White Hill Wind Farm Electricity Substation & Electricity Line

Environmental Impact Assessment Report

Annex 3.5: Planning-Stage Construction & Environmental Management Plan

White Hill Wind Limited

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Contents

1.0 Introduction 1
1.1 Purpose of this Report 1
1.2 Objectives of this CEMP 1
1.3 Structure of this CEMP 1
1.4 Roles & Responsibilities 2
1.5 Reporting Procedures 2
2.0 Description of the Project 2
3.0 General Construction Sequence 3
3.1 Construction Method 3
3.2 Site Entrances 4
3.3 Site Access Tracks 5
3.4 Temporary Construction Compound 5
3.5 Chemical Storage and Refuelling 5
3.6 Electricity Substation 6
3.7 Interface Masts & Underground Electricity Line 7
3.8 Underground Electricity Line 7
3.9 Electrical Control Unit 9
3.10 Construction Waste Management 9
3.11 Construction Employment 10
3.12 Construction Traffic 10
4.0 Environmental Management Measures 11
4.1 'Designed-In' Measures 11
4.2 Population & Human Health 15
4.3 Biodiversity 15
4.4 Land & Soil 20
4.5 Water 23
4.6 Air Quality & Climate 30
4.7 Landscape 31
4.8 Cultural Heritage 31
4.9 Noise & Vibration 32
4.9.1 Noise 32
4.9.2 Vibration 33
4.10 Transport & Access 33
4.11 Waste Management 35
5.0 Implementation of Environmental Management Measures 35

6.0 Communication Plan 36
7.0 Staff Training & Environmental Awareness 36
8.0 Emergency Response Procedures 37
9.0 Recording & Reporting 37
10.0 Compliance & Review Procedures 37
10.1 Site Inspections & Environmental Audits 37
10.2 Auditing 37
10.3 Environmental Compliance 38
10.4 Corrective Actions 38

1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Planning-Stage Construction & Environmental Management Plan (CEMP) for the construction of the White Hill Wind Farm Electricity Substation & Electricity Line.

1.1 Purpose of this Report

This CEMP has been prepared to outline the management of activities during the construction of the project to ensure that all construction activities are undertaken in an environmentally responsible manner. This CEMP summarises the environmental commitments made in respect of the project and the measures to be adopted to ensure compliance with legislation and the requirements of statutory bodies.

This CEMP (Planning-Stage/Preliminary) is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated CEMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (ECoW), as necessary, to confirm the appropriateness of the measures set out therein. This CEMP will form part of the main construction works contract. The contractor will take account of the structure, content, methods and requirements contained within the various sections of this CEMP when further developing this document (to include environmental plans and other related construction management plans and method statements) as required.

1.2 Objectives of this CEMP

This CEMP has been developed in accordance with the Institute of Environmental Management and Assessment (IEMA) *Practitioner Environmental Management Plans Best Practice Series Volume 12 (December 2008)* and has been designed to address the proposed environmental construction strategies that are to be implemented in advance of and during the construction of the project.

This CEMP aims to define good working practices as well as specific actions required to implement mitigation requirements as identified in the Environmental Impact Assessment Report (EIAR), Natura Impact Statement (NIS), the planning process, and/or other licensing or consenting processes.

1.3 Structure of this CEMP

The CEMP has been structured such that it can be read as consolidated document or as discreet documents addressing specific environmental topics. In particular, we refer to the technical annexes enclosed which address specific matters such as spoil management, surface water management, waste management, and emergency responses.

A copy of the CEMP will be maintained in the site offices for the duration of the construction phase and will be available for review at any time. The contractor's EM will be responsible for the continued development of the CEMP throughout the construction phase.

Where specific construction management plans or method statements are prepared by the contractor, these will be inserted into the relevant section of this CEMP.

1.4 Roles & Responsibilities

White Hill Wind Limited, and its appointed Project Manager, will be responsible for the overall implementation of the environmental measures and procedures set out in the CEMP. The role of the Project Manager relates to compliance monitoring with the CEMP and other planning/environmental/licensing requirements. Additionally, the Project Manager shall be empowered to halt works where he/she considers that continuation of the works would be likely to result in a substantial environmental risk.

The Project Manager will also carry out site checks that the works are being undertaken in accordance with the CEMP and will prepare a record of same.

The contractor will appoint an EM who will be responsible for coordination and development of the CEMP and any other surveys, reports or construction management plans necessary for the discharge of the requirements of the CEMP. The EM will also review the contractors construction management plans as required, carry out compliance auditing during the construction phase and coordinate the Environmental Management Group (see below) and required liaisons between White Hill Wind Limited, the contractor, and other statutory authorities.

Prior to commencement of construction, the contractor will identify a core Environmental Management Group, comprising of specific project personnel and including the Project Manager, EM and ECoW. The Environmental Management Group will meet monthly to discuss the monthly environmental report and will advise site personnel on areas where improvements may be made on site. The group will draw on technical expertise from relevant specialists where required and will liaise with other relevant external bodies as required.

1.5 Reporting Procedures

Appropriate reporting procedures are key to the proper implementation of the measures outlined within this CEMP, and include reporting between parties involved in the construction of the project and also external stakeholders, such as the relevant local authorities.

Emergency and environmental incident reporting procedures are set out in the Environmental & Emergency Response Plan (see **Annex 1**).

2.0 Description of the Project

White Hill Wind Limited intends to construct the project which will consist of:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;
- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.8km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 3.3km of the underground electricity line located in County Kilkenny and c. 5.5km of the underground electricity line and the electrical control unit located in County Carlow. Electrical equipment suppliers,

construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

Various environmental reports have been prepared in respect of the project and have been utilised in the preparation of this CEMP, including:-

- Environmental Impact Assessment Report (Galetech Energy Services); and
- Natura Impact Statement (SLR Consulting).

3.0 General Construction Sequence

The construction phase is likely to last for approximately 15-18 months from commencement of further site investigations through the installation of underground electricity line, construction of the electricity substation and concluding with the commissioning of the electrical apparatus, site reinstatement and landscaping.

The construction phase of the development will comprise a 6 no. day week with normal working hours from 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays or public holidays. It may, however, be necessary to undertake works outside of these normal hours in exceptional circumstances or in the event of any emergency. Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification.

3.1 Construction Method

The construction method will consist of the following general sequence:-

- Establishment of necessary traffic management measures at the substation site entrance, with site entrance to be fully established (including provision of visibility splays) in advance of other works commencing on site;
- Installation of preliminary surface water control measures;
- Carriageway widening works along the L66732;
- Progressive construction of the access track and installation of drainage system and surface water control measures;
- Establishment of temporary construction compound;
- Site preparatory works and groundworks associated with the substation compound including EirGrid Building and IPP Building;
- Establishment and continued management of spoil deposition areas;
- Construction of the EirGrid Building and IPP Building;
- Construction of bases or plinths for electrical apparatus;
- Erection of palisade fencing around substation compound;
- Installation of internal and external electrical apparatus in EirGrid Building and IPP Building and within compound;
- Installation of underground electricity line between electricity substation and electrical control unit including the advance installation of any surface water protection measures and the completion of HDD works;
- Installation of temporary wooden pole-sets to carry and maintain strain of the 110kV Kellis-Kilkenny electricity transmission line during installation of interface masts;
- Preparatory groundworks associated with the interface mast foundations;
- Installation of interface masts;
- Installation of underground electricity line between substation and interface masts;

- Establishment of necessary traffic management measures at the electrical control unit site entrance, with site entrance to be fully established (including provision of visibility splays) in advance of other works commencing on site;
- Site preparatory and groundworks associated with the control unit compound including installation of surface water control measures and construction of access track;
- Erection of palisade fencing around compound;
- Installation of electrical control unit;
- Commissioning and testing of electrical apparatus within electricity substation and electrical control unit;
- Connection of underground electricity line to the electricity substation and 110kV Kellis-Kilkenny electricity transmission line;
- Decommissioning of temporary wooden pole-sets;
- Connection of underground electricity line to the electrical control unit;
- Final commissioning of electrical apparatus and underground electricity line; and,
- Progressive site reinstatement, restoration, landscaping and planting proposals including the installation of stockproof fencing and the erection of gates.

In addition to the roles of the EM and ECoW described above, the construction phase will be supervised by a range of environmental and engineering specialist personnel; including a Project Supervisor for the Construction Stage (PSCS), Archaeological Clerk of Works (ACoW), and Geotechnical Clerk of Works (GCoW), among others; who will liaise closely with the appointed contractor's EM to monitor and to ensure that all applicable measures are implemented.

3.2 Site Entrances

Access to the substation site will be provided via a new site entrance from the L66732 local public road. The site entrance will not be required to accommodate any abnormal size loads but has been designed to ensure ease of access and egress for standard HGVs which will deliver construction materials and electrical apparatus to the site.

The site entrance will be constructed in accordance with the requirements of the Planning Authority and appropriate visibility splays of 90m in each direction have been provided. Due to the requirement to provide visibility splays, it will be necessary to trim back roadside hedgerows; however, there will be no requirement for the removal of any hedgerow.

Following the completion of construction, the site entrance will be appropriately fenced off and gated to prevent unauthorised access. The reinstatement of the site entrance will also incorporate the replanting of hedgerows, with native species. Hedgerows will be appropriately sited to allow for future growth while ensuring, at all times, that visibility splays are maintained during the operational phase.

To the north of the site entrance, the width of the paved carriageway of the L66732 will be increased to accommodate the delivery of construction materials to the electricity substation. The existing carriageway will be widened by c. 1.5m over a distance of c. 130m. Along this section, existing roadside verge will be removed, and any roadside drainage features piped and backfilled, to accommodate the increased carriageway width. No hedgerow or trees will be removed; however, trimming of roadside vegetation will be undertaken.

The electrical control unit will be accessed via the creation of a new site entrance, from the L7117 local road. The site entrance will be constructed generally as described above with c. 10m of roadside hedgerow being removed and visibility splays of 90m in each direction being provided. The provision of visibility splays will not require the removal of any roadside hedgerow due to the width of the existing roadside verge; however, hedgerows may be trimmed back to ensure full visibility is maintained.

3.3 Site Access Tracks

A total of approximately 1.35km of on-site access track (c. 1.1km at electricity substation and c. 250m at electrical control unit) will be required for construction purposes and for site access during the operational phase. The access track shall be similar to normal agricultural tracks but with a slightly wider typical running width of approximately 4m. The access track will largely be unsealed and constructed of crushed stone material to allow for permeability; however, c. 150m of access track within the electricity substation compound will be finished with concrete (in accordance with EirGrid specifications). Due to the findings of site investigations and the geological characteristics of the site, usable rock material for the construction of the access track is unlikely to be encountered during excavations and, therefore, it is likely that all aggregate material will be imported from local quarries.

The access tracks will generally be constructed as follows:-

- Topsoil and subsoil will be excavated, side-cast and stored in separate mounds in appropriate areas adjacent to the access track;
- Crushed stone will be laid on a geo-textile mat (where required) and compacted in layers to an appropriate depth. The access track will not be finished with tar and chips or concrete (other than a short section within the electricity substation compound which shall be finished with concrete) and the surface will be permeable to allow incidental rainfall to percolate to ground; thus avoiding significant volumes of surface water run-off being generated and avoiding changes to the natural drainage regime;
- Drainage infrastructure and the underground electricity line will be installed adjacent to the access track; and,
- The edges of the access track will be finished and reinstated with excavated material and reseeded or allowed to vegetate naturally.

3.4 Temporary Construction Compound

Topsoil will be removed from the required area and side cast for temporary storage adjacent to the compound area. The compound base will be made up of well graded aggregates, compacted as necessary. A designated waste management area and fuels and chemicals storage area will be provided along with site offices, parking, staff welfare facilities and equipment storage areas. The compound will be fenced with temporary security fencing to restrict access. Following the completion of the construction phase, the temporary construction compound will be fully removed and the compound will be reinstated with excavated material and reseeded.

3.5 Chemical Storage and Refuelling

Storage areas for chemicals and fuels will comprise bunded areas of sufficient capacity within the temporary construction compound. An oil interceptor will be installed within the surface water drainage system during the construction phase to intercept any accidental hydrocarbon spillages/discharges that may be present.

From the construction compound, fuel will be transported to the works area, by a 4x4, in a double skinned bowser with drip trays under a strict protocol and carried out by suitably trained personnel. The bowser/4x4 will be fully stocked with spill kits and absorbent material, with delivery personnel being fully trained to deal with any accidental spills. The bowser will be bunded appropriately for its carrying capacity. A 50m buffer will be observed around all natural surface water features and no refuelling will be permitted within this zone.

3.6 Electricity Substation

The footprint of the substation (overall compound area) will measure approximately 10,600m^2 and will be surrounded by a palisade fence, with associated gates, of 2.6m in height for safety and security reasons. The electricity substation will contain 2 no. control buildings and all necessary electrical equipment and apparatus to facilitate the export of electricity from the permitted White Hill Wind Farm to the national grid. Ancillary infrastructure located within the footprint of the compound will include transformers, busbars, insulators, circuit breakers, and lightning poles.

The substation site is relatively flat and slopes gently to the south/southeast with ground elevations ranging from c. 68m AOD in the southeast of the site to c. 73m AOD in the northwest (interface masts). There will be a requirement to undertake minor modifications to ground levels in order to achieve the required levels for the control buildings, structures and electrical equipment. A 'cut and fill' exercise will be implemented whereby material at higher elevations (i.e. topsoil and subsoil) will be excavated and imported material (i.e. aggregates) used to make up levels at areas of lower elevation. This process, which accords with best practice construction techniques, will avoid the excavation of significant volumes of soil or the importation of significant volumes of stone aggregates in order to provide a level compound.

The substation compound will be surfaced with c. 400mm of free-draining crushed stone such that rainwater can percolate to ground. Due to the findings of site investigations and the geological characteristics of the site, usable rock material for the construction of the access track is unlikely to be encountered during excavations and, therefore, it is likely that all aggregate material will be imported from local quarries

The loss of hedgerow will be off-set through the planting of hedgerows (native species) around the boundaries of the electricity substation and elsewhere within the project site.

The electricity substation will contain 2 no. control buildings; one of which, the Customer MV Switchgear Room ('the IPP Building'), will be operated and maintained by the Developer while the Transmission System Operator (TSO) Control Building ('the EirGrid Building') will be operated by EirGrid.

The IPP Building will measure c. 8.5m x 20m (gross floor area of 172m^2) and will have an overall height of c. 5.5m to ridge height. The building shall be constructed of blockwork and will be finished in sand and cement render, slate roof covering and steel doors. The IPP Building will house switchgear and associated electrical equipment and apparatus.

The EirGrid Building will measure approximately 25m x 18m (gross floor area of 450m^2) and will have an overall height of approximately 8.5m to ridge height. The building shall be constructed of blockwork and will be finished in sand and cement render, slate roof covering and steel doors. The control building will contain a control room to

allow operatives monitor and manage the operation of the electrical apparatus and will also include storage and welfare facilities.

During the project design process, the Developer engaged with the Shankill Group Water Scheme to determine the feasibility of obtaining a water supply for the EirGrid Building and the IPP Building. While water infrastructure is located adjacent to the electricity substation site, the Developer was advised that "*Shankill GWS would not be in a position to grant a water connection to your proposed developement* [sic] *at this time.*" Subject to a grant of planning permission, the Developer will liaise with the Group Water Scheme prior to the commencement of development to re-assess the feasibility of obtaining a water connection. However, if a connection cannot be provided at that time, a well will be bored to provide water to the respective buildings.

Wastewater arising from the EirGrid and IPP buildings will be stored in a sealed sub-surface foul holding-tank and will be removed from site as required by a local licensed waste collector. Waste water management proposals of this nature are common practice for developments of this type located in remote/rural areas with infrequent usage.

Electrical equipment; including, but not limited to, a transformer, busbars, switchgear, insulators, cable sealing ends, and lightning poles; will be located outside the control building (within the palisade fence).

3.7 Interface Masts & Underground Electricity Line

The interface masts will be lattice-type masts and will be located immediately beneath the Kellis-Kilkenny overhead electricity transmission line. The masts will have a maximum height of 16m and a permanent above-ground footprint of c. 100m^2 (total; c. 50m^2 per mast) with concrete foundations below ground to a depth of c. 2m. However, it should again be noted that the precise specifications of the interface masts may be immaterially altered to ensure compliance with any future revised EirGrid specifications.

At the location of the interface masts, the existing overhead transmission line will be broken and the 110kV underground electricity line (c. 320m) will connect the existing overhead line to the electricity substation.

3.8 Underground Electricity Line

The electricity substation will be connected to the electrical control unit at the permitted White Hill Wind Farm via an underground electricity line of c. 8.8km in length. The underground electricity line will comprise c. 5,925m (c. 5.9km) located within private agricultural lands/forestry and c. 2,850m (c. 2.9km) with the carriageways of the L6673, L6738, L7117 and L71172 local roads.

The electricity line will be installed within ducting in an excavated trench of c. 1.2m deep and c. 2.2m wide and pulled through the ducting in sections of c. 1,200m in length or depending on the length of cable required. Cable (electricity line) lengths will be connected at designated 'jointing plinths' to be installed along the route. It is estimated that 8 no. jointing plinths will be required along the route of the underground electricity line; however, the exact number to be constructed will be confirmed as part of the post-consent detailed design process. Jointing plinths will comprise a concrete slab of c. 2m^2 which will be installed within the trench to provide a firm foundation for the joining of the electricity line. Traditional joint bay chambers will not be required. Jointing plinths will, insofar as possible, be located within private lands to minimise the extent of infrastructure within the public road network.

Following the installation of the ducting and jointing plinths; ground levels will then be made up using appropriate material (including sand and excavated material, if appropriate, and finished/reinstated to the requirements of the Planning Authority (public road) or landowner (private lands).

All public roads along which it is proposed to install the underground electricity line will be subject to a full-carriageway reinstatement (re-surfacing) of the section where the electricity line is installed thus ensuring that there are no long-term effects on the public road network. Where the electricity line crosses a public road, a 20m section (i.e. 10m either side of the centre point of the trench) will be subject to a full carriageway reinstatement.

Within private lands, the trench will be backfilled, finished with topsoil and reseeded or allowed to naturally revegetate. Where the electricity line passes through a hedgerow, c. 4-5m of hedgerow will be removed to facilitate construction activities; however, all such hedgerow will be replaced/replanted on a like-for-like basis. The electricity line will also pass through a number of existing stonewalls and stone/earthen banks. Insofar as possible, the electricity line has been routed to avoid the requirement for the removal of stonewalls and will pass through existing access points in the stonewalls. In the event that a stonewall is disturbed during the construction of the electricity line, it shall be replaced and re-constructed to its original condition. Similarly, stone/earthen banks will be re-constructed to their original condition.

All trenching works will be undertaken to ensure that only short sections of trench are open at any one time. Excavated materials will be stored separately (topsoil, subsoil and aggregates [as encountered]) for use during the reinstatement of the trench or disposed of at an appropriate licensed facility as necessary. The sequence of works is typically as follows:-

- Identify existing underground services prior to excavation;
- Excavate the trench to the required dimensions;
- Place a blinding layer (sand) at the base of the trench;
- Place and joint the high-density polyethylene (HDPE) power ducts using ties at 3m intervals;
- Lay in and compact a layer of sand around and above ducts and place yellow warning tape above;
- Install HDPE communications cable ducts;
- Lay in and compact an additional layer of gravel/excavated material;
- Final backfill layer to include yellow warning tape; and,
- Appropriate reinstatement, as discussed above.

Horizontal Directional Drilling (HDD) will be undertaken at 5 no. locations along the underground electricity line; namely at the intersections of the electricity line and the Paulstown Stream, Moanmore Stream, Shankill Stream and the crossing of the unnamed stream along the access track leading to the electricity substation. The use of this methodology will avoid any in-stream works or any direct or indirect effect on the morphology of the stream. Launch and receptor pits will be excavated at either side of the streams; a minimum of 10m away from the streams; to accommodate the drilling rig. The bore will be at a minimum depth of 2.5m below the stream channels to ensure that there are no effects on the respective channels. Following the installation of the ducts, the launch and receptor pits will be fully reinstated. Marker posts will be placed at either side of the streams to indicate the location and alignment of the electricity line.

The electricity line crosses a Gas Network Ireland high pressure gas pipeline along the

L6673. Following consultation with Gas Network Ireland, it was confirmed to the Developer that a minimum separation between the gas line and the electricity line of 0.6m would be required. Due to the below-ground depths of the existing gas line (3.2m) and the proposed electricity line (1.1m to ducts), a separation of 2.1m is achievable and will be provided for.

The installation of the underground electricity line will be undertaken in strict accordance with the *Code of Practice for Working in the Vicinity of the Transmission Network* (Gas Networks Ireland, 2021) and particularly with respect to the use of hand-held equipment within 1.5m (linear distance) of the pipeline.

3.9 Electrical Control Unit

The electrical control unit will measure approximately 10.5m x 4m (total gross floor area of 42m^2) and will have an overall height of approximately 4.5m. The unit, which will be pre-fabricated, will be installed on concrete supports approximately 1.2m above the finished level of the compound (see below); and will be finished, externally, in an off-white or light grey colour and a black roof.

The control unit will be installed within an enclosed hardcore-surfaced compound which will measure approximately 315m^2 and will be surrounded by a palisade fence, with associated gates, of 2.6m in height for safety and security reasons. The compound site is relatively flat; however, there will be a requirement to undertake minor excavations to provide a level footing for the control unit. The compound will be surfaced with c. 400mm of free-draining crushed stone such that rainwater can percolate to ground.

The compound will be accessed via the creation of a new site entrance, from the L7117 local road, and the construction of c. 250m of access track. The site entrance will be constructed as described above; with c. 10m of roadside hedgerow being removed and visibility splays (90m in each direction) will be provided in accordance with Section 16.10.7 of the *Carlow County Development Plan 2022-2028*. The provision of visibility splays will not require the removal of any roadside hedgerow due to the width of the existing roadside verge; however, hedgerows may be trimmed back to ensure full visibility is maintained.

The construction of the access track will again be undertaken as described above and will necessitate the removal of c. 10m of existing hedgerow; however, this removal (and that required for the site entrance as described above) will be off-set through replanting elsewhere within the project site. The control unit will be largely screened from view; however, bolstering of an existing hedgerow immediately south of the compound will be undertaken to provide an increased level of screening from the L7117 local road.

3.10 Construction Waste Management

Waste will be generated during the construction phase and the main items of anticipated construction waste are as follows:-

- Hardcore, stone, gravel, concrete, plaster, topsoil, subsoil, timber, concrete blocks and miscellaneous building materials;
- Waste from chemical toilets;
- Plastics; and
- Oils and chemicals.

Waste disposal measures proposed include:-

- On-site segregation of all waste materials into appropriate categories including, for example, topsoil, subsoil, concrete, rock, tiles, oils/fuels, metals, electricity cable off-cuts, dry recyclables (e.g. cardboard, plastic, timber);
- All waste materials will be stored in skips or other suitable and sealed receptacles in a designated area of the construction compound;
- Wherever possible, left-over materials (e.g. timber off-cuts) and any suitable demolition materials shall be re-used on-site;
- Uncontaminated excavated material (topsoil, subsoil, etc.) will be re-used on-site in preference to importation of clean inert fill;
- If suitable rock is encountered, it will be utilised for landscaping and site reinstatement;
- All waste leaving the site will be transported by licensed contractors and taken to suitably licensed facilities and will be recycled or reused where possible; and,
- All waste leaving the site will be recorded in accordance with legal requirements and copies of relevant documentation maintained.

3.11 Construction Employment

It is estimated that up to 40 no. people will be employed during the approximately 15-18 month construction phase. The actual number will depend on the activities being undertaken at any given time and will vary throughout the course of the construction programme. Employment will be the responsibility of the construction contractor appointed by the Developer, but it is likely that the workforce will include labour from the local area.

