Appendix 2-3 – Engineering Services Report (ESR)

TOBIN
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Bord na Móna

Drehid Waste Management Facility – Further Development

Engineering Services Report

DREHID WASTE MANAGEMENT FACILITY – FURTHER DEVELOPMENT

ENGINEERING SERVICES REPORT

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1.0 INTRODUCTION

Bord Na Móna is proposing to further develop its existing Drehid Waste Management Facility (WMF) at a site located in Killinagh Upper, Carbury, County Kildare. The proposed development comprises the construction of new waste treatment infrastructure to be co-located adjacent to the existing Drehid WMF and will utilise much of the existing infrastructure in place at the site. The description of the proposed development is set out in Section 2.0.

This Engineering Services Report (ESR) sets out the proposed infrastructure requirements to support the proposed development and the design considerations which underpin the proposed development. It has been prepared at the planning stage of the project to support the development of the planning stage design and to inform the full description of the development as set out in the Environmental Impact Assessment Report (EIAR).

1.1 Site Location

The Bord na Móna property, as outlined in blue in the Site Location Map (Drawing No.'s 11290-2001 & 2002), is located within the County Kildare townlands of Drehid, Ballynamullagh, Kilmurry, Mulgeeth, Mucklon, Timahoe East, Timahoe West, Coolcarrigan, Corduff, Coolearagh West, Allenwood North, Killinagh Upper, Killinagh Lower, Ballynakill Upper, Ballynakill Lower, Drummond, Kilkeaskin, Loughnacush, and Parsonstown. This landholding has a total area of 2,544 ha.

The application boundary, outlined by the red line in Drawing No.'s 11290-2001 & 2002, and which is defined as the area in which the application for development is being made and within which all activities associated with the proposed development will occur, is confined to the townlands of Timahoe West, Coolcarrigan, Killinagh Upper, Killinagh Lower, Drummond, Kilkeaskin, Loughnacush, and Parsonstown. The activities associated with the proposed development will be confined to a landbank of approx. 262 ha within the overall Bord na Móna landholding. This area incorporates both the proposed new infrastructure and the existing infrastructure, as the overall facility will have widespread overlap between new activities and existing activities.

The planning application boundary for the proposed development is approx. 2.6 km from the centre of the village of Derrinturn located to the north-west of the site and is approx. 1.7 km from Timahoe Crossroads located to the east.

The existing and operational waste management facility at Drehid is accessed from the R403 Regional Road via a dedicated entrance and private 4.8 km long access road. This entrance and road will also be used to access the proposed development from the public road network. The R403 runs north-west to south-east around the overall Bord na Móna landholding as shown in Drawing No. 11290-2000. The R403 joins with the R402 at Carbury to the north-west of the site and joins to the R407 in Clane to the east of the site. The R402 links Edenderry and Enfield connecting to the M4 Dublin to Sligo Motorway on the outskirts of Enfield. The R407 links Naas to Kilcock and also links to both the M4 and the M7 (Dublin to Limerick Motorway). The M4 is located approximately 9 km to the north of the proposed development and the M7 is located approximately 17 km to the south-east.

1.2 Topography

A topographical survey was carried out at the site in February 2016 by TOBIN and has been verified by additional surveys of the site carried out by Bord na Móna in 2022. The output of these surveys are presented in a topographical contour map included in the planning drawings (Drawing No. 11290-2004).

The topography across the overall Bord na Móna landholding is relatively flat ranging from 80 m above ordnance datum (AOD) to 90 m AOD. The existing landfill at the site is well screened from nearby roads by existing hedgerows and trees and is located a considerable distance from the main road network in each direction, i.e., >750 m north to the L5025, >2.1 km east to the L1019 and >2.4 km south and east to the R403. The separation distance is enhanced by the growth of bog willow and birch tree stands over several parts of the cutaway bogland and by dense hedge lines and commercial forestry to the east, south and west of the site.

The topography underlying the proposed development is flat and gently undulating, ranging from 82.0 m AOD to 86.5 m AOD. Existing vegetation provides significant screening from the general public and will be supplemented by additional planting as described in the EIAR. The proposed new landfill infrastructure will be remote from the surrounding road network; c. 1.0 km south from the L5025, c. 1.9 km west from the L1019 and c. 3.0 km east from the R403.

1.3 Existing Site Infrastructure

The existing waste management infrastructure comprises a non-hazardous waste landfill and a biowaste composting facility. In addition to the main waste infrastructure, the existing facility comprises a private site entrance, high-quality 4.8 km long access road from the R403, weighbridge, access control kiosk, administration building, car parking, maintenance building, domestic wastewater treatment system and surface water drainage network.

The existing facility includes a leachate storage and landfill gas utilisation compound located adjacent to Phase 9 of the existing landfill. The compound is used to collect leachate generated from within the existing landfill waste body and temporarily store it within two dedicated leachate storage tanks prior to collection and removal off-site by road tankers. Also located in this compound is a 5-megawatt (MW) landfill gas utilisation plant (LGUP) which takes landfill gas generated within the waste body and converts it into electricity which can be used at the facility or exported to the electrical grid. This compound also includes a dedicated ESB substation.

<u>Site Access</u>

Access to the proposed development will be via the existing permitted site entrance, located on the R403 Regional Road. The existing access comprises a T-Junction from the R403 to a dedicated entrance to the Drehid WMF. The facility entrance is clearly identified with stone walls and signage. The site access is controlled using metal gates and is monitored by security from the weighbridge kiosk.

From the entrance gate, access to the waste facility is via an existing 4.8 km two-lane private access road. This access road will only be used by vehicles travelling to and from the Drehid WMF, including the proposed development.

Members of the public are not permitted to access the facility. Visitors are required to stop at the weighbridge prior to entering the operational areas and are prevented from entry by the weighbridge operators unless authorised.

Site Security

Existing site security arrangements to prevent unauthorised access to the facility which will be maintained and expanded as part of the proposed development include:

- The existing entrance from the R403 Regional Road comprises a 2.4 m high stone wall with pillars and metal palisade fencing. The road entrance is secured with a 2.4 m high and 7 m wide rolling metal security gate which is closed outside of normal operating hours. In addition, there is a cantilever barrier on the incoming lane to restrict access to the facility as required;
- The existing perimeter fencing comprises a post and chain link fence which surrounds the waste facility and includes an additional palisade security fence close to the weighbridge to prevent access to the facility;
- An existing CCTV system monitors the entrance gate from the R403 and is visible in real-time for operators at the weighbridge kiosk. Additional CCTV cameras are located throughout the existing facility and will be extended to include the new infrastructure; and
- Anti-intruder alarms are located in the facility buildings and will be extended to the new buildings.

A facility notice board is installed at the entrance gate specifying the opening times and contact details for facility personnel.

1.4 Existing Utilities

Electricity & Telecommunications

There is an existing overhead power line which connects from an onsite substation along the site access road to the distribution network on the R403. The alignment of this power line is shown on Drawing No. 11290-2015. Local electrical distribution throughout the site is underground. The site substation is located adjacent to the landfill gas utilisation plant (LGUP) and Phase 9 of the existing landfill.

Telecommunications (CCTV and internet) cabling across the site is also underground, typically running in ducts alongside the underground electrical cables. Internet connection across the site is also provided on a wireless network.

Surface Water Drainage

The Timahoe South Bog, within which the Drehid WMF has been developed, contains a network of drains which were constructed and maintained across the bog during historical peat harvesting to remove water from the production areas. Peat harvesting has ceased on the bog; however, the bog drains remain in place. This drainage network has been altered with the development of the Drehid WMF to divert the water in the bog drains around the waste facility.

Within the Drehid WMF, surface water is collected in a series of open swales and piped drainage. Surface water collected from the hardstand areas, building roofs and clean run-off from the landfill capping is diverted to four surface water lagoons, identified as SWL1, SWL2, SWL3 and SWL4. These lagoons provide storage of clean water, attenuate the flow from the site and allow for the removal of suspended solids in the collected run-off. Discharge from the lagoons is into a small Integrated Constructed Wetland (ICW) area before discharging into a central drain. This central drain discharges into a settlement pond developed as part of the historical bog drainage network and finally outfalling into the Cushaling River.

Foul Water Drainage

A foul water drainage network exists at the facility to manage domestic wastewater generated in the administration building, weighbridge kiosk and contractor facilities. Foul water is routed through a storage tank and a Purflo treatment system prior to collection in storage tanks located in the leachate storage compound. Here the domestic wastewater is blended with the landfill leachate and stored in the leachate storage tanks, prior to collection by a wastewater haulage company. The collected wastewater is transferred offsite to Irish Water operated wastewater treatment plants (WWTPs) or other suitably authorised facilities for treatment, as described in Section 2.2.5 of the EIAR.

Leachate Collection

Leachate generated in the existing landfill is collected in a network of collection pipes embedded in a drainage layer at the base of the engineered liner. The collection pipes are laid out in a herringbone formation to maximise leachate collection which is drained under gravity to a collection sump before being pumped out of the lined landfill body by a submersible pump. From here the leachate is pumped to raw leachate storage tanks located in a bunded area adjacent to the landfill gas management compound. This area is located adjacent to the completed Phase 9 of the existing landfill.

Leachate can be pumped independently from each of the leachate collection sumps and the quantity of leachate pumped as well as the depth of leachate in the cell are monitored automatically at the leachate headwall. This allows for more flexibility with respect to the management of the leachate on-site, particularly during the active life of the site. Some leachate is recirculated back into the waste body in a network of pipes located within the capping layer. The quantity of leachate recirculated varies depending on the time of year and the nature of the waste within the landfill. Recirculation helps to promote the generation of landfill gas and encourages the degradation of waste.

The leachate, combined with domestic wastewater as per ‘Foul Drainage Network’ above, is stored temporarily in two 200 m^3 glass reinforced plastic (GRP) tanks located within a bunded area. From here, the leachate is collected on a regular basis by a collection tanker and transferred off-site for treatment.

Leachate is also generated in the composting facility from the incoming organic wastes. This leachate is collected on the concrete floor of the building and drained to a storage tank within the building from where it is recirculated for use in controlling the moisture content of the waste in the composting tunnels. If required, excess leachate from the composting facility can be diverted to the raw leachate storage tanks and transferred off-site.

Landfill Gas Collection

Landfill gas is generated from the biodegradation of waste placed within the landfill. Vertical gas collection wells are installed as waste is placed in the landfill and are surrounded with suitable material to promote permeation of gas into the wells. Crushed glass is typically used for this purpose. An average depth of 1 m of crushed glass, or other similar material, is applied around the wells. The vertical wells are then connected to horizontal collector drains which take the gas out of the waste body and above the landfill capping.

A landfill gas ring main pipeline connects the gas wells to the landfill gas treatment plant in the landfill gas compound. Knock-out pots are installed at regular intervals to collect condensate from the saturated landfill gas. An extractor fan draws the landfill gas back to the landfill gas compound, where LGUP consisting of four engines, are powered by the gas to generate renewable electricity. The LGUP has a capacity to generate approx. 5.5 megawatts (MW) of which 4.99 MW is exported as renewable electricity to the national grid, with the remaining surplus used to power the infrastructure at the site and minimising the mains electricity supply consumed.

