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Fort Dunree, Donegal

Drainage and Water Supply Report

22130-DID-ZZ-XX-RP-C-1001

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Contents

1 Introduction

1.1. Project Scope

The purpose of this document is in support of the planning application and sets out the proposed drainage strategy during the construction and operational phases and proposed water supply.

1.2. Project Background

The Fort Dunree project aims to provide a creative, historically sensitive and imaginative tourism experience, from revitalized historic landscapes and structures, rich biodiversity and new distinctive insertions that will enhance the existing infrastructure and visitor experience. The focus of the project is to unlock Fort Dunree's potential and help deliver a sustainable future for this historical and unique setting.

The site covers an approximate area of c. 26 hectares and is currently occupied by a military museum and peace centre.

The proposed development comprises the refurbishment of various structures across the site, upgrades to the existing access routes including the provision of a new car park, upgrades to existing pathways, provision of general infrastructure including more toilet facilities and the upgrade to café facilities.

1.3. Site Location

The site has evolved as a key entry point into Ireland, from Napoleonic fort, to become a major defensive Fort during WW1 and currently transformed to a military museum and peace centre. The site is located on the shores of Lough Swilly to the north of Buncrana town in Inishowen. The site is located on a strategic clifftop site. The site location and current site layout are shown below in Figures 1 and 2.

Figure 1 – Site Location (Google Maps)

Figure 2 – Existing Site Arrangement (Google Maps)

2 Site Constraints

2.1. Ground Conditions

A desktop review of available geotechnical information has been carried out. An extract of the bedrock geology map is shown below. As illustrated in figure 3 below the general geology is Quartzite with multiple outcrops present on the site. Due to the high rock levels present across the site, as demonstrated by the outcrops, it is expected there will be a lack of soil depth on site. The high rock level on site will result in poor subsoil percolation characteristics.

An initial site assessment has been carried out by Tecsoil. The purpose of the assessment involved a review of the site ground conditions at the locations of the proposed wastewater treatment plants. See Appendix A for the site assessment information carried out to date. Tecsoil summarises the ground conditions as consisting of rocky outcrops with a very thin covering of soil that is fragmented with horizontal or sloping bedrock exposures. This corresponds with the desktop review of the available geotechnical information.

Due to the lack of soil depth it was not possible to carry out trial hole and percolation tests at the proposed treatment plant locations to achieve an infiltration rate. Due to the lack of infiltration on site it is proposed that all materials relating to the disposal of treatment plant effluent will have to be imported. The impact of the on site ground conditions will be discussed on the surface water and foul water drainage strategies later in this report.

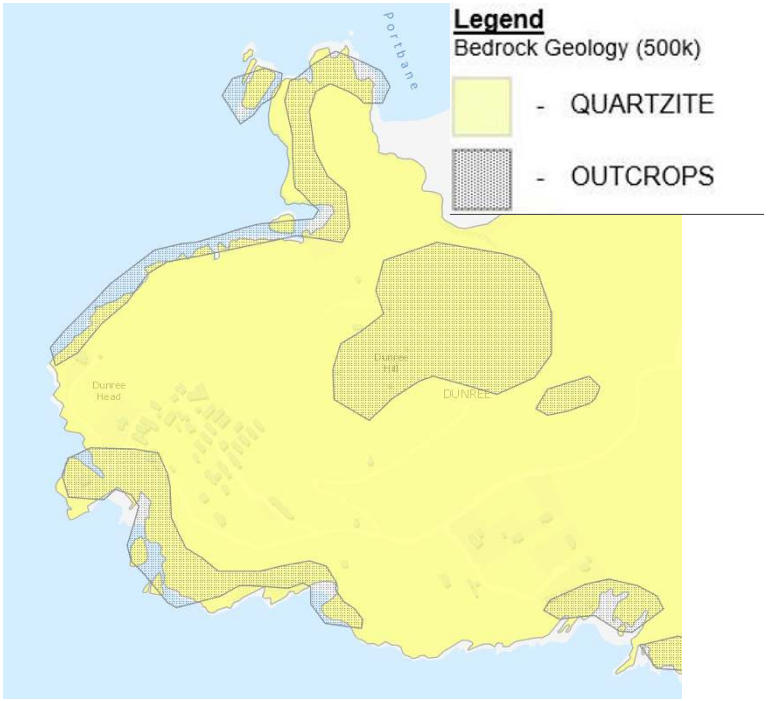


Figure 3 – 500k GSI Geology Map Illustrating Bedrock

2.2. Existing Watercourse

Fort Dunree is located on the shores of Lough Swilly. Lough Swilly is a large sea inlet lying between the western side of the Inishowen Peninsula and the Fanad Peninsula. Along with Carlingford Lough and Killary Harbour it is one of the three glacial fjords in Ireland. The clifftop site has varying levels across the site with low lying infrastructure at approximately 23 m AOD before grading steeply down to the Lough. The nearest identified surface watercourse to the site is the Owenerk River, located across Dunree Bay approximately 700 m north east from the top fort on site.

2.3. Flood Risk

The Office of Public Works national flood information portal has been reviewed to assess flood risk information available for the proposed development site. The National Fluvial Mapping for the present day illustrates some localised medium probability flooding around the Owenerk River to the northeast of the site. The odds of occurrence for a medium probability event in a given year is defined at 100:1. Due to the low lying level nature of this river when compared to the proposed development at Fort Dunree there is a very low risk to the site of fluvial flooding.

