accepting all feedback from the Quality Audit.

11.7 Proposed Greenway Infrastructure

11.7.1 Avondale Crescent

As part of the LRD Application Submission, it is proposed to extend the recently granted greenway infrastructure that links the permitted 84-unit residential development to Arklow Town via Avondale Crescent to the South of the site. The proposal shall increase connectivity to Arklow town and satisfies the AAP3 of the Arklow and Environs Local Area Plan.

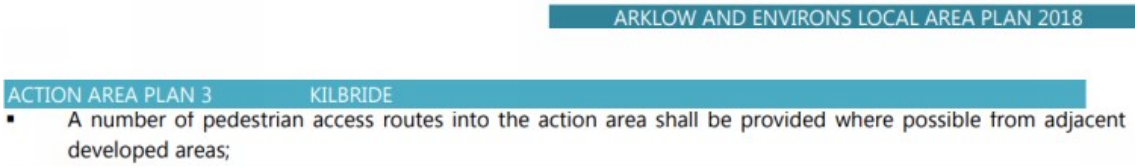


Figure 30 Extract from Arklow and Environs Local Area Plan indicating criteria including pedestrian connectivity to adjacent developments

The proposed route/ extension highlighted in green in figure 31 shall provide increased VRU permeability for the entire area to Arklow town via the proposed boardwalk, including for existing residents in adjacent developments such as Avondale Crescent.

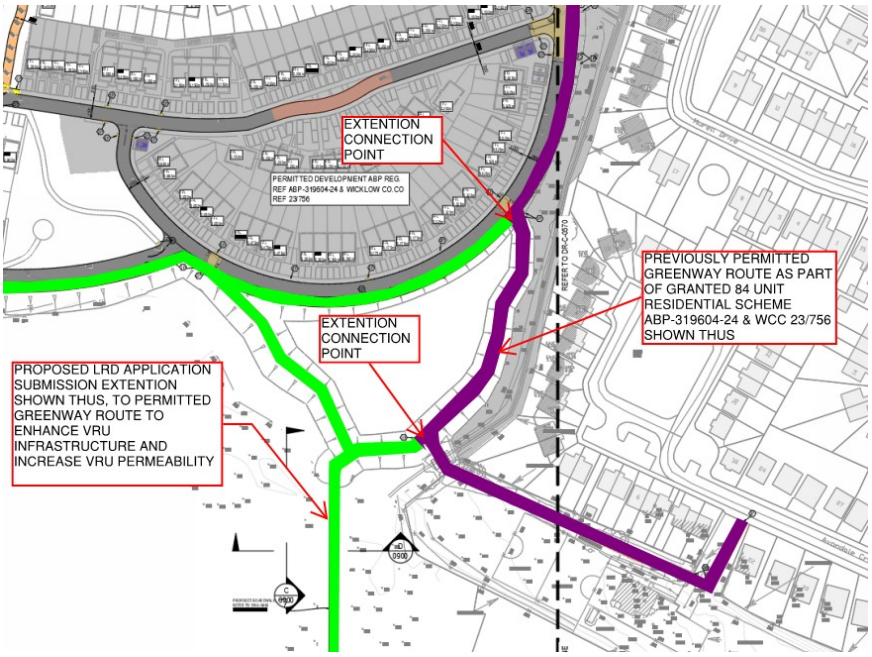


Figure 31 Extract from DOBA Engineering drawing C-0500 indicating the proposed Greenway infrastructure (Green) linking to permitted Infrastructure (Purple).

11.7.2 Proposed Boardwalk

It is proposed to construct greenway infrastructure in the form of a boardwalk which crosses the marshlands to the south of the proposed development in order to increase connectivity and permeability to the centre of Arklow Town. The proposed infrastructure shall traverse Wicklow County Council owned lands and will consist of a 3.0m clear width shared cycle and footpath along a raised decking structure. The proposed boardwalk shall traverse the marsh to the south of the site at an elevated level of 4.00mOD, 950mm above the 1:100-year flood level of 3.05mOD along the route of the boardwalk. The proposed route of the boardwalk shall be routed in a southernly direction with resting areas at intervals. The extent of the boardwalk route is indicated on Engineering Drawing **C-0900.**