3.12 Construction Traffic

Vehicular traffic required for the construction phase is likely to include:-

- Articulated trucks (HGVs) to bring initial plant and machinery to site and later to bring electrical equipment and other construction materials;
- Tipper trucks and excavation plant involved in site development and excavation works;
- Miscellaneous vehicles and handling equipment, including vehicles associated with construction workforce.

Effects from construction traffic could include temporarily increased local traffic levels and traffic noise; while disruption is likely to occur during the installation of the underground electricity cables. Construction traffic on the local road network and construction works along the electricity cable route will be managed in accordance with a Traffic Management Plan and the requirements of Kilkenny County Council and Carlow County Council.

Traffic management measures will be implemented during the construction phase, as follows:-

- Signage on approach roads and at the site entrances giving access information;
- Temporary traffic restrictions kept to minimum duration and extent;
- Diversions put in place to facilitate continued use of roads where restrictions have to be put in place (e.g. along the electricity line route). Local access for residents and landowners will be maintained at all times;
- Appropriate arrangements will be implemented for emergency services, school bus routes and other public transport services;
- One way systems will be implemented for construction traffic, where possible, to prevent construction vehicles meeting;

- Speed limits will be strictly enforced;
- A designated person will be appointed to manage access arrangements and act as a point of contact to the public; and,
- All reinstatement works to be carried out in full consultation with Kilkenny County Council and Carlow County Council.

4.0 Environmental Management Measures

4.1 'Designed-In' Measures

The following measures will be implemented, as standard, as part of the construction of the project:-

- There will be a requirement to undertake minor modifications to ground levels in order to achieve the required levels for the control buildings, structures and electrical equipment. A 'cut and fill' exercise will be implemented whereby material at higher elevations (i.e. topsoil and subsoil) will be excavated and imported material (i.e. aggregates) used to make up levels at areas of lower elevation. This process, which accords with best practice construction techniques, will avoid the excavation of significant volumes of soil or the importation of significant volumes of stone aggregates in order to provide a level compound;
- The substation compound will be surfaced with c. 400mm free-draining crushed stone such that rainwater can percolate to ground thus avoiding significant generation of surface water;
- Wastewater arising from the control building will be stored in a sealed sub-surface foul holding-tank and will be removed from site as required by a local licensed waste collector;
- The site entrance will be constructed, and visibility splays provided, in accordance with Section 13.22.1 of the *Kilkenny City & County Development Plan 2021-2027*. Having regard to the physical characteristics of the L66732-3 and the nature of the road being a cul-de-sac, it is assessed that the L66732-3 has a design speed of 60kph and, accordingly, visibility splays of 90m in each direction have been provided;
- Following the establishment of the entrance, it will be appropriately fenced off and gated to prevent unauthorised access. Access gates will be set back 18m from the road edge to allow HGVs pull off the public road before accessing the site which will prevent any disruption to local road users. The reinstatement of the site entrance will also incorporate the replanting of hedgerows, as appropriate;
- The access track at the electricity substation site will largely be unsealed and constructed of crushed stone material to allow for permeability; however, c. 150m of access track within the electricity substation compound will be finished with concrete (in accordance with EirGrid specifications);
- Some cut/fill in the construction of the access track will be necessary to ensure that horizontal and vertical alignments are suitable to accommodate HGV loads and drainage infrastructure. Where excess material arises from the construction of the access track, it will be utilised in the construction of trackside berms, if required, or permanently stored at the spoil deposition areas;
- The access track intersects with a private residential/agricultural laneway and, as a consequence, it will be necessary to create 2 no. additional access points. The access points will be constructed and finished in a similar manner to that described for the site entrance above. While the access points do not adjoin a public road and there is no requirement to provide visibility splays, it is proposed

to provide visibility splays of 30m in each direction to ensure the safety of all construction and operational phase traffic associated with the project and the users of the private laneway. Existing vegetation along the laneway will be trimmed back, as required, to ensure visibility is maintained at all times;

- The construction of the access point to the south of the laneway will involve the demolition of an existing agricultural shed/structure. The structure will be dismantled in its entirety with all materials removed from site and disposed of at an approved waste management facility;
- Temporary welfare units, including chemical toilets, to be provided at the temporary construction compound for construction staff will be sealed units to ensure that no discharges escape into the local environment. These will be supplied and maintained by a licensed supplier. Potable water (for drinking, food preparation, and hand washing etc.) will be supplied on-site by water dispensers and this will also be sourced and maintained by a licensed supplier;
- The construction compound will be marked out and fenced to prevent encroachment onto non-designated areas. Following the completion of all construction activities, the compound will be decommissioned with all structures removed and fully reinstated. Reinstatement will involve removing crushed stone and underlying geotextile, covering with topsoil and reseeding;
- The temporary construction compound has been located and designed such that all cabins, storage containers, waste management facilities and bunded areas will be located a minimum distance of 50m from all watercourses/drainage ditches in order to minimise the risk of pollution and the discharge of deleterious matter. Stormwater which may arise from the roofs of cabins, containers or from sealed bunds will be passed through an oil interceptor prior to being discharged to the local environment;
- Given the linear nature of the electricity line route, it is likely that a number of small material storage areas will be utilised along the route during the construction phase to minimise the transportation of construction materials (e.g. ducting, electricity line, etc.). Such temporary compounds are likely to be located within agricultural farmyards or business premises along the route;
- Joint bases will, insofar as possible, be located within private lands to minimise the extent of infrastructure within the public road network;
- Following the installation of the ducting and joint bases; ground levels will then be made up using appropriate material (including sand and excavated material, if appropriate) and finished/reinstated to the requirements of the Planning Authority (public road) or landowner (private lands);
- All public roads along which it is proposed to install the underground electricity line will be subject to a full-carriageway reinstatement (re-surfacing) of the section where the electricity line is installed thus ensuring that there are no long-term effects on the public road network. Where the electricity line crosses a public road, a 20m section (i.e. 10m either side of the centre point of the trench) will be subject to a full-road reinstatement;
- All trenching works will be undertaken to ensure that only short sections of trench are open at any one time;
- Excavated materials will be stored separately (topsoil, subsoil and aggregates [as encountered]) for use during the reinstatement of the trench or disposed of at an appropriate licensed facility as necessary;
- Horizontal Directional Drilling (HDD) will be undertaken at 5 no. locations along the underground electricity line; namely at the intersections of the electricity line and the Paulstown Stream, Moanmore Stream, Shankill Stream and the crossing of the unnamed stream along the access track leading to the electricity

substation. The use of this methodology will avoid any in-stream works or any direct or indirect effect on the morphology of the stream. Launch and receptor pits will be excavated at either side of the streams; a minimum of 10m away from the streams; to accommodate the drilling rig. The bore will be at a minimum depth of 2.5m below the stream channels to ensure that there are no effects on the stream channels. Following the installation of the ducts, the launch and receptor pits will be fully reinstated. Marker posts will be placed at either side of the streams to indicate the location and alignment of the electricity line;

- All HDD works will be undertaken in strict accordance with best practice methodologies with surface water measures being installed; including implementation of exclusion zones within 10m of the stream channels, installation of double silt fencing, avoidance of any refuelling activities within 100m of the river, bunding of the Clear Bore™ batching, pumping and recycling plants, spill kits being available in the event of an accidental spillage or leakage, and the provision of adequately sized skips for the temporary storage of drilling arisings and drilling flush. All such arisings and flush will be disposed of to a licensed waste management facility;
- The installation of the underground electricity line in the environs of the high-pressure gas pipeline will be undertaken in strict accordance with the *Code of Practice for Working in the Vicinity of the Transmission Network* (Gas Networks Ireland, 2021) and particularly with respect to the use of hand-held equipment within 1.5m (linear distance) of the pipeline;
- The electrical control unit compound will be surfaced with c. 400mm of free-draining crushed stone such that rainwater can percolate to ground;
- The compound will be accessed via the creation of a new site entrance, from the L7117 local road, and the construction of c. 250m of access track. The site entrance will be constructed as described above; with c. 10m of roadside hedgerow being removed and visibility splays (90m in each direction) will be provided in accordance with Section 16.10.7 of the *Carlow County Development Plan 2022-2028*. The provision of visibility splays will not require the removal of any roadside hedgerow due to the width of the existing roadside verge; however, hedgerows may be trimmed back to ensure full visibility is maintained;
- It is proposed that excavated material (topsoil, subsoil and peat [where present]) will, insofar as possible, be utilised in the post-construction reinstatement of the project (e.g. at the electricity substation site, interface mast foundations, access track and electricity line trench);
- Where excess material is generated at the electricity substation site or along the route of the underground electricity line which cannot be utilised for reinstatement or landscaping purposes, it is proposed to develop 2 no. dedicated spoil deposition areas immediately northeast of the electricity substation where excess material will be stored permanently;
- At the electricity substation site, a series of embedded best-practice drainage measures have been incorporated within the project design. Firstly, clean water drains will be installed upslope of the works area to intercept incidental surface water runoff and direct it away from the works area to prevent it becoming contaminated. Clean water drains will include check dams to control flow rates and avoid erosion or scouring of the drain; before water is discharged by a buffered outfall or level spreader at greenfield rates. Water will be discharged from the clean water drains over grassland to provide filtration and to ensure that no silt or sediment is discharged to the drainage network;

- All surface water runoff from works areas, excavations, stockpiles, or from dewatering activities at the electricity substation site will be intercepted by downslope dirty water drains. The dirty water drains will include check dams to limit flow rates to avoid any erosion or scouring of the drains. The drains will direct dirty water to stilling ponds (also known as silt/settlement/sediment ponds/traps)[1] where water will be stored for an appropriate period of time such that silt/sediment or suspended material falls to the floor of the pond. The treated (clean) water will then be discharged from the stilling pond to a lagoon-type settlement pond which will store the water for a further period of time to ensure that all entrained sediment is removed. Finally, the clean water will be discharged from the lagoon-type settlement ponds via a buffered outfall or level spreader, at greenfield rates, over grassland to provide a further layer of filtration and treatment;
- Surface water control measures will be implemented as construction progresses through the substation site; however, prior to the commencement of earthworks, temporary silt/sediment control infrastructure (e.g. straw bales) will be placed in any agricultural drains around the site until the full range of construction phase measures are installed;
- Along the route of the underground electricity line, temporary surface water control measures will be installed within roadside drainage features, agricultural drains and streams as construction progresses along the route. Such features may include silt fences, silt traps or straw bales which will ensure that silt/sediment or suspended material is not discharged to downstream waters;
- Due to the permeable nature of the substation compound, electrical control unit compound and access tracks, the vast majority of rainfall will percolate to ground during the operational phase. Accordingly, the majority of surface water drainage infrastructure installed during the construction phase (dirty-water drawings, stilling ponds and lagoon-type settlement ponds) will be decommissioned following the completion of construction;
- Stormwater drainage infrastructure will be installed around the EirGrid Building, IPP Building and electrical control unit to capture any runoff from roofed or paved areas; while permanent surface water drainage infrastructure will be installed at the perimeter of the electricity substation compound. All stormwater and surface water from the electricity substation compound will be directed to a permanent attenuation pond which will allow for the storage of water until such time as all suspended sediment is removed and the water can be safely discharged. Water will be discharged to an existing sheough at greenfield rates via a buffered outfall to prevent any erosion or scouring. Additionally, all stormwater and surface water from the substation compound will be passed through an oil/hydrocarbon interceptor to prevent the discharge of any hydrocarbons;
- Surface water discharge rates have been designed to mimic greenfield runoff rates thus avoiding any long term alteration to the hydrological or hydrogeological regime of the substation site;
- In order to assist in the assimilation of the electricity substation into the existing landscape fabric, a series of landscaping proposals have been incorporated into the design of the project and comprise the following:-
  - Bolstering of existing field boundaries;
  - Planting of new hedgerows and trees around the electricity substation;

[1] Please note that the nomenclature of this surface water protection infrastructure may be used interchangeably within this EIAR and accompanying documentation.

    - Planting of wild flower or wild grass mixes at infrastructure margins and residual areas of the substation site;
- Hedgerow and tree species to be planted will be native Irish species and will be selected to complement those current found within the local landscape
- Only fully licensed quarries which have been subject to EIA and have appropriate planning permission for the volumes of material to be extracted will be used;
- The construction phase will be supervised by a range of environmental and engineering specialist personnel; including a PSCS, ECoW, ACoW, and GCoW, among others; who will liaise closely with the EM to monitor and to ensure that all applicable measures are implemented; and,
- Waste will be generated during the operational phase including, for example, cooling oils, lubricating oils and packaging from spare parts or equipment. All waste will be removed from site and reused, recycled or disposed of in accordance with best-practice and all regulations at a licensed facility.

4.2 Population & Human Health

No measures, specific to population and human health, are necessary during the construction phase. Local residents and communities will be protected through the implementation of measures relevant to other topics including the protection of water quality, minimisation of dust emissions, minimisation of noise emissions, and appropriate traffic management procedures.

4.3 Biodiversity

4.3.1 Nature Conservation Sites, Fisheries and Aquatic Ecology

Mitigation measures to prevent adverse effects on downstream European sites during construction are provided in full in the NIS. These will ensure no deterioration in the quality of water entering the River Barrow and River Nore cSAC; and will ensure there will be no effects on any QI habitats and species. The same is true for IEF non-QI aquatic habitats and species.

To mitigate likely effects during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes.

While no significant effects are considered likely, as a precaution, specific measures to prevent any effects on freshwater pearl mussel are included, following the design of Altmüller and Dettmer (2006). These measures will also be beneficial for any other downstream aquatic habitat and species.

All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

During the construction phase, all works associated with the construction of the project will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

4.3.1.1 Habitats (Whitehall Quarries pNHA)

The project footprint predominately overlaps with lower-value terrestrial habitats and will be located almost entirely within existing roads and improved agricultural grassland. Some treelines and hedgerows (and mosaics of the same) will be removed. To avoid widespread disturbance to habitats, access within the project will be restricted to the footprint of the proposed works corridor and no access between different parts of the project will be permitted, except via the proposed works corridor. An Ecological Clerk of Works (ECoW) will be employed throughout the construction phase to ensure that construction activities do not encroach unnecessarily into any important habitats.
During dry weather (i.e. no rainfall), dust generated will be managed using dust suppression bowsers.

4.3.2 Invasive Plants

The following will be implemented to avoid the accidental spread of any invasive or non-native species:-

- An invasive species management plan will be developed and implemented. This will include the general prevention and containment measures and species-specific treatment measures below; and,
- An Ecological Clerk of Works will be employed for the duration of the construction period to make contractors aware of any invasive and non-native species sensitivities of the project and to undertake pre-construction surveys, enforcing any exclusion zones and mitigation measures as required.

4.3.2.1 General Prevention Measures

- Use of toolbox talks as part of site introduction to workers, including what to look out for and what procedures to follow if invasive species are observed;
- Signs will be used to warn workers of invasive species contamination;
- Only planting and sowing of native species if any reinstatement works are required or where invasive plant species are physically removed;
- Unwanted material contaminated with invasive species will be transported off-site by an appropriate licenced waste contractor and disposed of at a suitably licenced facility (NRA, 2010); and,
- Good hygiene practices will be adhered to including the removal of build-up of soil on equipment; keeping equipment clean; washing vehicles exiting the site using a pressure washer to prevent the transport of seeds; storing wastewater from washing facilities securely and treating to prevent spread of invasive species; checking footwear and clothing of workers for seeds, fruits or other viable material before leaving the site; any plant material arising from cleaning equipment, footwear and clothing will be carefully disposed of following (NRA, 2010) guidelines in such a manner not to cause the spread of invasive species.

4.3.2.2 General Containment Measures

- A pre-construction walkover survey of the project will be undertaken during the growing season (April to August). This will search for invasive and non-native species, which could change over time. The extent of invasive plant species will be physically marked out if there have been any changes since baseline surveys; and,

- If any are identified, then appropriate exclusion zone(s) will be implemented. A 1m buffer (except for the named species below) will be used to cordon off invasive species outside the works footprint.

4.3.2.3 Himalayan balsam

The following treatment options are recommended by TII (2020) guidance.

Chemical control

Chemical control of Himalayan balsam is possible and the use of glyphosate-based products can provide a very successful outcome. As the plant is an annual and the roots are extremely short, it is not necessary to hold off spraying until after flowering, as with deep rooted, rhizomatous and perennial species. Treatment in late May or early June will provide a good kill of treated plants but seeds from the previous season will germinate to replace the treated individuals and further spraying will be required in August or September. Since the seeds can remain dormant for more than one year, spraying, as in the first year will be required in the subsequent season. In Years 3 and 4, if no seeds have been deposited in the area, few plants should survive but monitoring and localised retreatment will be required.

If found near a watercourse crossing, bioactive-formulation glyphosate-based herbicide treatment is suitable.

Physical control

Mechanical control of Himalayan balsam is only likely to be effective where good access is available and the ground is smooth or level enough to permit either mowing or cutting. Where accessible, plants can be cut, mown or strimmed back to ground level before flowering in June. Do not cut earlier as this promotes greater seed production in plants that regrow. Unless the plant is cut to below the lowest node, it will re-sprout. Regular mowing will control the plant, provided the frequency of mowing is regular enough to prevent sprouting and flower formation. This should be repeated annually until complete control is achieved.

As the plants are very shallow-rooted, they can also be easily pulled from the ground by hand. Himalayan balsam has no spines, thorns or stinging cells and, hence, is not a danger to those doing the pulling, although it is always recommended to wear gloves as brambles and nettles commonly grow amongst the stands of Himalayan balsam plants. This control method, commonly referred to as 'balsam bashing', should be conducted in late April or early May when the plants are circa 1 m high. This puts less strain on the back of those pulling the plants. The pulled plants should be broken to discourage flowering, which can occur even with plants that have been removed from the ground. The broken plants can be placed in piles to rot naturally. Because seeds from the previous season will germinate and produce new plants following hand pulling in April or May, the exercise will need to be repeated later in the season, probably in August. As with herbicide spraying, hand pulling will be required the following year to account for the fact that seeds are capable of surviving for at least one year. Monitoring and localised hand pulling should be conducted for the following two years or as monitoring dictates.

Vegetative material can be disposed of by composting provided the compost will not be disturbed for a minimum of two years. Material may also be disposed of to a licensed landfill or incineration facility, or the material could be disposed of by shallow or deep burial.

4.3.2.4 Montbretia

The following treatment options are recommended by NRA (2010) guidance.

Chemical control

Montbretia can be treated with herbicide during the active growing season. Due to the potential for re-infestation from seeds, corms and/or rhizome fragments, regular monitoring and follow-up treatment, as dictated by the monitoring, will be required over several years. If found near a watercourse crossing, similar bioactive-formulation glyphosate-based herbicide treatment is recommended as for Japanese knotweed (see above).

Physical control

Physical control of montbretia is difficult as individual corms easily break from their chains and can result in ready re-infestation or further spread. Where infestations are limited in extent, the entire stand can be excavated and buried or disposed of to a licensed landfill or incineration facility under licence. The most effective time to remove montbretia is before the flowering/seeding season. The corms are very hardy and are not suitable for composting. Due to the potential for re-infestation from corms, regular follow-up will be required over several years to deal with any re-growth.

4.3.2.5 Salmonberry

In the event of interaction of works with salmonberry, excavation of the entire root system is recommended, in addition to the general prevent and containment measures outlined earlier.

This must be done before the plants' seeds ripen in autumn and plant matter from this process can be disposed of at a licenced landfill site or may be buried on-site up to a depth of >2 m.

4.3.2.6 Snowberry

As snowberry is present within hedgerows in third-party lands, the primary means of preventing spread will be avoidance.

In the event of interaction of works with snowberry, excavation of the entire root system is recommended, in addition to the general prevent and containment measures outlined earlier.

This must be done before the plants' seeds ripen in autumn and plant matter from this process can be disposed of at a licenced landfill site or may be buried on-site up to a depth of >2m.

4.3.3 Birds

To avoid widespread disturbance to birds, access will be restricted to the footprint of the proposed works corridor.
Disturbance is predicted to have the greatest effect on breeding IEF passerines that use scrubby habitats.
The following will be implemented to reduce the possibility of damage and destruction (and disturbance to sensitive species) to occupied bird nests:-

- if site clearance and construction activities are required to take place during the main breeding bird season, pre-commencement survey work will be undertaken to ensure that nest destruction and disturbance is avoided;

- once vegetation has been removed from the works corridor, these areas will be retained in a condition that limits suitability for nesting birds for the remainder of the construction phase e.g. cover for ground nesting species will be made unsuitable for cutting vegetation or tracking over with an excavator; and,
- a suitably experienced Ecological Clerk of Works will be employed for the duration of the construction period to make contractors aware of the ornithological sensitivities of the project and to undertake surveys for nesting birds throughout the construction period, and enforcing exclusion areas, as required.

4.3.4 Terrestrial Mammals (excluding bats)

Measures proposed above will prevent deterioration of water quality and adverse effects on mammals relying on downstream habitats, such as otter. Habitat features important for mammals will be retained a (e.g. hedgerows and treelines).

A pre-construction walkover survey of the project will be undertaken. This will search for mammal resting/breeding places which could change over time. If any are identified, then appropriate exclusion zone(s) will be implemented and construction activities timed to avoid sensitive periods, such as the breeding season or hibernation, as relevant.

The following will be implemented to reduce the possibility of direct and indirect effects on mammals:-

- limiting constructions works to daylight hours;
- providing exit points for any excavations (e.g. escape planks or spoil runs) so mammals do not become trapped; and,
- if any threatened or legally protected mammals are recorded during the pre-construction walkover survey, the Ecological Clerk of Works make contractors aware of the mammalian sensitivities of the project and to undertake surveys for breeding or resting mammals throughout the construction period, enforcing exclusion areas as required. These are 50m for red squirrel, 100m for pine marten, 150m for otter and 50m for badger. If in the unlikely event that exclusion zones cannot be implemented, advice will be sought from NPWS, and appropriate mitigation and compensation measures will be put in place and an application will be made to NPWS for a derogation licence if required.

4.3.5 Bats

While some hedgerows and treelines will be lost due to construction, the majority of these will be replaced in situ, so there will be no net loss of commuting and foraging routes for bats.

The only structure located within the project footprint is the corrugated roofed component of structure PRF9, which has negligible bat roosting potential. Therefore, it will not be necessary for an ecologist to undertake a comprehensive survey of any structures in advance of construction works. Similarly, there are no PRF-I trees within or nearby the project footprint, and so no further surveys for bats are required.

A precautionary working method statement (PWMS) will be prepared prior to felling any trees to ensure work methods and timings avoid any effects on bats. This will detail how tree felling will be carried out to avoid any effects to bats.

Soft-felling will be carried out in suitable weather conditions and at appropriate times of year (other than winter when they are hibernating). Briefly, this involves the following:-

- removal of the tree in sections, starting with the top branches and working down the trunk avoiding cutting through cavities;
- lowering of any sections with potential roost features with care, positioning them on the ground with potential entrances to roosts facing upwards to allow bats to exit the roost; and
- leaving these sections in place for at least 24-hours in suitable weather.

During early-morning and evening working hours, the electricity substation and temporary construction compound and electrical control unit compound will be illuminated to enable construction activities. To avoid any effects on bats, cowled lighting will be used, directing light inwards, and away from hedgerows, to minimise disturbance of any commuting or foraging bats.

