Project:

Large-scale Residential Development at Ross Road, Killarney, Co. Kerry

Report Title

Drainage Impact Assessment

Document Reference

24041-OSL-00-RP-C-0002

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1.0 INTRODUCTION

OSL Butler Consulting Engineers (OSL) has prepared this Drainage Impact Assessment on behalf of Homeland Projects Ltd., for a proposed Large-Scale Residential Development at Ross Road, Killarney, County Kerry on a circa 3.8-hectare site.

The site is located to the southwest of Killarney Town Centre, centred at grid reference E: 496243, N: 589941 (ITM) as highlighted in Figure 1 below.

Figure 1: Site Location (Site boundary shown indicatively)

The lands are bound to the north by Ross Road and then to the west, south and east by existing residential neighbourhoods (Castle Falls, Cahernane Meadows and King's Park).

To summarise, the proposed development will consist of a largescale residential development (LRD), comprising of 134no. residential dwellings as follows: 65no. houses consisting of 10no. 4-bed dwellings and 55no 3-bed dwellings; 51no. townhouses consisting of 32no. 3-bed units and 19no. 2-bed units; and 18no. apartments consisting of 12no. 2-bed units and 6no. 1-bed units.

The proposed development also includes crèche (585sqm) with capacity to accommodate 102no. children, and all ancillary site development works including 2no. vehicular and pedestrian accesses onto the Ross Road.

Access to the proposed development will be via a proposed vehicular and pedestrian access to the existing Ross Road.

2.0 SITE TOPOGRAPHY

Within the subject lands, ground levels predominantly fall in a northerly direction across the site from circa 26.25m OD along the southern site boundary to the northern boundary at an elevation of approximately 22.22m OD.

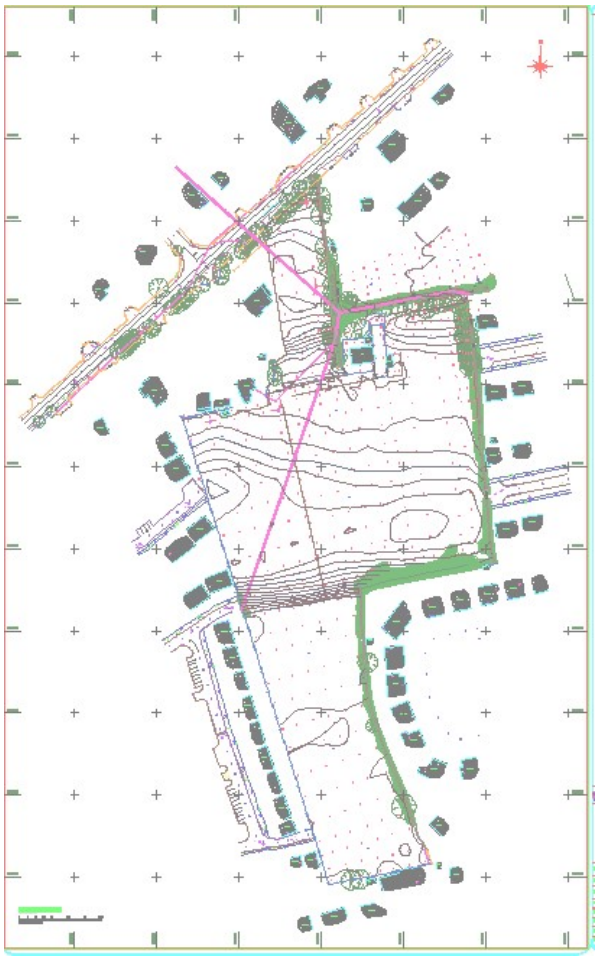

Figure 2: Site Topography

3.0 PROPOSED DEVELOPMENT

As mentioned previously, Homeland Projects Ltd. intend to apply for planning permission for a proposed residential development at Ross Road, Killarney, County Kerry on a circa 3.8-hectare site.

There is no formal surface water network within the subject lands. There is an existing 300mm diameter surface water sewer to the north of the site, within Ross Road. This surface water sewer drains westward and eventually discharges into Lough Leane.

Figure 3: Proposed Site Layout

4.0 PRINCIPLE DESIGN CONSIDERATIONS

During the design of the surface water drainage for the proposed site, including SuDS, the following key documents/standards were taken into consideration.