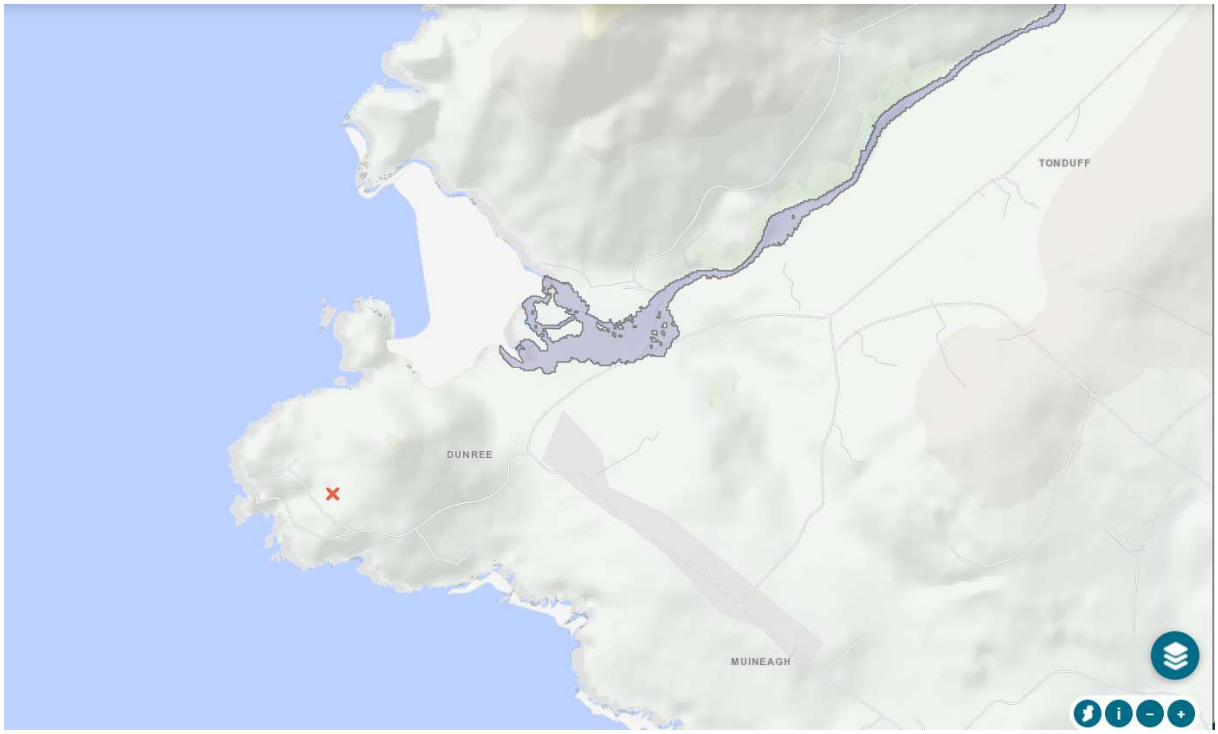


Figure 4 – National Indicative Fluvial Mapping – Present Day – Medium Probability (Floodinfo.ie)

The National Coastal Flood Hazard Mapping has also been consulted which indicates the extent of land that is at risk of flooding by the sea. The figure below presents the land at risk of a 0.1% AEP (1 in 1000 year) flood extents. Due to the coastal nature of the site this is to be expected. As these are localised areas there will be no works proposed as part of this development at Fort Dunree within these flood extents.

Overall the proposed development works are considered to be of low risk of flooding from all sources.

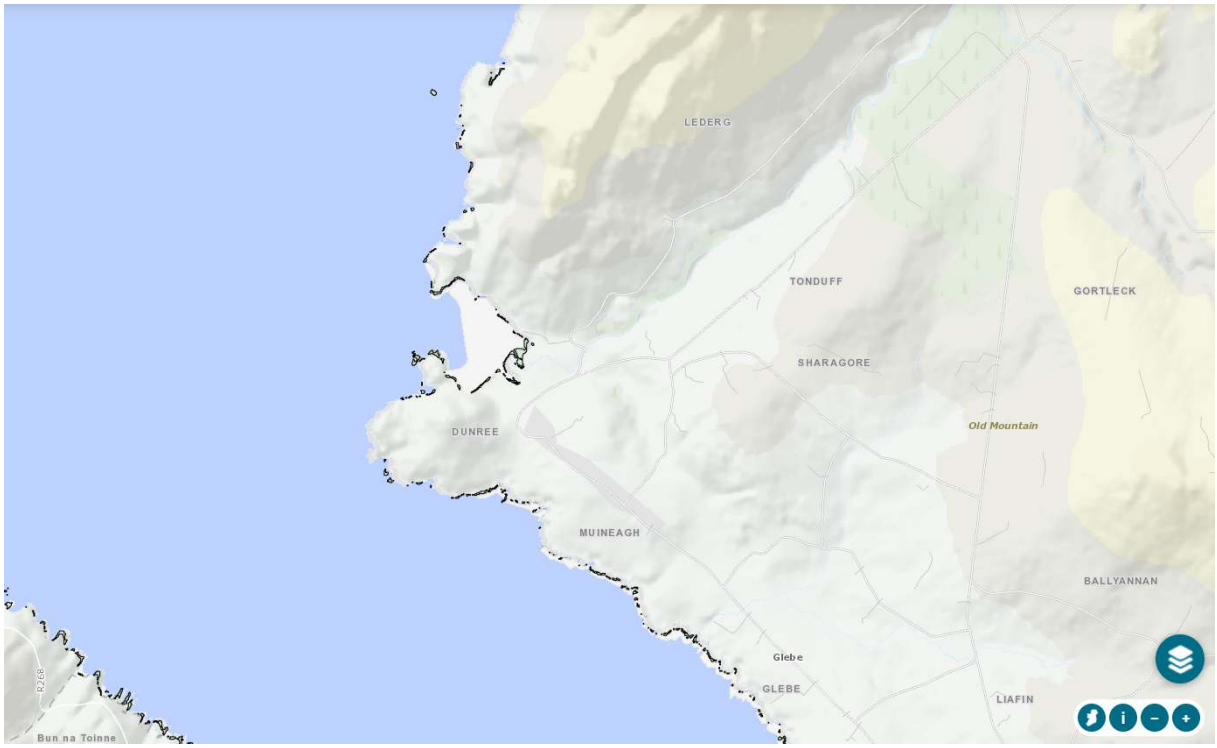


Figure 5 – National Coastal Flood Hazard Mapping – Present Day – 0.1% AEP Flood Extents (Floodinfo.ie)

3 Civil Drainage

3.1. Scope

Design ID have prepared a drainage strategy for separate foul and surface water drainage systems.

The below ground drainage systems shall be designed in accordance with the following standards and guidance:

- Technical Guidance Document H – Drainage and Waste Water Disposal (2016)
- Donegal County Council Effluent Requirements
- Environmental Protection Agency Guidance

3.2. Existing Drainage Infrastructure

As part of the review of the existing drainage infrastructure, Irish Military Archives site layout has been reviewed as record survey information with regards to the site drainage. Existing drainage outfalls to Lough Swilly have been recorded in conjunction with separate storm and foul water drainage across the site. Surface water is moved across the site by a series of gullies, ditches and pipework eventually outfalling to the sea at Lough Swilly. Foul water on site is currently directed towards an existing package sewage treatment plant by FM Environmental, Model 3 STD with 4 operational zones and an equivalent PE of 20. A review of the existing treatment plant capacity against the proposed visitor figures stipulated by the Client has determined that the existing plant will not support the requirements of the proposed development. Refer to Appendix A for Tecsoil comments on the current wastewater treatment arrangement.

A topographical survey was carried out by ‘Benchmark’ surveying and site engineers in October 2022. This survey determined the location of existing utility covers and any visible drainage infrastructure. Open channels and ditches have been recorded draining the majority of existing trails across the site and routing towards the sea.

The existing drainage infrastructure has been indicated as part of the proposed drainage layout drawings for the development.

3.3. Surface Water Drainage Strategy

3.3.1. Drainage Hierarchy

The Department of the Environment, Heritage and Local Government recommend the design of surface water systems to be based upon the following drainage discharge hierarchy, as much as possible, in order to maximise benefits to the site and local area:

Hierarchy	Discharge Method
1	Surface water runoff is collected for use
2	Discharge into the ground via infiltration
3	Discharge to a watercourse or other surface waterbody
4	Discharge to a surface water sewer, highway drain or another drainage system discharging to a watercourse or other surface waterbody
5	Discharge to a combined sewer

Table 1 – Discharge Hierarchy

A design hierarchy for sustainable drainage systems will also be reviewed as part of the drainage design proposals for this site:

Hierarchy	Sustainable Drainage System
1	Use surface water runoff as a resource (e.g. rainwater harvesting, use for
2	Manage rainwater close to where it falls, at source
3	Manage runoff on the surface, above ground (e.g. permeable pavements)
4	Allow rainwater to soak into the ground (infiltration)
5	Promote evapotranspiration (soft landscaping, rain garden)
6	Slow and store runoff to mimic natural runoff rates and volumes (below ground attenuation structure)
7	Reduce contamination of runoff through pollution prevention and by controlling the runoff at the source
8	Treat runoff to reduce the risk of urban contaminants causing environmental pollution

Table 2 – Drainage Hierarchy

3.3.2. Sustainable Drainage Systems (SuDS)

In addition to being a regulatory requirement, Sustainable Drainage Systems are incorporated within the proposed development where feasible, to attain improvements to water quality, biodiversity, and amenity. A management system of sustainable drainage techniques will be employed as part of the surface water drainage strategy.