Appropriate luminaire specifications will also be used for lighting at the substation as outlined in BCT (2023). These include:-

- All luminaires should lack UV elements when manufactured. Metal halide, compact fluorescent sources should not be used;
- LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;
- A warm white light source (2700Kelvin or lower) should be adopted to reduce blue light component;
- Light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats (Stone, 2012);
- Column heights should be carefully considered to minimise light spill and glare visibility. This should be balanced with the potential for increased numbers of columns and upward light reflectance as with bollards;
- Only luminaires with a negligible or zero Upward Light Ratio, and with good optical control, should be considered; and,
- Luminaires should always be mounted horizontally, with no light output above 90° and/or no upward tilt.

4.3.6 Other Protected Flora

Pre-construction checks will be undertaken for spawning frogs in drainage ditches adjacent to the underground electricity line if construction works are undertaken in February. If found, adults and spawn will be translocated under NPWS licence to suitable alternative locations if present. Pitfall traps and drift fences will be used to capture adult frogs.

Amphibian-proof fencing close to any ponds/pools will be used to prevent frogs or smooth newts from accessing any parts of the project most hazardous to amphibians during the construction phase.

4.4 Land & Soil

4.4.1 Soil, Subsoil and Bedrock Excavation

Mitigation measures at the electricity substation site and electrical control unit site include:-

- Placement of infrastructure in areas of suitable ground conditions based on detailed site investigation data;

- The soil and subsoil which will be removed during the construction phase will be localised to the proposed infrastructure location;
- The project has been designed to avoid sensitive habitats;
- No unnecessary excavation of soil or subsoil will be undertaken;
- At the identified spoil deposition areas, the vegetative topsoil layer will be removed to allow for spoil to be placed and, upon reaching the recommended height, the vegetative topsoil layer will be reinstated over the spoil. Alternatively, the deposition areas may be covered with topsoil and allowed to vegetate.;
- The spoil deposition areas will be developed in a phased approach, with the topsoil removed and temporarily stockpiled within the defined area while the spoil is being placed. The stockpiled topsoil will then be reinstated over the placed spoil, and the exercise will continue within the same spoil deposition area until the area is full;
- The placement of spoil will be restricted to a maximum height of 3.5m, subject to confirmation by the Geotechnical Engineer;
- Where practical, the surface of the placed spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spoil will be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil;
- Finished/shaped side slopes of the placed spoil will be not greater than 1(v):2(h) in the deposition areas and not greater than 1(v):1(h) alongside access tracks;
- Inspections of the spoil deposition areas will be made by a Geotechnical Engineer on a weekly basis during the construction phase and monthly for a 6-month period thereafter. The appointed contractor will review work practices at the spoil deposition areas when periods of heavy rainfall are expected so as to prevent excessive dirty water runoff from being generated;
- An interceptor drain will be installed upslope of the spoil deposition areas to divert any surface water away from these areas;
- The surface of the deposited spoil will be profiled to a gradient to be agreed with the Geotechnical Engineer;
- All the above-mentioned general guidelines and requirements will be confirmed by the Geotechnical Engineer prior to construction; and,
- Spoil deposition areas are at a minimal distance from excavation areas to avoid excessive transport of excavated materials.

Mitigation measures along the underground electricity line include:-

- Soils and subsoils excavated along the underground electricity line will be temporarily stored in covered stock piles along the edge of the trench or immediately removed from site to a licensed waste management facility, as appropriate; and,
- The tarmacadam road surface will be replaced with the same design standard as the surrounding carriageway.

4.4.2 Erosion of Exposed Soil and Subsoil

The following mitigation measures are proposed to prevent the erosion of soil and subsoil:-

- Excavated soil will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping;
- Silt fences will be installed around all temporary stockpiles and excavated areas to limit movement of entrained sediment in surface water runoff;

- In order to minimise runoff during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems will be implemented to limit runoff effects during the construction phase;
- Bog mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood for soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;
- Following the completion of construction, the spoil deposition areas will be covered with the vegetative topsoil layer removed from the footprint of the deposition areas or covered with topsoil and allowed to vegetate;
- The underground electricity line will be constructed in a stepwise manner along its length. This will minimise the time any particular section of the underground electricity line trench is open before being reinstated;
- A detailed Spoil Management Plan will be prepared as part of the Construction & Environmental Management Plan prior to the commencement of development; and,
- Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a six month period thereafter, by an appropriately qualified Geotechnical Engineer.

4.4.3 Contamination of Soil by Leakages and Spillages and Alteration of Soil/Subsoil Geochemistry

The following measures are proposed to specifically prevent contamination of soils and subsoils:-

- The volume of fuels or oils stored on site will be minimised;
- All fuel and oil will be stored in an appropriately bunded area of sufficient capacity within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- An oil interceptor will be installed within the surface water drainage system at the electricity substation site during the construction phase to intercept any accidental hydrocarbon spillages;
- From the construction compound, fuel will be transported to the works area by a 4x4, in a double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The bowser/4x4 jeep will also be fully stocked with fuel absorbent material, pads and spill kits in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during refuelling;
- All waste tar material arising from road cuttings (from trenching in public roads) will be removed off-site and disposed of at a licensed waste facility. Due to the

potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works; and,
- An emergency plan for the construction phase to deal with accidental spillages is enclosed at **Annex 1**. This emergency plan will be further developed by the contractor prior to the commencement of construction.

4.5 Water

The overarching objective of the proposed mitigation measures is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. A Surface Water Management Plan (SWMP), incorporating the surface water drainage design has been prepared for the electricity substation and electrical control unit and incorporates the principles of Sustainable Drainage Systems (SuDS) through an arrangement of surface water drainage infrastructure.

While the SuDS, overall, is an amalgamation of a suite of drainage infrastructure; the overall philosophy is straightforward. In summary:-

- Clean water drains will be installed upslope of the works area to intercept clean surface water to prevent it becoming contaminated by silt/sediment from construction activities;
- All surface water runoff from construction areas will be directed to specially constructed downslope dirty water drains surrounding all areas of ground proposed to be disturbed (including areas for the temporary storage of material);
- The swales will direct runoff into stilling ponds and, subsequently, lagoon-type settlement ponds[2] where silt/sediment will be allowed to settle; and,
- Following the settlement of silt/sediment, clean water will be discharged to the local drainage network or to ground via buffered outfalls or level spreaders thus ensuring that no scouring occurs.

The suite of surface water drainage infrastructure will include *inter alia* upslope clean water drains, downslope dirty water drains, sedimats, flow attenuation and filtration check dams, stilling ponds, lagoon-type settlement ponds and buffered outfalls or level spreaders.

The design criteria implemented as part of the SuDS are as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;
- To minimise sediment loads resulting from the development run-off during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement;

[2] *The design of the lagoon-type sediment ponds shall generally accord with the principles Altmüller R. & Dettmer, R. (2006)* Successful species protection measures for the Freshwater Pearl Mussel (Margaritifera margaritifera) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject.

- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally; and,

To manage erosion and allow for the effective revegetation of bare surfaces.

4.5.1 Earthworks (Removal of Vegetation Cover, Excavations, Trenching and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water)

4.5.1.1 Electricity Substation and Electrical Control Unit

The management of surface water runoff and subsequent treatment prior to release off-site will be undertaken during construction work as follows:-

- Prior to the commencement of earthworks, silt fencing will be placed down-gradient of the construction areas, as required, until the full range of construction phase measures are installed;
- These will be embedded into the local soils to ensure all site water is captured and filtered;
- Clean water drains will include check dams to control flow rates and avoid erosion or scouring of the drain;
- Water from the clean drains will be discharged by a buffered outfall or level spreader at greenfield runoff rates;
- Water will be discharged from the clean drains over natural grassland or to existing agricultural drains which will provide further filtration;
- All surface water runoff from works areas, excavations, stockpiles at the electricity substation site and electrical control unit site will be intercepted by downslope drains which will also include check dams;
- These dirty water drains will direct water to stilling ponds where water for treatment and attenuation;
- From the stilling ponds, water will be discharged to lagoon-type settlement ponds for final treatment. The settlement ponds will follow a design outlined by Altmuller and Dettmer (2006);
- The treated water will then be discharged via a buffered outfall or level spreader, at greenfield rates, over natural grassland which will provide additional filtration and treatment;
- The precise design, sizing and sitting of the drainage infrastructure will be confirmed as part of the post-consent detailed design process, however the design will be reflective of predicted rainfall levels with an appropriate allowance for climate change
- Daily monitoring of the excavation/earthworks, the water treatment and pumping system and the discharge areas will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will enter the main drainage channel;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied; and,
- Earthworks will take place during periods of low rainfall to reduce run-off and potential siltation of watercourses.

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall,

therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

4.5.1.2 Electricity Line

The majority of the underground electricity line is in excess of 50m from any nearby watercourse with the exception of the 5 no. watercourse crossings.

No in-stream works are required at the crossing locations as HDD is proposed, however due to the proximity of the watercourses to the construction works, there is a risk of surface water quality effects during trench excavation work.

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:-

- All existing dry drains that intercept the works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps (e.g. straw bales);
- Clean water diversion drains will be installed upgradient of the works areas, as required;
- Check dams/silt fence arrangements (silt traps or straw bales) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zones such as at watercourse crossing locations.

4.5.1.3 Pre-emptive Site Drainage Management

The works programme for the construction stage of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2-days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3-hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15-minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended, the following control measures should be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

4.5.2 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be installed as relevant;
- The interceptor drainage will not be discharged directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build up of water in the excavation;
- All pumped water will be directed to the surface water drainage system for treatment prior to discharge. In the case of the electricity line, any pumped waters will be discharged over grassland to allow for filtration;
- There will be no direct discharge to local drains, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of site excavations by the EM will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites and will be used as final line of defence, if required.

4.5.3 Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;

- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer, will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillage;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the possibility of contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP. This emergency plan will be further developed prior to the commencement of development, and will be agreed with the Planning Authority as part of the detailed CEMP.

4.5.4 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the temporary construction compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site during construction, nor will any wastewater be discharged to the site.

4.5.5 Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds within the temporary construction compound with waters being tankered off site and disposed of at an approved licensed facility. There will be no discharge of cement contaminated waters to the construction drainage system or to any drain;

- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.5.6 Morphological Changes to Surface Watercourses & Drainage Patterns

Temporary silt fencing/silt trap arrangements (e.g. straw bales) will be placed within existing roadside/field drainage features along the electricity line route to remove any suspended sediments from the works area.

The trapped sediment will be removed and disposed of at an appropriate licenced facility. Any bare-ground will be re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

The following mitigation measures are proposed in respect of the installation of the culvert over the unnamed stream to the north of the electricity substation:-

- The stream crossing will be a clear span bridge (bottomless culvert) and the stream bed will remain undisturbed. No in-stream excavation works are proposed or anticipated as being required and therefore there will be no effect on the stream;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI); and,
- The installation of the culvert will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The stream crossing will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

4.5.6.1 Directional Drilling

- Although no in-stream works are proposed, the drilling works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions;
- The crossing works areas will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material/equipment or overnight parking of machinery inside a 10m buffer zone which will be imposed around the watercourses;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 10m buffer zone boundary;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions/channels that slope towards the watercourse;

- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank/sump to prevent migration from the works area;
- Spills of drilling fluid will be clean up immediately and stored in an adequately sized skip before been taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed percolation area at least 50m from the watercourses;
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain;
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted;
- Daily monitoring of the works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated;
- The silt fencing upslope of the river will be left in place and maintained until the works area has been fully reinstated;
- There will be no batching or storage of cement allowed at the watercourse crossing;
- There will be no refuelling allowed within 100m of the watercourse crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:-

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;

- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

4.5.7 Effects on the Castlewarren GWS, Shankill GWS and Paulstown PWS Water Supplies and Bagenalstown Abstraction

Due to the significant setback distance from the Monefelim River inner protection zone to the electrical control unit (c. 0.6km), the limited construction works to be undertaken within the catchment (i.e. electrical control unit and electricity line), the lack of direct surface water pathways (i.e. drains/streams) between the project site and the Monefelim River in addition to the comprehensive array of drainage control measures and pollution prevention measures (discussed above), it is assessed that the project will have no effects on the Paulstown Public Water Supply.

It should also be highlighted that the proportion of water coming from the Monefelim River catchment which supplies the Paulstown PWS spring is reported by the GSI to be less important than the portion coming from the Acore catchment (in which there are no elements of the project).

The fact that the electricity line route within the Monefelim River catchment is limited to only 3.5km, will be installed at a shallow depth and that no instream works are required at the 1 no. watercourse crossing (Paulstown Stream), means that no effects on the Paulstown Public Water Supply will occur.

As an additional pollution prevention measure, no fuel storage will be permitted along the electricity line located within the Monefelim River catchment.

In addition, approximately 1.3km of the electricity line route is located inside the Castlewarren GWS source groundwater protection area. Due to the shallow nature of the works and poorly productive aquifers with short groundwater flowpaths, there is no potential to affect groundwater flowpaths towards the source wells.

As above, no fuel storage will be permitted along the electricity line route within the Castlewarren GWS source protection area.

Similarly, due to the short distance (0.5km) of electricity line route immediately upslope of the Shankill GWS source, there is no likelihood of affecting groundwater serving the source spring.

4.6 Air Quality & Climate

In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a Planning-Stage Dust Minimisation Plan. A detailed Dust Minimisation Plan will be formulated prior to the construction phase of the project, and will include the following measures:-

- The on-site access tracks and public roads in the vicinity of the project site shall be regularly cleaned to remove mud, aggregates and debris and maintained as appropriate. All road sweepers shall be water assisted;
- If the access tracks have the potential to give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions;
- In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated, and satisfactory procedures implemented to rectify the problem before the resumption of operations;
- If issues persist and the above measures are not satisfactorily controlling dust emissions, a wheel washing system with rumble grids to dislodge accumulated dust and mud prior to leaving the site should be installed;
- During movement of materials off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and,
- The Dust Minimisation Plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

4.7 Landscape

Aside from standard construction phase measures to minimise land and vegetation disturbance (such as delineating the works area) and dust emissions (through damping down of access tracks if necessary), no specific landscape and visual mitigation measures are to be implemented. The appropriate management and reinstatement of excavations promptly will ensure that any adverse effects caused, for example, at the site entrance or along the route of the underground electricity line, are minimised insofar as possible.

Similarly, the progressive reinstatement and landscaping of the project site will remediate any short-term adverse effects on the local landscape. As part of the reinstatement and landscaping process, the planting of hedgerows will also be completed at the electricity substation and electrical control unit locations.

4.8 Cultural Heritage

Archaeological, architectural and cultural heritage resources will be protected through the following mitigation and monitoring measures:-

- Archaeological monitoring of all excavations associated with construction of the electricity substation shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;
- Archaeological monitoring of all excavations associated with construction of the

electrical control unit shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;

- Archaeological monitoring of all excavations associated with construction of the underground electricity line shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;
- Archaeological monitoring of all excavations at townland, parish, barony and county boundaries shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring; and,
- Written and photographic records will be created of any townland, parish, barony and county boundaries that may be affected. The written and photographic records will be created in advance of excavations commencing on site.

4.9 Noise & Vibration

4.9.1 Noise

The contractors involved in the construction phase will be obliged, under contract, to undertake specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria:-

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed at **Chapter 11** of the EIAR using methods outlined in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*; and,
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 and 19:00 Monday to Friday and between 07:00hrs and 13:00hrs on Saturdays

(unless in the event of an emergency), with no operations on Sundays or public holidays.

Based on assessment of the geological composition of the site, it is concluded that rock breaking is not likely to be required. In the unlikely event that rock breaking is necessary, the following measures will be implemented to mitigate noise emissions:-

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened breaking bit to eliminate a 'ringing' sound; and,
- Erect an acoustic screen around breaking activities. Where possible, line of sight between top of machine and reception point should be obscured.

4.9.2 Vibration

Vibration from construction activities shall be limited to the values set out at **Chapter 11** of the EIAR. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Given the substantial distances between locations where vibration may be generated and the nearest sensitive locations, no significant effect is likely to be experienced. Therefore, no mitigation measures are proposed.

4.10 Transport & Access

In order to ensure the avoidance of significant effects and reduce the predicted magnitude of effects to the greatest possible extent, a suite of mitigation measures are available which will reduce any likely effects during the construction phase. The following mitigation measures will be implemented:-

- A Traffic Management Plan shall be agreed as part of the Construction Environmental Management Plan (CEMP) with the Planning Authority (Authorities) prior to the commencement of development. The Traffic Management Plan shall include *inter alia* confirmed details of construction material haul routes; confirmed details of vehicle specifications; a materials delivery programme; traffic management measures including details of signage, road closures and diversionary routes; and road reinstatement details;
- Appropriate traffic management; including maintenance of local access and pedestrian access (where safe to do so); shall be implemented to facilitate continued public use of roads where temporary traffic restrictions have to be put in place. Precise details of these measures will be detailed in the Traffic Management Plan;
- Construction phase traffic movements will be limited to 07:00-19:00 Monday to Friday and 07:00–13:00 on Saturdays with no movements on Sundays or public holidays. It may be occasionally necessary to undertake works outside of these hours, for example in the event of an emergency, which would necessitate traffic movements. Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority (Authorities) will receive prior notification;

- Due to the transient nature of the underground electricity line works, rolling road closures will be implemented where the electricity line is to be installed within the carriageway of public roads. Traffic restrictions shall be kept to minimum duration and extent;
- All reasonable steps shall be taken to ensure that national and regional routes are used to transport all materials to the site, insofar as is possible;
- Prior to, and post, construction; pavement condition surveys will be undertaken along all non-national access routes proposed to be utilised in the delivery of construction materials. Given the high-quality and well-maintained nature of motorways and national routes, it is not assessed as necessary to carry out surveys of these carriageways or structures. Following the completion of the pre-construction surveys, any works which are assessed as necessary to facilitate the delivery of components and materials to the project site shall be undertaken, while any deterioration of carriageways or structures identified in the post-construction survey shall be put right at the expense of the Developer and to the satisfaction of the Planning Authority (Authorities);
- Appropriate and adequate signage shall be provided at all entrances providing access, safety and warning information;
- At the site entrances leading to the electricity substation and electrical control unit, roadside hedgerows shall be trimmed prior to the commencement of construction to ensure that visibility splays are provided in advance of the delivery of construction materials;
- Sufficient car parking spaces will be available at the temporary construction compound during the construction phase. Additionally, during construction of the underground electricity line, it is likely that agricultural premises will be used for the temporary storage of materials (e.g. ducting, cabling, etc.) and for the parking of construction plant, machinery, and work vehicles (cars, vans, etc.). No parking of cars by persons associated with the project will be permitted on any part of the public road that is not closed to traffic. All staff will be instructed to ensure that private entrances remain unobscured (particularly along the electricity line route);
- A dry wheel washing facility (or facilities) will be provided, as necessary, to prevent any debris being transferred from electricity substation site and the electrical control unit compound to the adjacent public roads. All drivers will be required to ensure that their vehicle is free from dirt and stones prior to departure from the project site. Where conditions exist for dust to become friable, techniques such as damping down of the affected areas will be employed and vehicles/loads will be covered to reduce dust emissions;
- All works within the public road corridor (i.e. underground electricity line) shall be undertaken in consultation with, and agreed in advance with, the Planning Authority (Authorities) and only following receipt of all necessary licences, permits and consents;
- Joint bases will be installed within private lands and not within the public road corridor;
- Road sweeping, particularly along the underground electricity line route, will be carried out as appropriate to ensure construction traffic does not adversely affect road conditions;
- Speed limit compliance will be emphasised to all staff and contractors prior to the commencement of construction during site induction, and will be strictly enforced throughout the construction phase;
- Following the installation of the electricity line ducting, the trench will be backfilled with appropriate material and temporarily reinstated. Following the

installation of the underground electricity line, all public roads within which it is proposed to install the underground electricity line will be subject to a full-width carriageway reinstatement (re-surfacing) of the relevant road section. Road reinstatement specifications and methodologies will be agreed with the Planning Authority (Authorities) prior to the commencement of development and as part of the road opening licencing process;

- The project will not require the delivery of any abnormal-sized or abnormal-weight loads. The electrical transformer to be installed at the electricity substation will be delivered to site via multiple loads; the heaviest of which will have a weight of c. 68-tonnes; and maximum axle loadings shall be strictly enforced in accordance with the Road Traffic (Construction and Use of Vehicles) Regulations 2003 (S.I. No. 5 of 2003). The Developer will engage with all relevant stakeholders once the precise delivery route of the electrical transformer is known. Furthermore, and in accordance with Circular RW18 of 2024 as published by the Department of Transport, the project will not require the delivery of any Exceptional Abnormal Loads;
- A designated contact point and coordinator will be put in place to manage all access arrangements and to interface with the public and the Planning Authority (Authorities); and,
- The electricity substation site and active underground electricity line works area shall be closed, and strictly secured, to the public during the construction phase.

4.11 Waste Management

The contractor shall ensure that all waste generated at the project site is managed in an appropriate manner. The precise methods to be implemented are detailed in the accompanying Waste Management Plan (see **Annex 2**) which shall ensure that waste is managed in accordance with all relevant legislation, best practice methods, and in accordance with the waste management priority hierarchy.

Excavated spoil material, which also constitutes 'waste', shall be managed in accordance with the provisions of the accompanying Spoil Management Plan (**Annex 3**). Only material which cannot be re-used for reinstatement or landscaping shall be removed from the project site and disposed of at an approved waste management facility.

5.0 Implementation of Environmental Management Measures

In the first instance, the construction phase of the project shall be undertaken in strict compliance with all measures set out in the EIAR and NIS; unless where revised or where required to be revised in order to ensure compliance which a condition of planning consent. All relevant conditions of consent shall be inserted at **Table 1** below.

Planning Conditions		
Condition No.	**Content**	**Relevance to Construction Phase (Yes/No)**

Table 1: Planning Conditions

This CEMP; which will be further developed prior to the commencement of construction; all associated documentation, construction management plans, and construction method statements shall be prepared to ensure strict accordance with each of the measures of the EIAR, NIS, and conditions of consent. As stated at **Section 1.4** above, it will be the responsibility of the EM to ensure coordination between this CEMP, all associated construction management plans & method statements, and the requirements set out in relation to the project.

6.0 Communication Plan

Given the multitude of stakeholders to be involved in the construction phase of the project, a clear and concise communications plan will be implemented to ensure that all matters arising are appropriately reported and recorded. The Communications Plan, which will be developed by the contractor, will include a reporting strategy including, but not limited to, the following personnel:-

- White Hill Wind Limited Project Manager;
- Contractor Project Manager;
- White Hill Wind Limited Project Supervisor Construction Phase (PSCS);
- Contractor Site Foreman;
- Environmental Manager;
- Ecological Clerk of Works;
- Geotechnical Clerk of Works; and,
- Archaeological Clerk of Works.

Additionally, White Hill Wind Limited shall appoint a dedicated Community Liaison Officer (CLO) who shall be responsible for engaging with members of the local community regarding the provision of project updates, etc., and shall also be responsible for relaying any matters raised to the project team.

A list of project contacts, to be developed prior to the commencement of construction and included within the detailed CEMP, shall be made available to all construction staff while a copy shall also be provided at the site offices.

7.0 Staff Training & Environmental Awareness

Only staff who have received appropriate training and have the necessary safety training/certification shall be permitted on-site.

All construction phase personnel will receive environmental awareness information as part of their initial site induction. The extent of their induction shall be tailored to the scope of their work; however, as a minimum, all environmental protection matters will be addressed in full. This will ensure that staff are familiar with environmental obligations associated with the construction process and the procedures and measures to be implemented. Staff will also be advised of the likely effects of any non-compliance with the relevant environmental measure.

As described at **Section 1.4**, the EM shall provide regular environmental updates to personnel and shall advise of any improvements which can be implemented.