- Kerry County Council Development Plan 2022 - 2028
- Department of Environment and Local Government - Recommendations for Site Development Works for Housing Areas (1998)
- GDSDS - Regional Drainage Policies - Volume 2 - New Development (2005)
- IS EN 752:2008 - Drain and Sewer Systems Outside Buildings
- Building Regulations (2005) - Section H - Drainage and Wastewater Disposal
- CIRIA documents C753 (The SuDS Manual, 2015), C697 and C609

5.0 SURFACE WATER DESIGN OVERVIEW

The proposed surface water system has been designed to cater for all surface water runoff from all hardstanding surfaces within the proposed development, including roads, footpaths, roofs, parking areas etc.

It is proposed to use a Sustainable Urban Drainage System (SuDS) approach to stormwater management throughout the site where possible.

All surface water generated within the proposed development will flow via gravity through the proposed surface water network including; petrol interceptors, swales, tree pits, permeable pavers, cellular attenuation systems and detention basins. The proposed SuDS features will reduce the runoff volume through evaporation, transpiration, infiltration and depression storage of the water within each system.

The proposed development catchment has been subdivided into 6 sub-catchments. A diagram, Figure 2, has been included below to illustrate the surface water network catchment locations, flow routes, attenuation features and controls.

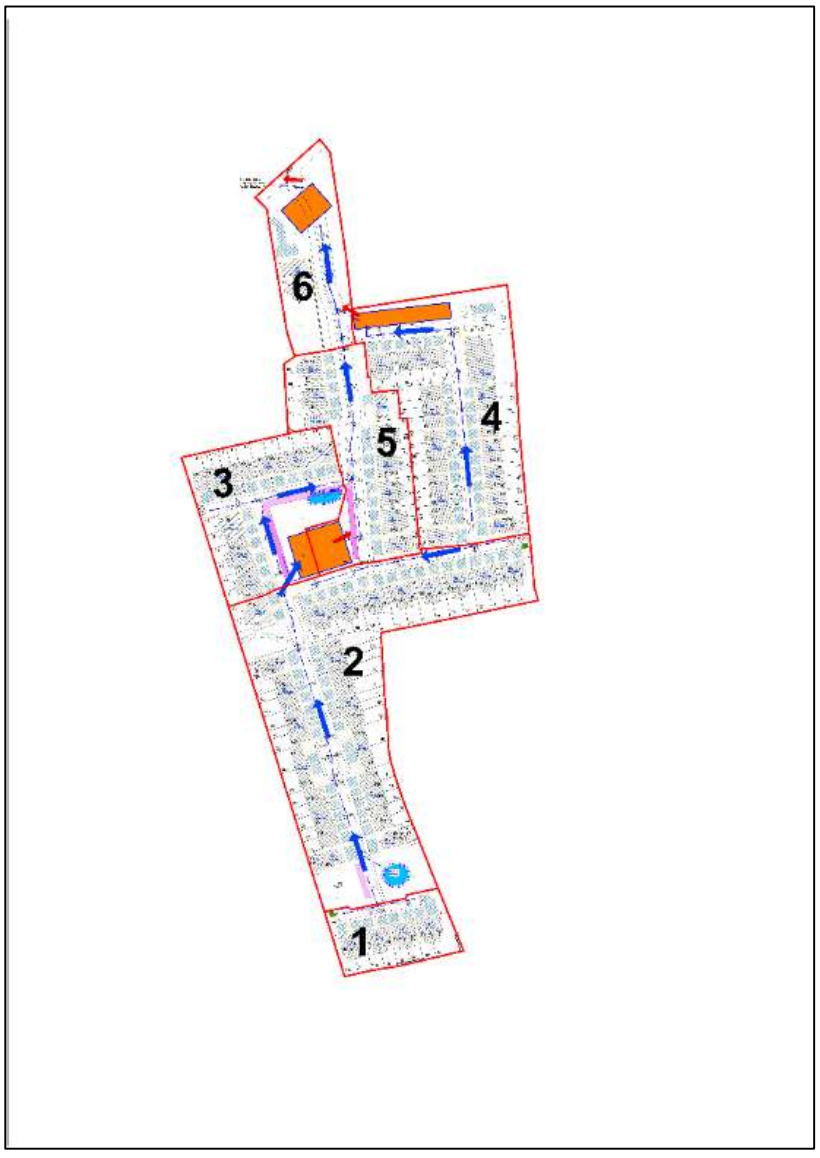

Figure 4: Surface Water Catchments

$QBAR_{rural}$, which is the mean annual flood flow from a rural catchment, was calculated by means of the IH124 method as per GDSDS section 6.6.1. The permissible site discharge for the development ($QBAR_{rural}$) was calculated as 17,7 l/s.