To comply with the principles of Sustainable Urban Drainage Systems it is proposed to incorporate an attenuation system into the surface water drainage design for the proposed car park development via a permeable pavement solution. This will assist in minimising the impact of urbanisation by replicating the runoff characteristics of the cliff face site.

Permeable paving solution within the car park will be used to increase the 'time of concentration' and to reduce peak runoff rates. Permeable pavements help re-establish a more natural hydrological balance and reduce runoff volume by trapping and slowly releasing precipitation into the ground instead of allowing it to flow into storm drains and out to receiving waters as effluent. The same process also reduces the peak rates of discharge by preventing large, fast pulses of precipitation through the stormwater system. As infiltration is not possible on this site, it is proposed to use a tanked permeable paving system and allow water to slowly leave the car park area via a flow control device.

The subbase of the parking areas shall be formed with crushed clean stone which will be wrapped with impermeable geotextile which will breakdown hydrocarbons and is used in lieu of a petrol interceptor. Please refer to the Water Quality Management section of this report for further details.

3.3.3. Surface Water Drainage Strategy

The proposed surface water drainage strategy for the site is as follows. Due to the clifftop nature of the site, the proposed surface water drainage strategy will replicate as close as possible the natural behaviour of the surface water runoff on the site by overland flows and discharge to Lough Swilly due to its close proximity. Rainwater from the existing buildings being redeveloped as part of this scheme shall continue to be collected in an underground gravity surface water drainage network and routed towards the existing piped outfalls. The use of permeable pavements has been implemented in the external car park to help reduce run-off rates and flow volumes from parking areas as well as the circulation route. Permeable pavements will be introduced to the car parking spaces where areas of acceptable fill volumes are required. Run-off from the circulation route falls towards the permeable spaces created by permeable block pavers and allow rainwater to infiltrate through the paved surface and into the underlying stone areas where storage is to be provided. Due to the impermeable nature of the underlying rock the permeable pavements will be wrapped in impermeable membranes and the water collected via a perforated pipe, acting as a flow control before it routes downstream and outfalls to the Lough. As car parking areas will be trafficked by cars and buses with the occasional maintenance vehicle, the porous paving, geotextile and clean stone shall act as treatment to the runoff. The upgrades and any extension to the trail network drainage strategy will again aim to replicate the natural behaviour of the clifftop. Surface water runoff will be routed away from the path via suitable gradients and existing

topside ditching, with small additions where required. Overland flows will route towards the outfall at the Lough.

Proposed drainage has sought to re-use the existing drainage network and trenches where possible to minimise ecological impact and carbon cost.

The existing drainage infrastructure has been indicated as part of the proposed drainage layout drawings for the development.

3.3.4. Maintenance of Sustainable Drainage Systems

Regular maintenance of sustainable drainage systems is essential to maintain its performance and ensure the continued benefits are achieved. It is proposed that maintenance of the surface water network and sustainable drainage components will be instructed by the Client and undertaken by an experienced Contractor, in accordance with the maintenance strategy outlined in The SuDS Manual, C753, CIRIA.

Porous Paving - Many of the specific maintenance activities for pervious pavements can be undertaken

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface).	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds or management using glyphospate applied directly into the weeds.	As required – once per year on less frequently used pavements.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials.	As required.
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).
Monitoring	Initial Inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action.	Three-monthly, 48 hours after large storms in first six months.

	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.

Inlets, Outlets, Flow Controls, and Inspection Chambers

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect surface structures removing obstructions and silt, as necessary. Check there is no physical damage.	Monthly
	Strim vegetation 1m min. surround to structures and keep hard aprons free from silt and debris	Monthly
	Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.	Annually
	Undertake inspection after leaf fall in autumn.	Annually
Occasional Maintenance	Check topsoil levels are 20mm above edges of baskets and chambers to avoid mower damage	As required
Remedial Work	Repair physical damage if necessary.	

3.3.5. Water Quality Management

The surface water drainage network has been designed to meet recommendations and guidance within The SuDS Manual, CIRIA, C753.

The Simple Index Approach has been used to determine whether the proposed water quality measures are sufficient for the site. Indices are used to approximate the level of pollution from different land uses, with 0 indicating no pollution hazard and 1 indicating a high pollution hazard. Hazards can be managed and reduced using mitigation indices for each SuDS component which are summarised in The SuDS Manual.

The proposed treatment mitigation indices for the permeable paving solution is detailed below. This treatment brings the total suspended solids, metals and Hydrocarbons to an acceptable level.

Treatment Stage	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Pre-Treatment Levels	0.5	0.4	0.4
Treatment Mitigation Indices	0.7	0.6	0.7
Post-Treatment Levels	0	0	0

3.4. Foul Water Drainage Strategy

The proposed development shall include an upgraded and extended café, welcome building and toilet facilities for the staff and visiting public. Wastewater from the site is based on anticipated visitor figures stipulated by the Client. Refer to Appendix A for visitor numbers and calculated loadings.

Foul water from the proposed facilities will be collected in a separate system from the surface water and will gravitate towards private treatment plants. As the wastewater shall be dealt with on site there is no requirement to connect the system to the Uisce Éireann wastewater network. The majority of the site with the exception of the 'High Fort' facilities at the top fort will be route towards a proposed treatment plant to the south of the site, adjacent to the existing treatment plant. The 'High Fort' facilities at the top fort will gravitate towards a separate treatment plant located at the existing septic tank location at this higher level. The treatment plants are designed in accordance with the performance specification detailed below and the required Donegal County Council effluent requirements. As a high rock level is present on site at the location of both of the proposed treatment plants, a traditional drainage field disposal method is not suitable. An assessment has been carried out by TecSoil (See Appendix A) on the existing ground conditions which is in agreement that infiltration is not possible on this site. In this case it has been recommended that all materials relating to the disposal of treatment plant effluent will have to be imported.

In combination with the TecSoil assessment and recommendations available in Appendix A, a foul water drainage strategy has been developed which takes into consideration the characterisation of the site. The proposals also ensure wastewater is disposed in a manner that safeguards the local environment & public health.

Treatment proposed at the lower site location will include a suitably sized grease trap, installed no less than 5m from the waste source at the proposed café facilities. A proposed wastewater treatment plant has been designed with a capacity to serve a population equivalent of 267. The proposed system will include a buffer zone with a forward feed airlift to ensure a constant flow through the system in peak loading. A pre-settlement tank which allows the settlement of material as part of the system has also been incorporated within the treatment plant. This will satisfy the settlement recommendations made by TecSoil. Wastewater must then be pump fed to an intermittent monograde sand filter to provide tertiary treatment. At the lower site an infiltration area of 275 m^2 is required. GRP impermeable panels shall be introduced to enclose the sand filter, preventing decay and ensuring longevity of the structure. The tertiary treated wastewater shall then discharge to an underlying soil polishing filter. The soil polishing filter shall also measure 275 m^2 and made up using imported soil with a percolation value in the 5-20 range.