Tool box talks will be held by the EM, or other relevant personnel at the commencement of each day or at the commencement of new activities. The aims of the tool box talks are to identify the specific work activities that are scheduled for that day or phase of work. In addition, the necessary work method statements will be identified and discussed. Additionally, any non-compliance with a measures in this CEMP will also be discussed with the aim of avoiding a re-occurrence of the same non-compliance.

8.0 Emergency Response Procedures

Prior to the commencement of construction, the contractor shall prepare a comprehensive emergency response procedure to be implemented by on-site personnel. This on-site procedure shall be incorporated within the Environmental & Emergency Response Plan (**Annex 1**) to ensure that appropriate procedures are in place to manage any incident and report same to the relevant stakeholders.

9.0 Recording & Reporting

Over the course of the construction phase, a significant volume of reporting will be undertaken to record the activities, methodologies, and measures implemented during the construction phase. With regards to environmental recording, the following is a non-exhaustive list of reports/records which are likely to be appended to the CEMP as the construction phase progresses:-

- Site Sign-In Records;
- Weekly Environmental Reports;
- Monthly Environmental Reports;
- Site Visual Inspection Checklists;
- Environmental Audits;
- Ecological Survey Reports;
- Water Quality Monitoring Reports;
- Archaeological Monitoring Reports;
- Geotechnical Monitoring Reports;
- Traffic Management Plans;
- Waste management documentation;
- All relevant licences, consents, and permits;
- All correspondence (internal and external) regarding environmental matters; and,
- Staff Training Records.

10.0 Compliance & Review Procedures

10.1 Site Inspections & Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Contractor Project Manager, PSCS, Contractor Site Foreman, EM, and ECoW to ensure all environmental controls, relevant to the construction activities taking place at the time, are in place. Environmental inspections will ensure that the works are undertaken in accordance with this CEMP and all other relevant documentation.

10.2 Auditing

The contractor will be responsible for ensuring that all construction staff are aware of the requirement to, and understand the importance of, strictly implementing the procedures of the CEMP. Environmental audits will be undertaken during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to identify the underlying causes of non-compliances and not to merely detect the non-compliance itself.

Moreover, audits are the means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by the contractor or by external personnel acting on their behalf. The impartiality and objectivity of the audit process is crucial in the identification of improvements to the

activities being undertaken at the project site. Environmental audits will be scheduled and conducted at regular intervals to determine whether the CEMP is being appropriately implemented. The findings of the audits will be provided to the White Hill Wind Limited Project Manager, Contractor Project Manager, PSCS, EM, and ECoW.

A sample Environmental Audit is included at **Annex 1**.

10.3 Environmental Compliance

As has been set out in the preceding sections, construction activities will be continuously and rigorously assessed to ensure that works are undertaken in accordance with the provisions of the detailed CEMP (to be prepared prior to construction). Where an environmental 'event/occurrence' has been identified, the following definitions shall apply:-

- Near-Miss: An event which has not resulted in an adverse environmental effect but which, if not addressed, could re-occur and result in adverse effects;
- Incident: An event which has occurred and which, if un-controlled, could result in substantial effects; however, on-site measures/procedures avoided such effects;
- Exceedance Event: Where an event has resulted in identifiable adverse effects which exceed the appropriate limit value (e.g. a deterioration of downstream water quality below acceptable limits). An exceedance event usually triggers the cessation of particular activities until an investigation has been completed and additional measures implemented; and,
- Non-Compliance: The identification of an un-agreed deviation from prescribed procedures/measures set out in this CEMP.

10.4 Corrective Actions

A corrective action relates to the implementation of revised measures/procedures to rectify an identified environmental matter/concern/issue. Corrective actions will be implemented by the Contractor Project Manager, as advised by the PSCS and EM,

Corrective actions may be required as a consequence of:-

- Environmental Audits;
- Environmental Inspections; Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required. A Corrective Action Notice will describe the cause and effect of the environmental issue/concern and will detail the recommended corrective action to be implemented.

If an environmental matter/concern/issue arises which requires immediate intervention; direct communications between the Contractor Project Manager, PSCS and EM will be conducted. A Corrective Action Notice will be completed subsequently.

Annex 1 –
Environmental & Emergency Response Plan

White Hill Wind Farm Electricity Substation & Electricity Line

Planning-Stage Construction & Environmental Management Plan

Environmental & Emergency Response Plan

White Hill Wind Limited

Galetech Energy Services

Clondargan, Stradone, Co. Cavan Ireland

Telephone +353 (0)49 555 5050

www.galetechenergyservices.com

Contents

1.0 Introduction 1
1.1 Purpose of this Report 1
1.2 Environmental Incident 1
1.3 Reference Documents 2
2.0 Requirements of an EERP 2
3.0 Description of the Project 2
4.0 Incident and Hazard Reporting 3
5.0 Waste Disposal after Environmental Incidences 3
6.0 Site Induction and Toolbox Talks 3
7.0 Summary Sheet for Machinery & Plant Operators 3
7.1 Procedures for an Incident 3
8.0 Communication Plan 4
8.1 Environmental Response Plan 6
8.2 External Contacts 7
8.3 Internal Contacts 7
8.4 Chemical Product & Waste Inventory 7
8.5 Pollution Prevention Equipment Inventory 8
8.6 Site Environmental Incident Report Form 8

1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Environmental and Emergency Response Plan (EERP) which should be instigated if an emergency or environmental incident occurs either within the project site or elsewhere linked to the construction of the project.

1.1 Purpose of this Report

Many construction and industrial sites have the potential to cause environmental harm which could pose threat to public health, water supplies and wildlife in the event of an environmental incident. The purpose of this report is to outline how, in the event of an emergency, effects on humans and the local environment can be limited through quick action.

This EERP forms part of the pre-commencement requirement for the works and outlines conditions of work for staff, and for every contractor or sub-contractor at the site.

This document is a live document which will be updated regularly and forms part of the Planning-Stage Construction & Environmental Management Plan (CEMP) for the White Hill Wind Farm Electricity Substation & Electricity Line. Consequently, the majority of specific details can only be provided prior to the commencement of construction activities.

It contains details of:-

- Who should be contacted in an emergency;
- Procedures to be followed in an emergency; and
- Staff responsibilities in an emergency.

1.2 Environmental Incident

This EERP should be implemented once there has been an emergency or environmental incident on site or elsewhere linked to the construction of the White Hill Wind Farm Electricity Substation & Electricity Line. Incidents can be a discharge to air, land or water that could cause environmental damage. Causes of environmental incidents on site include:-

- Land Slide;
- Vandalism;
- Fire;
- Leaking plant or equipment;
- Containment Failure;
- Overfilling of containment vessels;
- Discharge of raw or partially treated effluent;
- Wind-blown waste, litter or dust;
- Flooding on site;
- Leaking Portaloo;
- Fuel drips or spills during refuelling;
- Leak from fuel or chemical containers;
- Failure of pumps and pipelines; and
- Contaminated water or sediment/silt entering a waster course or drain.

Any of these incidents could affect drainage systems, surface waters, ecosystems, groundwater and soil. The production of toxic fumes and airborne pollutants could affect air quality which may damage human health, wild and domestic animals and ecosystems.

1.3 Reference Documents

The production of this EERP has been supported by current legislation and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other guidance documents have been used to develop this EERP; including a Planning-Stage Construction & Environmental Management Plan, Waste Management Plan, Spoil Management Plan and Surface Water Management Plan.

2.0 Requirements of an EERP

This EERP provides guidance for environmental incidents and includes:-

- Summaries of local environmental sensitivities;
- An outline of the construction works and sources to relevant existing environmental plans;
- Key mapping reference points for the site;
- Contact information for key external bodies and emergency response numbers who will assist in the event of an emergency;
- An identification of key staff and 24-hour contact details for those who will assist in the event of an emergency;
- An identification of Inventory of Pollution Prevention Equipment;
- Details of an Inventory of Chemical Products and Waste Inventory on Site*;
- Details of reporting requirements;
- Details of staff who are trained in the use of spill kits and booms etc.;
- Procedures to be followed in the event of an emergency and an identification of those responsible for re-positioning and moving the plant; and
- A widely available summary sheet for operatives that outlines the key procedures in the event of an emergency.

3.0 Description of the Project

White Hill Wind Limited intends to construct the following:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;
- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.8km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 3.3km of the underground electricity line located in County Kilkenny and c. 5.5km of the underground electricity line and the electrical control unit located in County Carlow. Electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

As well as the reference documents listed in **Section 1.3**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);

- Population & Human Health chapter (Galetech Energy Services);
- Biodiversity chapter (SLR Consulting);
- Land & Soil chapter (Hydro Environmental Services);
- Water chapter (Hydro Environmental Services);
- Material Assets [Transport & Access] chapter (Galetech Energy Services); and
- Natura Impact Statement (SLR Consulting).

4.0 Incident and Hazard Reporting

To ensure that all environmental incidents or hazards are accurately recorded, a reporting system has been developed. The logging of environmental incident reports will ensure that regular revisions and reviews can be made. In the event of an accident/incident, a blank environmental incident report has been attached on the last page of this report that includes details of all non-compliance and corrective actions carried out as a result of any incidents.

5.0 Waste Disposal after Environmental Incidences

In the event of a pollution incident where a spill kit etc. may be used, operatives must dispose of the used equipment by placing them into a sealed bag or container. Used equipment will then be removed from site by a licensed waste contractor to a licensed waste facility.

6.0 Site Induction and Toolbox Talks

It is crucial that all contractors, sub-contractors and staff on site are fully familiar with this EERP. Toolbox talks will be regularly given to the workforce on the aspects of health and safety of this project and, during these talks, they will receive regular reminders of the importance of not only the local environment but of the necessary environmental controls that are in place on site.

7.0 Summary Sheet for Machinery & Plant Operators

This summary sheet is for all site personnel. A laminated copy will be kept on all site vehicles/machinery.

7.1 Procedures for an Incident

The following procedures are a guide when dealing with incidents. To ensure health and safety for yourself and others, this health and safety guidance should be followed at all times alongside applying common sense:-

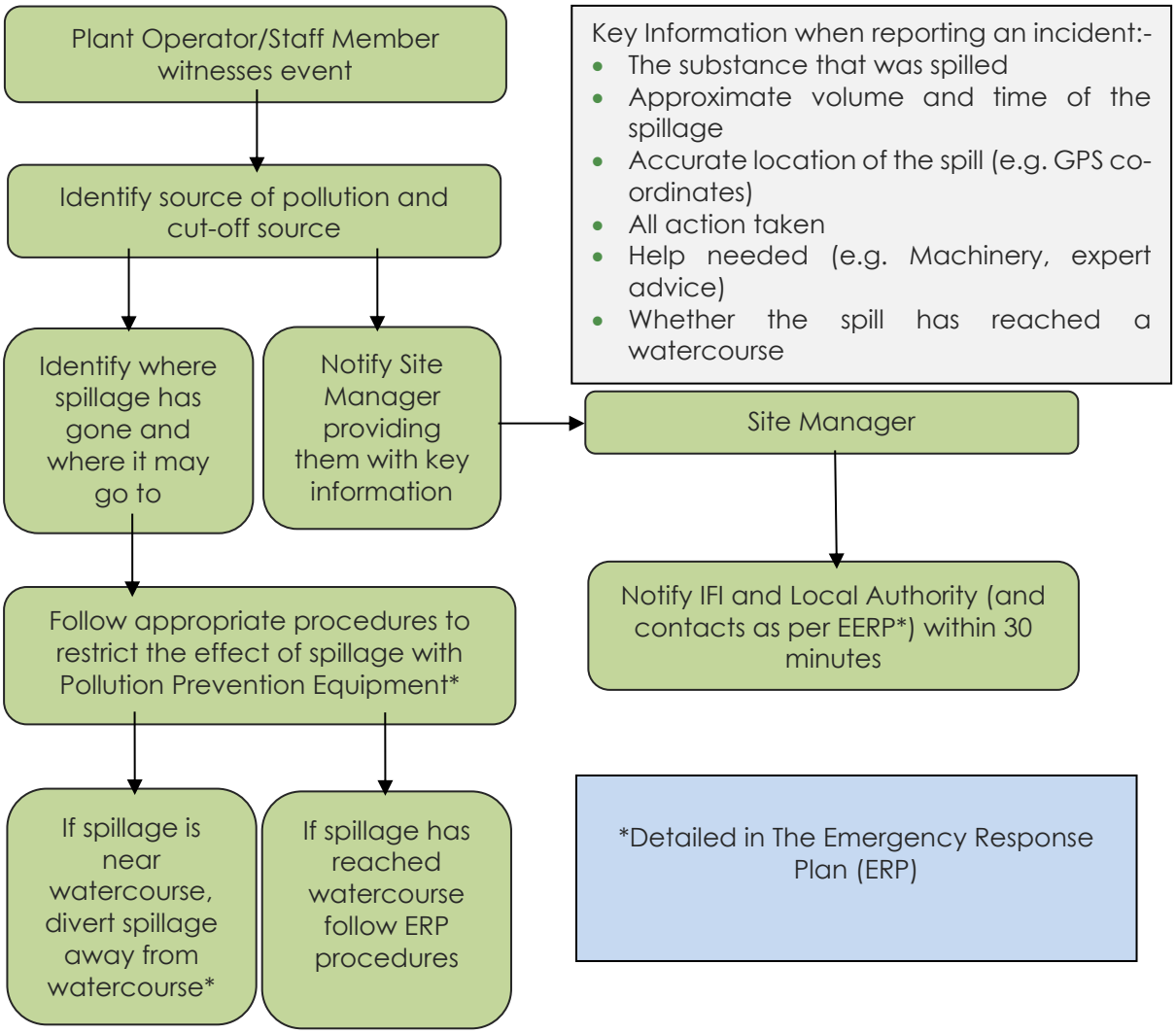
1. Identify the source of the spillage and cut off source if possible through closing a valve or righting container etc.;
2. Discontinue all work on site and all operatives will assist in placing spill mats correctly on affected area. Immediately contact Site Manager/main contact;
3. Identify the spillage route. If spillage is in close proximity to a watercourse (drainage/ditch/river), divert spillage away from the watercourse through the use of absorbent materials from the spill kit;
4. If a watercourse is at risk of contamination from suspended solids from a slope failure, do the following:-
   a. Place straws bales wrapped in geotextile or sand/gravel bags with geotextile curtains immediately in the watercourse(s) at regular intervals downstream from the incident. These sand/straw bags and bales will be removed and replaced with stone filters once water quality is stabilized;

b. Stone check dams faced with a layer of geotextile will be constructed at critical points along the watercourse; and
c. Small sumps will be formed intermittently between the check dams to reduce the amount of suspended solids contained in the water;

5. If there has been an oil spill in the watercourse, do the following:-
   a. Place flexible absorbent booms across the watercourse, ahead of the contamination within a quiet stretch of water;
   b. Place absorbent cushions in the water immediately upstream of these booms as well as downstream of the booms; and
   c. Remove and replace saturated absorbent material as required. Please ensure removed cushions are placed in sealed polythene bags/containers and disposed of by the principal waste contractor;
6. Notify all parties in the order listed overleaf. Notification should be made by one member of staff whilst remaining staff present deal with the spill;
7. Dig up all contaminated ground as soon as possible. All contaminated materials should be placed in sealed polythene bags/containers and disposed of appropriately by a licensed waste contractor; and
8. Complete required record of incident and response into reporting system.

8.0 Communication Plan

A detailed Communication Plan will be provided by the Contactor, in liaison with relevant stakeholders, and will be included in the updated EERP prior to the commencement of construction. An outline Communication Plan is set out below.


Plant Operator/Staff Member witnesses event
Identify source of pollution and cut-off source
Identify where spillage has gone and where it may go to
Notify Site Manager providing them with key information
Follow appropriate procedures to restrict the effect of spillage with Pollution Prevention Equipment*
If spillage is near watercourse, divert spillage away from watercourse*
If spillage has reached watercourse follow ERP procedures
Key Information when reporting an incident:-
The substance that was spilled
Approximate volume and time of the spillage
Accurate location of the spill (e.g. GPS co-ordinates)
All action taken
Help needed (e.g. Machinery, expert advice)
Whether the spill has reached a watercourse
Site Manager
Notify IFI and Local Authority (and contacts as per EERP*) within 30 minutes
*Detailed in The Emergency Response Plan (ERP)

8.1 Environmental Response Plan

<table>
<tr><th colspan="2">Incident Response Plan for the White Hill Wind Farm Electricity Substation & Electricity Line
Based on template provided in GPP 21 – Guidance for Pollution Prevention</th></tr>
<tr><td>Site Address:
Shankill, County Kilkenny; Shankill and Ballygorteen, County Kilkenny; and Moanmore, Lackan and Baunreagh, County Carlow.

Official Company Address:
White Hill Wind Limited
Greaghcrotta
Tullyco
Cootehill
County Cavan

Key Holders for site (Name and Contact numbers):</td><td>Coordinates:

Map references:</td></tr>
<tr><td colspan="2">Overview of the activities on site:
Include number of employees at different times of the day:

Daylight hours:

Dusk to Dawn

Weekend Dusk to Dawn:

Bank Holidays:</td></tr>
<tr><td colspan="2">Description of surrounding area:</td></tr>
<tr><td>Date and Version of the plan:</td><td>Name & position of person responsible for compiling/approving the plan:</td></tr>
<tr><td>Review date:</td><td>Date of next exercise:</td></tr>
<tr><td colspan="2">Objectives of the plan:</td></tr>
<tr><td colspan="2">List of external organisations consulted in the preparation of this plan with contact details:</td></tr>
<tr><td colspan="2">Distribution list of who has received this plan and which version: Please note that it is recommended that you review and revise this plan regularly</td></tr>
</table>

8.2 External Contacts

External Contacts		
Contact	**Office Hours**	**Out of Office**
Emergency Services (Fire/Garda/Ambulance)	999 or 112	999 or 112
Local Garda Station	Muinebheag (Bagenalstown): 059 977 4120	999 or 112
Local Hospital	St Luke's General Hospital: 056 778 5000	999 or 112
Environment Section	Kilkenny County Council County Hall John Street Kilkenny 056 779 4470	081 839 9399
Environment Section	Carlow County Council County Buildings Athy Road Carlow 059 913 6231	059 917 0300
EPA Regional Inspectorate	Seville Lodge Callan Road Kilkenny 056 779 6700	
Inland Fisheries Ireland	01 884 2600	1890 347 424 (24 hours)
ESB	01 852 9534	
Telecommunications – Eircom/Eir	1800 475475	

8.3 Internal Contacts

Internal Contacts		
Names and position of staff authorised and trainers to activate and co-ordinate the plan. Staff to be contacted if needed to move or evacuate the site		
Other Staff:		
Managing Director		
Site Manager		
Environmental Manager		

8.4 Chemical Product & Waste Inventory

Chemical Product & Waste Inventory						
Trade name/ substance	Solid/liquid/gas or powder	UN number	Max amount	Location marked on site plan	Type of Containment	Relevant health & Environmental properties

8.5 Pollution Prevention Equipment Inventory

Pollution Prevention Equipment Inventory (On/Off-Site Resources)			
Type	Location	Amount	Staff contact

8.6 Site Environmental Incident Report Form

Site:		Date:	
Time:		Weather:	
Report By:		Position:	
White Hill Wind Limited personnel present:		Position:	
Contractor personnel present:		Position:	

Description of Incident:

Item Spilled:	
Estimate of Volume of Spillage:	

List of actions followed once incident was noted	Time:	Corrective Action Action:	By:
Who first observed incident?			
First action			
Next action			
Time Pollution Hotline was contacted			
Other			

Details of Clean-Up contractor or how contamination was removed from site:

Details of how this could be avoided in future:	
Details of review of internal procedures as result of this incident:	

Date of Report Completion: _____

Item	Questions	Yes	No	Corrective Action Action:	By:
1. Miscellaneous					
1.01	Does the contractor carry out regular internal environment audits on the site? Are recommendations recorded and is corrective action monitored?				
1.02	Have any environment incidents occurred and have these been reported as per on site procedure?				
1.03	Does the site induction contain a section on environmental requirements, including spill procedures, and is this communicated effectively?				
2. Land					
2.01	Are areas of hard standing (excluding bunded and refuelling areas) appropriately drained?				
2.02	Have local roads been inspected and cleaned where necessary?				
2.03	Has all test pitting and soil stripping been monitored by an archaeologist?				
2.04	Have all site clearance works been checked by an ecologist prior to works?				
3. Materials and Equipment					
3.01	Is there knowledge of the IFI Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters (2016) and OPW Environmental Guidance: Drainage Maintenance & Construction (2019)				
3.02	Are transformers/generators located in secondary containment bunds?				
3.03	Are all bunds capable of containing 110% of the volume of the largest container?				
3.04	Is refuelling carried out in a designated refuelling bay?				
3.05	Does all site drainage on hard standing drain to an oil interceptor?				
3.06	Is the designated area for oil, fuel and chemical storage appropriately sited (i.e. on				

	hard standing at least 10m from a watercourse)?				
3.07	Are there procedures in place to monitor bund integrity and manage bund rainwater levels? Are these followed and recorded?				
3.08	Is there awareness that oil or residue from contaminated water removed from bunds should be disposed of as special waste and not discharged to land or the water environment? (oil absorbent materials (pads etc.) should be used first)				
3.09	Are all drums and mobile plant (e.g. generators) placed on drip tray more than 10m from any watercourse?				
3.10	Is all plant maintained in a good state of leaks? Are there records of this?				
3.11	Are there adequate spill kits available and stored in close proximity to potential risks?				
3.12	Are all refuelling browsers double skinned, locked when not in use, and in a good state of repair?				
3.13	Is there evidence of unmanaged/unrecorded fuel/oil spillages on site?				
3.14	Are dry or wet wheel washing facilities fully operational and effective?				
3.15	If wet wheel washing facilities are required, are these closed systems with no discharge to the water environment?				
3.16	Are there laboratory certificates (accredited by the Irish National Accreditation Board) to confirm that imported material stone aggregate brought onto site is free from any contamination?				
4. Noise, Dust & Light					
4.01	Are there facilities to dampen stockpiles and site working areas/roads to suppress dust?				
4.02	Are vehicles carrying loose material sheeted at all times?				
4.03	Are construction works, or deliveries of materials to and				

	from the department, audible at noise sensitive premises?				
4.04	Has all external construction lighting received the approval of the planning authority?				
5. Waste					
5.01	Is the site tidy and free from litter?				
5.02	Is there evidence of waste beyond the site boundary?				
5.03	Is waste segregated and kept securely in containers in clearly designated areas?				
5.04	Does all waste leaving the site have the appropriate duty of care paperwork?				
5.05	Is all waste leaving the site being taken to an appropriately licensed site?				
5.06	Does all special/hazardous waste (e.g. oil contaminated soils, waste oil) have the appropriate Special Waste Consignment Note?				
5.07	Is material re-used/recycled on site where possible?				
5.08	Are waste management practices in line with the site waste management plan?				
5.09	Are relevant Waste Management Exemptions in place for use of waste on site (e.g. use of waste concrete to create foundation sub-base)?				
5.10	Is there any evidence of burning on site?				
5.11	Is there any evidence of unlicensed burial of waste?				
6. Water					
6.01	Do all discharges to land or watercourses have appropriate authorization from Local Authorities/IFI?				
6.02	Do all watercourses engineering (bank protection, crossing etc.) have the appropriate authorization from Local Authorities/ IFI?				
6.03	Do any abstractions from a watercourse or groundwater body have the appropriate authorization from Local Authorities/ IFI?				
6.04	Has confirmation for the SUDS design for access roads been				

	gained from Local Authorities/ IFI?				
6.05	Are cut-off ditches installed on the uphill side of the working area to avoid contaminated surface water run-off?				
6.06	Has vegetation removal/clearance of the site been minimized to avoid unnecessary areas of bare-ground?				
6.07	Is adequate treatment (e.g. settlement tank/lagoons/discharge to land) provided to prevent silt contaminated water entering watercourses and groundwater?				
6.08	Has vegetation removal/clearance of the site been minimized to avoid unnecessary areas of bare-ground?				
6.09	Have buffer-strips been left between working area and watercourses?				
6.10	Is plant operating in the watercourse?				
6.11	Have all culverts been installed at the base of stockpiles situated within close proximity to watercourses?				
6.12	Have silt fences been installed at the base of stockpiles situated within close proximity to watercourses?				
6.13	Are there adequate controls on site construction roads to minimize sediment runoff into watercourses (in particular, are the adequate flow attention measures within surface drain?)				
6.14	Are there any sign of decaying straw bales in watercourses? (this could lead to organic pollution of the watercourse)				
6.15	Are silt traps regularly maintained?				
6.16	Has ease of maintenance been considered in the design of permanent drainage features?				
6.17	Is there evidence of contamination of any watercourse (e.g. with oil,				

	sediment, concrete, waste) in the vicinity of the works?				
6.18	Is monitoring of potential effects on watercourses carried out on a regular basis and fully recorded?				
6.19	Are dewatering operations being carried out in such a way to minimize sediment contamination?				
6.20	Is drainage and run off in concrete batching areas adequate?				
6.21	Are adequate pollution prevention measures considered and put in place during concrete pours?				
7. Landscape					
7.01	Have earthworks been designed to promote successful re-instatement of vegetation?				
7.02	Are reinstatement and restoration works being implemented in a timely manner as per the requirements of the Contract?				
8. Ecology					
8.01	Have storage sites (soil, plant etc.) been sited on areas of lower quality habitat where possible?				
8.02	Have buffer zones been constructed and maintained around designated protected species exclusion areas (e.g. red squirrel dreys, water vole habitats, otter holts, badger holts etc.)?				
8.03	Have toolbox talks on the subject of ecology and environmental responsibilities on site been delivered? Have attendance records been maintained for these?				
9. Documentation Check					
9.01	Start-up meeting record				
9.02	Full contacts list in CEMP				
9.03	Induction records				
9.04	Pollution Prevention Measures Register				
9.05	Geotechnical Risk Register				
9.06	Weekly meeting minutes				

9.07	Records of environmental checks and routine monitoring of mitigation measures				
9.08	Water Quality Monitoring Results				
9.09	Safety and Environmental Awareness Reports (SEARs). Filed and entered in database?				
9.10	Safety and Environmental Audit Reports for the site. (If yes, insert date of last audit)				
9.11	Contractor's Environmental Plans (or Construction Method Statements)				

Annex 2 –
Waste Management Plan

White Hill Wind Farm Electricity Substation & Electricity Line

Planning-Stage Construction & Environmental Management Plan

Waste Management Plan

White Hill Wind Limited

Galetech Energy Services

Clondargan, Stradone, Co. Cavan Ireland

Telephone +353 (0)49 555 5050

www.galetechenergyservices.com

Contents

1.0 Introduction 1

1.1 Purpose of this Report 1

1.2 Scope & Requirements 1

1.3 Waste Policies & Legislation 1

1.4 Reference Documents 3

2.0 Requirements of a WMP 3

2.1 Planning 3

2.2 Implementation 3

2.3 Monitoring 4

2.4 Review 4

3.0 General Waste Management Principles 4

4.0 Typical Waste Streams 6

4.1 Waste Inventory 6

4.2 Management of Waste 7

1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Waste Management Plan (WMP) to detail the measures to be implemented for the control, management and monitoring of waste associated with the project.