The surface water network was assessed for the 5, 30- and 100-year return periods (+20% climate change) where no flooding from manholes was encountered. The surface water network has been designed for the 5-year return period and assessed for the critical storm to minimise the risk of flooding.

Freeboard of 500mm has been provided for in the design between top of water level during a 100 year (+20% Climate Change allowance) event and the proposed building floor levels.

This surface water system has been hydraulically modelled in InfoDrainage to ensure that the overall discharge at the end of the hydraulic system (i.e. the outlets to the existing surface water network) is at, or below, the greenfield runoff rate.

The InfoDrainage Simulation uses the Wallingford Procedure, time/area full hydrograph methodology, including energy and momentum equations for dynamic analysis of surface water networks.

The site drainage network is modelled as one system where all flows, capacities, water levels, surcharged manholes etc are determined throughout the network for each critical storm duration. Therefore, the final combined discharge rate to the existing sewer from the outlet will be kept at (or below) the total permissible discharge rate defined above

It is proposed to service the proposed development by means of a connection to the existing 300mm diameter surface water pipe to the north.

6.0 SUSTAINABLE DRAINAGE STRATEGY

6.1 PROPOSED SUSTAINABLE URBAN DRAINAGE (SUDS) STRATEGY

For the proposed development, a 'SuDS Triangle' was utilised to ensure all three functions are provided for within the Suds Strategy.

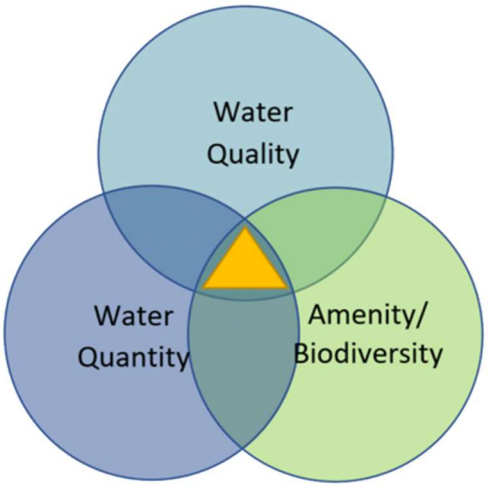

Figure 5: The SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural process by;

- Encouraging infiltration (where appropriate) and attenuating peak flows,
- Improving water quality by providing treatment to surface water prior to discharge
- Providing habitat and function where possible for those using the area (including wildlife)

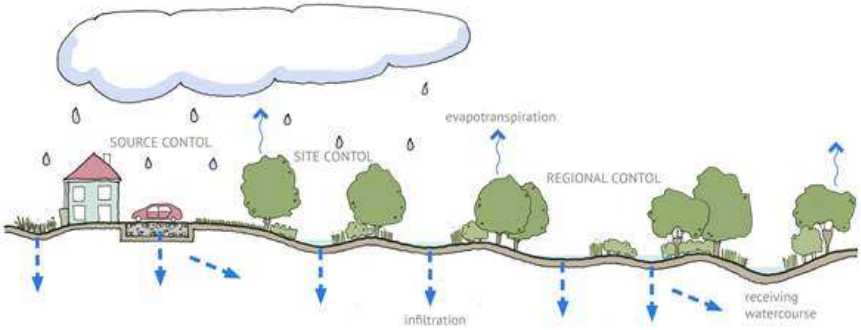

Figure 6: SuDS Treatment Train

The principles of a SuDS Treatment Train were used during the design of the surface water drainage system. The treatment train, as illustrated in the image above, provides an understanding of prevention and source control to reduce surface water run off from the site and improve water quality.

Criterion 1: River Water Quality Protection

Satisfied by providing surface water attenuation tanks and treatment of surface water run off by SuDS features such as full/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volumes.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information relating to the site's proximity to tidal and fluvial flood plains. Please refer to the Site Specific Flood Risk Assessment submitted as part of this Planning Application.

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains. Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was conducted using the facility on the website of Irishsuds.ie (Guidance and Tools).

The preliminary analysis indicated that the following techniques were possibly suitable Attenuation Tanks, Basins, Permeable Paving, Soakaways, Swales and Rainwater Harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

6.2 SUDS APPRAISAL

It is proposed to use a Sustainable Urban Drainage System (SuDS) approach to stormwater management throughout the site where possible.

The overall strategy aims to provide an effective system to mitigate the adverse effects of urban stormwater runoff on the environment by reducing runoff rates, volumes and frequency, reducing pollutant concentrations in stormwater, contributing to amenity, aesthetics and biodiversity enhancement and allow for the maximum collection of rainwater for re-use where possible. In addition, SuDS features aim to replicate the natural characteristics of rainfall runoff for any site by providing control of run-off at source and this has been achieved by the current proposals.