Excess or unsuitable landfill gas (referred to as sour gas) which cannot be utilised in the combustion plant is flared off as per standard practice at such installations. An upgraded landfill gas flare was installed at the facility in 2021/2022 to ensure optimum treatment of waste gas.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The development will consist of an extension of the existing Drehid WMF to provide for the acceptance of up to 440,000 TPA of non-hazardous waste material, comprising:

- Increase in acceptance of non-hazardous household, commercial & industrial and C&D waste at the existing landfill from the currently permitted disposal quantity of 120,000 TPA to 250,000 TPA until the permitted void space in the existing landfill is filled and no later than the currently permitted end date of 2028;
- Development of extended landfill footprint of approximately 35.75 ha to accommodate the landfilling of 250,000 TPA of non-hazardous household, commercial & industrial and C&D waste for a period of 25 years to commence once the existing landfill void space is filled. The new landfill will have a maximum height of approximately 32 m above ground level (115.75 m AOD);
- Provision, as part of the extended landfill infrastructure, for 30,000 TPA of contingency disposal capacity for non-hazardous waste, to be activated by the Planning Authority only as an emergency measure, for a period of 25 years;
- Development of a new Processing Facility, for the recovery of 70,000 TPA of inert soil & stones and C&D waste (rubble) and use of same for engineering and construction purposes within the site, including as engineering material in the landfill;
- Increase in acceptance of waste at the existing Composting Facility from 25,000 TPA to 35,000 TPA and removal of the restriction on the operating life of the Composting Facility contained in Condition 2(2) of ABP Ref. No. PL.09.212059;
- Extension to, and reconfiguration of, the existing Composting Facility to provide for a new MSW Processing and Composting Facility with an additional capacity of 55,000 TPA (giving a combined total for the MSW Processing and Composting Facility of 90,000 TPA), allowing for the combined facility to accept both MSW and other organic wastes;
- Construction of a new odour abatement system at the existing Composting Facility including two emissions stacks to a height of 17 m above ground level;
- Construction of a new odour abatement system as part of the new MSW Processing and Composting Facility including two emissions stacks to a height of 17 m above ground level;
- Development of a new Maintenance Building with staff welfare facility, office, storage and a laboratory;
- Installation of a new bunded fuel storage area to the rear of the new Processing Facility for the recovery of soil & stones and C&D waste (rubble);
- Construction of two new permanent surface water lagoons and one new construction stage surface water lagoon;
- Construction of a new integrated constructed wetland (ICW) area comprising five ponds;
- Car-parking provision for operational staff;
- Landscaping and screening berms; and

- All associated infrastructure and utility works necessary to facilitate the proposed development and the restoration of the facility following the cessation of waste acceptance.

Further discussion on the description set out above is provided in Section 2.2 of the EIAR.

2.1 Proposed Site Infrastructure Summary

The proposed development will comprise the construction of new waste treatment infrastructure at the site. This infrastructure is listed in Table 2-1.

Table 2-1 – Proposed new waste infrastructure

Facility Element	Type of Waste to be Accepted/Processed	Summary
Non-Hazardous Waste Landfill	• Non-hazardous soil & stones • Construction & Demolition (C&D) waste / rubble • C&D fines • Residual municipal solid waste (rMSW) • Incinerator bottom ash • Biostabilised organic fines	Construction of a new landfill footprint adjacent to the existing landfill with associated landfill gas and leachate collection infrastructure which will connect to existing utilities at the site.
MSW Processing and Composting Facility	• MSW • Organic waste	New facility will comprise an extension to the existing composting building to provide a combined facility for the treatment of MSW and composting of suitable organic waste. The proposal will include some reconfiguration internal to the existing composting building and new odour abatement infrastructure.
Soil & Stones and C&D Waste (Rubble) Processing Facility (Soils Processing Facility)	• Non-hazardous soil & stones • C&D rubble	This facility will be a new building for the processing and screening of the waste types listed prior to disposal, recovery or reuse within the site.

In addition to the main waste treatment infrastructure listed in Table 2-1, the following ancillary elements listed in Table 2-2 will be developed at the site.

Table 2-2 – Proposed ancillary infrastructure

Ancillary Elements
Maintenance Building including welfare and laboratory facilities
Fuel storage area
New access roads including additional lane along existing access road in advance of weighbridge

Staff car parking including electric vehicle charge points
Inspection/Quarantine area
Surface water drainage network including three new surface water lagoons (one for construction waters and two for stormwater and undercell groundwater.)
Foul water drainage network
Leachate/Process water infrastructure
Odour abatement system (as part of the MSW Processing and Composting Facility)
Integrated constructed wetland
Environmental screening berms
Contractor's Compound

A full list of the Planning Drawings submitted with the Planning Application is included in Appendix A.

2.2 Detail of the Proposed Site Infrastructure

This section provides further details on the infrastructure as set out in Table 2-1 and Table 2-2.

Non-Hazardous Waste Landfill

It is proposed to provide additional capacity for the landfilling of up to 290,000 TPA of non-hazardous wastes for disposal. In addition to this quantity, engineering materials are required during operations for the development of access ramps/roads, turning areas, tipping platforms, daily cover, intermediate/temporary/final cover and for installation around landfill gas collection wells. It is estimated that approximately 70,000 TPA of engineering materials will be required for this purpose. A further 30,000 TPA of contingency capacity will also be accommodated in the landfill – these waste quantities are described in detail in Chapter 2 (Description) of the EIAR. This further capacity will be provided by way of new landfill infrastructure at the location shown in Drawing No. 11290-2010.

The landfill has been designed with a void space capacity of 7,250,000 m^3 which provides a buffer capacity for variances in waste density and the potential utilisation of contingency capacity during the lifetime of the facility.

The proposed new landfill will have a maximum footprint of 35.75 ha. The maximum elevation of the landfill mound will be 115.75 m AOD at the peak of the landfill capping as shown on Drawing No. 11290-2070. The capping will be graded down in all directions from this peak height at a rate of 1:30 to join with the side slopes which will be constructed at a maximum grade of 1:3. Sections through the proposed landfill are shown in Drawing No.'s 11290-2031 and 11290-2032. Further detail on the design of the landfill is provided in Section 2.3 of the EIAR.

MSW Processing and Composting Facility

It is proposed to develop a new MSW Processing and Composting Facility at the site to cater for the acceptance of MSW material which has not been subject to any pre-treatment previously. This facility will be constructed as an extension to the existing Composting Facility and will utilise existing road access and utility infrastructure at this location. The new extension will have a processing capacity of 55,000 TPA giving the overall building a combined capacity of 90,000 TPA.

The new extension will have a footprint of 82.5 m x 101.5 m and will extend to the east of the existing composting building. The building will comprise a three bay steel structure with reinforced concrete walls and metal cladding and will have an identical appearance to the existing building. The new building will also have an odour abatement system constructed in a 'lean-to' structure on the southern façade of the building. This structure will have a footprint of 40 m x 17 m to accommodate two enclosed biofilters. Two new stacks will be installed to provide for dispersion of the treated air from withing the building. These stacks will be installed to a height of 17 m above ground level (100.35 m AOD) and will have an internal diameter of 1.1 m.

A new Technical Room will also be constructed on the southern façade of the new building as shown on Drawing No. 11290-2081, 2082 and 2083. This area will have a footprint of 34.5 m x 14.6 m with a 'lean-to' roof rising from 6.3 m at the eaves (89.65 m AOD) to 7.65 m at the ridge (91.0 m AOD). The building will comprise a steel frame with metal cladding to match the adjacent existing and proposed buildings. The Technical Room will house a fan and scrubber area, pump room, control room, electrical room and welfare facilities.

Soil & Stones and C&D Waste (Rubble) Processing Facility

A new processing building for inert soil & stones and C&D waste (rubble) (hereafter referred to as Soils Processing Building) will be constructed at the location as shown on Drawing No. 11290-2010. This building will be used for the acceptance, screening and temporary storage of waste soil & stones and C&D rubble prior to placement in the new landfill or use as engineering fill, where possible. The provision of this building will allow for a dedicated area to sort the incoming materials and to recover suitable materials which can be used in the landfill and the wider facility for engineering purposes, such as construction of roads, turning areas or tipping areas or for use as daily/intermediate/final capping.

This processing building will be constructed as a single-bay steel portal framed structure with reinforced concrete walls, metal cladding and will include roller shutter doors for ease of access for machinery. The building will be 7.6 m in height at the eaves (90.95 m AOD) and 12.5 m in height at the ridge (95.85 m AOD). The building will have a footprint of 27 m x 27 m with a concrete reinforced floor. Access will be via a 6 m wide door opening which extends the full height of the building to allow tipping trailers to offload material at the entrance. Plans, elevations and sections of the proposed structure are provided in Drawing No. 11290-2085.

Maintenance Building

A new Maintenance Building will be provided as part of the proposed development at the location as shown on Drawing No. 11290-2010. This building will provide critical facilities for the daily operation of the facility including a location for the maintenance and repair of site machinery, such as dozers, excavators and dump trucks. The new Maintenance Building will replace the existing maintenance building which itself will be used for additional operational storage.

The new Maintenance Building will be constructed as a single-bay steel portal framed structure with metal cladding and will include roller shutter doors for ease of access for machinery. The building will be 7.6 m in height at the eaves (90.95 m AOD) and 9 m in height at the ridge (93.95 m AOD) with a footprint of 27 m x 25 m. The building floor will comprise a reinforced concrete slab with a service pit for machinery works. The building will include secure areas for storage of power tools and other small plant and equipment commonly used at the facility. The building will be supplied by 3-phase electrical power, include both security and fire alarm systems and provide welfare facilities, canteen, office space, laboratory, first aid and storage. Plans, elevations and sections of the proposed structure are provided in Drawing No.'s 11290-2096 and 2097.

Fuel Storage Area

Adjacent to the new Soils Processing Building will be a new storage area for fuels used on site. This will comprise a 60,000 litre double walled two-chamber storage tank divided as 45,000 litre for diesel fuel used for site machinery and 15,000 litre for storage of kerosene fuel used for heating purposes in the administration building and welfare areas. Smaller quantities of oils (hydraulic, gear and engine oils) for servicing and maintenance of machinery will be stored within the Maintenance Building on bunded spill pallets.

In compliance with the Environmental Protection Agency's (EPA) *IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities* (June 2004), the double walled storage tank will be equipped with leak detection monitoring to identify any issues with the internal containment system.

This fuel storage will be located on a concrete hardstand area to the rear of the Soils Processing Building and filled into a mobile fuel bowser to transfer to site machinery. This hardstand area will drain to the surface water drainage network via the fuel/oil interceptor to ensure any leaks or spills during refuelling are contained and retained. The location and sizing of the fuel tank is shown on Drawing No. 11290-2085.

New Access Roads and Parking

A new incoming waste queuing lane will be created to allow for incoming heavy goods vehicles (HGVs) to safely queue while awaiting access onto the weighbridge. This queuing lane will have an overall length of c. 280 m and will allow for queuing of up to 15 no. HGVs. The queuing lane will be in addition to the existing two-lane road and will be constructed alongside the existing incoming lane as shown on Drawing No. 11290-2046.

New internal roads will be provided as shown on Drawing No. 11290-2045 to facilitate the safe and efficient movement of traffic within the development. A new road will be constructed on a phased basis around the perimeter of the new landfill footprint which will tie in with the perimeter road around the existing landfill.

Roads and parking areas will typically be designed as bituminous macadam pavements or, where appropriate, as concrete pavements. Impermeable concrete hardstanding will be used around the perimeter of the MSW Processing and Composting Building, Soils Processing Building, Maintenance Building and fuel storage area due to the nature of activities in these areas. Drainage from hardstand areas will be to the surface water drainage network via a Class 1 fuel/oil interceptor.