Treatment proposed at the High Fort site location will include a suitably sized grease trap, installed no less than 5m from the waste source at the proposed tea/ coffee facilities. A proposed wastewater treatment plant has been designed with a capacity to serve a population equivalent of 52. The proposed system will include a buffer zone with a forward feed airlift to ensure a constant flow through the system in peak loading. Wastewater must then be pump fed to an intermittent monograde sand filter to provide tertiary treatment. At the lower site an infiltration area of 52 m^2 is required. GRP impermeable panels

shall be introduced to enclose the sand filter, preventing decay and ensuring longevity of the structure. The tertiary treated wastewater shall then discharge to an underlying soil polishing filter. The soil polishing filter shall also measure 52 m^2 and made up using imported soil with a percolation value in the 5-20 range.

The wastewater treatment plants shall be installed in accordance with the manufacturer's instructions. The frequency of de-sludging shall also be in accordance with the manufacturer's recommendations. All wastewater treatment plants will be installed with an alarm to indicate operational failure. Access routes have been provided to ensure maintenance of the treatment plants. The siting of systems has allowed for access for a sludge tanker and maintenance equipment to de-sludge the tank. (A maximum of 30 m from a hardstand with 3 m invert level is typically recommended.) Storm water drains, water mains, service pipes, soakaways, access roads, driveways, paved areas or land drains have not be located within or around the sand filter area. The minimum separation distances should be in accordance with the EPA Code of Practice – Section 6.

Under the Water Pollution Act 1977 a Discharge Licence is required where the effluent is being discharged to a surface water course and this has dictated the final effluent quality in accordance with the EPA Code of Practice - Section 10.

The treatment plants have been suitably positioned to minimise the impact of visitors to Fort Dunree. Screening of the plant has been incorporated with vegetation proposals. Refer to the Landscape Architect drawings for details. Wild flower planting can be incorporated to above ground sand filter to minimise visual impact.

In summary the treatment plants have been designed to the following criteria and performance specifications:

1. Lower Fort Site: Population Equivalent of 267 . Effluent requirements as per Donegal County Council and listed below. 3 Phase power to be supplied to plant.
2. High Fort site: Population Equivalent of 52. Effluent requirements as per Donegal County Council and listed below. 3 Phase power to be supplied to plant.

Effluent requirements provided by Donegal County Council:

Parameter	Units	Limit(s)
pH	pH units	6 – 8.5
B.O.D. grab sample	mg/litre	20
B.O.D. composite sample	mg/litre	15
C.O.D. grab sample	mg/litre	80
C.O.D. composite sample	mg/litre	70
Suspended Solids grab sample	mg/litre	35
Suspended Solids composite sample	mg/litre	30
Orthophosphate (as P) of grab and composite discharge samples	mg/litre	3
Ammonia (NH_3) as N of grab and composite discharge samples	mg/litre	10
Nitrates (as N)	mg/litre	37.5
Fats, Oils/grease	mg/litre	10

3.4.1. Maintenance of Sustainable Drainage Systems

Regular maintenance of the foul water drainage network is critical to the long-term performance of the foul water drainage network. It is proposed that maintenance of the foul water network will be undertaken by Fort Dunree on a regular basis through the appointment of an experienced Contractor.

3.5. Construction Phase Drainage Strategy

The risks prevalent during the construction phase are identified as:

- Polluted water entering the sewerage system and out falling into a watercourse.
- The risk that the drainage system will be severed or become blocked by the construction activities causing surface water flooding; and
- Polluted water entering the groundwater.

(Referenced from Control of Pollution from Construction Sites (C532) and PPG 6 Construction and Demolition Sites: Prevention of Pollution)

Good practice guidance recommends that pervious surfaces should be constructed at the end of the development programme and should not be used as access roads or storage areas, unless adequate protection is provided to prevent clogging or binding once it has been constructed. It is the recommendation of this report that the porous paving is to be constructed last in order to ensure the long-term efficacy of the SuDS feature.

The most likely sources of pollution for this development and proposed mitigation measures are outlined below:

- Storage of materials, in particular sands and gravels that can be washed into the sewers. All stockpiles should be kept well away from any drains or openings in the drainage system and kept covered and located on an impermeable surface.
- Washing of plant and equipment involved with concreting excavations shall be carried out in a designated area where a sump pit is provided to capture the runoff and the solids are allowed to settle before removal off site.
- Excavation works for the various elements including construction build ups, treatment plants and drainage infrastructure in addition to the removal of the existing treatment plant/ septic tank.

Measures to minimise the risk of polluting agents reaching the groundwater of surface water sewers and prevent localised flooding include:

- Create an impermeable area as hardstanding for use during the construction period to store materials and vehicle parking.
- Place a cut off barrier at site entrance and exit points to direct any surface water into a sump where silts, muds, etc can settle before removal from site; and
- Any drains/gullies should be sealed or bunded off to prevent silts from entering the drainage network.
- A fully licensed de-sludge company shall fully empty the contents of the existing wastewater systems prior to removal. The existing unit should also be taken to a facility licensed to accept the items being disposed.

Subject to the above actions, the risk of pollution and flooding during the construction phase is considered to be low.

4 Water Supply

Donegal County Council have supplied a plan illustrating the watermain location that is currently serving the Fort Dunree site and a review of the this information has been carried out as part of these proposed works. Please see Appendix B for the existing watermain plan.

The existing main is listed as a 50 mm PVC main with the nearest hydrant to the site denoted by the red square, located on the approach road to the Fort Dunree site. The plan illustrating the existing watermain shows the main terminating at the existing café facilities. As part of the proposed development water supply will also be required to the welcome building for the provision of sanitation facilities and the high fort building. It is proposed that a new connection will be required to service these upgraded facilities. Please see 'Proposed Watermain' layout for information noting the anticipated demand below.

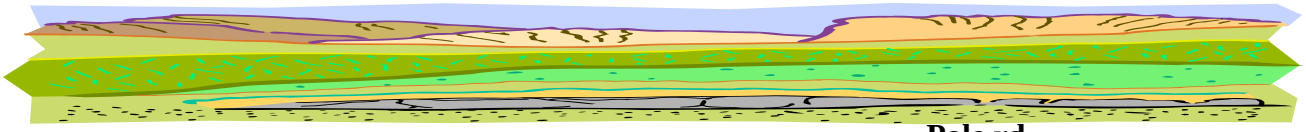
- Welcome Building (5.01) – 20 WC's, 12 WHB's and 1 changing places
- High Fort (3.01) – 3 WC's, 3 WHB's and 1 kitchen facility

Demands for the proposed facilities have been assessed and the existing 50 mm supply is considered insufficient to serve these additional requirements in the welcome building. A new 63 mm MDPE mains is proposed to accommodate the new welcome building sanitation facilities with a new 32 mm MDPE main to the high fort. Existing roads and path routes, or where new or widened road infrastructure is proposed, has been utilised as far as possible for the proposed new water supply route to minimise unnecessary excavation works. The existing 50 mm main will continue to serve the café facilities and the remaining facilities not part of the proposed new development.