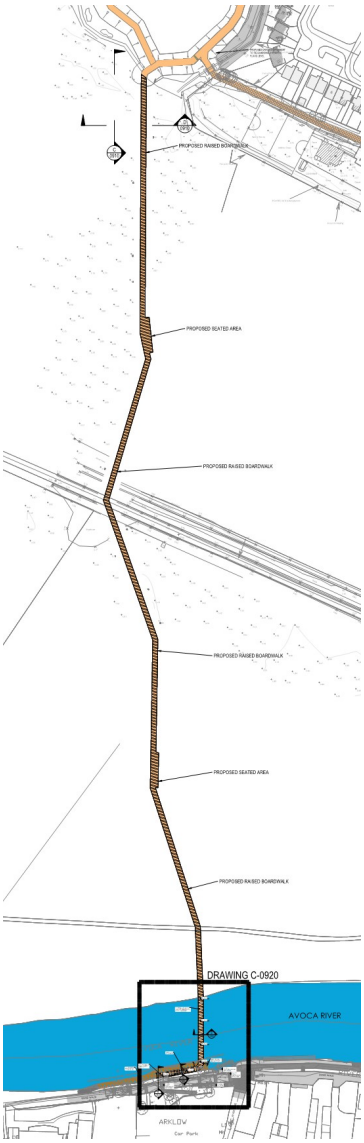


Figure 32 Extract from DOBA Engineering drawing C-0900 illustrating the Proposed Boardwalk Alignment traversing Southern Marsh.

11.7.2.1 OPW Flood Relief Scheme

Wicklow County Council have recently granted a Part 8 Planning Application from the Office of Public Works (OPW) which proposes to implement a flood relief scheme along the Avoca River including the construction of Flood Embankments to the North of the Avoca River, 'Dolphin Nose' column debris traps which will be located across the Avoca to intercept large debris floating towards the 'Nineteen Arches Bridge' to the east. The proposals of the flood relief scheme also include the rearrangement of the Southern bank of the River Avoca to include a 'Public Realm' which has been developed to be integrated into the flood relief scheme.

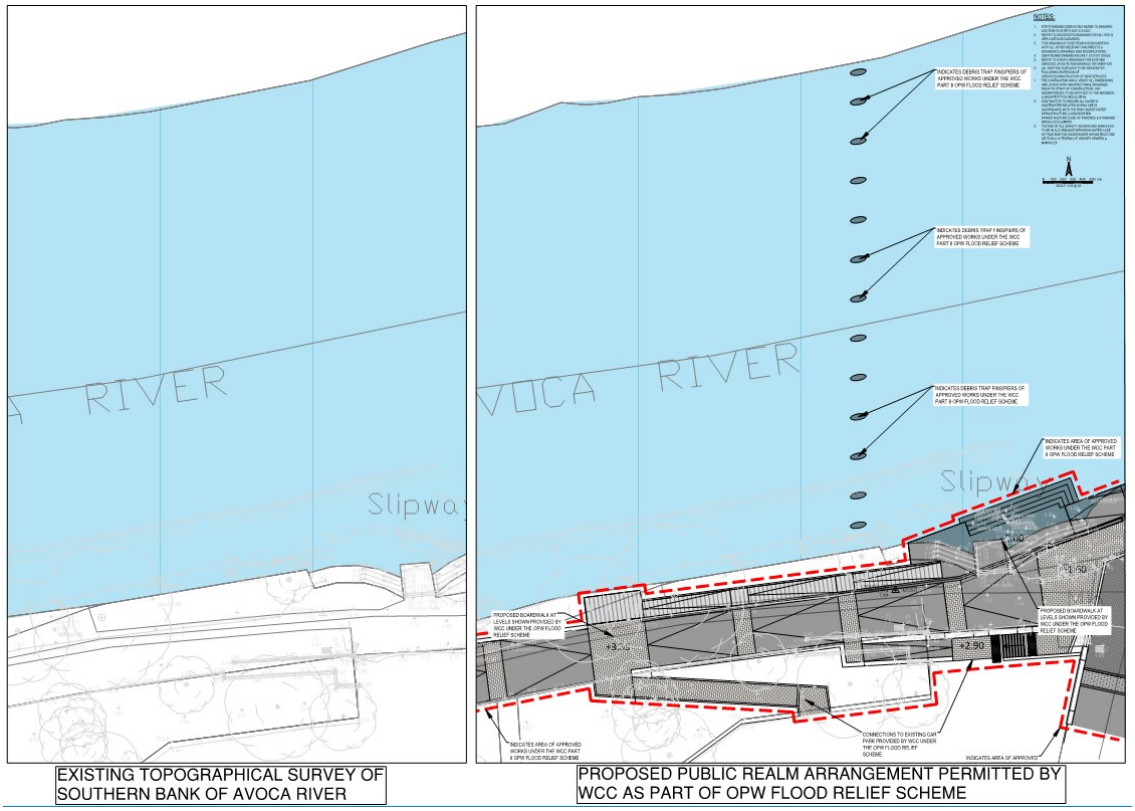


Figure 33 Extract from DOBA Engineering drawing C-0910 illustrating the Existing Southern Bank of the Avoca River vs The Proposed Arrangement to the Southern Bank of the Avoca River.