Surface Water Drainage Network

The surface water network has been designed to incorporate gravity flow, where feasible. The majority of surface water flow from the site originates from the landfill capping. This runoff is collected by the proposed swale network as shown on Drawing No. 11290-2014 and travels by gravity to the related surface water pumping station. Surface water runoff from all yard areas, buildings and impermeable hardstand areas will be collected via a network of pipes and channel drains as indicated on Drawing No. 11290-2014. This runoff will pass through a grit interceptor and Class 1 fuel/oil interceptor prior to reaching the pump station.

The surface water pump station will lift run-off from a sump into two surface water lagoons (referred to as SWL 5 and SWL 6) prior to discharge from the site via an Integrated Constructed Wetland (ICW). Further details on the surface water drainage network are set out in Section 6.0.

Foul Water Drainage Network

Potential sources of foul water from the proposed development are:

- Wastewater from sanitary facilities;
- Overflow water from the wheel wash;
- Leachate from MSW processing and compost facility; and
- Leachate from the new landfill.

Sanitary wastewater (i.e., wastewater from toilets, washing facilities, kitchens etc.) will be generated in the new Maintenance Building and technical room at the MSW Processing and Composting building. This wastewater will be collected and routed to a new primary treatment tank located adjacent to the new Soils Processing Building as shown on Drawing No. 11290-2014 prior to transfer to a wastewater storage tank in the leachate storage compound. The proposed foul drainage layout is shown on Drawing No. 11290-2014.

Leachate/process wastewater will be generated in the new landfill and MSW Processing and Composting Facility.

Further details on the foul water drainage network are provided in Section 7.0.

Odour Abatement System

As part of the proposed increase in waste intake at the existing compost facility, a new odour abatement system will be installed to treat air extracted by the building ventilation system and the process air exhausted from the composting process. This new odour abatement system will be located in a new 'lean-to' extension to the south of the existing compost building as shown on Drawing No. 11290-2081 and will include an acid scrubber and biofiltration system.

Similarly, the new MSW Processing and Composting building will incorporate a building ventilation system to control air within the building, maintain negative air pressure to prevent odour/dust release and to divert controlled air through an odour abatement system located on the southern façade of the building as shown on Drawing No. 11290-2081. This odour abatement system will comprise biofilters and acid scrubber which will be located in a separate technical room.

Integrated Constructed Wetland (ICW)

Outfall from the surface water lagoons will be diverted to an ICW area via drainage pipes as shown on Drawing No. 11290-2014. The ICW area will provide a further step in the treatment train to minimise suspended solids and ammonia loading in the managed waters. Discharge from the ICW will be to an existing bog drain adjacent to the engineered ponds. The indicative layout of the ICW area is shown in Drawing No. 11290-2064.

Further details on the development and construction of the ICW is described in the ICW reports in Appendix 2-4 of the EIAR.

Environmental Screening Berms

Excavated peat will be used to create an environmental screening berm on the perimeter of the landfill footprint as per the existing landfill. This will ensure reuse of excavated materials within the project and provide screening of the landfilling works. The berm will be 4 – 6 m in height and constructed on a phased basis with the development of the landfill at the location as shown on

Drawing No. 11290-2071. The berm will be planted with bands of native peatland tolerant woodland mix with remaining areas allowed to naturally revegetate over time.

Contractor's Compound

Due to the phased nature of the development of the landfill infrastructure which will occur over a 20 – 25-year period, there is a requirement for a dedicated contractor compound in close proximity to the new landfill. This area is shown in Drawing No. 11290-2010 and will be maintained for contractor facilities until the completion of construction activity. Utilities, water supply and foul waste drainage, will be extended to this area to allow contractors to connect into for the duration of construction activity. The contractor's compound is described further in the Construction Environmental Management Plan (CEMP) which is included as Appendix 2-5 to the EIAR.

2.3 Buildings Overview

The buildings to be constructed as part of the proposed development are:

- MSW Processing and Composting Building
- Maintenance Building
- Soil, Stones and C&D Waste (rubble) Processing Facility (hereafter referred to as Soils Processing Facility)

The locations of the above buildings are shown on Drawing No. 11290-2080, with details shown on Drawing No.'s 11290-2081 to 11290-2097.

2.3.1 Structural Form

The buildings are designed as steel portal frame structures, with a proprietary cladding, constructed on reinforced concrete floor slabs. This reflects the structural design of the existing Composting Building at the site and the cladding materials will be selected to match the existing building and maintain consistency in the design across the facility.

The building foundations are anticipated to be constructed using concrete pads on suitable bearing strata to support the steel columns as per the existing Composting Building. Further site investigations will be carried out at detailed design stage to confirm this approach.

The buildings will be constructed to the levels and details provided in the drawings accompanying the planning application.

2.3.2 Structure Heights

The MSW Processing and Composting Building will have a ridge (maximum) height of 12 m above ground level (AGL). Two new air emissions stacks to be constructed with the new building will extend to 17 m AGL to maximise dispersion of emissions. Similarly, two new stacks at 17 m in height will also extend from a new biofilter infrastructure to be installed at the existing compost plant.

The new Maintenance Building will have a ridge height of 9 m AGL, and the new Soils Processing Facility will have a ridge height of 12.5 m AGL.

For comparison, the proposed new landfill will have a maximum final capping elevation of 115.75 m AOD which will be approximately 32 m AGL. The existing landfill will have a final maximum capping elevation of 103.25 m AOD which is approximately 16 m AGL.

3.0 ROADS, PARKING & INSPECTION/QUARANTINE AREAS

3.1 Roads

Access to the proposed development is from the R403 Regional Road to the south-west of the Applicant's landholding, via a previously permitted private access road, as per Drawing No. 11290-2000. As part of the proposed development, additional roads will be constructed to gain access to the landfill and the new buildings. The traffic flow through the facility will remain largely as per existing with the introduction of new signage to direct vehicles to the relevant areas.

An additional lane will be provided on the existing access road in advance of the weighbridge for incoming traffic as shown on Drawing No. 11290-2046. This lane will act a queueing lane for incoming waste and will have an overall length of c. 280 m allowing for queueing of up to 15 no. HGVs.

New internal roads will be provided as shown on Drawing No. 11290-2045 to facilitate the safe and efficient movement of traffic within the development. A new road will be constructed on a phased basis around the perimeter of the new landfill footprint which will tie in with the perimeter road around the existing landfill.

Internal roads have been designed to cater for articulated truck movements using auto tracking software. Road signage is shown on 11290-2047 with indicative text for signage and locations of STOP signs.

Roads will be designed as bituminous macadam pavements or, where appropriate, as concrete pavements. Impermeable concrete hardstanding will be used around the perimeter of the MSW Processing and Composting Building, Soils Processing Building, Maintenance Building and fuel storage area due to the nature of activities in these areas. Cross falls and longitudinal falls will be provided to promote drainage of the surfaces. Drainage around most of the landfill footprint will comprise an open swale while the remaining, more heavily trafficked, sections of the perimeter road will drain to filter drains. Drainage around the new buildings will collect in gulley's and underground piped drainage will divert run-off to the surface water lagoons (SWLs). All collected run-off will discharge to the SWLs via a fuel/oil interceptor (Class 1 bypass type).

Road and pavement construction details are shown on Drawing No. 11290 – 2051 and further detailed design of the pavements will be undertaken prior to construction. Site investigation works carried out to date indicated that access roads can be founded on the subsoils below any peat deposits.

3.2 Car Parking

There are currently 23 no. parking spaces provided adjacent to the administration building including 1 no. disabled space and 4 no. spaces with electric charging facilities. It is proposed to provide an additional 22 no. parking spaces for Bord na Móna employees in a new car-park located to the rear of the Maintenance Building as shown on Drawing No. 11290-2010. Of these 22 no. new spaces, there will be 2 no. spaces for disabled users (3 no. in total at the facility) and 3 no. spaces with electric charging facilities (7 no. in total). The car parking area will comprise a bituminous macadam with drainage to gulley's. Edge restraints will be provided using an appropriate kerbing system and control on access to this car parking area will be installed.

Parking will also be provided for construction staff and HGVs in the construction compound. This area will have compacted gravel finish with drainage discharging to ground.

3.3 Inspection/Quarantine Areas

All hauliers bringing waste into the Drehid WMF are required to be pre-approved prior to arriving at the facility so that incoming waste composition is known in advance and checks at the weighbridge are carried out with maximum efficiency. Any unauthorised incoming waste hauliers or hauliers with incorrect waste transfer paperwork will not be permitted access to the facility and will be diverted to a dedicated quarantine area until the correct paperwork is provided or, where the haulier is not approved, to turn and exit the facility immediately. The quarantine area is located adjacent to the weighbridge as shown on Drawing No. 11290-2010.

This area will also serve as a temporary parking and inspection area where HGVs can be taken off-line from the incoming waste traffic as needed.

4.0 EARTHWORKS

The topography of the site is relatively flat, meaning that significant earthworks are not required for the construction of the buildings set out in Section 2.3 or for the build-up of roadways. Existing peat cover will need to be removed to achieve a suitable subgrade. Excavated peat will be used within the site to construct environmental screening berms to the east and south of the proposed landfill footprint as shown on Drawing No. 11290-2010. Road, yard and foundation build up will be constructed using engineering fill materials. Incoming C&D rubble and stones waste will be screened, tested and reclassified for use as engineering fill where the material can be shown to be suitable for its intended use. This will reduce the quantity of incoming fill material required for the roads, yards and foundation build up.

For the landfill construction, significant earthworks are required to excavate down to the design formation levels for the landfill basal liner as set out in Drawing No. 11290-2011. A material balance exercise has been carried out which estimates that 277,888 m^3 of peat will need to be excavated from the landfill footprint over the lifetime of the development of the facility, which equates to approximately 23,157 m^3 on average per landfill phase. This material will be deposited around the perimeter of the landfill footprint to form the environmental berms. The material balance exercise identified that c. 500,000 m^3 of peat is required to form the environmental screening berms to the extent as shown on Drawing No. 11290-2010 to a height of 4-6 m. The berms will be developed on a gradual basis using the peat as excavated across the development footprint.

Once peat has been removed, the subsoil material will be excavated to the required formation levels within each of the phases as shown on Drawing No. 11290-2011. As the subsoils are excavated from the floor of the landfill cells, it will be moved a short distance to form the embankments which rise from the cell floor above ground to provide a containment area. Site investigations carried out to date show that these subsoils will be suitable for use in the embankments and will be laid in lifts of no more than 0.5 m depth and compacted in place. The preparation of the subgrade to receive the basal lining system will be carried out in accordance with the guidelines set out in the EPA *Landfill Manuals – Landfill Site Design* (2000).

The material balance exercise estimates that 747,855 m^3 of subsoil material will need to be excavated to achieve the desired landfill formation levels and that 138,333 m^3 will be required to form the landfill embankments where these extend above the natural subsoil level. The excess subsoils excavated from the landfill footprint will be used within the development footprint for landfill capping and to form the desired pond infrastructure for the ICWs and SWLs.

Further peat deposits will be excavated for the construction of the ICW area as well as the three SWLs and the building infrastructure. This quantity of peat is calculated as 228,171 m^3 and will also be used in forming the environmental screening berms. Table 4-1 sets out the overall cut/fill balance of material for peat and subsoils across the entire development area.

Table 4-1 – Material balance for peat and subsoils

Material	Excavation Estimate (m^3)	Fill Estimate (m^3)
Peat	506,058	506,058 (for use in environmental screening berm)
Subsoils	747,855	281,985 (for use in embankment and liner fill in landfill, SWLs and ICW)
		465,870 (for use in capping works, daily/intermediate cover and landscaping)

The design levels for the landfill, buildings, yards, parking and roads have been designed to match with the existing ground levels as much as possible to reduce the scale of earthworks required. In the case of the landfill, environmental and operational constraints and subsurface conditions are dictating the formation levels required. All excavated materials will be reused within the development footprint to avoid removal of material from the site on the public road.