Fire tender access is to be provided to all required upgraded buildings and on this basis new fire hydrants have not been included.

Appendix A – Site Suitability Assessment

TecSoil Site Assessment Ltd



Pole rd,
Meenmore,
Dungloe,
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Mobile Number: 087 2868411
Date: 16/08/2023

To whom It May Concern

Re: Fort Dunree Tourism Project

I have been retained Design ID Consulting Limited,23 Lisburn Road,Hillsborough, BT26 6AA to determine site suitability for the safe disposal of wastewater regarding a proposed transformational tourism project at Fort Dunree. The proposed Fort Dunree project has the potential to increase employment, attract visitors and extend the tourism season beyond the summer.

The project will physically link the 3 unique elements of Fort Dunree: Lough Swilly below the Fort; the Promontory Fort and the 'High Guns' Fort; provide immersive heritage and cultural touch points with a new route that opens up the site, with viewing points via modern interventions such as the proposed Funicular (the only one in Ireland) and interpretive instillations, including the development of the Dunree Lighthouse.

It is expected that over the first 5 years of operation the project will generate approx. €20m in direct tourism expenditure supporting 550 jobs in the area and 12 new jobs will be created at the attraction.

Projected Visitors Numbers

Table 3.4.1 Spread of Visitors Across the Year

Projected **114000** annual visitors

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
Spread of visitors across each month	4%	4%	4%	6%	10%	12%	12%	15%	11%	9%	9%	4%
Monthly visitors	4560	4560	4560	6840	11400	13680	13680	17100	12540	10260	10260	4560
Weekday visitors (assumes 40% of visitors)	1824	1824	1824	2736	4560	5472	5472	6840	5016	4104	4104	1824
Weekend visitors (assumes 60% of visitors)	2736	2736	2736	4104	6840	8208	8208	10260	7524	6156	6156	2736
Daily Weekday Visitors	92	92	92	137	228	274	274	342	251	206	206	92
Daily Weekend Visitors	342	342	342	513	855	1026	1026	**1283**	941	770	770	342

The above information provided shows that, potentially, 1283 visitors could visit daily at weekends during August months.

I first visited Fort Dunree on Friday 4th August 2023 carried out a visual assessment of the existing wastewater treatment systems and the proposed locations for the reception of final wastewater. It was immediately obvious that it was not possible to carryout the standard and percolation tests because of the lack of soil depth and gaining safe access for a digger to the land areas earmarked for the disposal of final wastewater. It was / is clear to me This is a case where **all materials** relating to the disposal of secondary treated effluent will have to be imported.

Because I deemed it not possible to carryout standard trial hole and percolation tests, I felt compelled to seek the advice of Barry Callaghan (Environmental Health Officer).

I met with Barry Callaghan onsite on the 15th August 2023. I explained to Barry the proposal with regards wastewater treatment is to provide 2no wastewater treatment and disposal arrangements i.e. one of the new proposed treatment & disposal arrangements is to replace the existing treatment system that serves the military museum and wildlife centre etc with the other proposed treatment & disposal arrangement to replace a septic system (not being used at present) that once served the High Fort.

Usage

- It is projected that 80% of those visiting will utilize the wastewater treatment and disposal arrangement that will serve the military museum and wildlife centre etc.
- It is projected that 20% of those visiting will utilize the wastewater treatment and disposal arrangement that will serve The High Fort

Barry Callaghan (EHO) agreed that it would not be possible to carryout the standard trial hole & percolation tests and that all materials concerning tertiary treatment and polishing would need to be imported. Mr Callaghan advised that because of a topography that strongly indicates flow paths that descend towards the shores & sea, and the close proximity of the wastewater treatment and disposal arrangement that will serve the military museum and wildlife centre etc to receiving waters. that, every effort be made to ensure the final effluent is of good quality and does not negatively impact on the environment, public health or receiving waters. Mr Callaghan informed me of the well documented growing concern about Lough Swilly's water quality.

The Initial Wastewater Treatment Process (Military Museum and Wildlife Centre etc)

Barry Callaghan advised that the wastewater treatment and disposal arrangement that will serve the military museum and wildlife centre etc should involve a suitably sized primary settlement tank or tanks so as to remove material that could interfere with or inhibit subsequent treatment stages.

The Initial Wastewater Treatment Process (High Fort)

Because of the expected volume and nature of wastewater treatment that will be generated at the High Fort, it was agreed that raw wastewater could be discharged directly to an aerobic biological treatment plant.

The current wastewater treatment arrangement serving the Military Museum and Wildlife Center etc. (Lower Treatment Plant)

Wastewater discharges to an FM Environmental Biofilter Model 3STD (PE 20). This treatment plant is not working in the manner intended, in that, the submersible pump that recirculates settled wastewater through the Biofilter where biological treatment takes place is non-operational. This means that wastewater treatment within this treatment plant consists of nothing more than basic sedimentation and a measure of anaerobic digestion.

Wastewater from this treatment plant discharges via gravity to a percolation area. There is evidence of grass enrichment within this land area – this indicates poorly or untreated wastewater.

The current wastewater treatment arrangement serving the Military Museum and Wildlife Center etc. (High Fort)

The High Fort is currently not generating any wastewater. The existing septic tank system is out of date and inadequate to treat future wastewater generation.

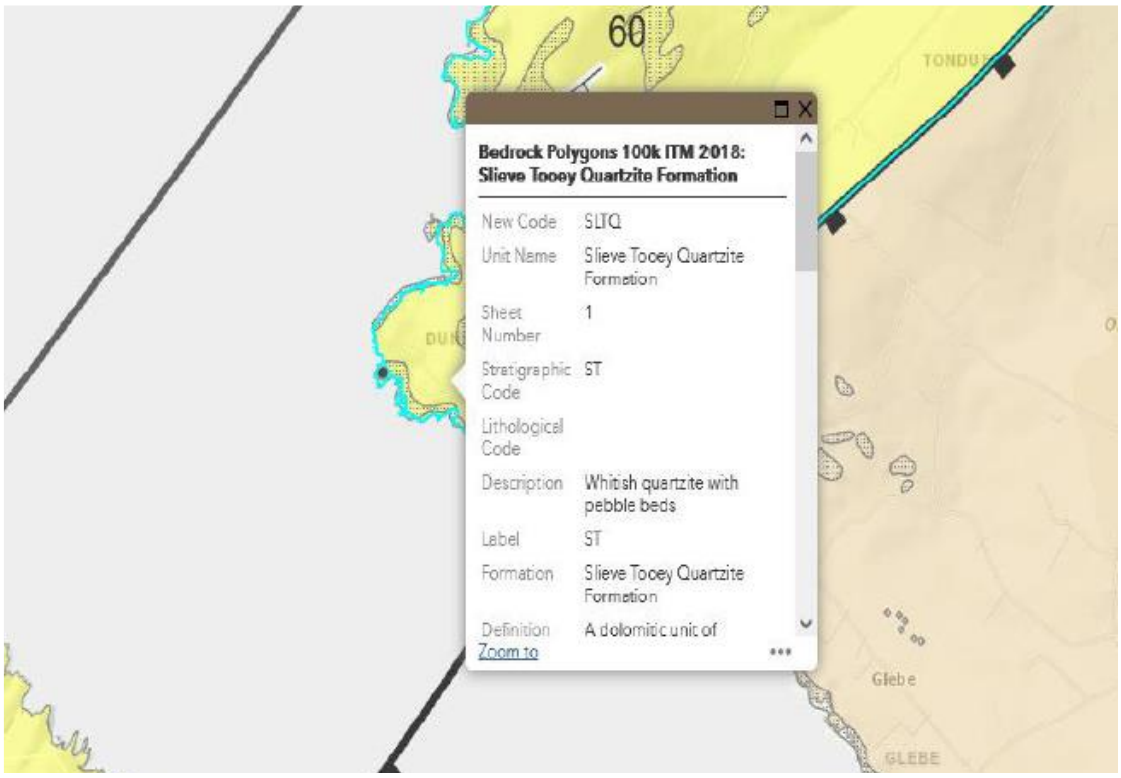
Site Description
The topography of Dunree consists of rocky outcrops with a very thin covering of soil that is fragmented with horizontal or sloping bedrock exposures. The shattered bedrock appears to be providing very good natural drainage. The vegetation within both of the land areas earmarked for the disposal of final wastewater consists predominately of Fern and Perennial Grasses both of which are good visual indicators of good natural drainage during all seasons.