SuDS are a requirement under the 'Regional Code of Practice for Drainage Works' and 'The Greater Dublin Strategic Drainage Study'. Additionally, these systems are recommended under the 2009 guidelines, 'The Planning System and Flood Risk Management'.

A number of SuDS features are proposed as part of this development. These have been designed in accordance with CIRIA documents C753, C697 and C609 as follows:

- **Petrol Interceptors:** A proprietary oil/water separator which prevents hazardous chemical and petroleum products from entering watercourses and public sewers. It is proposed to provide a petrol interceptor upstream of the attenuation tanks to ensure that any remaining hydro-carbons or pollutants within the runoff from trafficked areas are treated prior to outfall to the existing watercourse.

In conclusion the water quality from this catchment should be of a high quality due to the abovementioned measures, which are applied in a treatment train to treat the water before discharge at a restricted rate to the local network. The above measures ensure a suitable management train is provided.

- **Swales:** Broad, shallow drainage channels covered in grass which can treat, convey and attenuate runoff, at source, and can infiltrate to the ground where the subgrade is suitable. Swales also can promote biodiversity. The swales will allow for an element of infiltration but ultimately have a connection to the attenuation system. These are located adjacent to roads and shared surfaces.
- **Bioretention Raingardens:** Bioretention Raingardens employs an engineered topsoil and is used to manage polluted urban rainfall runoff in street locations and car parks. These features can contribute significantly to the urban scene and will be designed to meet urban design standards.
- **Tree Pits:** Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly.

  Tree pits are proposed to be in green space areas to treat and control runoff, while at the same time providing amenity value to adjacent pedestrian, and residential zones. It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows while high flows will discharge into the surface water network during extreme rainfall events. Rainwater gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.
- **Permeable Pavers:** Porous surfacing (paving block or open graded material) which can treat rainwater, at source, and allow infiltration through to an underlying porous subbase where water can be stored within the voids of the subbase before being slowly released to the drainage collection system through natural flow via the porous medium.

  Partial infiltration systems are proposed and includes a permeable geotextile at its base as well as an outlet to the surface water system. These systems will allow some form of storage for small rainfall events and will result in infiltration, water evaporation and adsorption in small quantities, therefore there will be less runoff from these areas in small rainfall events thus mimicking the natural response for this catchment. Permeable Pavers are proposed for the public car park areas (e.g. creche, amenity parking) as well as in private driveways.
- **Rainwater Harvesting:** In relation to rainwater harvesting, an option is to provide a rainwater butts at each individual dwelling. This could be located to the rear of each unit. This rainwater butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants. The intention would be that these are provided retrospectively by the homeowner.
- **Cellular Attenuation System:** Proprietary modular block or arch structure with a maintenance/inspection tunnel for providing underground surface water attenuation storage and can infiltrate run off to the ground where subgrade is suitable. The proposed attenuation system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site.

  The site has a number of the existing trees which are to be retained. This has reduced the amount of open space in the development, therefore careful consideration was required in the location of the attenuation systems. There are 3 Attenuation systems proposed throughout the proposed development, each responsible for managing designated sub-catchments within the larger development.

- **Basins, wetlands and ponds:** Basins, wetlands and ponds on any site allows safe and contained storage for excess rain and storm water as it allows for its release over time into the sewer system at a controlled rate. This removes much of the potential flooding risk caused by the inability for excess water to drain safely. Furthermore, basins, wetlands and ponds can treat, convey and attenuate runoff, at source, and can infiltrate to the ground where the subgrade is suitable. It can also promote biodiversity.

  It is proposed to incorporate detention basins in green spaces to compliment the SuDs strategy. These are vegetated depressions designed to store runoff on the surface and infiltrate it gradually into the ground. They are dry except in periods of heavy rainfall.

  The detention basins proposed will be located in green areas and will cater for some runoff from adjacent roadways but primarily the open spaces areas where they are situated. The surface water design includes for 2 no detention basins as an initial interception measure, prior to entering the main network, for surface water run off management of some of the sub-catchments within the larger development.