Proposed site levels are indicated on the relevant planning drawings and will be further defined at the detailed design stage.

5.0 WATER SUPPLY

To provide a supply to the new site infrastructure and activities, including the proposed Maintenance Building, laboratory facility, and welfare facilities, which are to be constructed as part of the proposed development, connection to the existing water supply at the Drehid WMF will be required.

Water supply at the Drehid WMF is currently provided from the following sources:

- Bottled water imported to the site;
- On-site groundwater borehole; and
- Recycled water from on-site SWLs.

5.1 Potable Water

Bottled water is imported into the site for use in water dispensers in offices and welfare facilities for drinking. This practice will continue under the new development as the on-site water sources do not comply with the *EU Drinking Water Regulations 2014*, as amended.

Drinking water supply to the facility will be increased or decreased as necessary with a stock of bottled water maintained on site at all times. Contractor's will be required to supply their own bottled water for their welfare facilities during times of construction activity.

5.2 Non-Potable Welfare Water

An on-site borehole located north of Phase 15 of the existing landfill is currently used to supply water in the existing buildings for non-potable uses as well as for cleaning, wash-down and dust suppression activities. This water supply is treated in a water treatment plant (WTP) located in the administration building to reduce iron, manganese and ammonia. Pump test data (compiled in 2003) indicates a yield of approximately 40 m^3/day from this groundwater supply borehole.

Groundwater supplied from the borehole will be used to supply non-potable water to the new welfare facilities provided under the proposed development as well as cleaning, wash-down and dust suppression at the new infrastructure locations. Water from the borehole is used to supply water for construction activities, including for the on-site / mobile batching of bentonite enhanced soil (BES), and a supply connection will be extended to the new contractor's compound for this purpose going forward. The Contractor will also be provided with access to this water supply for temporary welfare facilities established at the construction compound.

Records from the 2022 Annual Environmental Report (AER) for the facility show that 1,356 m^3 of groundwater was consumed in that year which is well within the available yield from the borehole. Construction of Phase 15 of the existing landfill was ongoing in 2022 which shows that the well has sufficient supply for combined operational and construction demand.

Water demand for non-potable welfare uses is calculated at <5 m^3/day for the proposed development using Uisce Éireann (formerly known as Irish Water) guidance[1]. Water supply from the on-site borehole to the required locations will be via 100 mm diameter pipe. New distribution mains pipework will be looped, as per best practice. However, where dead ends occur, they will terminate in duckfoot hydrants as set out in relevant guidance[2]. The calculations for non-potable welfare water demand are set out in Appendix B.

5.3 Firefighting Water

Firefighting water for the proposed development will be supplied primarily from the new and existing SWL's with back-up supply from the on-site borehole where required. The proposed new permanent SWL's (SWL 5 and SWL 6) will provide a storage volume of approximately 9,600 m^3, which is well in excess of the firefighting water demand of 1,800 m^3 required in accordance with the Guidelines as set out in Appendix B. The design allows for the proposed SWL's to be 'topped up' with water supplied from the on-site borehole in the event that extreme dry conditions reduce the volume of water in the ponds, which would be available for fire-fighting.

The fire-fighting water ring main will be extended as shown in Drawing No. 11290-2015 and will be charged by a suitable pumpset, altered or upgraded as required to ensure minimum required pressures are achieved. The ring main will be serviced by a number of hydrants which are shown at indicative locations on Drawing No. 11290-2015. The hydrants' locations and pressure requirements for fire main system will be subject to detailed design in accordance with the current *Technical Guidance Document B – Fire Safety* of the Building Regulations and other requirements of the EPA for waste treatment facilities in accordance with the requirements of an Industrial Emissions (IE) Licence.

The requirements of the Planning Authority in relation to fire safety and fire-fighting will be fully complied with in the Fire Safety Certificate Application for the site, which will be prepared

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[1] Uisce Éireann, *Code of Practice for Water Infrastructure – Connections and Developer Services Revision 2* (2020)
[2] Department of the Environment and Local Government, *Recommendations for Site Development Works for Housing Areas* (1998)

during the detailed design of the proposed development and in advance of construction commencement.

5.3.1 Fire Water Retention

Firewater generated as a result of fighting a fire at the facility will be managed in accordance with the EPA's *Guidance on Retention Requirements for Firewater Run-Off* (2019) and the requirements of the revised IE Licence which will be issued by the EPA. An existing *Fire Prevention and Response Plan* is in place for the existing facility and is included in Appendix 2-7 of the EIAR. This document will be updated as part of the new IE Licence for the facility.

Firewater, which has the potential to be contaminated, will be collected in the site surface water drainage system and retained in the surface water lagoons. The lagoons will be fitted with valves to ensure the outflow can be stopped and prevent any release downstream until the contents are sampled and tested to determine whether contaminants are present or not. As per Section 5.3, the proposed SWL's have a total capacity of 9,600 m^3 which can be utilised to retain potentially contaminated firewater.

Where sampling results indicate that the water is not suitable for discharge, it will be suctioned into tankers and removed off-site to a suitably licensed wastewater treatment plant or waste facility.

5.4 Process Water Requirements

The proposed development will have a process water demand for waste treatment in the new MSW Processing and Composting facility. Process water will be required to control moisture levels of waste in the composting tunnels which ensures the optimum conditions for biodegradation of the waste. The increased waste intake for composting in the existing composting facility will also require additional process water demand.

A preliminary design including a mass balance calculation has identified that the process water demand for the proposed development will be 30-35 m^3/day.

This water demand will be mainly supplied from the recirculation of leachate generated from the incoming and composting waste materials. This leachate will be collected in drainage infrastructure installed in the floor of the building and routed to a storage tank from where it can be recirculated into sprinklers, or similar system, within the compost tunnels. Where there is a deficit of process water supply from the recirculated leachate, water will be supplied from the SWL's meaning that no groundwater resource is required.

5.5 Other Water Requirements

Other water requirements which currently exist at the facility and for which demand is likely to increase slightly as a result of the proposed development are:

- Wash down and cleaning activities within the facility buildings;
- Replenishing wheel wash supply; and
- Dust suppression.

The estimated water demand for the above purposes will be 20-30 m^3/day, at peak demand for dust suppression, and will be supplied mainly from the SWL's with back-up supply from the on-site borehole where required.

6.0 SURFACE WATER

6.1 General

The topography of the site is relatively level and varies from approximately 82 m to 87 m AOD. There are several existing bog drains running through the site of the proposed development, as indicated on Drawing No. 11290-2005. As part of the proposed development, any drains crossing the proposed development footprint will be removed and water redirected to bog drains which will be retained around the perimeter of the infrastructure. As per Drawing No. 11290-2005, drain blocks will be installed where the bog drains approach the proposed landfill footprint, which will allow water in the drains to build up. A partial drain block at the perimeter of the development boundary will allow the rising water in the bog drain to overflow into cross drains which are being installed as part of the bog rehabilitation works, to divert water away from the proposed development. These cross drains are shown on Drawing No. 11290-2005 and described in more detail in Chapter 8 of the EIAR.

Surface water run-off from all yard areas, buildings and impermeable hardstand areas will be collected via a network of pipes and channel drains as indicated on Drawing No. 11290-2014. This storm run-off will pass through a fuel/oil interceptor prior to reaching two proposed new SWL's. Storm water will be stored in the SWL's through the use of actuated valves which will limit the outflow of storm water to the greenfield runoff rate of 113.39 l/s. The greenfield runoff rate was calculated using the QBar method and can be seen in Appendix C.

All clean surface water collected from the landfill, and its subsequent capping, will discharge to a surface water swale around the perimeter of the landfill embankment where it will flow by gravity to a pumping station and into the SWL's as shown on Drawing No. 11290-2014. There are two permeant SWL's (SWL 5 & SWL 6) which will attenuate surface water collected from all the proposed hard surfaced areas to be developed as part of this proposal. A third SWL (SWL 7) will be utilised for the attenuation of water from construction activities only and will be decommissioned on completion of construction activity at the site.

Surface water from the Waste Inspection/Quarantine Area, Contractors Yard and Car Parks will also be collected as indicated on Drawing No. 11290-2014. Similarly, surface run-off from the roofs and yards of the Maintenance Building and Soils, Processing Facility will be collected in drainage gulley's and diverted to the SWL's via the pumping station. Run-off from the yard around the Maintenance Building will have a dedicated fuel/oil interceptor given the nature of the maintenance and servicing activities to be carried out there.

It is proposed to re-use water in the SWL's for several purposes, namely;

- Supply of water for waste treatment processes (i.e., composting);
- Supply of water for firefighting requirements; and
- Supply of water for operational and maintenance requirements (washdown, dust suppression etc.).

The proposed surface water network, showing attenuation structures, pumping station, outfall locations, manhole locations, and direction of flow, is shown on Drawing No.' 11290–2014 and 11290-2016 to 11290-2024.

The surface water drainage network has been designed and simulated for a range of storm events (including 1 in 1, 1 in 30 and 1 in 100-year storm events) using the Network module of MicroDrainage. Refer to Appendix D for MicroDrainage Simulation Criteria and Results.

Appendix C contains calculations for the greenfield runoff rate.

6.2 Surface Water Design

Surface water drainage for the Proposed Development is designed using the recommendations of the Greater Dublin Strategic Drainage Strategy (GDSDS), EN752 and BS8301:1985, with the following parameters applied:

- Return period for pipe network 2 years
- Time of entry 4 minutes
- Pipe Friction (Ks) 0.6 mm
- Minimum Velocity 0.75 m/s
- M5 – 2D = 59.1
- M5-60 = 16.5 mm
- Ratio r (M5-60/M5-2D) = 0.279
- Climate Change 30% for rainfall intensities

6.3 Sustainable Urban Drainage

Kildare County Council (KCC) Water Services Department were consulted in relation to the Proposed Development. The reply from KCC is included in Appendix 1-3 of the EIAR and sets out the Councils desired approach and strategy as follows:

- *"Implement a SuDS strategy for the Proposed Development that seeks to reduce impermeable surface and hardstanding areas and shall consider rainwater recovery and reuse systems and green or blue roofs on any ancillary buildings in order to reduce the amount of rainfall runoff that discharges to the site drainage systems and adjoining watercourses."*
- *"Drainage design shall be in accordance with GDSDS and other recognised drainage design guidance and apply a 30% climate change factor."*
- *"Where feasible, nature-based SuDS solutions including constructed wetlands, retention ponds and bioretention areas for attenuation storage, road, path and car parking runoff shall discharge directly to bioretention swales and tree trenches or smaller tree pits and where rainwater recovery and reuse is not deemed feasible, any roof runoff shall discharge to rain gardens and planters."*

Implementing the design standards of the GDSDS and recommendations from KCC, the surface water drainage system utilises SuDS (sustainable urban drainage) devices where appropriate. The layout of the site has been designed to collect surface water runoff from hardstanding areas and roofs within the development and discharge to the SWL's within the boundary of the Proposed Development. From here, water will be available for use in the composting process, if required, or will outfall to the ICWs and subsequently the existing site drainage system at the appropriate Greenfield run off rates.

The principal behind SuDS is to reduce the quantity of discharge from developments to predevelopment flows and to improve the quality of run-off from Proposed Developments. In this case, it is proposed to decrease the quantity of run-off to Greenfield rates by providing attenuation in the SWL's and utilising some of the stored water in the processing of waste and general onsite operations. Calculations for the sizing of attenuation lagoons are provided in Appendix D, with lagoon details shown on Drawing No. 11290-2050.