1.1 Purpose of this Report

The objective of this WMP is to minimise the quantity of waste generated by construction activities, to maximise the use of materials in an efficient manner and to maximise the segregation of construction waste materials on-site to produce uncontaminated waste streams for off-site recycling.

The WMP shall be implemented throughout the construction phase of the development to ensure that:-

- All site activities are effectively managed to minimise the generation of waste and to maximise the opportunities for on-site reuse and recycling of waste materials;
- All waste materials are segregated into different waste factions and stored on-site in a managed and dedicated waste storage area; and
- All waste materials generated by site activities are removed from site by appropriately permitted waste haulage contractors and that all wastes are disposed of at approved waste licensed / permitted facilities in compliance with the Waste Management Act 1996 and all associated waste management regulations.

1.2 Scope & Requirements

This WMP forms part of the pre-commencement requirement for the works and outlines conditions of work for staff, and for every contractor or sub-contractor at the site. The contractor will continually oversee changes to this document and will work alongside the Environmental Manager (EM) prior to any work commencing.

This document is a live document which will be updated regularly and forms part of the Planning-Stage Construction & Environmental Management Plan (CEMP) for the project. Consequently, the majority of specific details can only be provided prior to the commencement of construction activities.

1.3 Waste Policies & Legislation

The Department of the Communications, Climate Action & Environment published *A Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020-2025* in 2020. One of its guiding principles is to minimise waste and, therefore, it is key that the development has an efficient waste management plan in place.

The *European Union (Waste Directive) (Amendment) Regulations 2016* ('the Regulations') imply a duty on all waste producers to take measures to apply the waste hierarchy priority order. In these Regulations, the 'Act of 1996' refers to the Waste Management Act 1996 (No. 10 of 1996) and 'Principal Regulations' refers to the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011). The 'Waste Directive' refers to Directive 2008/98/EC of the European Parliament.

The Waste Management Priority Hierarchy, which the developer is obligated to apply in the management of waste, is as follows:-

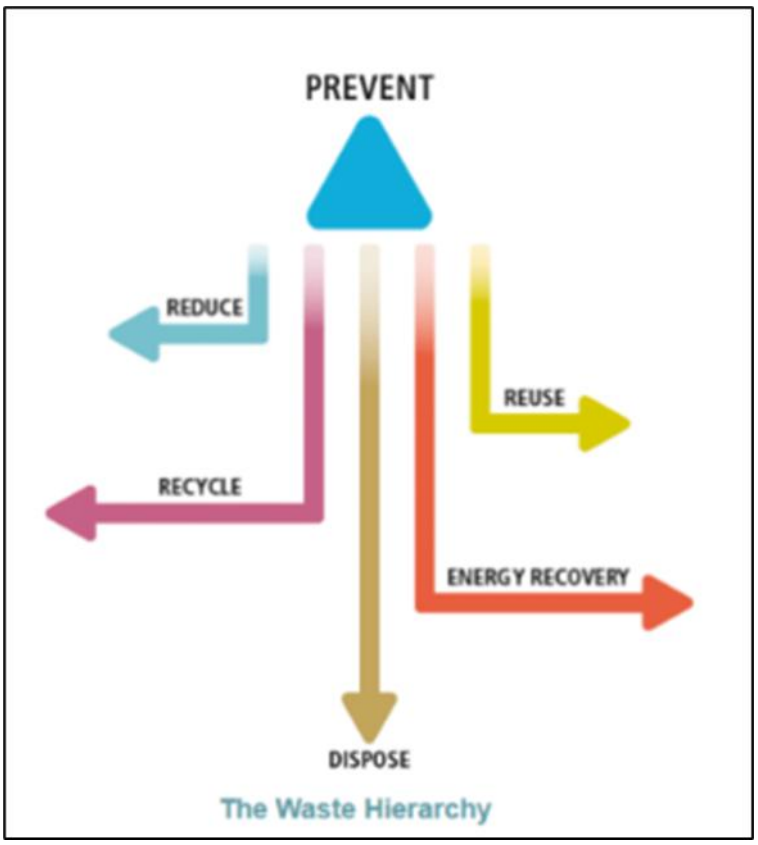


Figure 1: Waste Management Hierarchy

The waste management hierarchy shown above applies to all waste, including hazardous waste. The diagram conveys that above all, the prevention of waste production is the top priority.

The PCB/PCT Directive (Directive 96/59/ EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls) deals with the disposal of certain hazardous chemicals that represent a particular threat to the environment and to human health.

The *European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) (Amendment) (No. 2) Regulations 2017 (S.I No. 282 of 2017)* shall be adhered to in the case of transportation to and from the site of any dangerous goods.

The contractor, in accordance with the abovementioned Directives, is legally required to:-

- Prevent waste disposal constituting a public nuisance through excessive noise levels or unpleasant odours, or to degrade places of special natural interest;
- Prohibit the dumping or uncontrolled disposal of waste;
- Ensure that the disposal and recovery of waste does not present a risk to water, air, soil, plants and animals;
- Ensure that waste treatment operations are licensed;
- Prepare a Waste Management Plan;
- Require waste collectors to have special authorisation and to keep records; and,
- Ensure that the waste which cannot be prevented or recovered is disposed of without causing environmental pollution.

The EU Integrated Pollution Prevention and Control (IPPC) Directive (Directive 96/61/EC) provides for a permit system for activities including waste management. In adherence with this Directive, the contractor must:-

- Be in possession of a waste permit for waste disposal; and
- Be prepared at all times for inspection regarding monitoring of waste activities.

1.4 Reference Documents

The production of this WMDP has been supported by best practice manuals, including the *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (Department of the Environment, Heritage and Local Government, 2006).

Other guidance documents have been used to develop this WMP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, Surface Water Management Plan, and Environmental & Emergency Response Plan.

2.0 Requirements of a WMP

There are four stages to be followed in the management of waste:-

- Planning;
- Implementation;
- Monitor; and,
- Review.

2.1 Planning

During the planning/design/development stages of the project, the nature of the site has been accounted for as well as the environmental considerations and the design of the project. Insightful planning at the early stages will help minimise the quantity of waste produced.

2.2 Implementation

The detailed WMP, to be prepared prior to construction, will implement the management of the following:-

- A brief of waste types expected to be produced;
- Estimates of quantum of each type of waste expected to be produced;
- An explanation of how the contractor aims to minimise the different waste types produced prior to any activity that generates this waste; and
- Procedures for identification of the waste management actions proposed for each different waste type, including re-using, recycling, recovery and disposal (as per the waste hierarchy priorities).

All workers will be fully briefed of waste management procedures and aware of their requirements under the WMP. All site visitors will be briefed on appropriate waste storage and disposal units. Littering will not be tolerated and all personnel will have a duty to challenge those who do not comply with WMP procedures.

2.3 Monitoring

2.3.1 Checks and Records

All stores on site of oil, fuel and chemicals should be visually inspected on a regular basis, especially during extreme weather conditions. Visual inspections will reveal evidence of leaks, spills or contamination.

Records of all visual checks must be maintained and be made available upon request for inspection. The topic of waste management will be regularly discussed during team meetings and, as required, waste management practices should be continually revised.

2.3.2 Waste Inventory

A waste inventory should be continually updated and will include a list of all waste materials leaving the site for disposal as well as the name of the appropriately licensed operator and intended disposal facility. A waste inventory will be added to this plan by the contractor.

2.3.3 Monitoring of WMP

The contractor will appoint the EM to implement and monitor the WMP. The WMP should include an inventory of the types of estimates of the waste to be produced on site. The aim will be to keep the volumes of waste produced below the estimates of waste to be produced. The EM will ensure that a waste audit is carried out every 6-months.

2.4 Review

Upon completion of the construction phase, a waste management review will be undertaken. The aim will be to measure compliance with the WMP objectives and to consider lessons learnt. The review will be carried out by the EM in conjunction with the contractor.

3.0 General Waste Management Principles

- All personnel will be made aware of the objectives of this WMP and their responsibilities to minimise the generation of waste and, where it arises, to ensure its appropriate management;
- The generation of waste products will be minimised insofar as possible;
- Appropriate management, storage and disposal procedures will prevent pollution in compliance with legislation;
- All waste storage receptacles shall be secured within the development site;
- All waste receptacles shall be maintained in good condition;
- No waste receptacles shall be stored within 10m of any surface water feature;
- For general waste, wheelie bins should be selected or, where required, covered skips should be obtained;
- All waste to be transported off-site shall only be removed by a licenced waste carrier. Local waste carriers and disposal facilities will be selected where possible;
- Maintain appropriate waste records. Such records must detail:-
  - An adequate description of the waste;
  - Where the waste came from;

  - The appropriate code from the List of Wastes Regulations for waste (commonly referred to as the EWC code);
  - Information on the quantity and nature of the waste and how it is contained;
  - Names and addresses of the transferor (the person currently in control of the waste) and the transferee (usually either a registered waste carrier or a waste management license holder (waste manager);
  - The Standard Industry Classification (SIC) CODE (2007 or 2003 for hazardous waste only) of the business from where the waste was received;
  - Where applicable, indicate that the waste hierarchy has been complied with;
  - The place, date and time of transfer of the waste. If using a season ticket, the period for which it is valid (i.e., valid from dd/mm/yyyy to dd/mm/yyyy); and
  - If the waste is being taken to landfill the transfer note must also contain details of any treatments or processes that have already been applied;
- Waste records will be stored for a period of 3-years. Where records are provided through an online portal, access to the portal shall be maintained by the relevant contractor;
- Only trained operatives should handle hazardous substances. All stored hazardous waste will be clearly labelled;
- No hazardous waste shall be removed from site in the absence of all appropriate documentation;
- No storage of hydrocarbons or any toxic waste chemicals should occur within 50m of a watercourse/drainage ditch;
- All associated hazardous waste residuals (including used oil spill kits), such as oil, solvents, used absorbent materials on minor oil spills, glue and solvent based paint containers will be stored within appropriately covered skips prior to removal by a suitable local authority or EPA approved waste management contractor for off-site treatment/recycling/disposal;
- Waste storage areas will be clearly located and made known to all operatives;
- Oil waste shall be stored in a double skinned tank. However, if a double skinned tank is not available, the oil waste will be bagged and stored in a secure storage vessel with secondary containment in the form of a drip tray or bund. The oil waste shall then be removed from site by a specialist contractor;
- Oily wastes, such as rags and spill absorption material, shall be placed in a bag and stored within a secure container within secondary containment which is capable of ensuring no spilled or collected oil waste escapes. The oil wastes shall then be removed from site by a specialist contractor;
- Obsolete electronic equipment, e.g., computers and associated accessories shall be labelled as WEEE (waste electrical and electronic equipment) and stored safely for a maximum of 12-months prior to sending for recycling;
- All waste will be transported from the site as soon as practicable to prevent over-filling of waste containers; and,
- Frequency of Checks: the contractor will ensure that all storage facilities are checked on a weekly basis. The checklist for completion is attached below.

Waste Checklist		
Waste area checked	Date Checked	Checked By
General office waste		
Bowser		
Portaloo		
Excavated soil		

Washings		
Concrete		
Oil		
Hazardous Waste		

4.0 Typical Waste Streams

4.1 Waste Inventory

The typical waste arising during the construction of the project is provided below. This inventory will be further expanded upon by the contractor prior to the commencement of construction.

Waste Item	EWC	Disposal Method
Re-use		
Non-contaminated spoil arising from groundworks (e.g., topsoil, subsoil, vegetation, stone aggregates, concrete, etc.)	170107 & 170504	Re-use locally within the site for reinstatement or landscaping
Wood Pallets	150103	Return to supplier
Recyclable		
Aluminium Cans	150104	To recycling centre
Cardboard	150101	To recycling centre
Plastic Cups	200139	To recycling centre
Metals	020110	To appropriate recycling centre
Glass (bottles/containers)	200102	To recycling centre
Packaging (general)	150106	To recycling centre
Paper (general)	200101	To recycling centre
Plastics (general)	150102	To recycling centre
Plastics (bottlers, containers, etc.)	200139	To recycling centre
Polystyrene	200104	To recycling centre
Wood/Timber packaging (e.g., crates)	150103	To recycling centre
Disposal		
Food Waste	200108	Disposal by local contractor
General Waste	200301	Disposal by local contractor
Foul Waste	190805	Collection by specialist contractor
Aerosol Cans	160504	Disposal by local contractor
Diesel (hazardous waste)	130701	Collection by specialist contractor
Greases (hazardous waste)	130899	Collection by specialist contractor
Oily water mix from bunds/sumps (hazardous waste)	130507	Collection by specialist contractor
Insulating Oils with PCB contamination (hazardous waste)	130301	Collection by specialist contractor
Synthetic Oils (hazardous waste)	130310	Collection by specialist contractor

Other Oils (hazardous waste)	130203	Collection by specialist contractor
Oil Drums (hazardous waste)	150110 & 150104	Collection by specialist contractor

4.2 Management of Waste

All waste will be segregated and securely stored at the temporary construction compound, in skips and receptacles, which will be covered to protect the contents from the weather. A licensed operator will collect and transfer the skips/receptacles of both recyclable and non-recyclable wastes as they are filled. Where this is not practicable, or where the quantity of waste is small, the contractor will remove the waste to his yard on a daily basis for onward disposal.

A list of licensed operators will be identified provided below.

Permit Number	Name of Permit Holder	Address of Waste Facility	Type of Waste Permitted

Annex 3 –
Spoil Management Plan

White Hill Wind Farm Electricity Substation & Electricity Line

Planning-Stage Construction & Environmental Management Plan

Spoil Management Plan

White Hill Wind Limited

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Contents

1.0 Introduction 1
1.1 Purpose of this Report 1
1.2 Aims of this SMP 1
1.3 Reference Documents 1
2.0 Description of the Project 1
3.0 Description of Baseline Environment 2
3.1 Site Location 2
3.2 Topography 2
3.3 Geological Environment 3
3.4 Hydrological Environment 3
4.0 General Spoil Management Proposals 4
5.0 Estimated Excavation Quantities 4
5.1 Spoil Generation & Management 5
6.0 Use of Excavated Material 5
6.1 Landscaping/Reinstatement of Infrastructure 5
6.2 Permanent Storage 5
6.3 Disposal Off-Site 6
7.0 Conclusion 6

1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Spoil Management Plan (SMP) to detail the appropriate management of excavated material arising from the construction of the White Hill Wind Farm Electricity Substation & Electricity Line ('the project').

1.1 Purpose of this Report

This SMP provides the framework for the management of spoil at the project site for contractors and incorporates the measures set out in the various environmental assessment documents associated with the development. The purpose of this report is to ensure that spoil is managed safely and re-used without resulting in any adverse environmental effects, and to ensure that all spoil handling/management activities are carried out in accordance with best practice methods.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SMP will be reviewed by the Environmental Manager (EM) to confirm the appropriateness of the measures set out therein.

1.2 Aims of this SMP

The overall objective of this SMP is to provide for the appropriate management of excavated material arising from the construction of the project. In doing so, the re-use of excavated material, locally to its excavation, will be maximised through reinstatement and landscaping proposals.

The reinstatement of excavated materials will occur as close to the site of excavation as possible. Excavated material horizons (topsoil and subsoil, etc.) will be stored separately to ensure appropriate re-use; and will be replaced in sequence and to depths similar to those recorded prior to excavation.

Excavated material may also be used in the landscaping of the site; for example, along access tracks and around the electricity substation compound to ensure consistent ground profiles. Again, material will be placed close to its source and in a fashion which allows for vegetative re-growth thus allowing for spoil to be assimilated into the local environment.

1.3 Reference Documents

The production of this SMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other documents have been used to develop this SMP; including a Planning-Stage Construction & Environmental Management Plan, Surface Water Management Plan, Waste Management Plan and Environmental & Emergency Response Plan.

2.0 Description of the Project

White Hill Wind Limited intends to construct the project which will consist of:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;

- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.8km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 3.3km of the underground electricity line located in County Kilkenny and c. 5.5km of the underground electricity line and the electrical control unit located in County Carlow. Electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

In addition to the reference documents listed in **Section 1.3**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity chapter (SLR Consulting);
- Land & Soil chapter (Hydro Environmental Services);
- Water chapter (Hydro Environmental Services); and
- Natura Impact Statement (SLR Consulting).

3.0 Description of Baseline Environment

3.1 Site Location

The project will be located approximately 11km northeast of Kilkenny City, c. 15km southwest of Carlow Town, c. 3km west of Muine Bheag (Bagenalstown) and c. 1km north of Paulstown. The electricity substation will be located within the townland of Shankill, County Kilkenny; Shankill and Ballygorteen, County Kilkenny; and Annagar, Lackan and Baunreagh, County Carlow. The electrical control unit will be located within the townland of Baunreagh, County Carlow. The underground electricity line will, from the electricity substation, be located within private lands and within the carriageways of locally-classed public roads.

The project site is located at the southern extent of the Castlecomer Plateau. The Castlecomer Plateau is an elevated plateau located in south County Laois, northwest County Carlow and northeast County Kilkenny. The Castlecomer Plateau is characterised by undulating hills and steep escarpments at its fringes. Dissecting the lowlands on either side of the plateau are the Barrow and Nore rivers, which lie to the east and west respectively. The lowlands are a mixture of pasture and tillage with fields typically bordered by mature broadleaf tree lines and hedgerows. Agricultural land uses extend into the upland areas in the form of more marginal grazing with scrubby hedgerow field boundaries. Extensive commercial conifer plantations emerge on higher slopes throughout the Castlecomer Plateau.

3.2 Topography

The project site, and surrounding topography, are typical of this region and comprise an undulating landscape with the ground elevation rising considerably from the substation along the route of the underground electricity line to the electrical control unit and the permitted White Hill Wind Farm site. Ground elevations at the electricity substation range between 68 metres (m) and 73m above ordnance datum (AOD). Ground elevations along the electricity cable route generally range between 68m

and 310m. To the south and east of the project site, the terrain is gently undulating and generally trends towards the River Barrow located c. 3km to the east.

3.3 Geological Environment

Based on the GSI/Teagasc soils mapping (www.epa.ie), the location of the electricity substation is overlain by poorly drained, mainly basic mineral soils (BminPD). The location of the electrical control unit is mapped as shallow acid poorly drained mineral soils (AminSP).

The mapped soil types along the underground electricity line chiefly consist of a mixture of acidic natured soils such as shallow well drained mineral soils (AminSW), poorly drained mineral soils (AminPD), deep well drained mineral soils (AminDW), Shallow, rocky, peaty/non-peaty mineral complexes (AminSRPT) and poorly drained mineral soils (AminSP). Alluvium soils are mapped briefly (c. 400m section) along route where the Shankill Stream nears the local road towards the southern section of the route.

Till derived from limestones (TLs) is mapped to underly the electricity substation. There is little subsoil coverage in the more upland areas of the project site underlying the electrical control unit, as bedrock outcrop/subcrop (Rck) is mapped here by the GSI.

Similarly, there is little subsoil coverage mapped to underly much of the electricity line route as bedrock outcrop/subcrop (Rck) is dominant throughout. Any subsoils that are mapped along the route are chiefly Till derived from Namurian sandstones and shales (TNSSs). Alluvium subsoils are also mapped briefly along the southern section of the route near the Shankill Stream. As the route progresses nearer to the electricity substation, the subsoils are mapped as Till derived from limestones (TLs).

As part of the EIAR for the White Hill Wind Farm, 2 no. trial pits (referred to herein as TP1/CU and TP2/CU) were carried out at the location of the electrical control unit on 6 October 2021.

In addition, 3 no. trial pits were carried out at the location of the electricity substation (TP1/ST – TP3/ST) on 24 October 2024.

The subsoils encountered at electrical control unit consist mainly of SILT with increasing gravel/stone content with depth due to the underling shallow weathered bedrock. Depth to bedrock at electrical control unit ranged from 0.5m to 1m.

The subsoils encountered at the electricity substation comprise a layer of SILT above gravelly CLAY. Bedrock was not encountered at the substation site at the maximum trial pit depth of 2.5m.

No ground stability issues were identified by the trial pit investigation and all subsoils were found to be firm to very firm and cohesive which is generally typical of shale, sandstone and limestone tills.

A walkover survey of the off-road sections of the underground electricity line confirmed the presence of mineral soils/subsoils and generally firm under foot ground conditions.