  In response to the local authority's concerns regarding the risk of drowning associated with detention basins, we confirm that the design has been undertaken with due regard to safety and risk mitigation, in accordance with the principles and best practices set out in the CIRIA SuDS Manual (C753). The design incorporates features that align with the guidance outlined in Section 36.5 of the manual, which emphasizes the importance of shallow side slopes (not steeper than 1 in 3), appropriate landscaping, controlled access where necessary, and clear visibility to deter unsafe behaviour. These measures ensure the detention basins are safe for all users while still fulfilling their function in surface water management.
- **Flow Control Device:** It is proposed to provide a flow control device at strategic locations within the sub-catchments (described above) to restrict the outflow of water from the subject site. The flow control devices will be fitted with a pull cord bypass and a penstock valve, installed on the inlet to the manhole for maintenance purposes.
- **Green / Sedum Roofs:** Green and Sedum roofs involve covering a roof of a building with vegetation laid over a drainage layer and a waterproofing membrane. They are designed to intercept and store rainwater and therefore, reduce surface water runoff. They are suited to the flat type of roof being proposed for the proposed apartment buildings. Sedum roofs have ecological and aesthetic benefits and remove pollutants from rainwater.
- **Raised Planters:** It is proposed, as part of the landscaping of the development, to install raised planters within the courtyard areas at the proposed apartment block units as an additional SuDS source control. This allows a small volume of water to be stored within the planter and integrated within the proposed surface water network of the development. The planter will have an overflow outlet pipe in times of storm events. The raised planters are to be installed as a SuDS measure that will have ecological and aesthetic benefits.
- **Existing Ditches, Trees and Hedgerows within the Site:** Within Site where possible, existing ditches, trees and hedgerows are to be maintained. Incorporating these existing drainage features into the proposed overall SuDS strategy would provide for greater storage volume capacity within the site and will assist in the conveyance and treatment of the generated surface water runoff. The retention of existing trees and hedgerows will also assist in the reduction of surface water runoff by evapotranspiration.

Surface water runoff will be treated by means of the measures discussed above prior to entering the below ground attenuation system. A manhole with a 450mm deep sump will be provided to intercept and trap silt/sediment, located upstream of each of the attenuation tanks and attenuation basin.

The proposed SuDS features will reduce the runoff volume through evaporation, transpiration, infiltration and depression storage of the water within each system.

6.3 MANAGEMENT TRAIN

The management train commences with source control through the provision of permeable paving where possible and rain-water butts in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pits will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors and swales in open areas which provide a degree of treatment before discharging to the attenuation system.

The attenuation tanks offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

6.4 SURFACE WATER SYSTEM

The existing 300mm diameter surface water pipe located within Ross Road has been chosen as the suitable surface water discharge point for the proposed development.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site through the use of attenuation facilities.

Control of runoff by means of attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting a flood storage attenuation tank along with restricted outlets as the control devise.

The storage volume required has been designed by means of hydraulic modelling using in the computer aided design package, InfoDrainage.

The attenuation strategy for the site is for the detention of flows in interlinked attenuation tanks. Figure 5 below provides a schematic of the flow and control routes through the catchments.

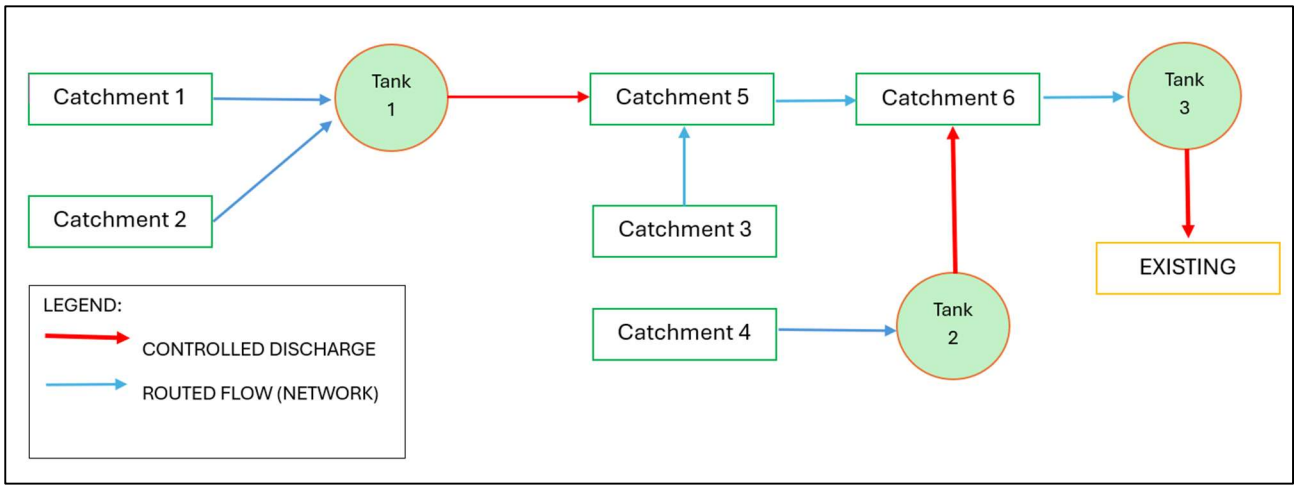

Figure 7: Surface Water Flow and Control Schematic

6.5 SURFACE WATER DRAINAGE NETWORK

Surface water sewers are designed in InfoDrainage using the Modified Rational Method. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