Applying the GDSDS, in conjunction with site-specific rainfall data, an allowable outflow from the site of 113.39 l/s was calculated (See Appendix C). As discussed above, it is proposed to limit outflow from the site through the SWL's, controlled by way of actuated valves.

Bearing in mind the requirements of the GDSDS and in order to avoid flooding of the site, a storage volume for a 1 in 100-year storm event was decided upon with provision included for a climate change factor of 30%, as per the guidelines in the GDSDS and KCC. This determined a storage requirement of 9,600 m^3 for the site serviced by the new SWL's. This is achieved through the provision of 1 m of freeboard in the lagoons. The detailed calculations are contained in Appendix D.

As part of the Proposed Development, it is proposed to provide ICW ponds for further polishing of the surface water prior to discharge. These ICW's are located downstream of the SWL's as shown on Drawing No. 11290-2014 with details on Drawing No. 11290-2064. The design of the ICW's has been carried out by specialist designers, Vesi Environmental Ltd. They have prepared a separate planning stage Design Report and Operations Manual which are included as Appendix 2-4 to the EIAR.

6.4 Network Design

The surface water network has been designed to incorporate gravity flow, where feasible. The majority of surface water flow from the site originates from the landfill capping cover. This run-off is collected by the proposed swale network as shown on Drawing No. 11290-2014 and travels by gravity to the related surface water pumping station.

Given the relatively flat levels of the site, it is not possible to have a gravity flow from the site into the SWL's as an excessive amount of fill would be required to achieve site levels to allow gradients conducive to gravity only flow.

As a result, the system has been designed to collect all run-off into a gravity sewer and deliver it to a sump adjacent to the lagoons. A pump will then lift this surface water into the lagoons (see standard detail in Drawing No. 11290-2049). All outflows from the lagoons to the ICW, and from the ICW to the existing 'bog drains' will be achieved by gravity flow.

Appendix D contains calculations providing pipe sizes, cover levels, invert levels and gradients for the pipe network.

6.5 Summary

The surface water discharge system has been designed as follows:

- The SWL's/attenuation ponds will cater for the 1 in 100-year storm event (and include for process requirements and firefighting requirements);
- The SWL's/attenuation ponds will have a minimum free board of 1 m;
- Outflow will be at Greenfield runoff rates (113.39 l/s);
- The inlet surface water pumping stations will incorporate the following back up measures;
    - Duty & standby electric pumps; and
    - Diesel powered back-up pump, to provide for the eventuality that there is a power cut.

The quality of run-off from the Proposed Development is improved by the following measures:

- Run-off from hardstands and parking areas will pass through a fuel/oil interceptor prior to discharge. The interceptor(s) will retain any hydrocarbons in the run-off and thereby improve the quality of the runoff;
- The SWL's/attenuation ponds will also act as settlement lagoons to reduce the levels of suspended solids in the surface water; and

- The surface water will be diverted through ICW's for final polishing prior to discharge to site drainage system.

7.0 FOUL WATER

Potential sources of foul water in the proposed development are:

- Wastewater from sanitary facilities;
- Overflow water from the wheel wash;
- Composting process wastewater/leachate; and,
- Leachate from the new landfill.

The foul water system has been divided into two distinct networks;

- Sanitary wastewater system, which will collect effluent from welfare facilities within the proposed buildings and transfer to an existing wastewater storage tank for blending with landfill leachate and removal off-site; and
- Leachate system, which will collect leachate from the new landfill infrastructure and transfer to an existing leachate storage area for removal off-site.

Both of the above system networks are shown on Drawing No. 11290-2014 and Drawing No.'s 11290-2016 to 11290-2024. Details of the leachate collection system within the landfill are shown on Drawing No. 11290-2012.

Leachate will also be generated in the MSW Processing and Composting Facility and will be recirculated internally for use in moisture control of composting waste. In the event that excess leachate is generated in this process, the leachate will be diverted to the leachate storage tanks and blended with the landfill leachate for collection and removal off-site.

7.1 Sanitary Wastewater

Sanitary wastewater comprises effluent from toilets, washing facilities and kitchens and characterised as typical domestic effluent. Welfare facilities are proposed in the Maintenance Building and the Technical Building attached to the MSW Processing and Composting Facility as shown on Drawing No.'s 11290-2081 and 11290-2096. In addition, a connection for contractor's welfare facilities will be provided to the construction compound.

Effluent from these facilities will discharge into a gravity foul network as shown on Drawing No. 11290-2014 and be diverted to a primary treatment tank located in the yard area in front of the Soils Processing Facility. This primary treatment tank will facilitate the separation of solids from the wastewater which will be removed by tanker to a wastewater treatment facility as required. This solids sludge will be typical of domestic wastewater sludge and will be suitable for acceptance at either Uisce Éireann operated or privately operated WWTPs depending on available capacity. An example of a proprietary wastewater treatment tank is provided in Appendix E.

The remaining liquid effluent will overflow from the treatment tank to a foul water pump station (see standard detail in Drawing No. 11290-2048) from where it will be pumped via a rising main to an existing wastewater storage tank located in the leachate storage compound. Here the wastewater will be combined with similar sanitary wastewater generated from the existing office and welfare facilities at the site. From this storage tank, the sanitary wastewater will be blended with landfill leachate in the leachate storage tanks and held prior to collection by tanker and removal from the site.

Calculations for wastewater generation are included in Appendix F.

7.2 Leachate Wastewater

Leachate/process wastewater will be generated from the proposed new landfill infrastructure as well as from the new MSW Processing and Composting Facility. As noted previously, leachate generated in the MSW Processing and Composting facility will be recirculated for use within the building. As the moisture content of incoming waste to this building can vary, the availability of leachate from the incoming waste to be recirculated in the process will also vary. There may be a shortage of available leachate in which case water will be supplied from the SWL's as described in Section 5.4. Conversely, there may be an excess of leachate which will be diverted from the facility to the leachate storage tanks.

Leachate will be generated in the new landfill through the percolation of liquid, primarily rainwater, through the landfill. This percolated liquid will pick up suspended and soluble materials that originate from, or are products of, the waste placed within the engineered liner.

Leachate generated in the landfill will be collected via a network of collection pipework embedded in the basal liner of the landfill as per current arrangements at the site. The collection pipework is contained within an engineered drainage layer within perforated pipework allowing wastewater to be collected and transferred to a low point, or sump, within the landfill. This system is designed in accordance with the EPA *Landfill Design Manual*, and in such a way to prevent excessive leachate levels in the landfill. Level sensors submerged in the leachate activate pumps which pump leachate out of the waste body when the level reaches a designated height. Further details on the leachate collection infrastructure within the landfill are set out in Section 2.3.3 of the EIAR.

The pumped leachate is transported to the storage tanks located adjacent to the LGUP for temporary holding prior to removal from site by tanker. There are two existing glass reinforced plastic (GRP) tanks with a capacity of 200 m^3 each located in the leachate storage compound, and it is proposed to install a third tank at this location to provide additional capacity. Leachate collected and removed off-site will be transferred to an appropriately licensed WWTP for further treatment as per current arrangements at the facility.

8.0 CONSTRUCTION QUALITY ASSURANCE

In order to provide assurance that the proposed development is constructed in accordance with intended design and technical specifications, a comprehensive Construction Quality Assurance (CQA) Plan will be implemented during the construction phase. The CQA Plan will include Construction Quality Control (CQC) procedures to ensure that materials and workmanship meet defined specifications.

CQC procedures will include the integrity testing of all landfill lining systems, surface water, foul water, process water pipework and structures in accordance with industry accepted standards and procedures which will be set out in the CQA Plan. All integrity testing will be inspected and witnessed by a suitably qualified and experienced Bord na Móna Engineer, or appointed Consultant Engineer acting on their behalf. Integrity test certificates will be signed by both the Contractor's Engineer and the Engineer representing Bord na Móna.

Following the completion of construction and testing of each element of the proposed development and prior to the acceptance of waste, a CQA Validation Report will be prepared by a third party in compliance with good industry practice. The CQA Validation Report will be required to be submitted to the EPA to obtain approval for licensed facility activities, including placement of waste in the landfill.

9.0 ANCILLARY SERVICES

Following a successful grant of permission for the development, Bord na Móna will engage with the ESB to plan the undergrounding of a section of the existing overhead power line which runs through the footprint of the proposed infrastructure. This overhead line will be replaced by an underground cable installed in ducting laid within the proposed internal roadways as shown on Drawing No. 11290-2015. Standard details for ducting installation in the roadways are shown on Drawing No. 11290-2054 and will be agreed with the ESB in advance of construction. Disconnection of the existing supply and rerouting in the underground ducting will be carried out by the ESB, or contractors appointed on their behalf. All works will be carried out under approval from the ESB.

It is envisaged that electrical distribution to the landfill and new buildings will be by means of a 10/20 kV medium voltage network supplied from the existing on-site substation. Additional upgrade works may be required to facilitate the new connections including additional panels in the substation and electrical kiosks as shown on the utility's layouts on Drawing No.'s 11290-2016 to 11290-2024.

Provisional lighting design layouts are also shown on the above referred drawings and ecological considerations factored into the lighting design are set out in Appendix 6-3 of the EIAR.

10.0 SUSTAINABILITY

Sustainability principles have been considered and factored into each element of the design of the Proposed Development. The siting and position of the proposed infrastructure has been optimised to utilise the existing physical infrastructure and utilities in place at the facility. Existing leachate storage and landfill gas treatment facilities in place adjacent to the existing landfill will be connected to the new landfill which will eliminate the need for new infrastructure and retain the existing functioning system for the lifetime of the facility. As noted previously, the existing landfill is anticipated to reach its maximum void capacity by 2026 after which landfill gas and leachate generation will start to decrease. By connecting the proposed landfill extension into the existing treatment compound, the effectiveness and efficiency of the installed equipment can be retained, without having to downsize or take equipment out of service. A new leachate storage tank will be installed in the compound within an existing bunded area to provide additional storage capacity which will be required until the leachate generation passes peak generation rates.

The existing electrical substation and distribution network will be utilised as much as possible to prevent building new structures or unnecessary connections. The new MSW Processing and Composting Facility is proposed as an extension to the existing Composting Building to maximise the efficiency between the two waste processing areas, extend existing utilities and control air movement within a single structure. This approach reduces the consumption of resources to build entirely new structures and reduces the land take at the site.

A number of other measures have been incorporated to reduce resource consumption, maximise efficiency and limit the environmental footprint of the Proposed Development.

10.1 Sustainable Urban Drainage (SuDs)

The principals of SuDs, as set down by the GDSDS, have been implemented in the design of this facility and specific reference should be made to Section 6 of this Report.

The following specific measures have been incorporated into the design which will reduce the quantity of run-off produced, control the rate of run-off and improve the quality of run-off:

- Provision of permeable tracks and access ways where suitable to promote natural infiltration to ground;
- Attenuation of storm water run-off (1 in 100-year storm event) and discharge at Greenfield runoff rates (controlled by a flow-controlled device);
- Reuse of attenuated storm water for:
  - Firefighting requirements;
  - Process water requirements; and
  - Operational requirements.
- Managed surface water will pass through fuel/oil interceptors to prevent release of hydrocarbons from the site; and
- Attenuation of surface water in the SWL's will reduce sediment loading on the discharge, while the ICWs will further reduce sediments as well as ammonia levels in the managed water.