Slopes within both of the land areas earmarked for the disposal of final wastewater vary significantly, therefore it will be imperative that the imported materials that will make up the tertiary treatment filter and polishing-filter are retained effectively. I would suggest the use of gabions or GRP impermeable panels with drainage outlets.

Water Supply
Public Mains

Bedrock Aquifer
PI – Poor Aquifer, Bedrock which is generally unproductive except in local zones.

Bedrock: Whiteish quartzite with pebble beds



Vulnerability: Extreme, Rock at or near surface

Estimated Wastewater Loadings

Based on this information received, I have calculated the loadings as follows,

Military Museum and Wildlife Centre etc. (Lower Treatment Plant)

80% of 1283 = 1026 visitors

	Total Flow litres / daily		**Total BOD grams / daily**
1,026 @ 15liters	15,390	1,026 @15grams	15.39kg
20 staff @60liters	1,200	20 staff @ 30grams	0.60kg
Totals	**16,590**		**15.99kg**

The estimated flow litres based on the information provided equates to 16.590m^3, therefore the hydraulic load is that of a 110.6 Population Equivalent (PE 110.6), the daily organic loading based on the information provided equates to 15.99kg (PE 266.5)

High Fort (Treatment plant)

20% of 1,026 = 205 visitors

A Kitchen and Snack Bar are proposed to offer off-site prepared food

	Total Flow litres / daily		**Total BOD grams / daily**
205@ 15 litres	3,075	205@15grams	3,075grams

The estimated flow litres based on the information provided equates to 1.025m^3, therefore the hydraulic load is that of a 20.5 Population Equivalent (PE 20.5), the daily organic loading based on the information provided equates to 3.075kg (PE 51.25)

Secondary Treated Wastewater Disposal

Disposal Of Secondary Treatment Plant Wastewater serving the Military Museum and Wildlife Centre etc.

(Lower Treatment Plant)

To enhance the quality of final effluent, I am recommending, that treatment plant wastewater is pumped intermittently to an Intermittent Mono-grade Sand Filter with an infiltration area of 275sqm. Intermittent Mono-grade Sand Filters are an effective form of on-site treatment and the area required for the filter is significantly less than that required for an intermittent soil filter or a soil and/or subsoil percolation area.
Sand Filter wastewater will discharge to a 900mm bed of imported soil with a percolation rate in the 5-20 range. I am be recommending that when importing the soils, that tests are carried out by a qualified person.

Note: The existing topography of the land area earmarked for the disposal of secondary treated wastewater strongly indicates that Gabions or GRP impermeable panels or similar may need to be used to retain all imported materials.

Disposal Of Secondary Treatment Plant serving the High Fort.

High Fort (Treatment plant)

To enhance the quality of final effluent, I will be recommending, that treatment plant wastewater is pumped intermittently to an Intermittent Mono-grade Sand Filter with an infiltration area of 20sqm. Sand Filter wastewater will discharge to a 900mm bed of imported soil with a percolation rate in the 5-20 range. The surface area of the soil bed will be 52sqm. I will be recommending that when importing the soils, that tests are carried out by a qualified person.

Note: The sloping ground here suggests that retention of all imported materials may also be required.

To ensure all wastewater generated by the **Military Museum and Wildlife Centre etc** is disposed in a manner that safeguards the Local Environment & Public Health, I recommend,

1. **That a suitability sized Grease Trap be fitted.**
   The correct size can be determined by two methods.
   Option 1 - Type of Kitchen: This looks at the type of operation, such as café, and requires the input of average meals per day with the kitchen operational hours per day.
   Option 2 - Type of Equipment: This looks at all the grease producing equipment within the kitchen which requires treating, the quantity of each particular sink or kitchen equipment is entered to calculate the required nominal size grease management system.
   The grease trap should be fitted, no less than 5m from the waste source

2. **That a suitability sized settlement tank be provided.**
   This settlement tank will allow heavier solids to sink to the bottom and lighter solids to float to the top. Once these materials have settled, they are held back while the liquid is moved onto the secondary phase of treatment. The advantage of employing a settlement tank in this case is that it allows the infiltration area of the Intermittent Monograde Sand Filter to be reduced in size significantly.
   Let me explain,
   Usually, the infiltration area is calculated on the population equivalent of the required treatment plant which is 266.5 x 2.5sqm -this equates to an infiltration area of 666.25sqm. Considering the topography of this location, in my opinion, it would be challenging to achieve and infiltration of such a size. Therefore, the provision of a settlement tank allows me to base the infiltration are on hydraulic loading rather than the organic loading i.e. an infiltration of 275sqm.

3. **That a Certified Secondary Wastewater Treatment Plant with a minimum capacity to serve a Population Equivalent of 267 be provided**.
   The second stage of wastewater treatment involves aerobic breakdown. This process occurs in the aeration chamber where naturally occurring bacteria live in a filter media. These bacteria feed on air which is supplied through a compressor. As the liquid flows through the filter media, the bacteria feed on the waste and remove it from the liquid.
   Note: If it is the case that wastewater from the settlement tank cannot discharge to the secondary wastewater treatment plant and that a pump has to be employed, then a stilling chamber will have to be provided so as to allow the liquid flow rate to significantly decrease prior to entering the treatment plant.