Following discussions and agreement with Wicklow County Council, it is proposed to utilise the previously permitted debris trap columns which form part of the OPW flood defence scheme to traverse the Avoca River to the south bank as a landing point, forming a pedestrian/cyclist 'bridge' like structure across the Avoca River. The proposal shall provide increased VRU permeability for the proposed masterplan site, adjacent developments and for the entire Kilbride & Ticknock area to Arklow town via the proposed boardwalk route. The landing point on the southern bank is adjacent to the existing public parking in Arklow town centre.

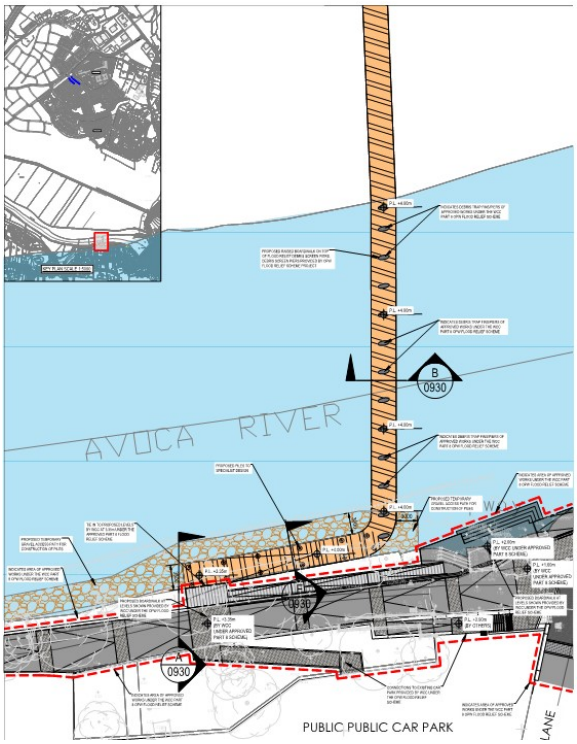


Figure 34 Extract from DOBA Engineering drawing C-0920 illustrating the Proposed Boardwalk Route crossing on the Permitted Debris Traps.

Figure 35 Image of Proposed Boardwalk Through Avoca Marsh (Source: NMP Landscape Architects)

12 Project Phasing

As part of the LRD Opinion received from Wicklow County Council, the applicant has been requested to identify the key infrastructural deliverable along with the phasing period to which they will be constructed. Given the extent of the project, along with the site's masterplan and the AAP3 lands, the outline phasing strategy for the delivery of necessary external infrastructural works shall be phased in accordance with table 2.

The tables below should be read in conjunction with figure 36 below and Section 4.5 of the Outline Construction Management Plan prepared by Donnachadh O'Brien & Associates Consulting Engineers and submitted as part of this application (2432-DOB-XX-SI-RP-C-0004).

Table 2 Outline Infrastructural Phasing Works

Infrastructural Upgrade	Commentary	Phasing/Delivery
Dublin Road / Beech Road Junction Improvement	Including signalisation and pedestrian improvement works	Phase 1
Realignment of L-6179 Road to north of site		Phase 1
Avondale Crescent VRU Links	These are already approved as part of the 84 unit scheme	Phase 1
Greenway Boardwalk across Marsh and Avoca River	The phasing of this will be dependent on the delivery of the debris trap columns and the riverside public realm works as part of the Arklow Flood Relief Scheme. Following consultation with WCC on the programme, these works are currently scheduled to be complete in Q3/ Q4 2028. It is therefore expected that this infrastructure can only be delivered in Q1/Q2 2029.	Phase 3 / 4 (subject to completion of OPW Arklow Flood Relief Scheme)
Uisce Eireann – Wastewater (based on advice in current Confirmation of Feasibility from UE)	PWSA currently in place between Lioncor & UE. Upgrade works are required for successful connection agreement.	Phase 1
Uisce Eireann – Water (based on advice in current Confirmation of Feasibility from UE)	(a) Network adjustments to valving arrangements/ DMA on the existing network (b) Upgrade of 300m of 6" AC main to 300mm diameter main along Monument Lane (c) Tie in 50mm uPC main in Ticknock Lane with approx. 130m of 150mm diameter main (d) Upgrade approx. 900m of 6" AC main to 300mm diameter pipe (across bridge)	Phases 1 & 2 Phase 1 Phase 2 Phase 4