3.4 Hydrological Environment

On a regional scale, the electricity substation, electrical control unit and electricity line are located entirely within the River Barrow surface water catchment within Hydrometric Area 14. The River Barrow flows approximately 3.5km to the east of the electricity substation site.

On a more local scale, the substation is located in the Barrow_SC_120 sub-catchment and within the Moanmore_010 river waterbody sub-basin (Moanmore Stream catchment).

The electrical control unit is also mapped within the Barrow_SC_120 sub–catchment, whilst being situated more locally in the Monefelim_010 river sub-basin (Monefelim River catchment).

The majority of the electricity line is also located in the Barrow_SC_120 sub–catchment with the exception of 1.3km which is located in the Barrow_SC_110 sub-catchment and more locally within the Old Leighlin Stream_010 river waterbody sub-basin (Old Leighlin Stream catchment).

In all, the electricity line passes through 4 no. sub-basins; the Monefelim_010 (c. 1.4km), Monefelim_030/Paulstown Stream (c. 2.1km), Old Leighlin Stream_010 (c. 1.3km) and Moanmore_010 (c. 4.0km).

4.0 General Spoil Management Proposals

The following are a suite of general measures which will be adhered to in the management of excavated material:-

- Excavated material will be re-used on-site for reinstatement and landscaping insofar as possible;
- Excavated material will be stored, separately, according to its characteristics (e.g. topsoil shall not be contaminated by subsoil or rock);
- Excavated subsoil shall be prioritised for the reinstatement of infrastructure (e.g. temporary construction compound, access tracks, electricity line trenches);
- Excavated topsoil shall be prioritised for final landscaping measures (e.g. ground profiling/grading, finishing of spoil deposition areas, finishing of electricity line trenches within private lands, etc.);
- Road pavement material, or other unsuitable material, shall not be used for reinstatement and shall be removed from site and disposed of at an approved waste management facility;
- Where excavated material is to be re-used (for reinstatement or landscaping), it shall be side-cast and stored temporarily in an appropriate manner. Where excess material arises which will not be re-used at the excavation location, it shall be transported to the spoil deposition areas for permanent storage;
- Temporary storage locations shall be appropriately sited to avoid any smothering of important habitats or risk of sediment discharge to watercourses;
- Temporary storage locations will be carefully selected to avoid any ground instability risks;
- The temporary storage locations will be regularly inspected by the EM; and
- Reinstatement/landscaping works will commence as soon as practicable following the completion of individual work streams thus allowing for the timely management of material and early commencement of re-vegetation thus reducing the likelihood of soil erosion or release of silt/sediment.

5.0 Estimated Excavation Quantities

On the basis of site investigations undertaken at the project site and the completion of the preliminary project (civil/electrical) design process; estimated volumes of material likely to be excavated during construction have been identified. The project will, should planning permission be granted, be subject to a further detailed design process where the volume of material to be excavated will be further refined.

Accordingly, it is important to highlight that the volumes set out below are estimates based on the design process completed to date, the findings of the site investigations, and past experience of similar developments.

5.1 Spoil Generation & Management

Project Element	Volume of Material to be Excavated (m^3)	Volume of Material to be utilised for reinstatement/ landscaping (m^3)	Volume of Material to be disposed of in deposition area (m^3)	Volume to be disposed of off-site (m^3)
Electricity Substation (incl. substation compound, access track, site entrance, interface masts)	7,965	200	7,755	10
Temporary Construction Compound	685	685	0	0
Underground Electricity Line	17,330	14,045	2,630	655
Electrical Control Unit (incl. compound, access track and site entrance)	950	100	850[1]	0

Table 1: Spoil Generation & Management

6.0 Use of Excavated Material

As outlined above, there are a number of possible uses for excavated material which has no further purpose in the construction process.

6.1 Landscaping/Reinstatement of Infrastructure

Excavated subsoil and topsoil will, in the first instance, be utilised for the reinstatement of infrastructure including access track edges, electricity substation compound, electrical control unit compound, electricity line trench reinstatement and reinstatement of the temporary construction compound following its decommissioning. Once again, this will ensure that material is, insofar as is practicable, be reinstated at or close to its source location. Following the placement of subsoil, a layer of topsoil will be spread across the affect area, graded to match the surrounding ground profile, and re-seeded or allowed to vegetate naturally.

6.2 Permanent Storage

Where excess material is generated at the electricity substation site or along the route of the underground electricity line which cannot be utilised for reinstatement or landscaping purposes, it is proposed to develop 2 no. dedicated spoil deposition areas immediately northeast of the electricity substation where excess material will be stored permanently. It is estimated that c. 10,385m^3 of excess material (topsoil and subsoil) will be stored in the deposition areas. The locations of the deposition areas

[1] It should be noted that due to the proximity of the location of the electrical control unit to the permitted White Hill Wind Farm, excess spoil will be deposited at spoil deposition areas permitted under An Bord Pleanála Reference ABP-315365-22)

were selected due to the general absence of environmental constraints, available separation distances to watercourses, generally flat or gently sloping gradient and close proximity thus avoiding traffic movements on the public road network.

Spoil will be transported to the deposition areas where it will be placed in layers in accordance with best-practice methods. The deposition areas will have a height of 3.5m. Appropriate drainage management measures will be implemented to ensure that the deposited spoil does not become waterlogged. Following the completion of construction, the vegetative topsoil layer which was removed to accommodate the deposition areas will be reinstated over the spoil. Alternatively, the deposition areas may be covered with topsoil and allowed to vegetate. Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified geotechnical engineer.

During the construction phase, material will be generated from the excavation of the underground electricity line trench. In total, it is estimated that c. 17,330m^3 will be excavated comprising topsoil, subsoil, rock and road pavement material. Approximately 14,045m^3 of this material will be reused in the backfilling and reinstatement of the electricity line trench, while 2,630m^3 will be stored at the spoil deposition areas. Due to the potential for soil contamination, all road pavement material (tar & chips, etc.) will be disposed of at an approved waste facility.

6.3 Disposal Off-Site

Any spoil generated which is unsuitable for reinstatement or landscaping purposes or for storage within the deposition areas shall be removed from site and disposed of at a licensed waste disposal facility. It is estimated that 665m^3 of such material will be transported off site.

7.0 Conclusion

This SMP has been prepared to detail the appropriate management of material excavated during the construction of the White Hill Wind Farm Electricity Substation & Electricity Line. Overall, it is assessed that there is sufficient capacity within the project site to accommodate all excavated material through re-use, reinstatement and permanent storage such that no significant volume of material will be transported off-site.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SMP will be reviewed by the EM to confirm the appropriateness of the measures set out therein.

Annex 4 –

Surface Water Management Plan

White Hill Wind Farm Electricity Substation & Electricity Line

Planning-Stage Construction & Environmental Management Plan

Surface Water Management Plan

White Hill Wind Limited

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Contents

1.0 Introduction 1
1.1 Purpose of this Report 1
1.2 Reference Documents 1
2.0 Description of the Project 2
3.0 Description of Baseline Environment 2
3.1 Site Location 2
3.2 Topography 3
3.3 Hydrological Environment 3
3.4 Geological Environment 3
3.5 Flood Risk Assessment 4
3.6 Nature Conservation Sites 5
4.0 Drainage System 6
4.1 Sustainable Drainage System 6
4.2 Design Measures 9
5.0 Surface & Ground Water Control Measures 12
5.1 Earthworks (Removal of Vegetation Cover, Excavations, Trenching and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water) 14
5.2 Excavation Dewatering and Effects on Surface Water Quality 16
5.3 Release of Hydrocarbons during Construction and Storage 17
5.4 Groundwater and Surface Water Contamination from Wastewater Disposal 17
5.5 Release of Cement-Based Products 17
5.6 Morphological Changes to Surface Watercourses & Drainage Patterns .. 18
5.7 Effects on Water Supplies 20
6.0 Conclusion 20

1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Surface Water Management Plan (SWMP) for the construction of the White Hill Wind Farm Electricity Substation & Electricity Line ('the project').

1.1 Purpose of this Report

This SWMP provides the framework for water management at the project site for contractors and incorporates the measures set out in the various environmental assessment documents associated with the project. The purpose of this report is to detail the practical implementation of these measures such that the construction of the project does not have an adverse effect on water quality.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

This SWMP aims to:-

- Describe environmental sensitives of the site and any applicable buffer zones;
- Describe how the system will operate to minimise modification and disruption to the existing site hydrology;
- Outline the proposed maintenance regime; and
- Outline the proposed drainage management post-construction.

1.2 Reference Documents

The production of this SWMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other documents have been used to develop this SWMP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, Waste Management Plan, and Environmental & Emergency Response Plan.

1.2.1 Legislative Background

This report has been prepared in accordance with the following legislation:-

- *S.I. 10 of 1972 Dangerous Substances Act, 1972, as amended*;
- *S.I. No. 293 of 1988 Quality of Salmon Water Regulations*;
- *S.I. No. 249 of 1989 Quality of Surface Water Intended for Abstraction (Drinking Water)*;
- *S.I. No. 94 of 1997 European Communities (Natural Habitats) Regulations*;
- *S.I. No. 41 of 1999 Protection of Groundwater Regulations*;
- *Water Framework Directive (2000/60/EC)*;
- *S. I. No. 600 of 2001 Planning and Development Regulations 2001, as amended*;
- *S.I. No. 722 of 2003 European Communities (Water Policy) Regulations*;
- *S.I. 547 of 2008 European Communities (Environmental Liability) Regulations*;
- *S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations*;
- *S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010*; and

- *S.I. No. 350 of 2014 European Union (Water Policy) Regulations 2014*.

1.2.2 Construction Industry Research & Information Association (CIRIA) Manuals

- *CIRIA (Construction Industry Research & Information Association) Report C502 Environmental Good Practice on Site*;
- *CIRIA 521 - Sustainable Urban Drainage Systems; Design Manual for Scotland and Northern Ireland*;
- *CIRIA Report C532 Control of Water Pollution from Construction Sites*;
- *CIRIA Report C648 Control of Pollution from Linear Construction Project Technical Guidance*;
- *CIRIA Handbook C650 Environmental good practice on site*;
- *CIRIA Handbook C651 Environmental good practice on site checklist*;
- *CIRIA Report C609 - SuDS - hydraulic, structural & water quality advice*;
- *CIRIA Report C697 - The SuDS Manual*; and
- *Guidelines on Protection of Fisheries during Construction Work in and Adjacent to Water* (Inland Fisheries Ireland, January 2016).

2.0 Description of the Project

White Hill Wind Limited intends to construct the project which will consist of:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;
- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.8km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 3.3km of the underground electricity line located in County Kilkenny and c. 5.5km of the underground electricity line and the electrical control unit located in County Carlow. Electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

In addition to the reference documents listed in **Section 1.2**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity chapter (SLR Consulting);
- Land & Soil chapter (Hydro Environmental Services);
- Water chapter (Hydro Environmental Services); and
- Natura Impact Statement (SLR Consulting).

3.0 Description of Baseline Environment

3.1 Site Location

The project will be located approximately 11km northeast of Kilkenny City, c. 15km southwest of Carlow Town, c. 3km west of Muine Bheag (Bagenalstown) and c. 1km north of Paulstown. The electricity substation will be located within the townland of

Shankill, County Kilkenny; Shankill and Ballygorteen, County Kilkenny; and Annagar, Lackan and Baunreagh, County Carlow. The electrical control unit will be located within the townland of Baunreagh, County Carlow. The underground electricity line will, from the electricity substation, be located within private lands and within the carriageways of locally-classed public roads.

The project site is located at the southern extent of the Castlecomer Plateau. The Castlecomer Plateau is an elevated plateau located in south County Laois, northwest County Carlow and northeast County Kilkenny. The Castlecomer Plateau is characterised by undulating hills and steep escarpments at its fringes. Dissecting the lowlands on either side of the plateau are the Barrow and Nore rivers, which lie to the east and west respectively. The lowlands are a mixture of pasture and tillage with fields typically bordered by mature broadleaf tree lines and hedgerows. Agricultural land uses extend into the upland areas in the form of more marginal grazing with scrubby hedgerow field boundaries. Extensive commercial conifer plantations emerge on higher slopes throughout the Castlecomer Plateau.

3.2 Topography

The project site, and surrounding topography, are typical of this region and comprise an undulating landscape with the ground elevation rising considerably from the substation along the route of the underground electricity line to the electrical control unit and the permitted White Hill Wind Farm site. Ground elevations at the electricity substation range between 68 metres (m) and 73m above ordnance datum (AOD). Ground elevations along the electricity cable route generally range between 68m and 310m. To the south and east of the project site, the terrain is gently undulating and generally trends towards the River Barrow located c. 3km to the east.

3.3 Hydrological Environment

On a regional scale, the electricity substation, electrical control unit and electricity line are located entirely within the River Barrow surface water catchment within Hydrometric Area 14. The River Barrow flows approximately 3.5km to the east of the electricity substation site.

On a more local scale, the substation is located in the Barrow_SC_120 sub-catchment and within the Moanmore_010 river waterbody sub-basin (Moanmore Stream catchment).

The electrical control unit is also mapped within the Barrow_SC_120 sub–catchment, whilst being situated more locally in the Monefelim_010 river sub-basin (Monefelim River catchment).

The majority of the electricity line is also located in the Barrow_SC_120 sub–catchment with the exception of 1.3km which is located in the Barrow_SC_110 sub-catchment and more locally within the Old Leighlin Stream_010 river waterbody sub-basin (Old Leighlin Stream catchment).

In all, the electricity line passes through 4 no. sub-basins; the Monefelim_010 (c. 1.4km), Monefelim_030/Paulstown Stream (c. 2.1km), Old Leighlin Stream_010 (c. 1.3km) and Moanmore_010 (c. 4.0km).

3.4 Geological Environment

Based on the GSI/Teagasc soils mapping (www.epa.ie), the location of the electricity substation is overlain by poorly drained, mainly basic mineral soils (BminPD). The

location of the electrical control unit is mapped as shallow acid poorly drained mineral soils (AminSP).

The mapped soil types along the underground electricity line chiefly consist of a mixture of acidic natured soils such as shallow well drained mineral soils (AminSW), poorly drained mineral soils (AminPD), deep well drained mineral soils (AminDW), Shallow, rocky, peaty/non-peaty mineral complexes (AminSRPT) and poorly drained mineral soils (AminSP). Alluvium soils are mapped briefly (c. 400m section) along route where the Shankill Stream nears the local road towards the southern section of the route.

Till derived from limestones (TLs) is mapped to underly the electricity substation. There is little subsoil coverage in the more upland areas of the project site underlying the electrical control unit, as bedrock outcrop/subcrop (Rck) is mapped here by the GSI.

Similarly, there is little subsoil coverage mapped to underly much of the electricity line route as bedrock outcrop/subcrop (Rck) is dominant throughout. Any subsoils that are mapped along the route are chiefly Till derived from Namurian sandstones and shales (TNSSs). Alluvium subsoils are also mapped briefly along the southern section of the route near the Shankill Stream. As the route progresses nearer to the electricity substation, the subsoils are mapped as Till derived from limestones (TLs).

As part of the EIAR for the White Hill Wind Farm, 2 no. trial pits (referred to herein as TP1/CU and TP2/CU) were carried out at the location of the electrical control unit on 6 October 2021.

In addition, 3 no. trial pits were carried out at the location of the electricity substation (TP1/ST – TP3/ST) on 24 October 2024.

The subsoils encountered at electrical control unit consist mainly of SILT with increasing gravel/stone content with depth due to the underling shallow weathered bedrock. Depth to bedrock at electrical control unit ranged from 0.5m to 1m.

The subsoils encountered at the electricity substation comprise a layer of SILT above gravelly CLAY. Bedrock was not encountered at the substation site at the maximum trial pit depth of 2.5m.

No ground stability issues were identified by the trial pit investigation and all subsoils were found to be firm to very firm and cohesive which is generally typical of shale, sandstone and limestone tills.

A walkover survey of the off-road sections of the underground electricity line confirmed the presence of mineral soils/subsoils and generally firm under foot ground conditions.

3.5 Flood Risk Assessment

OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping (NIFM), CFRAM River Flood Extents, historical OSI mapping (i.e. 6" and 25" base maps) and the GSI Surface Water and Groundwater Flood Maps were consulted. These flood maps are available to view at Flood Maps - Floodinfo.ie.

There are no areas on the historical OSI 6" or 25" mapping in the project site that are identified as "*Liable to Floods*".

No recurring flood incidents were identified near the electricity substation or the electrical control unit. A recurring flood event is however mapped along the electricity line route at the L7117 local road in the townland of Lacken (Flood ID:

2959). The road is noted to be periodically impassable within the Bagenalstown Area Engineer Meeting Minutes.

There is no CFRAM River Flood Extents mapping available for the project site. The nearest available CFRAM mapping is found along the main channel of the River Barrow c. 3.5km to the east of the project site.

There is also no National Indicative Fluvial Mapping available for the immediate vicinity of the project. NIFM river flood zones are mapped along the Moanmore Stream approximately 1.8km east and downstream of the electricity substation location, before its confluence with the River Barrow.

NIFM flood zones are also mapped along the Monefelim River and Paulstown Stream, however these are at significant downstream distances from the project. For example, river flood zones are mapped along the Monefelim_010 approximately 2.6km south and downstream of the electrical control unit.

Additionally, flood zones are mapped along the Monefelim_030 approximately 2.7km southeast and downstream of where the electricity line crosses the Paulstown Stream (EPA Code: 14P06).

The GSI's Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter's flood event. This flood event is recognised as being the largest flood event on record in many areas. The flood map for this event does not record any flood zones in the area of the project site. The nearest mapped surface water flood zones are mapped along the main channel of the River Barrow further east and downstream of the project site.

No modelled or historic groundwater flooding is mapped in the vicinity of the project site or surrounding lands.

There are no areas within the project site or downstream of it mapped as 'Benefiting Lands'. Benefiting lands are defined as a dataset prepared by the OPW identifying land(s) that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage.

A walkover of the project site was undertaken on 24 October 2024 during which it was surveyed for any signs or anecdotal evidence of flooding. No such signs were noted.

3.6 Nature Conservation Sites

Within the Republic of Ireland, designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The project site is not located within any designated conservation site.

All of the river waterbodies that drain the project site flow into the River Barrow and River Nore SAC (Site Code: 002162) to the southeast.

At its closest point, this designated site is located approximately 2.7km to the east (as crow flies) and downstream of the substation location.

The Whitehall Quarries pNHA (Site Code: 000855) is situated c. 500m to the southwest of the electricity line at its nearest point and is c. 1.7km northwest of the substation. There is no hydrological connectivity to this designated site.

4.0 Drainage System

4.1 Sustainable Drainage System

Surface water is a valuable resource and this should be reflected in that way it is managed. The appropriate management of surface water should be considered at the early stages of the project design process. It is important, particularly on large developments such as the subject project, that the management of surface water is managed in a fashion will prevents significant alterations to the existing hydrological regime whilst ensuring the appropriate drainage of the proposed site.

The project has been designed to implement a Sustainable Drainage System (SuDS) which seeks to:-

- Minimise any change to the surface water and groundwater conditions within the site;
- Avoid sensitive areas where possible by employing hydrological constraints (i.e. buffer zones);
- Replicate the natural drainage of the site;
- Minimise sediment loads in the runoff, with particular attention being given to the construction phase of the project;
- Maintain runoff rates and volumes at Greenfield rates for a range of storm events (to be incorporated into final detailed design); and,
- Avoid high flow velocities internally within new drain networks and at outfall locations to prevent erosion.

The purpose of a SuDS is:-

- To provide sufficient detail to ensure that water pollution will not occur as a result of construction and operational activities at the site and to minimise the risk of any such occurrence;
- To regulate the rate of surface water run-off downslope to prevent scouring and to encourage settlement of sediment locally; and
- To minimise the quantity of sediment laden stormwater and resulting settlement pond sizes by separating 'clean' water from the 'dirty' development runoff.

4.1.1 SuDS Design

The overarching objective of the SuDS design is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. While the SuDS is, overall, an amalgamation of a suite of drainage infrastructure; the objectives are straightforward. In summary:-

- All surface water runoff will be directed to specially constructed swales surrounding all areas of ground proposed to be disturbed;
- The swales will direct runoff into stilling ponds (silt traps) where silt/sediment will be allowed to settle; and
- Following the settlement of silt/sediment, clean water will be discharged indirectly to the local drainage network via buffered outfalls thus ensuring that no scouring/erosion occurs.

The design criteria for the SuDS is as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;

- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;
- To minimise sediment loads resulting from the development runoff during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;
- To provide appropriate retention times such that and no flooding will occur on local roads in the vicinity of the project site which may cause a traffic hazard;
- To provide stilling ponds (comprising primary and secondary ponds) to encourage sedimentation and storm water runoff settlement;
- To provide lagoon-type settlement ponds which follow a design outlined by Altmuller and Dettmer (2006). The tertiary treatment system of the lagoon-type settlement ponds will absorb the fine particles, which may not settle in the primary and secondary settlement ponds. These ponds are to be vegetated so as to perform the role of plant filtration best described on Page 7 of the Altmuller and Dettmer document[1] (see **Annex 1**);
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally;
- To manage erosion and allow for the effective revegetation of bare surfaces;
- To control water within the site and allow for the discharge of runoff from the site within the limits prescribed in the Freshwater Pearl Mussel and Salmonid Regulations;
- To ensure that oils, fuels and other contaminants are stored appropriately and bunded to prevent any discharge of such materials. The temporary construction compound, where such oils and fuels will be stored, shall incorporate an oil/petrol interceptor within its drainage system. Similarly, an oil/petrol interceptor shall be installed within the permanent drainage system for the electricity substation;
- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water;
- Storm water runoff from access tracks will be managed via filter drains consisting of open land drains, swales and stilling ponds/lagoon-type settlement ponds. Access tracks will crossfall downslope to mimic the natural drainage patterns of the site.
- Swale/stilling pond vegetation used will be appropriate to the local area;
- Temporary erosion protection together with silt fences may be required, pos-construction, until vegetation becomes established (coir matting or similar);
- Access tracks and areas of hardstandings will be constructed from aggregate and will not be surfaced with bitumen materials, thus helping to reduce runoff volumes. Therefore a reduced runoff coefficient of 50% is applicable;
- An additional 20% will be included to take account for global warming;
- A large portion of the hardstanding construction will be of single sized stone therefore the pore spacing in the hardstanding and road will also act to store and attenuate water;

[1] Altmüller R. & Dettmer, R. (2006*) Successful species protection measures for the Freshwater Pearl Mussel (Margaritifera margaritifera) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject*.

- Up-gradient swales will be primarily used to attenuate water and to encourage discharge into the ground locally;
- Outflow points will be taken from the swales into the existing onsite drainage channels. Silt fences will be maintained at the interface between the proposed and existing drainage channels for the duration of the construction phase;
- Stormwater runoff within the swale will also be treated through the provision of small silt fences or check dams, within a range depending on local slope of swale;
- The stone used for the construction of the check dams will be washed graded stone with a size range between approximately 5mm and 40mm;
- Swales will provide a flow route in extreme events to carry water to the existing surface water channels across site. It will be necessary to increase the cross sectional area of the swales further downstream of the footprint as larger volumes of stormwater are conveyed;
- Discharging directly back into the surrounding area will assist in maintaining the hydrological characteristics of the site;
- Vegetation will be reinstated on slopes as early as possible;
- Under track drainage will be provided with associated sumps and silt fences. The under track drainage will provide a means for flows to pass from a swale on the uphill side of the slope to the downhill side of the slope.
- A sump may be required to collect dewaterings from excavations; water will subsequently be pumped into the stilling pond system and allowed to settle prior to discharge;
- All swales (for clean and dirty water) and ponds will be kept as shallow as possible so that they do not pose any health and safety risk to plant or personnel;
- Field drains/streams will be piped directly under the track through appropriately sized drainage pipes;
- Prior to construction, the Office of Public Works (OPW) will be consulted with regard to a Section 50 licence for the installation of a culvert over the unnamed stream north of the electricity substation. The design of the culvert will follow guidance from Inland Fisheries Ireland;
- Appropriate site management measures will be taken such that runoff from the construction site is not contaminated by fuel or lubricant spillages;
- There will be no discharge of sewage effluent or contaminated drainage into any watercourse system or ditch; and
- The drainage system will be monitored regularly during the construction phase for effectiveness, and cleaned or unblocked if necessary.