10.2 Utilisation of Landfill Gas

As per existing conditions at the Drehid WMF, gas generated in the new landfill will be collected in a series of pipes and routed to the LGUP which consists of four engines. These engines use the landfill gas to produce renewable electricity which is used to power the facility and can be exported from the facility to supply the national electrical grid. This green electricity supplies virtually the entire electrical demand of the site; the 2022 AER for the facility stating that <0.1% of electrical consumption in 2021 was supplied from the mains. This is likely to have occurred during maintenance of the gas utilisation plant.

Gas generated from the new landfill will be routed to the LGUP to maximise the opportunity for renewable generation at the site. As the landfill development and filling progresses, the characteristics of landfill gas change and Bord na Móna will continue to monitor the quality of the gas to ensure the utilisation plant is working as efficiently as possible.

10.3 Reuse of the Process Water in the Composting Facility

The composting process will generate wastewater in the form of leachate and condensate. This collected leachate will be fully reused in the composting process, such that is very little to no excess leachate generated. The leachate is collected in floor drains and routed to a storage tank from where it is recirculated to the composting tunnels. Temperature and moisture probes in the composting tunnels regulate the supply of air and water to the composting mass to ensure that the conditions are optimal for the breakdown or organic matter in the waste.

In the event of a lack of leachate, process water supply will be from the new SWL's such that raw water supply is not required. These measures make most use of a closed loop system within the building reducing raw water demand from the on-site groundwater source and reducing the quantity of leachate to be removed off-site. This contributes to reduced traffic movements and associated traffic related carbon emissions.

10.4 Habitat Replacement

The construction of the proposed infrastructure will result in an unavoidable loss of habitat that exists within the Timahoe South Bog. Peat excavated to facilitate the development will be redistributed in an environmental screening berm around the perimeter of the landfill which will be allowed to naturally revegetate as well as being planted with peat tolerant grass and shrub species of similar species to those lost through the site clearance.

In addition, the ICW area and landfill capping will be planted with suitable species to replace those lost and to enhance biodiversity at the site. Further details on the habitat replacement measures and landscape plans are set out in Chapter 8 (Biodiversity) and Chapter 11 (Landscape & Visual Impact) of the EIAR.

10.5 Ecologically Sensitive Lighting Design

A planning stage lighting design has been prepared and is shown on Drawing No.'s 11290-2016 to 11290-2024. This lighting layout has been prepared in collaboration between the mechanical and electrical design team and the project ecologists. The identification of suitable habitat and the presence of potential susceptible fauna, namely bats, during ecological surveys has identified areas to seek to reduce potential impacts and provide a sensitive and sustainable lighting approach.

10.6 Groundwater Management

The Proposed Development works have also been co-ordinated with other teams within Bord na Móna including the Land and Habitats Division who have responsibility for the rehabilitation of bogs within the company's ownership. A *Cutaway Bog Decommissioning and Rehabilitation Plan 2022* has been prepared and agreed for the Timahoe South Bog which incorporates all the lands outside of the existing and Proposed Development footprint.

Measures being implemented as part of this Plan (which is included as Appendix 2-2 to the EIAR) include strategic blocking of drains to raise water levels to the surface of the bog and to encourage the natural colonisation of vegetation. Alongside the proposed drain blocks, new drains are being constructed to prevent flooding of adjacent lands including the footprint of the existing facility and the Proposed Development. To compliment the measures being put in place as part of the bog rehabilitation works, strategic and phased blocking of drains within the Proposed Development boundary will also be carried out to facilitate the construction of the infrastructure and to sustainably manage water flow, water quality and water levels in and around the works.

11.0 HEALTH AND SAFETY

11.1 General

The planning stage design of the Proposed Development as set out in this Report and in the Planning Drawings has been carried out in compliance with the obligations set out in the *Safety, Health and Welfare at Work Act 2005* as amended and all implementing regulations. The principles of prevention have been considered at each stage of the design and a Designer's Assessment of Risk has been carried out and provided to the Project Supervisor Design Process (PSDP) in accordance with the requirements of the *Safety, Health and Welfare at Work (Construction) Regulations 2013*, as amended. The Health and Safety Authority (HSA) *Guidelines on the Procurement, Design and Management Requirements of the Safety, Health* *and Welfare at Work (Construction) Regulations 2013* (2017) have also been consulted in the preparation of designs and methodologies for the Proposed Development.

Hazards have been identified and, where possible, they have been engineered out. Where this has not been possible, mitigation measures have been included. A record will be kept of any residual risks arising and these will be passed on to the Contractor in the Preliminary Health and Safety Plan, prior to the construction stage.

Appendix A – Index of Planning Drawings

DREHID WASTE MANAGEMENT FACILITY
FURTHER DEVELOPMENT
PLANNING APPLICATION DRAWINGS

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
11290-2000	REGIONAL SITE LOCATION MAP	11290-2045	PROPOSED ROADS KEY PLAN
11290-2001	SITE LOCATION MAP - Sheet 1 of 2	11290-2046	PROPOSED WASTE TRAFFIC LAY BY & NEW SITE EGRESS LANE
11290-2002	SITE LOCATION MAP - Sheet 2 of 2	11290-2047	SIGNAGE AND ROAD MARKINGS
11290-2003	SITE LAYOUT PLAN	11290-2048	FOUL PUMP STATION DETAILS
11290-2004	EXISTING SITE TOPOGRAPHY	11290-2049	SURFACE WATER PUMP STATION DETAILS
11290-2005	SITE DRAINAGE LAYOUT	11290-2050	ATTENUATION LAGOONS PLAN AND SECTION
11290-2006	SITE FENCING LAYOUT	11290-2051	CARPARK AND ROAD CONSTRUCTION DETAILS
		11290-2054	TRENCH BEDDING AND SWALE DETAILS
11290-2010	FACILITY MASTER PLAN	11290-2057	FENCING DETAILS
11290-2011	LANDFILL PHASING PLAN	11290-2058	PROPOSED PIPE CONTROL DAM DETAILS
11290-2012	LEACHATE COLLECTION SYSTEMS	11290-2059	PRIMARY TREATMENT TANK AND OIL INTERCEPTOR DETAILS
11290-2013	LANDFILL GAS & LEACHATE RECIRCULATION LAYOUT	11290-2060	EMBANKMENT & LINER DETAILS
11290-2014	SURFACE WATER AND FOUL DRAINAGE MASTER PLAN	11290-2061	GROUNDWATER PUMP STATION - DETAILS
11290-2015	UTILITIES MASTER PLAN	11290-2062	LEACHATE HEADWALL - DETAILS
11290-2016	DRAINAGE AND UTILITIES LAYOUT PLAN 1 of 9	11290-2063	LANDFILL GAS MANAGEMENT & CAPPING DETAILS
11290-2017	DRAINAGE AND UTILITIES LAYOUT PLAN 2 of 9	11290-2064	INTEGRATED CONSTRUCTED WETLANDS - DETAILS
11290-2018	DRAINAGE AND UTILITIES LAYOUT PLAN 3 of 9		
11290-2019	DRAINAGE AND UTILITIES LAYOUT PLAN 4 of 9	11290-2070	LANDFILL CAP FINAL RESTORATION LEVELS
11290-2020	DRAINAGE AND UTILITIES LAYOUT PLAN 5 of 9	11290-2071	LANDSCAPE PLAN
11290-2021	DRAINAGE AND UTILITIES LAYOUT PLAN 6 of 9		
11290-2022	DRAINAGE AND UTILITIES LAYOUT PLAN 7 of 9	11290-2080	STRUCTURES GENERAL ARRANGEMENT
11290-2023	DRAINAGE AND UTILITIES LAYOUT PLAN 8 of 9	11290-2081	MSW PROCESSING & COMPOSTING BUILDING, NEW BIOFILTERS & PLANT CONTROL ROOM - PLAN
11290-2024	DRAINAGE AND UTILITIES LAYOUT PLAN 9 of 9	11290-2082	MSW PROCESSING & COMPOSTING BUILDING, NEW BIOFILTERS & PLANT CONTROL ROOM - ELEVATIONS & SECTION
11290-2028	UNDERCELL DRAINAGE SYSTEMS	11290-2083	MSW PROCESSING & COMPOSTING BUILDING, NEW BIOFILTERS & PLANT CONTROL ROOM - ELEVATIONS
		11290-2085	SOIL & STONES AND C&D WASTE (Rubble) PROCESSING BUILDING & FUEL STORAGE AREA - PLAN, ELEVATIONS & SECTION
11290-2030	CELL LAYOUT		
11290-2031	PROPOSED LANDFILL - LONGITUDINAL SECTIONS	11290-2096	MAINTENANCE BUILDING PLAN
11290-2032	PROPOSED LANDFILL - CROSS SECTIONS	11290-2097	MAINTENANCE BUILDING SECTION AND ELEVATIONS

Appendix B – Water Supply Calculations (non-potable and fire)

Welfare Water Demand

Fire-fighting Water Demand

TOBIN
CONSULTING ENGINEERS

Checked	PF
Ref No:	11290
Sheet No:	1
Designer:	RH
Date:	30/01/2023

CALCULATION SHEET

PROJECT: Further Development Works - Drehid Waste Management Facility

ELEMENT: **Welfare Water Demand (Non-Potable)**

File Locati \\fserver4-dub\Tobin\Projects\11290 - Bord na Mona – Drehid Landfill Plan App 2021\04-Documents\01-
This Elem Welfare Water Demand (Non-Potable)

Welfare Supply for Business Use (Potable supply to be provided by bottled water)

Design Population

Site	Maximum No. of Temporary Staff	No. of Employees	Total (persons)
Drehid	25.0 persons (Visitors) 46.0 person (Construction)	9.0 persons	
	71.0 persons	9.0 persons	80.0 persons

Temporary Staff Water Usage Rate	60.0	l/day/person	NOTE 1
Permanent Staff Water Usage Rate	60.0	l/day/person	NOTE 1

Demand

	Commercial: Based on EPA Wastewater Manual	
Avg. Daily Demand (l/day)	4800.000	
Avg. Daily Demand (l/sec)	0.056	
Average Day/Peak Week Demand (l/sec)	0.069	1.25x average daily demand as per Uisce Éireann Code of Practice
Average Day/Peak Week Demand (l/sec) (for pipe sizing)	0.278	5x average daily demand as per Uisce Éireann Code of Practice

Pipe Sizing: NOTE 2

ø	velocity
100	0.04 m/s
150	0.02 m/s
200	0.01 m/s
250	0.01 m/s

Use 100 mm diameter pipe for watermain supply

Notes:

1. Domestic demand requirement from Uisce Éireann Code of Practice is 150.0 l/person/day. Industrial/Office demand value taken from EPA Wastewater Treatment Manual.

2. As per Uisce Éireann Code of Practice, velocity in mains supply should lie between 0.3m/sec and 1.5m/sec with a minimum 100mm nominal internal diameter.