6.6 DESIGN CRITERIA

Surface water sewers are designed in InfoDrainage using the Modified Rational Method. The return period for sizing pipes was based on the following:

- Department of Environment and Local Government - Recommendations for Site Development Works for Housing Areas (1998), Table 3.1.
- GDSDS - Regional Drainage Policies - Volume 2 - New Development (2005), Section 6.5;
- IS EN 752:2008 - Drain and Sewer Systems Outside Buildings, Table 2
- Building Regulations (2005) - Section H - Drainage and Wastewater Disposal, Section 1.5.7.

The following parameters applied for the design;

- Return Period for pipe work 5 year (+20% climate change)
- Return Period for Attenuation design 100 year (+20% climate change)
- SOIL Type and Soil Value 2, 0.30
- Allowable Discharge 17.7 I/s
- Time of Entry 5 minutes
- Ratio R 0.242
- M5-60 21.40 mm
- Pipe Friction Ks 0.6mm (Concrete), 0.15mm (uPVC)
- Minimum velocity 0.75m/s
- Maximum velocity 3.0m/s
- Roofs - Type 1 (Draining to traditional gullies) 1.00
- Roads and Footpaths - Type 1 (Draining to traditional gullies) 0.80
- Road and Footpaths – Type 2 (Draining to SuDS features) 0.70

6.7 STORM WATER OUTFALL

Surface Water from the proposed development shall discharge into the existing 300mm diameter surface water pipe to the north. This existing pipe eventually discharges into Lough Leane to the west.

A series of flow control devices withing the development will regulate/control the discharge in order to ensure that the amount of water discharging to the existing network and subsequent waterbodies are kept at QBARRURAL (Greenfield Runoff Rate).

All on site surface water attenuation facilities have been sized to cater for all storm water generated within the site boundary of the development.

6.8 SUDS CALCULATIONS

This report should be read in conjunction with the Engineering Services Report, 24041-OSL-00-RP-C-0002, submitted under separate cover as part of the application. Calculations of the various SuDS elements proposed are contained in the aforementioned Engineering Services Report. Attenuation Tank Sizes and Petrol Interceptor Sizing/Specifications

have been included as part of the Stormwater Network Design in this report. The nature-based SuDS principles proposed will have a positive impact from a sustainable impact. Despite this the volumetric capacity of the attenuation system has included the runoff from these areas in its calculations as a design contingency.

7.0 EXISTING SITE HYDROLOGY

A review of Historical Ordinance Survey Ireland information (www.osi.ie) was conducted to determine if the OSI 6- inch Maps indicated historic water courses / surface water features within the site.

The maps indicate existing watercourses to the north (Deenagh, EPA Code 22D01), to the west (Folies Stream, EPA Code 22F10) and to the south (Flesk [Kerry], EPA Code 22F02) of the subject site. Lough Leane is located approximately 1.5km to the west and south of the subject site. These waterbodies are the main hydrological features in close proximity to the site.

There is no formal surface water network within the subject lands. There is an existing 300mm diameter surface water sewer to the north of the site, within Ross Road. This surface water sewer drains westward and eventually discharges into Lough Leane.

Figure 8 below illustrates the main hydrological features associated with the area in the vicinity of the site.

Figure 8: Existing Site Hydrology

8.0 FLOOD & EXCEEDANCE FLOWS

OSL commissioned the services of IE Consulting, on behalf of Homeland Projects Ltd., to undertake a Site Specific Flood Risk Assessment in support of planning application for the proposed development at Ross Road, Killarney, County Kerry.

The Site Specific Flood Risk Assessment, IE3115 Report 6479, has been included with this planning application under separate cover.