4.1.2 SuDS Design Philosophy

The SuDS design principles are as follows:-

Minimise	→	Intercept	→	Treat	→	Disperse	→	Dilute

Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. This is achieved by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will

become diluted through contact with the clean water runoff before entering the natural drainage system.

Intercept

The key silt/sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the project site and surrounding lands. This significantly reduces the volume, and velocity, of dirty water that the control measures are required to manage. To achieve separation, clean water infiltration interception drains are positioned on the upslope and dirty water swales/drains positioned on the downslope, with site surfaces sloped towards dirty water swales/drains. Where required, the remainder of this clean water will be regularly piped under both the access tracks and dirty water swales/drains to prevent contamination. This process allow for the mimicking the paths which clean water would have taken in the absence of the project.

Treat, Disperse, & Dilute

'Dirty water' swales/drains collect all incident rainwater that falls on the development infrastructure and drain into the stilling ponds and lagoon-type settlement ponds. Following a period of attenuation, during which time all suspended solids will have 'fallen', the treated water is dispersed across vegetation (through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing any remaining small particle sizes to be taken up by the vegetation.

4.2 Design Measures

This SuDS adopts a design for the drainage of the site. The following elements in series are proposed:-

- Areas of ground to be disturbed should be kept to the minimum required;
- Open swales for development run-off collection and treatment;
- Infiltration Interception Drains for upslope 'clean' water collection and dispersion;
- Filtration Check Dams will be installed to reduce velocities along sections of road which run perpendicular to contours;
- Stilling ponds and lagoon-type settlement ponds will control and store development runoff to encourage settlement prior to discharge, at greenfield runoff rates, to eliminate any risk to Freshwater Pearl Mussel downstream of the project; and
- Disturbed Sediment Entrainment Mats (SEDIMATS) or other temporary surface water control measures will be installed in drainage features along the route of the underground electricity line to provide a further level of protection in relation to silt release.

These measures will provide a comprehensive surface water management train that will avoid any adverse effect on the hydrology of the site and downstream water quality during the construction phase of the project.

4.2.1 Infiltration Interceptor Drains

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or access track runoff. The SuDS design will ensure that infiltration interceptor drains are installed upslope of infrastructure, to intercept and divert clean surface water runoff, prior to it

coming in contact with areas of excavation. The contractor will ensure that natural runoff infiltration interceptor drains are installed ahead of earthworks being undertaken.

The purpose of interceptor drainage is to collect clean run-off water on the upstream side of new infrastructure and transfer it such that it can discharge to the downstream side of infrastructure without having to interact with new infrastructure/excavations where it could potentially pick up fine particles.

This will reduce the flow of natural runoff onto any exposed areas of rock and soil, thereby reducing the volume of silt laden runoff capable of being generated at the project site. Natural runoff water, upslope of infrastructure, will be collected in infiltration interceptor drains and be directed away from the earthworks etc. In certain areas, runoff will be passed through sub-surface clean water culverts (e.g. below access tracks or hardstandings) and will be kept separate to drainage provided for track runoff. The clean water runoff will be discharged downstream of works location and returned to the natural drainage network.

Temporary silt/sediment prevention and erosion protection measures will be provided in all drainage channels installed in order to mitigate the possibility of erosion and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions. All drainage is to be dispersed over vegetated ground as a further filtration method.

The frequency of outflow points will be designed to avoid collection and interception of large catchments creating significant point flows.

4.2.2 Swales

Swales will be utilised to capture surface runoff from excavated areas. Swales will direct the runoff to the stilling ponds and lagoon-type settlement ponds for further treatment and attenuation.

4.2.3 Filtration Check Dams

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within clean water drains and dirty water swales in order to reduce erosion and allow for greater flow control. Check dams allow for a reduction in the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent erosion of the drainage channel itself.

The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

- The maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- The centre of the check dam should be at least 0.2m lower than the outside edges;
- Side slopes should be 1:2 or less;
- Check dams should be keyed at least 0.1m into the drainage channel bottom in order to prevent the dam washing out; and
- Check dams will be maintained and monitored on a regular basis. Sediment should be removed before it reaches one half the original dam height.

4.2.4 Stilling Ponds

Runoff from large areas of hardstanding; including electricity substation compound, electrical control unit compound and temporary construction compound; will be attenuated to mimic natural runoff patterns. To capture runoff generated within the project site, swales (see **Section 4.2.2**) will be utilised to attenuate water and to direct 'dirty' water to stilling ponds, where the flow velocity will reduce to allow sediment and silt to be deposited.

From the primary and secondary stilling ponds, the water will flow through a tertiary treatment system; based on a design from Altmuller and Dettmer (2006); of lagoon-type sediment ponds which will absorb the fine particles that may not settle in the primary and secondary ponds.

All swales and ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Maximum depth of standing water will be limited to 0.75m within the stilling/settlement ponds.

The stilling ponds are utilised to attenuate rain water runoff rates to that of existing green field rates. In addition, the ponds shall aid the removal of suspended solids from runoff water.

4.2.5 Lagoon-type Settlement Ponds

In addition to the stilling ponds, a tertiary treatment system will also be provided to absorb any fine particles that may not settle in the primary and secondary settlement ponds. From the stilling ponds, water will flow through lagoon-type settlement ponds which will be designed with a retention time of 10-days. These ponds; the design of which will be adapted to the characteristics of the project site but based on the principles of Altmuller & Dettmer; will be vegetated so as to perform the role of a 'plant filtration bed' as described at **Annex 1** (pg. 7).

The project site is located in the catchment of the specified Freshwater Pearl Mussel (FPM) populations as set out in First Schedule of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. Sedimentation poses a significant threat to the FPM which is the qualifying interest of the River Barrow and River Nore Special Area of Conservation (SAC). All surface water run-off shall be strictly controlled such that no silt or other pollutants enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise, in accordance with the Fourth Schedule of the Regulations.

The stilling ponds and lagoon-type settlement ponds will assist as part of an overall strategy to remove any risk to FPM downstream of the project site.

Separately, it is also proposed to use Disturbed Sediment Entrainment Mats - SEDIMATS (see http://www.hy-tex.co.uk/ht_bio_sed.html). The use of these mats will provide a further level of protection in relation to silt release.

4.2.6 Temporary Surface Water Controls

In addition to the above, temporary surface water control measures will be implemented along the route of the underground electricity line. Due to the transient nature of works along the route, such measures will primarily comprise the installation of silt fencing downslope of the works area while straw bales will be installed within existing drainage channels.

Additionally, at the locations of horizontal directional drilling (HDD), all works will be undertaken in strict accordance with best practice methodologies with surface water measures being installed; including the installation of double silt fencing, avoidance of any refuelling activities within 100m of the streams, bunding of the Clear Bore™ batching, pumping and recycling plants, spill kits being available in the event of an accidental spillage or leakage, and the provision of adequately sized skips for the temporary storage of drilling arisings and drilling flush. All such arisings and flush will be disposed of at a licensed waste management facility.

4.2.7 Planning-Stage Design of Surface Water Management System

A planning-stage drainage/surface water management system has been designed by Jennings O'Donovan & Partners, enclosed at **Annex 2** hereto, and includes preliminary specifications for surface water management infrastructure particularly in relation to the appropriate sizing of stilling ponds. Details of the sizing of each pond, which have been informed by Met Éireann rainfall data for the project site, are provided at **Table 1** below.

Pond Reference (SP)	Development Area (m^2)	Length (m)	Width (m)	Depth (m)	Overall Volume of Stilling Pond (m^3)	Settling Velocity m/s <0.0016	Settling Duration Hours >4hrs
1	397	5	2.8	0.75	10.5	0.0002	8.12
2	720	8	2.8	0.75	16.8	0.0003	7.16
3	104	2	2.8	0.5	2.8	0.0001	8.26
4	414	4.6	2.8	0.75	9.7	0.0002	7.16
5	308	3.4	2.8	0.75	7.1	0.0001	7.12
6	866	9.6	2.8	0.75	20.2	0.0004	7.15
7	1375	10.7	4	0.75	32.1	0.0004	7.17

Table 1: Planning-Stage Stilling Pond Specifications

Prior to the commencement of development, the appointed contractor; in conjunction with the project design team, EM, and ECoW; shall prepare a detailed SWMP which shall detail the precise specifications and locations of all surface water management infrastructure to be installed.

5.0 Surface & Ground Water Control Measures

In the first instance, the project seeks to avoid adverse effects on all waters (surface and ground) through avoidance. In particular, the project has sought to avoid direct interactions with watercourses; through minimising the number of watercourse crossings and the implementation of a 50m buffer zone around natural watercourses. The design of the project has, where possible, sought to avoid this buffer area.

Best practice measures are also proposed to minimise effects to water quality, as follows:-.

- All site personnel will be made aware of their environmental responsibilities at the site;
- Contractors will be required to include contingency plans to deal with spillages, should they occur;
- Land disturbance will be kept to minimum and disturbed areas will be stabilised as soon as possible;

- In principle, soil excavation should be undertaken during dry periods, whenever possible;
- Site visits by a Design Engineer will be undertaken at various stages of the construction process to ensure that the SuDS scheme is being constructed and implemented appropriately; and
- In order to verify the efficacy of pollution prevention works during construction, water quality monitoring will be undertaken by a suitably qualified EM, prior to, during and post completion of construction works. This will include all watercourses within the catchment of the construction area. The monitoring will comprise visual and hydrochemistry monitoring, as described in detail in the Water Quality Monitoring Plan.

Finally, all mitigation measures proposed in the Water chapter of the EIAR will be implemented in full, as set out in the following sections.

The overarching objective of the proposed mitigation measures is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. This SWMP incorporates the surface water drainage design which has been prepared for the electricity substation and electrical control unit, see **Annex 2** hereto, and incorporates the principles of Sustainable Drainage Systems (SuDS) through an arrangement of surface water drainage infrastructure.

While the SuDS, overall, is an amalgamation of a suite of drainage infrastructure; the overall philosophy is straightforward. In summary:-

- Clean water drains will be installed upslope of the works area to intercept clean surface water to prevent it becoming contaminated by silt/sediment from construction activities;
- All surface water runoff from construction areas will be directed to specially constructed downslope dirty water drains surrounding all areas of ground proposed to be disturbed (including areas for the temporary storage of material);
- The swales will direct runoff into stilling ponds and, subsequently, lagoon-type settlement ponds[2] where silt/sediment will be allowed to settle; and,
- Following the settlement of silt/sediment, clean water will be discharged to the local drainage network or to ground via buffered outfalls or level spreaders thus ensuring that no scouring occurs.

The suite of surface water drainage infrastructure will include *inter alia* upslope clean water drains, downslope dirty water drains, sedimats, flow attenuation and filtration check dams, stilling ponds, lagoon-type settlement ponds and buffered outfalls or level spreaders.

The design criteria implemented as part of the SuDS are as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;

[2] *The design of the lagoon-type sediment ponds shall generally accord with the principles Altmüller R. & Dettmer, R. (2006)* Successful species protection measures for the Freshwater Pearl Mussel (Margaritifera margaritifera) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject.

- To minimise sediment loads resulting from the development run-off during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement;
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally; and,
- To manage erosion and allow for the effective revegetation of bare surfaces.

5.1 Earthworks (Removal of Vegetation Cover, Excavations, Trenching and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water)

5.1.1 Electricity Substation and Electrical Control Unit

The management of surface water runoff and subsequent treatment prior to release off-site will be undertaken during construction work as follows:-

- Prior to the commencement of earthworks, silt fencing will be placed down-gradient of the construction areas, as required, until the full range of construction phase measures are installed;
- These will be embedded into the local soils to ensure all site water is captured and filtered;
- Clean water drains will include check dams to control flow rates and avoid erosion or scouring of the drain;
- Water from the clean drains will be discharged by a buffered outfall or level spreader at greenfield runoff rates;
- Water will be discharged from the clean drains over natural grassland or to existing agricultural drains which will provide further filtration;
- All surface water runoff from works areas, excavations, stockpiles at the electricity substation site and electrical control unit site will be intercepted by downslope drains which will also include check dams;
- These dirty water drains will direct water to stilling ponds where water for treatment and attenuation;
- From the stilling ponds, water will be discharged to lagoon-type settlement ponds for final treatment. The settlement ponds will follow a design outlined by Altmuller and Dettmer (2006);
- The treated water will then be discharged via a buffered outfall or level spreader, at greenfield rates, over natural grassland which will provide additional filtration and treatment;
- The precise design, sizing and sitting of the drainage infrastructure will be confirmed as part of the post-consent detailed design process, however the design will be reflective of predicted rainfall levels with an appropriate allowance for climate change
- Daily monitoring of the excavation/earthworks, the water treatment and pumping system and the discharge areas will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will enter the main drainage channel;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will

recommence until the issue is resolved and the cause of the elevated source is remedied; and,
- Earthworks will take place during periods of low rainfall to reduce run-off and potential siltation of watercourses.

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

5.1.2 Electricity Line

The majority of the underground electricity line is in excess of 50m from any nearby watercourse with the exception of the 5 no. watercourse crossings.

No in-stream works are required at the crossing locations as HDD is proposed, however due to the proximity of the watercourses to the construction works, there is a risk of surface water quality effects during trench excavation work.

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:-

- All existing dry drains that intercept the works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps (e.g. straw bales);
- Clean water diversion drains will be installed upgradient of the works areas, as required;
- Check dams/silt fence arrangements (silt traps or straw bales) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zones such as at watercourse crossing locations.

5.1.3 Pre-emptive Site Drainage Management

The works programme for the construction stage of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2-days. Less useful than general forecasts as only available on a provincial scale;

- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3-hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15-minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended, the following control measures should be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

5.2 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be installed as relevant;
- The interceptor drainage will not be discharged directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build up of water in the excavation;
- All pumped water will be directed to the surface water drainage system for treatment prior to discharge. In the case of the electricity line, any pumped waters will be discharged over grassland to allow for filtration;
- There will be no direct discharge to local drains, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of site excavations by the EM will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites and will be used as final line of defence, if required.

5.3 Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer, will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillage;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the possibility of contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP (**Annex 3.5**). This emergency plan will be further developed prior to the commencement of development, and will be agreed with the Planning Authority as part of the detailed CEMP.

5.4 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the temporary construction compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site during construction, nor will any wastewater be discharged to the site.

5.5 Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds within the temporary construction compound with waters being tankered off site and disposed of at an approved licensed facility. There will be no discharge of cement contaminated waters to the construction drainage system or to any drain;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

5.6 Morphological Changes to Surface Watercourses & Drainage Patterns

Temporary silt fencing/silt trap arrangements (e.g. straw bales) will be placed within existing roadside/field drainage features along the electricity line route to remove any suspended sediments from the works area.

The trapped sediment will be removed and disposed of at an appropriate licenced facility. Any bare-ground will be re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

The following mitigation measures are proposed in respect of the installation of the culvert over the unnamed stream to the north of the electricity substation:-

- The stream crossing will be a clear span bridge (bottomless culvert) and the stream bed will remain undisturbed. No in-stream excavation works are proposed or anticipated as being required and therefore there will be no effect on the stream;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI); and,
- The installation of the culvert will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The stream crossing will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

5.6.1 Directional Drilling

- Although no in-stream works are proposed, the drilling works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (dryer) ground conditions;

- The crossing works areas will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material/equipment or overnight parking of machinery inside a 10m buffer zone which will be imposed around the watercourses;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 10m buffer zone boundary;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions/channels that slope towards the watercourse;
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank/sump to prevent migration from the works area;
- Spills of drilling fluid will be clean up immediately and stored in an adequately sized skip before been taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed percolation area at least 50m from the watercourses;
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain;
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted;
- Daily monitoring of the works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated;
- The silt fencing upslope of the river will be left in place and maintained until the works area has been fully reinstated;
- There will be no batching or storage of cement allowed at the watercourse crossing;
- There will be no refuelling allowed within 100m of the watercourse crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:-

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

5.7 Effects on Water Supplies

The drainage control measures and pollution prevention measures discussed above will ensure the protection of the Paulstown Public Water Supply.

As an additional pollution prevention measure, no fuel storage will be permitted along the electricity line located within the Monefelim River catchment.

6.0 Conclusion

This SWMP has been prepared to detail the practical implementation of surface water management infrastructure to address the requirements of measures set out in the EIAR. This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (ECoW), as necessary, to confirm the appropriateness of the measures set out therein.

The SWMP incorporates the principles of SuDS; with the overall objective of ensuring that no silt, sediment or other material is discharged from the site to surrounding drainage features; to ensure that the project does not adversely affect the drainage regime within the project site and in its vicinity.

The proposed SuDS comprises drainage infrastructure to intercept and direct 'clean' incidental runoff away from works locations; and a separate surface water management train to effectively control manage and treat 'dirty' water runoff from the works areas. Given the connectivity of the project site to a designated conservation site for Freshwater Peal Mussel, the surface water management train is supplemented by further lagoon-type settlement ponds with a retention period of 10-days thus encouraging settlement of any silt/sediment prior to discharge.

The efficacy of the measures set out in this SWMP will be regularly monitored and will be verified through water quality monitoring undertaken throughout the construction phase.

Annex 1 –

Altmuller & Dettmer Research Paper

Foreword and acknowledgment

This pdf-file is the English version of an article which is published with three other articles dealing with species and biotope protection for the freshwater pearl mussel *Margaritifera margaritifera* in Lower Saxony, North Germany (see: http://www.nlwkn.niedersachsen.de/master/C35794242_N14750639_L20_D0_I5231158.html). With this pdf-file we want to give our non-German speaking colleagues an opportunity to read about the chance to do something for this endangered mussel species in Europe.

To get a good readable English text we are very glad to have our Irish friends and colleagues EVELYN MOORKENS and IAN KILLEEN on our side in our efforts to help *Margaritifera*, and we are very thankful to them for helping us in bringing our “Denglish” to a readable English version.

Successful species protection measures for the Freshwater Pearl Mussel (*Margaritifera margaritifera*) through the reduction of unnaturally high loading of silt and sand in running waters
– Experiences within the scope of the Lutterproject -

by Reinhard Altmüller and Rainer Dettmer

Contents

1 Introduction and Objectives 1
2 Study of sediment levels entering the Lutter - an example from the Endeholz Ditch 2
3 Reduction of unnaturally high sand load through installation of sediment traps and monitoring by photo documentation 5
4 Accelerated reduction of fine sediment load by the use of a mill pond as a sediment trap 10
5 Successes for the biocoenosis of the brook 11
5.1 Example minnows (*Phoxinus phoxinus*) 11
5.2 Example of the Freshwater Pearl Mussel 15
6 Conclusion and outlook on the future 17
7 Table of the colleagues involved in the species protection measures for the freshwater pearl mussel 18
8 Summary 19
9 Literature: 19

1 Introduction and Objectives

The conservation of freshwater pearl mussels [FPM] (*Margaritifera margaritifera*) and thick-shelled river mussels (*Unio crassus*) is a task of european importance (Habitats Directive, Water Framework Directive). This task can only be solved by cooperative efforts of all groups and institutions that are involved with running waters.

All conservation efforts in the past for these two mussel species were focused on maintaining high water quality. For the FPM it is a requirement as all known populations of FPM live only in running waters with the highest water quality. For the thick-shelled river mussel this requirement is as well documented by the fundamental investigations from HOCHWALD (1997). But the question does arise as to whether there are more important factors for the survival of the thick-shelled river mussel than water quality alone. This species was widely distributed in Lower Saxony, for example the river Weser from the city Hannoversch-Münden

(in the south of Lower Saxony) to the city of Bremen (367 km to the north) in very different ecological conditions.

For the FPM, we have been able to clearly demonstrate that in addition to the best water quality, a naturally very low level of fine sediments is characteristic to an intact, recruiting FPM environment After leaving their host fish the young Freshwater Pearl mussels (only 0.5 mm long) live in the hollow system (=Interstitium) between gravel and stones, well protected against water current. The present day high amounts of input and load of fine materials in running waters resulting from current landuse clog up the interstitium and suffocate the typical freshwater organisms living there, including, the young FPM. Because of the failure of young mussels to survive, the FPM was threatened with extinction in the Lutter river and is threatened with extinction all over Europe in human populated regions. If the load of fine material is reduced to naturally occurring amounts, even brooks with overaged FPM populations can recover and numerous young mussels can survive and grow. This has been successfully demonstrated within the lutterproject (ABENDROTH 1993, ALTMÜLLER & DETTMER 2000, ALTMÜLLER 2005). The lutterproject is situated at the south edge of the Lüneburg Heath (Germany, Lower Saxony). It is a nature conservation project led by the counties of Celle and Gifhorn to restore the heather brook Lutter. The reason and main target organism is the freshwater pearl mussel. This very successful nature conservation project was made possible through the financial support of the German Federal Agency for Nature Conservation within the scope of its programme concerning riparian land (SCHERFOSE *et al*. 1996) by the Ministry for Environment of Lower Saxony and of the financial and manpower support of the counties of Celle and Gifhorn.

For successful measures to be taken to reduce unnaturally high sediment load it is necessary to know the origin of the sediment. Apart from the necessity to analyse the specific sediment origin throughout the catchment there are some general experiances and information knowledge. The experiences of unnaturally high loading in the Lutter catchment was reported by ALTMÜLLER & DETTMER (1996). The experiences of unnaturally high loading in the Lutter catchment was reported by ALTMÜLLER & DETTMER (1996). This paper showed that soil erosion and fish pond waste were important contributers to the high loading of fine sediments in running waters.

Since 1996 more knowledge and experience has been gained about the reasons for the unnaturally high load of fine material, which are described herein. All observations and measurements have been carried out to determine the reasons of the extreme sediment input to running waters and to find workable countermeasures.

2 Study of sediment levels entering the Lutter - an example from the Endeholz Ditch

Within the scope of the measurement program „quantifying load of sand and mud in heather creeks“ a sediment trap was installed in the Endeholz Ditch. The Endeholz Ditch is a small tributary of the Lutter river which has a catchment size of about 2.38 km^2 (HEUER-JUNGEMANN i. lit). Originally it was a small creek which has been extended to form a drainage ditch. About 10 m above it’s confluence with the Lutter river a wooden box was installed in the river bottom (Fig. 1).

Fig. 1: Sediment trap in the Endeholz Ditch to quantify the load of fine sediments. The wooden box (Size: 2 m long, 1 m wide, 0.5 m deep) is open on the top. The sandy material which is mostly transported by rolling over the substrate, along with organic material is deposited in and caught by the box. The sand ripples which are seen in Fig. 1 on the left are typical of an unnaturally high sandy load and are more characteristic of a beach than the bottom of a natural heather creek.

From the end of 1991 to mid 2002 the sediment trap was emptied every week by young men who were doing their civilian service[1] (Zivildienstleistende = ZDL) in the nature conservation specialist agency of Lower Saxony. The amount of deposited material was measured as exactly as possible (Fig. 2).

Fig. 2: Sediment trap in the Endeholz Ditch just before the confluence with the Lutter river (background) with the mound of sandy and organic material which was taken out of the trap from 1991 to 03. April 1998. The size of the mound shows the large amount of material carried by this small ditch.