4. **That a Pump-fed Intermittent Monograde Sand Filter be provided to provide Tertiary Treatment.**
   The infiltration area of this filter must measure a minimum 275sqm. To ensure even distribution of secondary treated wastewater over the infiltration area of the monograde sand filter, a dual pump station will have to be provided and zoned regions maybe be required. Uniform distribution of wastewater effluent over any filter bed is vital. Uneven distribution of wastewater over a filter bed is often the cause of on-site wastewater system failures, resulting in hydraulic and biological overloading in areas.
   The Dual Pump Station should be equipped with a High-Level Alarm

5. **That Tertiary Treated Wastewater discharges to an underlying Soil-Polishing Filter.** This Soil-Polishing Filter must measure a minimum 275sqm and made-up using imported soil with a percolation value in the 5-20 range.
   Note: When importing soils and/or subsoils onto sites as part of either site improvement works or the construction of a Wastewater Treatment System, it is necessary to perform testing of each 300 mm layer while the process of emplacing lifts of soil progresses. After each lift is placed, percolation tests should be carried out. A 150 mm square hole is excavated to a depth of 150 mm in the placed soil. After pre-soaking to completely wet the soil, 0.5 litres of water is poured into the hole and the time in minutes for the water to soak away is recorded. This time should be between 10 minutes and 2 hours.

6. That all surface water runoff and seepage be collected and diverted away from the land area earmarked for the reception of secondary treated wastewater

7. That two observation/monitoring ports be installed within the sand filter. One observation port /monitoring port be installed to the bottom of the sand medium. A second observation / monitoring port be installed to the bottom of the underlying polishing material.

8. The sides of the Intermittent Sand Filter should be enclosed by an impervious liner so as to prevent possible bypass of secondary treated wastewater to the surrounding environment. A geotextile fabric should be placed on top of the entire filter bed so as to prevent the entry of silt.

9. That the existing Septic System is retired and that the system and its contents are handled by a contractor with the correct equipment and facilities for their safe disposal. The contractor must also hold a Waste Collection Permit.

Quality Assurance: Installation & Commissioning

10. **That a suitably qualified person with appropriate Insurance** be invited to supervise the installation of the Treatment Plant & Dual Pump Station, plan & supervise the construction of the Intermittent Sand Filter and Soil-Polishing Filter and provide an Ancillary Cert so as to support a Certificate of Compliance.

Legal obligations regarding maintenance of wastewater treatment systems

11. **That a Maintenance Service Agreement be attained**.
    Part 4 of the Water Services Act, 2007 (as amended) and associated Regulations established a system for registration, inspection and enforcement of DWWTS and placed duties on owners, water service authorities and the EPA: 'A person who owns, has in his or her charge or otherwise has control over a wastewater works shall cause it to be properly maintained'. The property owner has, therefore, a legal responsibility to ensure that the system does not cause pollution, a health hazard, or a nuisance.

To ensure all wastewater generated at the High Fort is disposed in a manner that safeguards the Local Environment & Public Health, I recommend,

1. **That a suitability sized Grease Trap be fitted.**
   The correct size can be determined by two methods.
   Option 1 - Type of Kitchen: This looks at the type of operation, such as café, and requires the input of average meals per day with the kitchen operational hours per day.
   Option 2 - Type of Equipment: This looks at all the grease producing equipment within the kitchen which requires treating, the quantity of each particular sink or kitchen equipment is entered to calculate the required nominal size grease management system.
   The grease trap should be fitted, no less than 5m from the waste source

2. That a Certified Secondary Wastewater Treatment Plant with a minimum capacity to serve a Population Equivalent of 52 be provided

3. That a Pump-fed Intermittent Monograde Sand Filter be provided to provide Tertiary Treatment.
   The infiltration area of this filter must measure a minimum 52sqm.
   The Pump Station should be equipped with a High-Level Alarm

4. That Tertiary Treated Wastewater discharges to an underlying Soil-Polishing Filter. This Soil-Polishing Filter must measure a minimum 52sqm and made-up using imported soil with a percolation value in the 5-20 range.
   Note: When importing soils and/or subsoils onto sites as part of either site improvement works or the construction of a Wastewater Treatment System, it is necessary to perform testing of each 300 mm layer while the process of emplacing lifts of soil progresses. After each lift is placed, percolation tests should be carried out. A 150 mm square hole is excavated to a depth of 150 mm in the placed soil. After pre-soaking to completely wet the soil, 0.5 litres of water is poured into the hole and the time in minutes for the water to soak away is recorded. This time should be between 10 minutes and 2 hours.

5. That all surface water runoff and seepage be collected and diverted away from the land area earmarked for the reception of secondary treated wastewater

6. That two observation/monitoring ports be installed within the sand filter. One observation port /monitoring port be installed to the bottom of the sand medium. A second observation / monitoring port be installed to the bottom of the underlying polishing material.

7. The sides of the Intermittent Sand Filter should be enclosed by an impervious liner so as to prevent possible bypass of secondary treated wastewater to the surrounding environment. A geotextile fabric should be placed on top of the entire filter bed so as to prevent the entry of silt.

8. That the existing Septic System is retired and that the system and its contents are handled by a contractor with the correct equipment and facilities for their safe disposal. The contractor must also hold a Waste Collection Permit.

9. That a suitably qualified person with appropriate Insurance be invited to supervise the installation of the Treatment Plant & Dual Pump Station, plan & supervise the construction of the Intermittent Sand Filter and Soil-Polishing Filter and provide an Ancillary Cert so as to support a Certificate of Compliance.

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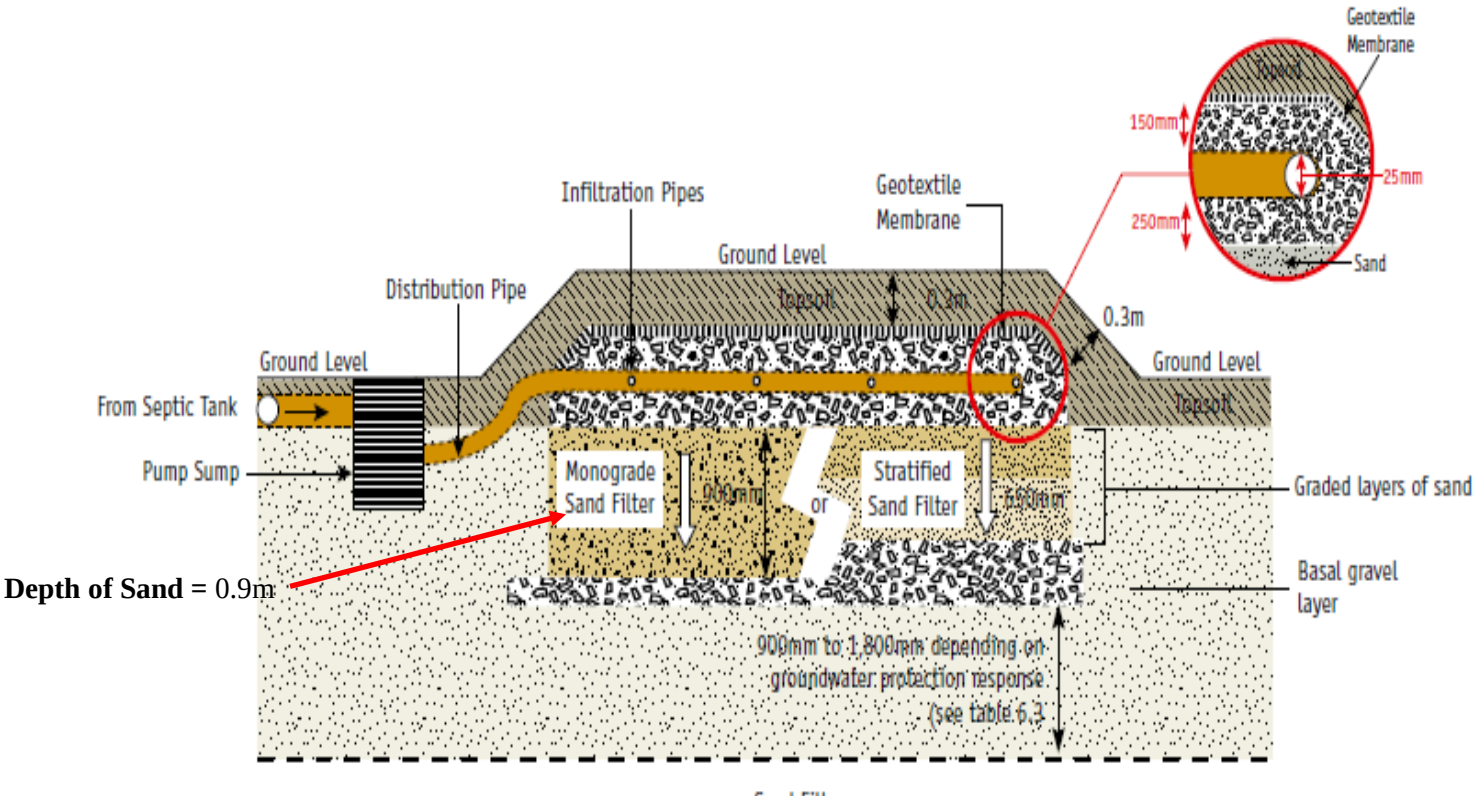
    Part 4 of the Water Services Act, 2007 (as amended) and associated Regulations established a system for registration, inspection and enforcement of DWWTS and placed duties on owners, water service authorities and the EPA: 'A person who owns, has in his or her charge or otherwise has control over a wastewater works shall cause it to be properly maintained'.
    The property owner has, therefore, a legal responsibility to ensure that the system does not cause pollution, a health hazard, or a nuisance.