In summary, through considering the findings within the Site Specific Flood Risk Assessment and analysis, the following conclusions were made in respect of the development as proposed;

- A Site Specific Flood Risk (SSFRA) assessment, appropriate to the type and scale of development proposed, and in accordance with 'The Planning System and Flood Risk Management Guidelines – DoEHLG-2009' and the Killarney Town Development Plan (2022 –2028) has been undertaken.
- The proposed development site has been screened, scoped, and assessed for flood risk in accordance with the above guidelines.
- The primary potential flood risk to the proposed development site can be attributed to an extreme fluvial flood event in the River Flesk located 175m beyond the southern boundary of the proposed development site.
- The screening assessment undertaken as part of this SSFRA indicates that the site is not at risk of pluvial or groundwater flooding.
- A detailed Digital Terrain Model (DTM) has been developed for the area of the proposed development site.
- A detailed hydrological assessment and analysis has been undertaken in order to determine the 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) peak flood flows in the River Flesk at this location.
- A linked 1D-2D hydraulic model has been developed of the River Flesk utilising the Flood Modeller Pro software. The model has been developed utilising surveyed watercourse cross sectional data and LiDAR data for the area.
- The hydraulic model developed for this Site Specific Flood Risk has incorporated the proposed permitted single residential units (Planning Reference 23/60005) located within the northern portion of the proposed development site.
- The hydraulic model developed for this Site Specific Flood Risk Assessment is considered to provide an accurate and site specific delineation of the predictive 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood zone at the location of the proposed development site.
- A small limited portion in the northern area of the proposed development site falls within a predictive Flood Zone 'B'.
- The vast majority of the proposed development site, including the area of the proposed residential units and proposed crèche falls within Flood Zone 'C'.
- In order to ensure a sustainable development, and to ensure that the potential flood risk to the portion of the proposed access road that falls within the delineated predictive 0.1% AEP (1 in 1000 year - Flood Zone 'B') fluvial flood zone is mitigated to an acceptable level, it is proposed to raise the finished ground level of the proposed access road to a level of **23.50m OD** which will ensure that the maximum potential flood depth along this portion of the access road will not exceed 0.3m during the occurrence of an extreme 0.1% AEP (1 in 1000 year) fluvial flood event.
- Vehicular access to and egress from the proposed development site and the permitted single residential unit would not impeded during the occurrence of an extreme 0.1% AEP (1 in 1000 year) fluvial flood event.
- The development as proposed is considered to comply with the requirement of the 'Justification Test'

- As illustrated in *Figure 30* within the Site Specific Flood Risk Assessment, the finished ground floor level of the proposed residential units and the proposed crèche shall be constructed to a minimum level of 0.3m above the predictive 0.1% AEP fluvial flood level.
- In consideration of findings and output of the Site Specific Flood Risk Assessment, the potential flood risk to and from the development as proposed is considered to be LOW. The development as proposed is not predicted to result in an adverse impact to the existing hydrological regime of the area or increase flood risk elsewhere and is therefore considered to be appropriate from a flood risk perspective.

9.0 MAINTENANCE REGIMES FOR PROPOSED SUDS DEVICES

The SuDS features proposed above for the site will require the following maintenance:

Wet Swales

Requires regular inspection of inlets and outlets, vegetation, mulching and the removal of nuisance plants and rubbish as necessary. Trees and vegetation should be trimmed every 2 years. Swale surface should be spiked, scarified and removed of 'thatch' every 3 years with regular inspection of surface infiltration to avoid areas of ponding. Repair erosion at inlets and outlets and re-turf surfacing as required. Wet swales will be maintained from adjacent access roads.

Attenuation Tanks

Inspection of the attenuation tanks should be carried out monthly for the first 3 months and then annually to ensure tank is working correctly. Debris should be removed from the silt traps on an annual basis to ensure the tanks work correctly. The tank should be flushed out as per manufacturers guidance.

The maintenance of the tanks will be undertaken on a regular basis including:

- Inspection for blockage and slit build up
- Checking Manhole covers
- Inspect Inlets, outlets and flow control devices
- Jet out tanks on a regulation basis.

The tanks are all situated adjacent to the estate roads which allows the pump/ tanker trucks to site close to the individual tanks.

Please see attached engineering drawings showing the proposed access chambers that will be incorporated in the structure to all safe access to the tanks for them to be maintained.

Attenuation Basins

The basins will be a landscape depression that will be normally dry except during and immediately following storm events. They will be an offline component of the drainage network into which runoff is diverted once flows reach a specified threshold. It's proposed that the basin will be hard landscaped storage areas that will be also provide an amenity facility. The design of the basin will take account of the local landscaping and will only require marginal embankments. It will require an additional 150mm of topsoil for planning proposals. The bottom and side slopes of the basin will be prepared to ensure that they are structurally sound and grading will be uniform to the correct slope to ensure that water does not pond in depressions.

Tree Pits

Maintenance of trees will be greatest in the first few years., which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibility irrigation during long dry periods.