Table 3 Outline Construction Phasing Works

Phase 1	
Enabling Works & Site Set Up	30 months for completion of first 265 units with associated infrastructure
Installation of the surface water outfall pipe and headwalls for both outfall locations	
Installation of Watermain Upgrade along Monument Lane and Installation of Connection to upgraded main.	
Installation of spine surface water sewers, wastewater	

sewers, water mains and surface water attenuation.	
Installation of Upgraded PWSA Wastewater sewers to the east of the site to the Dublin Road	
Construction of L6179 Road Alignment and modification works to the Beech Road and Dublin Road Junctions	
Construction of Phase 1 housing units	
Installation of Phase 1 roads, footpaths & cycle paths and shared surfaces	
Installation of Phase 1 hard and soft landscaping and permeability links including VRU Greenway link to Avondale Crescent.	
Phase 1A	
Site Set Up	18 months for completion of Neighbourhood Centre, 38 Apartment/ Duplex units with associated infrastructure
Installation of surface water sewers, wastewater sewers, water mains and surface water attenuation.	
Construction of Phase 1A Neighbourhood Centre and Apartment units	
Installation of Phase 1A roads and footpaths	
Installation of Phase 1A hard and soft landscaping and permeability links to adjacent phases	
Phase 2	
Installation of surface water sewers, wastewater sewers, water mains and surface water attenuation.	30 months for completion of second phase of 141 units with associated infrastructure & open space
Construction of Phase 2 housing units	
Installation of Phase 2 roads and footpaths	
Installation of Phase 2 hard and soft landscaping and permeability links to adjacent lands	
Upgrade of Watermain infrastructure in Ticknock Lane	
Phase 3	
Installation of surface water sewers, wastewater sewers, water mains and surface water attenuation.	20 months for completion of third phase of 139 units with associated infrastructure & open space
Construction of Phase 3 housing units	
Installation of Phase 3 roads and footpaths	
Installation of Phase 3 hard and soft landscaping and permeability links to adjacent lands	
Construction of the Boardwalk Greenway Link to Arklow Town	

Phase 4	
Installation of surface water sewers, wastewater sewers, water mains and surface water attenuation.	30 months for completion of second phase of 167 units with associated infrastructure & open space
Demolition of Existing Building and associated boundary walls and hardstanding to the north of the phase.	
Construction of Phase 4 housing units	
Installation of Phase 4 roads and footpaths	
Installation of Phase 4 hard and soft landscaping and permeability links to adjacent lands	
Upgrade works to approx. 900m Watermain to 19 arch bridge	

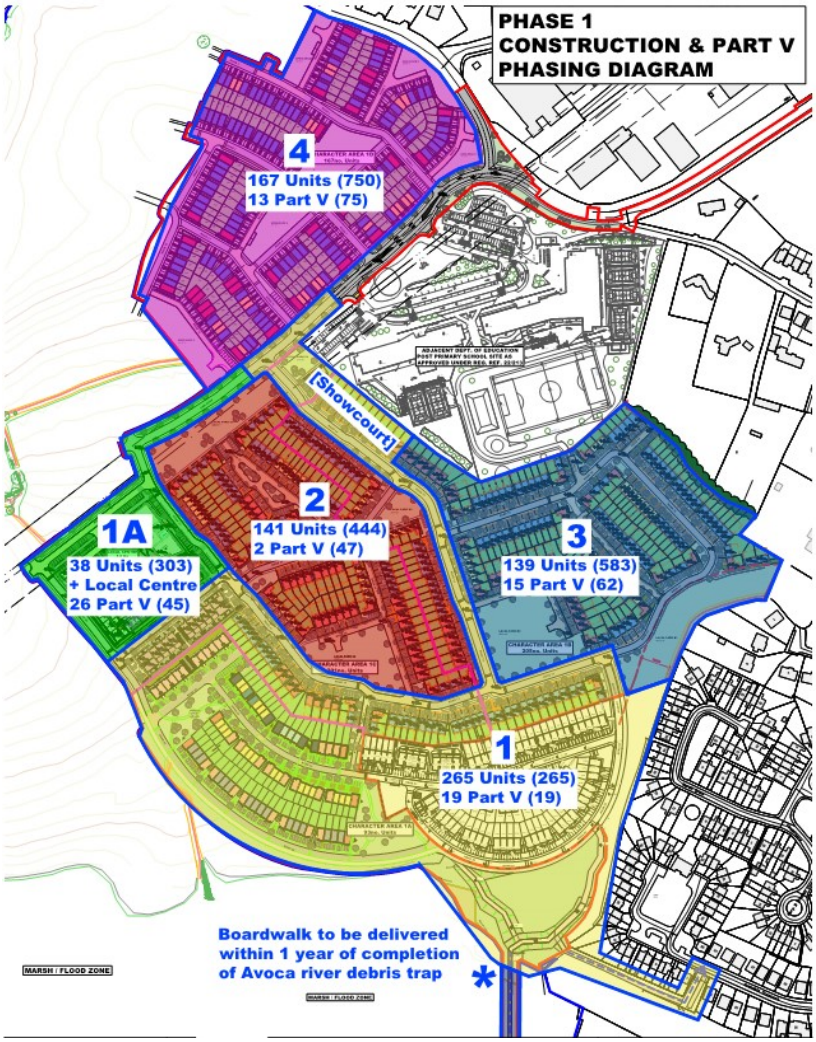


Figure 36: Preliminary Phasing Plan for 750 units