Sand Media

The ideal sand media for an intermittent mono-grade sand filter is a coarse sand with an effective size between 0.3 mm and 0.5 mm. The media sand grains should be relatively uniform in size having a low Uc value (less than 4.0) to promote movement of water and prevent clogging

Example of typical Pumped/Pressurised Mono-grade & Stratified Sand Filters



The infiltration pipes should be laid with the holes facing downwards

Note: Monograde Sand Filters are what is recommended in this report.

How to take care of sewage treatment plants – A few important tips

1. **Things that will block the treatment plant**

Any items that could block pumps, pipes or filter material should be kept out of the sewage system. These include:

- Nappies
- Sanitary material
- Wet wipes/face wipes
- Rags/cloths
- Soft toys

2. Things that will kill or harm bacteria

Material and liquids that could be damaging to bacteria should not be put down the drains. Harming the bacteria will have a negative impact on the treatment quality and can cause the system to smell, some of these include:

- Motor oil, grease, anti-freeze, brake fluid, etc.
- Weed-killers, insecticides, fungicides and other gardening chemicals.
- Medicines – all should be taken to your nearest pharmacy for safe disposal
- Paint, thinners, white spirit, turpentine, creosote, etc.
- Photographic developing fluids.
- Large quantities of bleach
- Large quantities of washing detergent

It must be noted that small quantities of bleach and detergent won't have a huge impact on the system. Furthermore, if you are using bleach it is advised to spread the usage over a few days rather than use it all on one day. This is also true for washing detergent. Most systems can handle it with no problem, unless you are doing a lot of washing (and cleaning) all on the same day.

3. Things that will overload the plant biologically

In a normal situation your treatment plant should be more than capable of dealing with the wastewater from your house. However, organic material places a demand on the water (and bacteria) and systems are sized for average amounts of organic material. The main things that overload a treatment plant are as follows:

- Cooking oil and fat.
- Food waste
- Too many people

Adding food (which hasn't been broken down by us humans first) could be the equivalent of adding another 4-5 peoples waste into your system. Also, as food breaks down it can smell rather pungent.

SCHEDULE

POLICY NUMBER	PI/D/12417/23/1
INSURED	Tecsoil Site Assessment Ltd
ADDRESS	Pole Road, Meenmore, Dungloe, Donegal
Description of Activities	Site Suitability Assessments/Percolation Testing and Design & Installation of Wastewater Treatment Systems
PERIOD OF INSURANCE	11th March 2023 (00:01hrs) to 10th March 2024 (23:59hrs)
RENEWAL DATE	11th March 2024
LIMIT OF INDEMNITY	€1,300,000 aggregate any one PERIOD OF INSURANCE, DEFENCE COSTS included
EXCESS	€2,500 each and every CLAIM. The EXCESS applies to DEFENCE COSTS
RETROACTIVE DATE	10th March 2006
JURISDICTION	Ireland/UK/IoM/EU
TERRITORIAL LIMITS	Worldwide excluding USA/Canada
CONDITIONS	As per DC AGG 0422 RLU policy wording plus the following endorsements:- BESPOKE ENDT Indemnity in respect of Site Suitability Assessments/Percolation Testing and Design & Installation of Wastewater Treatment Systems only BESPOKE ENDT Consumer Insurance Contracts Act 2019
DATE OF PROPOSAL FORM or STATEMENT OF FACT	This insurance is based on the proposal form or statement of fact, the dates of which are noted below and supporting documentation (if any accompanying the proposal form): Proposal form date: 07 February 2023 No Claims Material Changes Declaration Date (if applicable): 10 March 2023
NOTICE OF any CLAIM or CIRCUMSTANCE is to be given to:	RL Underwriting 10 The Courtyard, Kilcarbery Park, Nangor Road, Dublin 22 Tel: (01) 9131 155 Email: piclaims@rlunderwriting.com

This Schedule of Insurance outlines the basis of the insurance policy. This insurance is underwritten by Chaucer Insurance Company DAC. Registered in Ireland no. 587682. Registered office: 38 & 39 Baggot Street Lower, Dublin 2. Chaucer Insurance Company DAC is regulated by the Central Bank of Ireland. This policy is administered by Aston Lark Europe Limited t/a RL Underwriting under Binding Authority contract B1855E220002. Aston Lark Europe Limited t/a RL Underwriting, is regulated by the Central Bank of Ireland. Registered Ireland No. 338916. Registered office: 10 The Courtyard, Kilcarbery Park, Nangor Road, Dublin 22, Ireland.

FETAC
Further Education and Training Awards Council
Comhairle na nDámhachtainí Breisoideachais agus Oiliúna

Level 6 Specific Purpose Certificate
Teastas Cuspóra Shainiúil Leibhéal 6

Site Suitability On-Site Wastewater Treatment

Awarded to
Bronnta ar

Hugh Boyle

21/08/2007

Chair/Cathaoirleach FETAC

Chief Executive/Príomhfheidhmeannach FETAC

EF229890 722383

Signed: _ 

Hugh Boyle

Address: Tecsoil, Pole Rd., Dungloe, Co. Donegal

Qualifications/Experience: FAS/EPA Site Suitability Assessment for On-Site Wastewater Treatment Systems course (FETAC)

Professional Indemnity Insurance Policy Number: PI/D/12417/23/1. (ARB Underwriting Ltd)

Appendix B – Watermain Asset Map