Filter Drains

Inspection of the system should be conducted monthly on the inlet / outlet pipework and any control systems for blockages. Inspection of pre-treatment systems including should be conducted every 6 months for catch pits manholes prior to the filter drain with removal of silt or other buildups. Removal of silt build-up may be required more frequent. Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network. Perforated pipework should be cleared of blockage if required.

Hydro Brake Manhole

Little maintenance is usually required for hydrobrakes as there are no moving parts. Hydrobrakes should be inspected for blockages monthly for the first 3 months and thereafter at 6 monthly intervals and hosed down if required. Hydrobrakes are fitted with a pivoting by pass door, which allows the manhole chamber to be drained should any blockages occur.

Hydrocarbon Interceptor

Hydrocarbon interceptors should be inspected for every rainfall event for 30 days after installation and the amount of sediment measured to give the operator an idea of the expected levels of deposition. Interceptors should then be inspected every 6 months to verify the appropriate level of maintenance. Any debris should be removed and the sump cleaned. Filter media should be replaced and sediments, oils and greases should be removed.

Permeable Paving

The permeable paving has a design life equivalent to standard block paving. The surface blocks require routine maintenance.

There are four levels of cleaning that can be conducted on a paved area:

- General dirt should be removed by regular dry brushing.
- Where the paving has become dull, showing a loss of colour, a wet wash with a stiff bristle brush and garden hose can be adequate.
- For more stubborn areas a power washer can be used, taking care not to remove the jointing materials (sand or mortar). The washer should be on a medium pressure setting or lower and should not be aimed directly at the paving surface, but at an angle of 30° approximately.

Cleaning detergents can be used; however, some detergents are acidic, and overuse can damage some paving products. It is advisable to follow the manufacturer's instructions and rinse the areas fully. The resulting runoff should be carefully channelled to either drainage points or containers from where it can be safely disposed. Replace any washed-out jointing sand with new dried sand once the paving has dried.

10.0 CONCLUSION

This Drainage Impact Assessment under the guidelines provided in the Kerry County Development Plan and its associated advice note, achieves the following outcomes to align with best practices in surface water management:

1. Integration of Nature-based Solutions
   Sustainable Urban Drainage Systems (SuDS): Demonstrate the use of SuDS to manage surface water on-site, prioritizing above-ground solutions such as swales, retention basins, rain gardens, permeable paving, and green roofs.
   Minimizing Hard Engineering: Reduce reliance on hard infrastructure like pipes and tanks by retaining and infiltrating rainwater through natural means.
2. Management of Surface Water Quantity and Quality
   Greenfield Runoff Rates: Ensure that discharge rates from the development are limited to greenfield runoff rates or lower.
   Pollutant Control: Incorporate measures for removing pollutants in compliance with the CIRIA SuDS Manual C753, ensuring water quality improvements before any discharge.
3. Alignment with Climate Change Adaptation
   Design for Climate Resilience: Factor in climate change by increasing rainfall intensities by 20%, ensuring the drainage systems remain effective under extreme weather conditions
4. Comprehensive Drainage Design
   Detailed Plans: Include full drainage details, drawings, and calculations to provide a clear understanding of the proposed surface water management system.
   Modelling and Analysis: Utilize computer modelling tools like InfoDraiange to simulate storm events and analyze discharge impacts on receiving water systems
5. Addressing Maintenance and Longevity
   Maintenance Plans: Develop a draft long-term maintenance plan that outlines responsibilities, required activities, and access provisions for all SuDS features.
   Sustainability in Practice: Ensure that the design of SuDS considers long-term functionality, access, and integration with surrounding green infrastructure
6. Compliance with Relevant Policies and Standards
   Alignment with the Kerry County Development Plan: Address the policy requirements set out in the Kerry County Council Development Plan 2022-2028.
   Avoid Direct Discharge: Prohibit direct discharge into watercourses without appropriate attenuation and treatment
7. Holistic Integration with Development Features
   Multifunctional Spaces: Integrate SuDS into green spaces, achieving the four pillars of SuDS (Water Quantity, Water Quality, Amenity, and Biodiversity).
   Phased Development Strategy: For phased projects, implement an overall drainage strategy in the initial phases to ensure seamless functionality as the site develops.

By adhering to these principles, the DIA ensures compliance with the regulatory requirements, minimizes flood risks, enhances environmental sustainability, and supports the broader goals of biodiversity and urban resilience. This approach not only aligns with Kerry County Council's guidance but also establishes a forward-thinking framework for managing surface water effectively.