TOBIN
CONSULTING ENGINEERS

Checked	PF
Ref No:	11290
Sheet No:	1
Designer:	RH
Date:	30/01/2023

CALCULATION SHEET

PROJECT: Further Development Works - Drehid Waste Management Facility

ELEMENT: Firefighting Water Demand

File Locati \\fserver4-dub\Tobin\Projects\11290 - Bord na Mona – Drehid Landfill Plan App 2021\05-Design\01-
This Elem Firefighting Water Demand

Overall Demand

Quantity (l/s)	83.3

NOTE 1

Pipe Sizing

ø	velocity (m/s)
100	10.61
150	4.71
200	2.65

Therefore, use 150mm diameter firemains pipework

NOTE 2

Storage Sizing

Duration (hrs)	6.00
Storage Volume Required (m3)	1799.28

Notes:

1. Guidelines on flow requirements for developments served by Dublin Fire Brigade - Class II
2. Wavin Polyethylene Water Systems Technical Guide - maximum velocity = 5.0 m/s

Appendix C – Greenfield Run-Off Calculations

$$Q_{bar\ (rural)} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SPR^{2.17}$$

Where:

$Q_{bar\ (rural)}$ = the mean annual flood flow from a rural catchment

AREA = the area of the catchment in km^2 = 0.507745

SAAR = is the standard average annual rainfall = 834 mm

SPR = Standard Percentage Runoff coefficient for the soil category, where SPR values for the 5 soil types are as follows; Soil 1 = 0.1; Soil 2 = 0.3; Soil 3 =0.37; Soil 4 = 0.47; Soil 5 = 0.53

A SPR value of 0.3 (Soil Type 2) has been applied for the subject site.

$$Q_{bar\ (rural)} = 0.00108 \times 0.507745^{0.89} \times 834^{1.17} \times 0.3^{2.17}$$

$$Q_{bar\ (rural)} = 0.11339\ m^3/s$$

$$Q_{bar\ (rural)} = 113.39\ l/s \text{ for an area of } 0.507745\ km^2 \text{ (50.7745 hectares)}$$

Appendix D – Surface Water Simulation Criteria & Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes GDSDS Manhole Sizes IW Foul

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.200	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.284	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.80
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	30	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	92.735	0.548	169.1	0.063	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	62.328	0.312	199.8	0.260	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	62.328	0.312	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	74.086	0.247	300.0	0.217	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	39.456	0.259	152.2	0.039	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	66.832	0.334	200.0	0.357	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.54	81.925	0.063	0.0	0.0	2.6	1.00	39.9	11.1
2.000	50.00	4.94	81.925	0.260	0.0	0.0	10.6	1.11	78.4	45.8
2.001	50.00	5.87	81.613	0.260	0.0	0.0	10.6	1.11	78.3	45.8
1.001	50.00	7.06	81.226	0.540	0.0	0.0	21.9	1.04	115.0	95.1
3.000	50.00	4.62	81.925	0.039	0.0	0.0	1.6	1.06	42.0	6.9
4.000	50.00	5.01	81.925	0.357	0.0	0.0	14.5	1.11	78.3	62.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.001	85.201	0.536	158.9	0.183	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	89.052	0.297	300.0	0.250	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.003	89.052	0.297	299.8	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.000	323.477	0.647	500.0	5.981	4.00	0.0	0.600	1 _/	2000	1:1 Ditch	
5.001	676.842	1.354	499.9	6.042	0.00	0.0	0.600	1 _/	2000	1:1 Ditch	
5.002	362.863	0.726	499.8	5.862	0.00	0.0	0.600	1 _/	2000	1:1 Ditch	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.001	50.00	6.00	81.516	0.579	0.0	0.0	23.5	1.43	158.4	101.9
1.002	47.22	8.21	80.829	1.369	0.0	0.0	52.5	1.29	278.8	227.6
1.003	44.46	9.37	80.533	1.369	0.0	0.0	52.5	1.29	278.9	227.6
5.000	50.00	6.07	83.520	5.981	0.0	0.0	243.0	2.60	7803.2	1052.8
5.001	42.28	10.41	82.873	12.023	0.0	0.0	413.0	2.60	7803.8	1789.5
5.002	38.25	12.73	81.519	17.885	0.0	0.0	555.8	2.60	7804.4	2408.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	331.960	0.664	499.9	6.033	4.00	0.0	0.600	1 _/	2000	1:1 Ditch	
6.001	676.225	1.352	500.2	6.011	0.00	0.0	0.600	1 _/	2000	1:1 Ditch	
6.002	298.178	0.596	500.3	6.156	0.00	0.0	0.600	1 _/	2000	1:1 Ditch	
5.003	8.542	0.028	305.1	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit	
1.004	13.743	0.046	298.8	0.137	0.00	0.0	0.600	o	1200	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.000	50.00	6.13	83.520	6.033	0.0	0.0	245.1	2.60	7803.4	1062.0
6.001	42.17	10.46	82.856	12.043	0.0	0.0	412.7	2.60	7801.6	1788.3
6.002	38.82	12.37	81.504	18.199	0.0	0.0	573.9	2.60	7800.6	2487.1
5.003	38.15	12.80	79.965	36.084	0.0	0.0	1118.5	2.14	2416.5«	4846.8
1.004	37.99	12.91	79.561	37.591	0.0	0.0	1160.3	2.16	2442.1«	5027.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	83.350	1.425	Open Manhole	1200	1.000	81.925	225				
2	83.350	1.425	Open Manhole	1200	2.000	81.925	300				
3	83.350	1.737	Open Manhole	1200	2.001	81.613	300	2.000	81.613	300	
4	83.350	2.124	Open Manhole	1350	1.001	81.226	375	1.000	81.377	225	
								2.001	81.301	300	
5	83.350	1.425	Open Manhole	1200	3.000	81.925	225				
6	83.350	1.425	Open Manhole	1200	4.000	81.925	300				
7	83.350	1.834	Open Manhole	1350	3.001	81.516	375	3.000	81.666	225	
								4.000	81.591	300	
8	83.350	2.521	Open Manhole	1500	1.002	80.829	525	1.001	80.979	375	
								3.001	80.980	375	
9	83.350	2.817	Open Manhole	1500	1.003	80.533	525	1.002	80.533	525	
Swale 1.1	84.520	1.000	Junction		5.000	83.520	2000				
Swale 1.2	83.873	1.000	Junction		5.001	82.873	2000	5.000	82.873	2000	
Swale 1.3	82.519	1.000	Junction		5.002	81.519	2000	5.001	81.519	2000	
Swale 2.1	84.520	1.000	Junction		6.000	83.520	2000				
Swale 2.2	83.856	1.000	Junction		6.001	82.856	2000	6.000	82.856	2000	
Swale 2.3	82.504	1.000	Junction		6.002	81.504	2000	6.001	81.504	2000	
Swale	84.000	4.035	Open Manhole	5000	5.003	79.965	1200	5.002	80.793	2000	628

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN (Pipe Out)	Pipe Out Invert Level (m)	Diameter (mm)	PN (Pipes In)	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								6.002	80.908	2000	743
10	84.000	4.439	Open Manhole	1900	1.004	79.561	1200	1.003	80.236	525	
								5.003	79.937	1200	376
	83.350	3.835	Open Manhole	0		OUTFALL		1.004	79.515	1200	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	83.350	81.925	1.200	Open Manhole	1200
2.000	o	300	2	83.350	81.925	1.125	Open Manhole	1200
2.001	o	300	3	83.350	81.613	1.437	Open Manhole	1200
1.001	o	375	4	83.350	81.226	1.749	Open Manhole	1350
3.000	o	225	5	83.350	81.925	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	92.735	169.1	4	83.350	81.377	1.748	Open Manhole	1350
2.000	62.328	199.8	3	83.350	81.613	1.437	Open Manhole	1200
2.001	62.328	200.0	4	83.350	81.301	1.749	Open Manhole	1350
1.001	74.086	300.0	8	83.350	80.979	1.996	Open Manhole	1500
3.000	39.456	152.2	7	83.350	81.666	1.459	Open Manhole	1350

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	300	6	83.350	81.925	1.125	Open Manhole	1200
3.001	o	375	7	83.350	81.516	1.459	Open Manhole	1350
1.002	o	525	8	83.350	80.829	1.996	Open Manhole	1500
1.003	o	525	9	83.350	80.533	2.292	Open Manhole	1500
5.000	1 _/	2000	Swale 1.1	84.520	83.520	0.000	Junction	
5.001	1 _/	2000	Swale 1.2	83.873	82.873	0.000	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	66.832	200.0	7	83.350	81.591	1.459	Open Manhole	1350
3.001	85.201	158.9	8	83.350	80.980	1.995	Open Manhole	1500
1.002	89.052	300.0	9	83.350	80.533	2.292	Open Manhole	1500
1.003	89.052	299.8	10	84.000	80.236	3.239	Open Manhole	1900
5.000	323.477	500.0	Swale 1.2	83.873	82.873	0.000	Junction	
5.001	676.842	499.9	Swale 1.3	82.519	81.519	0.000	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.002	1 _/	2000	Swale 1.3	82.519	81.519	0.000	Junction	
6.000	1 _/	2000	Swale 2.1	84.520	83.520	0.000	Junction	
6.001	1 _/	2000	Swale 2.2	83.856	82.856	0.000	Junction	
6.002	1 _/	2000	Swale 2.3	82.504	81.504	0.000	Junction	
5.003	o	1200	Swale	84.000	79.965	2.835	Open Manhole	5000
1.004	o	1200	10	84.000	79.561	3.239	Open Manhole	1900

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.002	362.863	499.8	Swale	84.000	80.793	2.207	Open Manhole	5000
6.000	331.960	499.9	Swale 2.2	83.856	82.856	0.000	Junction	
6.001	676.225	500.2	Swale 2.3	82.504	81.504	0.000	Junction	
6.002	298.178	500.3	Swale	84.000	80.908	2.092	Open Manhole	5000
5.003	8.542	305.1	10	84.000	79.937	2.863	Open Manhole	1900
1.004	13.743	298.8		83.350	79.515	2.635	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.063	0.063	0.063
2.000	User	-	100	0.189	0.189	0.189
	User	-	60	0.118	0.071	0.260
2.001	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.172	0.172	0.172
	User	-	100	0.045	0.045	0.217
3.000	User	-	60	0.065	0.039	0.039
4.000	User	-	60	0.533	0.320	0.320
	User	-	60	0.062	0.037	0.357
3.001	User	-	60	0.035	0.021	0.021
	User	-	100	0.162	0.162	0.183
1.002	User	-	100	0.143	0.143	0.143
	User	-	100	0.108	0.108	0.250
1.003	-	-	100	0.000	0.000	0.000
5.000	User	-	60	0.218	0.131	0.131
	User	-	100	5.850	5.850	5.981
5.001	User	-	100	0.146	0.146	0.146
	User	-	100	5.896	5.896	6.042
5.002	User	-	100	5.862	5.862	5.862
6.000	User	-	60	0.218	0.131	0.131
	User	-	100	5.902	5.902	6.033
6.001	User	-	60	0.197	0.118	0.118
	User	-	100	5.893	5.893	6.011
6.002	User	-	60	0.292	0.175	0.175
	User	-	100	5.981	5.981	6.156
5.003	-	-	100	0.000	0.000	0.000
1.004	User	-	60	0.113	0.068	0.068

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	User	-	100	0.069	0.069	0.137
				Total	Total	Total
				38.331	37.591	37.591

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004		83.350	79.515	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	20.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.200	Cv (Summer)	0.750
Return Period (years)	5	Ratio R	0.284	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.004, Volume (m³): 37.3

Unit Reference	MD-SHE-0416-1134-1000-1134
Design Head (m)	1.000
Design Flow (l/s)	113.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	416
Invert Level (m)	79.922
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	113.3	Kick-Flo®	0.862	105.5
Flush-Flo™	0.575	113.4	Mean Flow over Head Range	-	85.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	11.3	0.400	109.6	0.800	108.6	1.400	133.5	2.000	158.8	2.600	180.5
0.200	40.6	0.500	112.7	1.000	113.3	1.600	142.4	2.200	166.4	3.000	193.6
0.300	79.2	0.600	113.3	1.200	123.8	1.800	150.9	2.400	173.6	3.500	208.8

Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.004, Volume (m³): 37.3

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
4.000	222.9	5.000	248.7	6.000	272.0	7.000	293.4	8.000	313.3	9.000	332.0
4.500	236.2	5.500	260.6	6.500	282.9	7.500	303.5	8.500	322.8	9.500	341.0

Storage Structures for Storm

Tank or Pond Manhole: 10, DS/PN: 1.004

Invert Level (m) 79.922

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4800.0	2.000	4800.0	2.001	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 20.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.200 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.284 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	1	600 Summer	100	+0%	30/600 Winter				82.276	0.126	0.000	0.17		6.5

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
1.000	1	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
2.000	2	15 Winter	100	+0%	100/15 Summer				82.459	0.234	0.000	1.18	
2.001	3	600 Summer	100	+0%	30/180 Winter				82.391	0.478	0.000	0.52	
1.001	4	240 Winter	100	+0%	30/15 Summer				82.523	0.922	0.000	0.46	
3.000	5	600 Summer	100	+0%	30/600 Winter				82.304	0.154	0.000	0.19	
4.000	6	15 Winter	100	+0%	30/15 Summer				82.844	0.619	0.000	1.52	
3.001	7	600 Summer	100	+0%	30/180 Winter				82.370	0.479	0.000	0.46	
1.002	8	180 Winter	100	+0%	30/15 Summer				82.839	1.485	0.000	0.50	
1.003	9	180 Winter	100	+0%	1/360 Winter	100/360 Summer			83.161	2.103	0.000	0.42	
5.000	Swale 1.1	15 Winter	100	+0%					84.013	-0.507	0.000	0.25	
5.001	Swale 1.2	15 Winter	100	+0%					83.494	-0.379	0.000	0.33	
5.002	Swale 1.3	30 Winter	100	+0%					82.331	-0.188	0.000	0.42	
6.000	Swale 2.1	15 Winter	100	+0%					84.016	-0.504	0.000	0.25	
6.001	Swale 2.2	15 Winter	100	+0%					83.477	-0.379	0.000	0.33	
6.002	Swale 2.3	30 Winter	100	+0%					82.323	-0.181	0.000	0.45	
5.003	Swale	7200 Summer	100	+0%	1/15 Summer				82.284	1.119	0.000	0.60	
1.004	10	180 Winter	100	+0%	1/120 Summer				83.213	2.452	0.000	20.56	

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
2.000	2	88.4	SURCHARGED	
2.001	3	38.6	SURCHARGED	
1.001	4	50.0	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
3.000	5	7.5	SURCHARGED	
4.000	6	114.1	SURCHARGED	
3.001	7	69.6	SURCHARGED	
1.002	8	130.9	SURCHARGED	
1.003	9	108.9	FLOOD RISK	
5.000	Swale 1.1	1914.0	OK	
5.001	Swale 1.2	2548.1	OK	
5.002	Swale 1.3	3315.5	FLOOD RISK*	
6.000	Swale 2.1	1919.4	OK	
6.001	Swale 2.2	2549.3	OK	
6.002	Swale 2.3	3502.6	FLOOD RISK*	
5.003	Swale	624.1	SURCHARGED	
1.004	10	26389.2	SURCHARGED	

Appendix E – Primary Wastewater Storage Tank Example

SEPTIC TANK

Tricel® Vento

For single dwellings & small communities

Certified to EN-12566-1

WARRANTY
10 years
FROM DATE OF PURCHASE

TRICEL
ENVIRONMENTAL

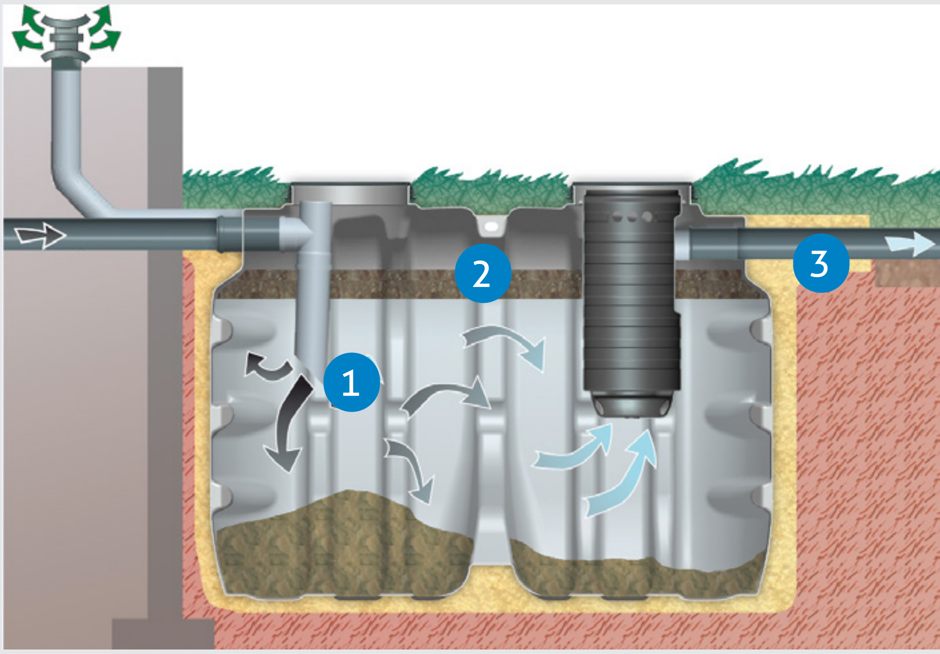
What is the Tricel Vento

Tricel Vento septic tanks are manufactured from high density polyethylene using the latest in blow moulding technology.

This market leading product is extremely durable with a much sought-after combination of high strength and low weight characteristics. These attributes ensure an ease of installation that make it ideally suited for all types of septic tank requirements.

How a Tricel Vento works

1. Wastewater flows by gravity into the tank and is diverted downwards with a T piece where the solids and heavier material settle to the base of the unit. A small amount of anaerobic breakdown occurs at this stage.
2. The lighter solids float to the top and form a scum and an outlet pipe fitted to the unit ensures that only the liquid element flows into the percolation area. This specially designed dip pipe prevents the scum from passing into the percolation area which may result in blocked pipes.
3. Final improvement of the wastewater occurs as it penetrates through the specially designed percolation area.



Key features & benefits

- All Tricel Vento septic tanks are tested to the highest quality standards and are **EU Certified to EN12566-1.**
- **Value for money.** Expertly designed, the Tricel Vento is extremely **durable and long lasting** for effective and efficient treatment of wastewater at a highly competitive price.
- The Tricel Vento is made from a high density and lightweight material called polyethylene **reducing the cost of transportation and installation.**
- Once on site, the Vento is extremely **easy to manoeuvre** making it **ideal for restricted and compact sites.** Most tanks, depending on site conditions, are installed without concrete. A Tricel Vento is suitable for gravel backfill in dry sites.
- This is a **low-profile tank/shallow dig tank** and requires only a small excavation for installation saving you money and keeping the disruption in your garden to a minimum. A tank suitable for population equivalent (PE) of six is only 1440mm high.
- The Tricel Vento comes complete with an integrated outlet filter system for increased solids removal and soakaway protection, **extending the life of the soakaway.**
- **Safe**, lids are fully securable for onsite safety.

Tricel Vento septic tank

Lightweight and easy to handle.

Tricel Vento with risers.

Tricel Vento installed.

Additional parts

If flexible invert levels are necessary, **risers** are available for deeper installation requirements and sold separately. When risers are in use, they are necessary on both the inlet and outlet sides of the Vento septic tank. Each riser is 180mm high and can be used to a maximum height of three risers.

A **distribution box** is available to help distribute effluent evenly into individual discharge points.

Technical characteristics/ Septic tank dimensions

A large range of sizes available in one tank format, from 6 to 20-person dwellings.

	Units	Vento 6	Vento 12	Vento 20
Capacity	litres	3080	4000	5000
Length	mm	2700	2040	2430
Width	mm	1190	1850	1850
Height	mm	1440	1540	1540
Inlet invert height	mm	1180	1220	1220

Further septic tank sizes are available on request.

Tricel Group

Tricel is a world recognised global provider of **high performance solutions.** Today, the company operates across multiple industries such as **Environmental, Construction, Water,** and **Distribution** including both composite materials and lubricants.

We are proud of being one of the largest manufacturers of wastewater treatment plants in Europe and are regarded by regulators as the standard setters within the industry.

Our company offers industry **leading innovative solutions** that our customers can trust, and with operations in 12 locations across Europe, we supply a comprehensive range of products to **over 50 countries worldwide.**

GLOBAL PRESENCE

Membership of European governing bodies on wastewater treatment

The Tricel environmental wastewater treatment plants are fully tested and accredited to **European standards for CE certification.**

PIA (Prüfinstitut für Abwassertechnik GmbH) is the leading Test Institute in Europe for wastewater technology. Tricel septic tanks meet with **EN12566-1** requirements which test both the quality of the components as well as the overall performance of the septic tank.

The **Irish Water Treatment Association (IWTA)** is the national association for the treatment, conservation, recycling and reuse of water and wastewater.

The **Irish Onsite Wastewater Association (IOWA)** formed in 2007 with the goal of improving the standard of professionalism in the on-site treatment of wastewater in Ireland.

Vento 1103612/01-IE-April-2021

WARRANTY

- Tricel Vento septic tanks carry a **ten years** warranty from date of purchase.
- All products are CE certified to EU safety, health and environmental requirements.

Call us today for a **free quote** or details of your **local partner**

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TRICEL
GENERATIONS OF INNOVATION

Appendix F – Foul Water Design

TOBIN
CONSULTING ENGINEERS

Checked	PF
Ref No:	11290
Sheet No:	1
Designer:	RH
Date:	30/01/2023

CALCULATION SHEET

PROJECT: Further Development Works - Drehid Waste Management Facility

ELEMENT: **Foul Water (Sanitary)**

File Locati \\fserver4-dub\Tobin\Projects\11290 - Bord na Mona – Drehid Landfill Plan App 2021\05-Design\01-
This Elem Foul Water (Sanitary)

Applying BS EN 752
Design Population

Site	Maximum No. of Temporary Staff	No. of Employees	Total (persons)
Drehid	25.0 persons (Visitors) 46.0 person (Construction)	9.0 persons	
	71.0 persons	9.0 persons	80.0 persons

Average Dry Weather Flow (DWF)

Temporary Staff Water Usage Rate	60.0	l/day/person	NOTE 1
Permanent Staff Water Usage Rate	60.0	l/day/person	NOTE 1
DWF	0.056	l/s	
	4.800	m3/day	
DWF (weekly)	33.60	m3/week	

Peak Design Flow

6*DWF	0.333	l/s

Colebrook-White Formula

Q (l/s) =	0.333	Pipe Diameter (ø) (mm) =	100.00	
ks =	1.5	Gradient =	75.00	
Kinematic Viscocity (m2/sec)	0.000001141	Q (l/s) =	6.033 l/sec	OK
Self Cleansing Vel. (m/sec)	0.750	v (m/sec) =	0.768	OK

BOD5 NOTE 2

Staff BOD5	30.0	g/person/day
Visitor BOD5	15.0	g/person/day
Total BOD5	2.34	kg/day

Summary

Use 100mm min. pipe size if using gravity sewers
Use 1:75 min. gradient to ensure self-cleansing velocities are achieved with gravity sewers

Notes:

1. The flow and BOD5 rates are obtained from Table 3 of the EPA Wastewater Treatment Manual (page 8)

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