[1] The sample collection within the measurement program „quantifying load of sand and mud in heather creeks“ has been done by the ZDL of the nature conservation agency. The following ZDL beared the main responsibility: Carsten Brauns (1991), Gundolf Reichert (1991/92), Gerrit Grannas (1992/93), Dierk Rischbieter (1993/94), Moritz Haupt (1994/95), Niels Ubbelohde (1995/96), Tobias Polch (1996/97), Michael Koslowski (1997/98), Gunther May (1998/99), Bernhard Schwarz (1999/2000) Arnold Ziesche (2000/01) und Michael. Herbst (2001/02).

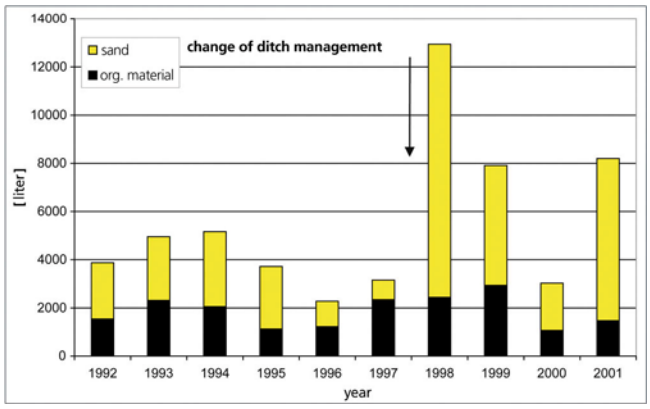

Fig 3: Annual sum of sediment load in the Endeholz Ditch. The change in the method of ditch management from hand clearance to machine clearance from the end of 1997 had a damaging effect on the ditch bottom and its banks, and the sediment load increased significantly. The amount of load after the maintenance of the ditch by machines was much higher than is shown in the figure as the sediment trap overflowed in the first weeks after that occasion.

In Fig 3 the result of weekly emptying the sediment trap is shown as annual sums. The change of load amount from about 3.2 m^3 in the year 1997 to about 12.9 m^3 in the year 1998. Up to 1997 management of the Endeholz Ditch was carried out by hand but from autumn 1997 it was was done using an excavator. The effect of the excavator was to loosen the sand from the banks and bed of the ditch and to transport it downstream. The authors only heard of this change from the young men who were doing their civilian service, who suddenly every week had to remove more than one m^3 out of the sediment trap. The figures 4 to 6 show the effect of this change.

Fig. 4: The Endeholz Ditch in spring of 1998 after management by machines. On the right side the excavated material can be seen. The river bottom is exclusively sand. The ripples are characteristic of the moving sand.

Fig. 5: Mouth of the Endeholz Ditch to the Lutter river in April 1994. At this time very little sand was transported into the Lutter river.

Fig. 6: Mouth of the Endeholz Ditch to the Lutter river on 03.04.1998. The large mass of sand which has been transported into the Lutter river after management of the ditch by machines is clearly seen. The sand which is seen here wasn't caught in the sediment trap 10 m upstream, because the trap was full. Therefore, the amount of load shown in Figure 3 for 1998 is an underestimate.

3 Reduction of unnaturally high sand load through installation of sediment traps and monitoring by photo documentation

The input of unnaturally high load of fine sediments in running waters can arise from several different sources depending on the type of land use. Therefore different measures are required to reduce the input. Erosion from farmland results in a considerable loss of valuable soil, therefore it makes sense for farmers to increase their efforts to minimize this loss. In spite of the efforts of the farmers, there will be soil conditions (for example directly after

ploughing) when heavy rainfall will bring high amounts of erosion. There needs to be methods utilised that will reliably prevent harmful input of fine sediments in all situations.

Once it was recognised that the unnaturally high sand load from drainage ditches which flow into the Lutter and its tributaries was the essential reason for the absence of FPM reproduction, sediment traps and plant beds were designed to stop the problem. Sediment traps are created by widening and deepening the drainage ditches. This causes the flow velocity in the area to be reduced so that the sand, silt and coarse organic material is deposited and can be excavated with ease. The function can be demonstrated by taking the sediment trap near the village of Bargfeld as an example. A photo series shows the origin of the sandy load and the successful disposal of these pollutants by the use of the sediment trap.

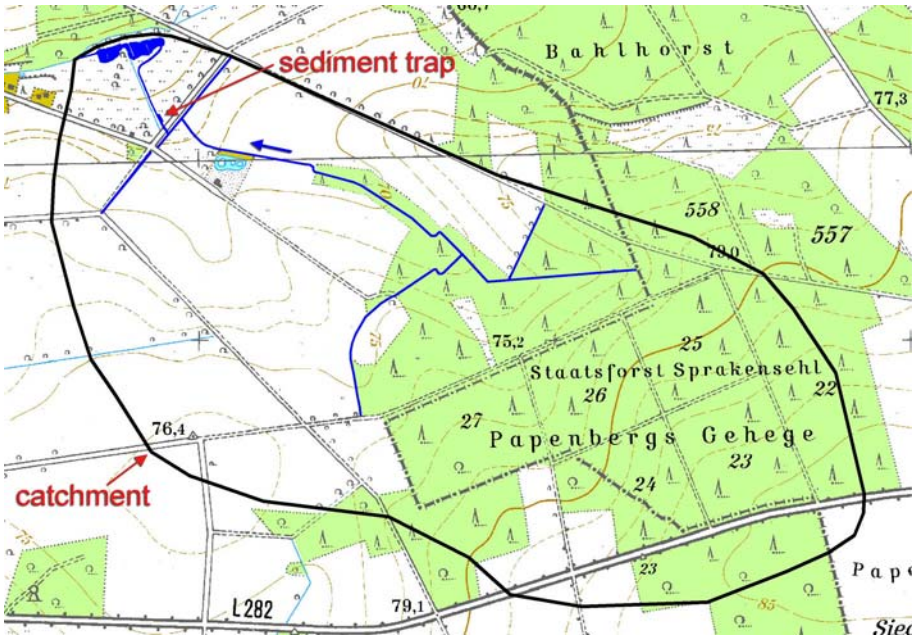

Fig.7: The sediment trap of Bargfeld (in the picture top on the left side) . The sediment trap is situated near a road and, therefore it is within easy and cost-effective reach by machines to empty it.

The sediment trap of Bargfeld (Fig. 7) (WIDRINKA in litt.) receives material from a catchment of about 2 km², of which about 50 % is farmland. This area is almost completely drained and the drainage ditches are cleaned out by machines every year as part of the obligations of water maintenance. The sandy soils are very thin and lay on impervious glacial till. Because of this they can hold and store only small amounts of water. So the drainage ditches are constantly water-bearing only in wet years. In „normal“ years they dry out in summertime.

As with all other cases within the Lutterproject, this sediment trap is situated for ecological reasons directly downstream of the part of the drainage ditch that is under periodic maintenance. So the total sand load of the entire stretch upstream can be caught. The riverbed downstream is not under water maintenance - only the vegetation above water level is cut, in exceptional circumstances. Being permanently water-bearing, the strech downstream of the sediment trap is free of unnatural sediment loads and can develop in a near-natural way.

For economic reasons the sediment trap is built near a road in order to reach it easily with machines for excavation. The system of water management is shown in Fig. 7 and 8. The water which comes from the farmland flows into ditches near the road, crosses the road (red arrow) and flows to the north north-west (nnw) into the little creek called “Köttelbeck” in the

region of “Langenfeld”. In this ditch a sediment trap was built near the road in the winter of 1998/99.

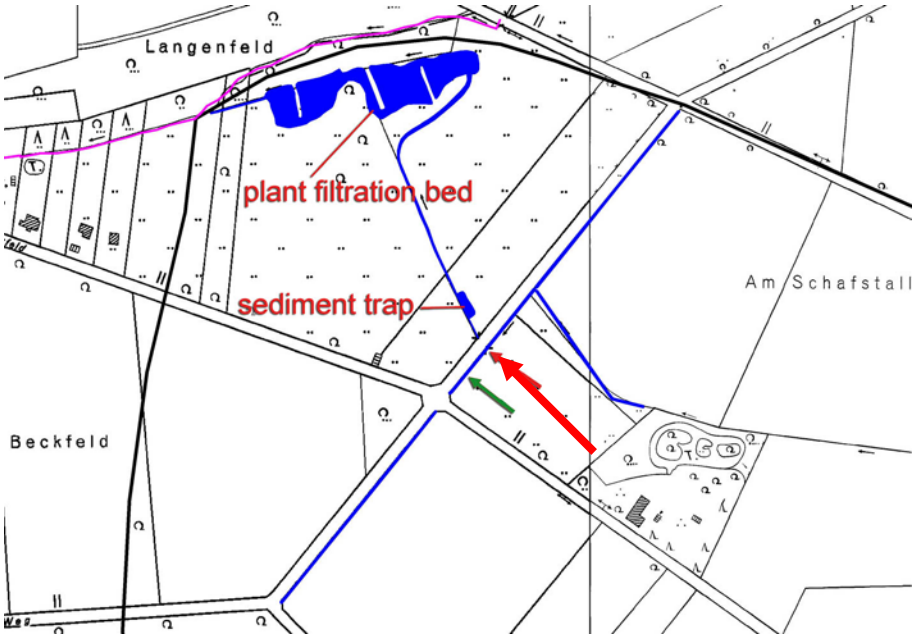

Fig. 8: The complete system, comprising the sediment trap and the plant-bed situated at the lower end of the catchment. The water from the drainage ditches first enters the the sediment trap and then flows through the plant filtration bed. This is a secondary system to absorb the fine particles, which are so small that they do not settle in the sediment trap.

Fig. 9: View in flow direction of the „Sediment trap Bargfeld“ in summer of 1999 about one year after completion and after the first time of excavation. In front of the left side the mouth of the drainage ditch can be seen. At the far end on the left of the sediment trap the drainage ditch continues its flow through dense vegetation.

In winter 2004/2005 the function of this sediment trap was documented photographically. It should be pointed out that there is a time difference between “cause of the unnaturally high load” (this means: ditch management) and “occurrence of the sand downstream” (this means: in the sediment trap).

The following photo series clearly show the effect of ditch management by machines, the successive transport of sand and the function of the sediment trap.

Photo series 1 (Fig. 10a-d)
The position of the photographer is about at the top of the red arrow in Fig. 8. For an illustration of the situation in autumn, a picture was taken in autumn of 2005. (Fig. 10a).

Fig. 10: Drainage ditch running parallel to the farm road. For position of the photographer see Fig. 8, top of the red arrow, view direction: sw.
Fig. 10a: Situation before the annual ditch maintenance (12.11.2005).
Fig. 10b: directly after maintenance by machines (21.11.2004).
Fig 10c: More than one month after maintenance at 30.12.2004 . Additional sand is transported in this stretch.
Fig. 10d: At 16. 03. 2005, most of the sand which was loosened during clearance is washed away. It remains a stony and gravely river bed as is typical for natural creeks in this region.

Photo series 2, Fig. 11a – 11 d: Position of the photographer the same as in fig. 9, south of the sediment trap. View direction: north in flow direction of the drainage ditch.

Fig. 11: Sediment trap ”Bargfeld”.
Fig. 11a: the sediment trap on 30 12. 2004. No sand has reached the sediment trap, more than five weeks after the ditch clearance and only 30 m downstream of position fig. 9 and 10. Only after two months (fig.: 11b, 22.01.2005), the amount of transported sand becomes more visible and then more evident two weeks later (fig. 11c, 06.02.2005). One month later (fig. 11d, at 16. 03. 2005) the sand transportation in the drainage ditch has been completed and the sand has reached the sediment trap. The plant has done its job. The sediment trap is approximately one third full, equivalent to about 50 m³. At this time the drainage ditch is already washed free of sandy material (see fig. 10d). Without the sediment trap the mass of sand would have been transported downstream to the Lutter River where it would have infiltrated and overlayed the naturally stony and gravely river bed similar to the situation visible in fig. 10b and 10c. Also, without the sediment trap there would be no evidence of the quantity of sand that was mobilised by only one episode of ditch management by machine.

Both photo series demonstrate and explain one origin of unnaturally high sand load in a small drainage ditch in a low gradient area. It is a stark demonstration of the ecological problem present for the FPM. They also show that the chances to minimize this source of threat for the biocoenosis of running waters is relatively easy when located at the right place. Additionally they show that one needs a sediment trap to demonstrate the huge amounts of sand which can be contributed to a natural creek by one small drainage ditch. At the same point on the drainage ditch the situation can look stable for a long time (Fig. 10b and 10c). However, the sand passes over this area and, therefore one is unable to formulate an impression of the quantity of the sand that has passed through.

The sediment trap Bargfeld is an example of how unnatural sand input is prevented from entering natural running waters within the Lutterproject. Installation of sediment traps in each of the numerous drainage ditches within the catchment of the Lutter River was reliant on the fact that the areas were purchased by the project management. Then a procedure was developed to get permission to install the sediment traps. The realization of all the necessary projects took a very long time - from 1989 up to the present (2006). Therefore the input of sand could only be reduced in successive stages. The effect to the biocoenoses of all these measures therefore could only arise after the gradual improvement of the ecological conditions.

4 Accelerated reduction of fine sediment load by the use of a mill pond as a sediment trap

The reduction of fine sediment load in the lower reaches of the Lutter River got an important boost through purchasing the rights to an old Mill in the village of Eldingen by the lutterproject management. The remaining semi natural streches of the river Lutter lie downstream of this mill. In the summer of 1989 the owner of the mill was informed about the problems the pearlmussels had with mobilized sediments coming from the mill pond. After this he kindly agreed not to drain off the mill pond. Previously, the mill weir had been raised during flood events to preserve the buildings. The effect or success of not raising the weir is shown in figure 12. After purchasing the watermill in 1992, the water level of the mill pond has been permanently lowered as far as it was possible, so that the water could pass the mill even in flood without damaging the buildings (See 12b). Since then the mill pond has never been emptied and it acts as a very large sediment trap. The accumulated sand and mud has been taken out by the use of a suction dredge. To date, about 6,800 m^3 of sand and mud have been pumped out (personal communication: government of the county of Celle and engineering office HEIDT & PETERS, Celle).

Fig. 12: Back water of the mill of Eldingen just before (left) and just after (right) the notary certification of the contract of sale. Prior to 1992, large quantities of sediments had already accumulated in the backwater of the mill (right picture).

As these pumped out masses of sediments are not washed downstream, they have not covered the natural river bottom and killed the typical biocoenosis. On the contrary, the sand masses which covered the stony and gravely river bottom up to this time were successively washed away so that gravel and stones appeared again at the surface. Fig. 13 shows how much the quantity of sediment drift has been reduced by this action. In the year 1968 under leadership of BISCHOFF a small bypass was built in a narrow curve of the Lutter about seven kilometres downstream of the mill of Eldingen. About 5 - 10 % of the Lutter water runs through this bypass. In January of 1991 a sediment trap like the one shown in fig. 1 was built in this bypass. This sediment trap has been emptied weekly since then. Fig. 13 shows the annual sum of the sediment drift from 1991 to 2006. The sum of rainfall has been measured in the private „weather station“ of the first author, which is located about 5 km from the sediment trap. The high rainfall in winter 1993/94 gave rise to a corresponding high flow in

the Lutter, and produced very high sediment drift. In 1994 up to 19 m^3 sand was removed from the sediment trap. This equates to about 190 - 380 m^3 sand transport in the Lutter. As with the trap in the Endeholz ditch, this sediment trap also overflows in the weeks with the highest sand transport. As the fine sand fraction doesn't deposit, the real amount of transported material is even higher than has been measured.

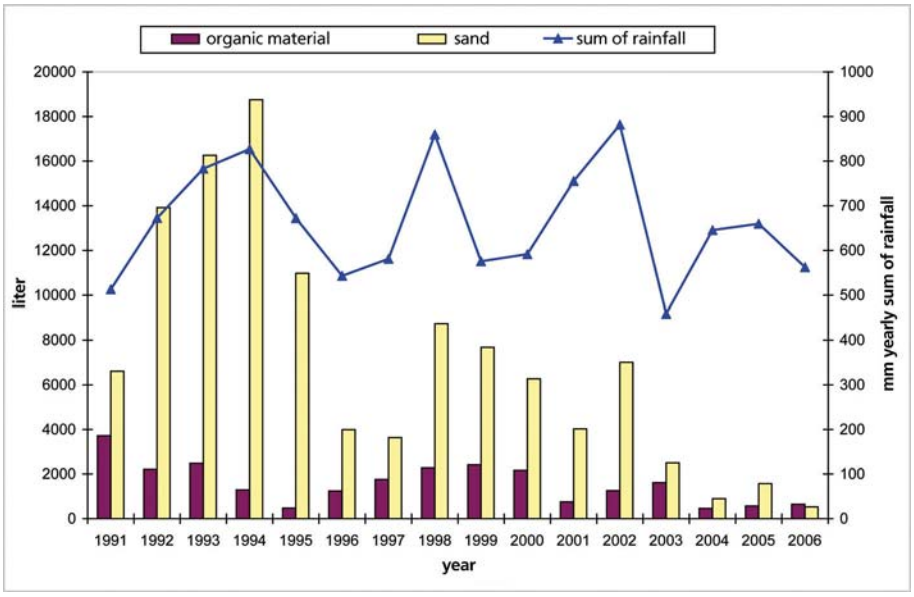

Fig. 13: Trend of sediment transportation in the Lutter. The amount has been measured in a sediment trap as shown in fig. 1. The success of the sediment trap "mill pond" and of the sediment traps in the drainage ditches is clearly seen.

Initially the upper reaches of the c. seven kilometre long stretch downstream of the mill were washed free from overlaying sand. The stony and gravely substrate emerged again and could be colonized by the typical Flora and Fauna. The typical inhabitants of a natural brook reacted immediately to this naturally recovered structure of the river bottom. An example of this phenomenon was the new high reproduction of minnows (*Phoxinus phoxinus*).

5 Successes for the biocoenosis of the brook

5.1 Example minnows (*Phoxinus phoxinus*)

Minnows are typical and numerous inhabitants of waters with stony gravely bottom and / or shores. In the lower reaches of the river Lutter downstream of the mill of Eldingen they had only seldom been caught by annual electro fishing, which had been carried out since 1985. This changed after the transport of fine sediments was stopped in summer 1992. The winter flood in 1993/94 then washed out the sand, which had previously covered the stony gravely river bottom (ALTMÜLLER & DETTMER 1996). The minnows reacted immediately to this and reproduced very successfully. Given their former rareness the sudden appearance of breeding minnows was very surprising. It was also confirmation that the large amounts of sand were the greatest remaining problem for the river ecosystem.
Minnows spawn in gravel material and prefer a grain size of 2 cm in diameter (BLESS 1992), and they spawn in sections with high current. While spawning the Minnow -♀ inject their eggs between the gravel (Fig. 14). The eggs cling on to the gravel because of their adhesive surface. Here they are protected against voracious individuals of the same species and are supplied by a circulation of oxygen rich water. After about a one week's embryonic development the hatched out fish larvae migrate as deep as possible into the substrate, most likely to escape the suction from the turbulent water above them. They are supported by a yolk sac and are not able to swim (benthic phase). They hide in narrow niches between stones where the current is at its lowest (Fig. 15). Here they are most protected. However,

these are also the parts of the river bed that are first clogged if sediments are brought into the river - which is fatal for the inhabitants. After development within the substrate the minnow larvae migrate upwards through the interstitium into the open water (pelagic phase, free swimming larvae).

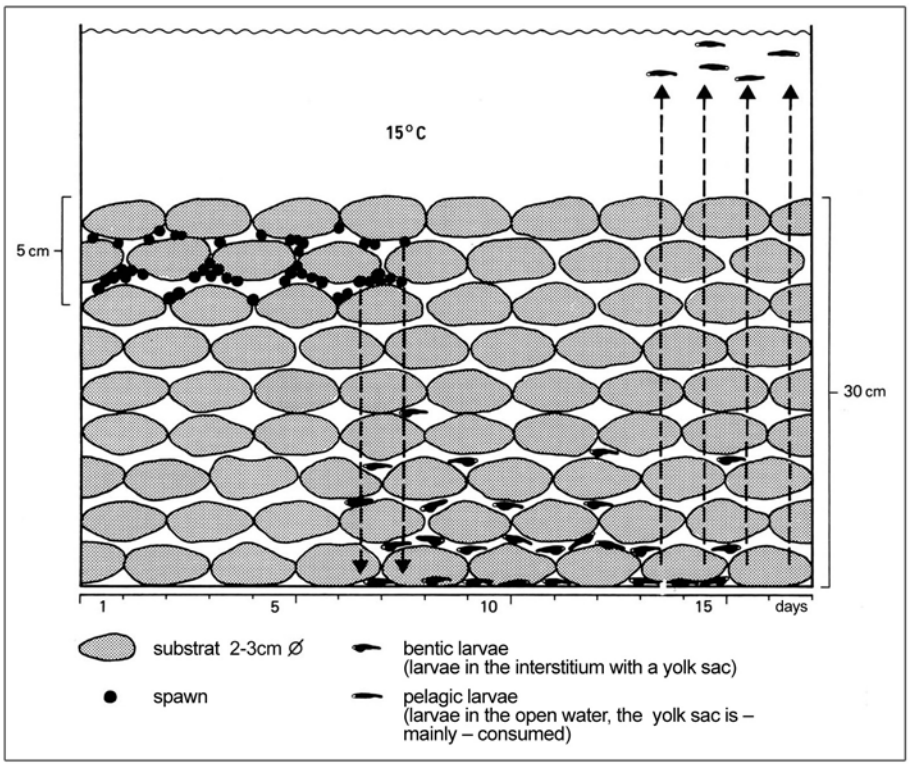

Fig. 14: Time table (Tage = days) of the space used by juvenile stages of minnows at 15 °C water temperature (after experiments in an aquarium). The aquarium is filled with a 30 cm thick gravel layer in a size which minnow-♀ prefer. For explanation see text (Figure adapted slightly from BLESS 1992).

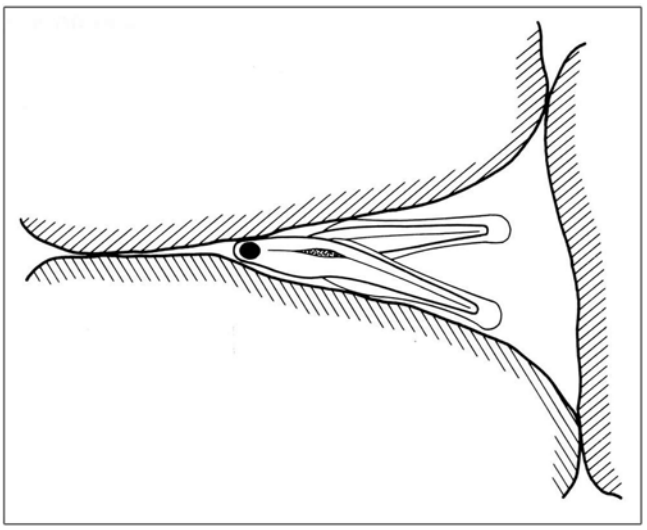

Fig. 15: Minnow larvae hide into narrow niches made by the gravel, probably to protect themselves against upward suction by the current. Here (as deep as possible in the bottom in the narrow niches formed by the gravel) the suction power is lowest and so is the danger of washout (after BLESS 1992).

The following graphs (Fig. 16a-e) show the minnow population in the lower reaches of the river Lutter downstream the mill of Eldingen. In the graphs the number of minnows per 100

metres is shown within each of the randomly selected fishing sectors. The sectors which have not been fished are marked. It can be clearly seen that the minnows - starting in the upper reaches - successively colonized (or re colonized) the river Lutter. Minnows are now (in 2006) again the typical and most numerous inhabitants of the river, and always accompany the author during the snorkelling surveys to investigate the pearl mussel population.

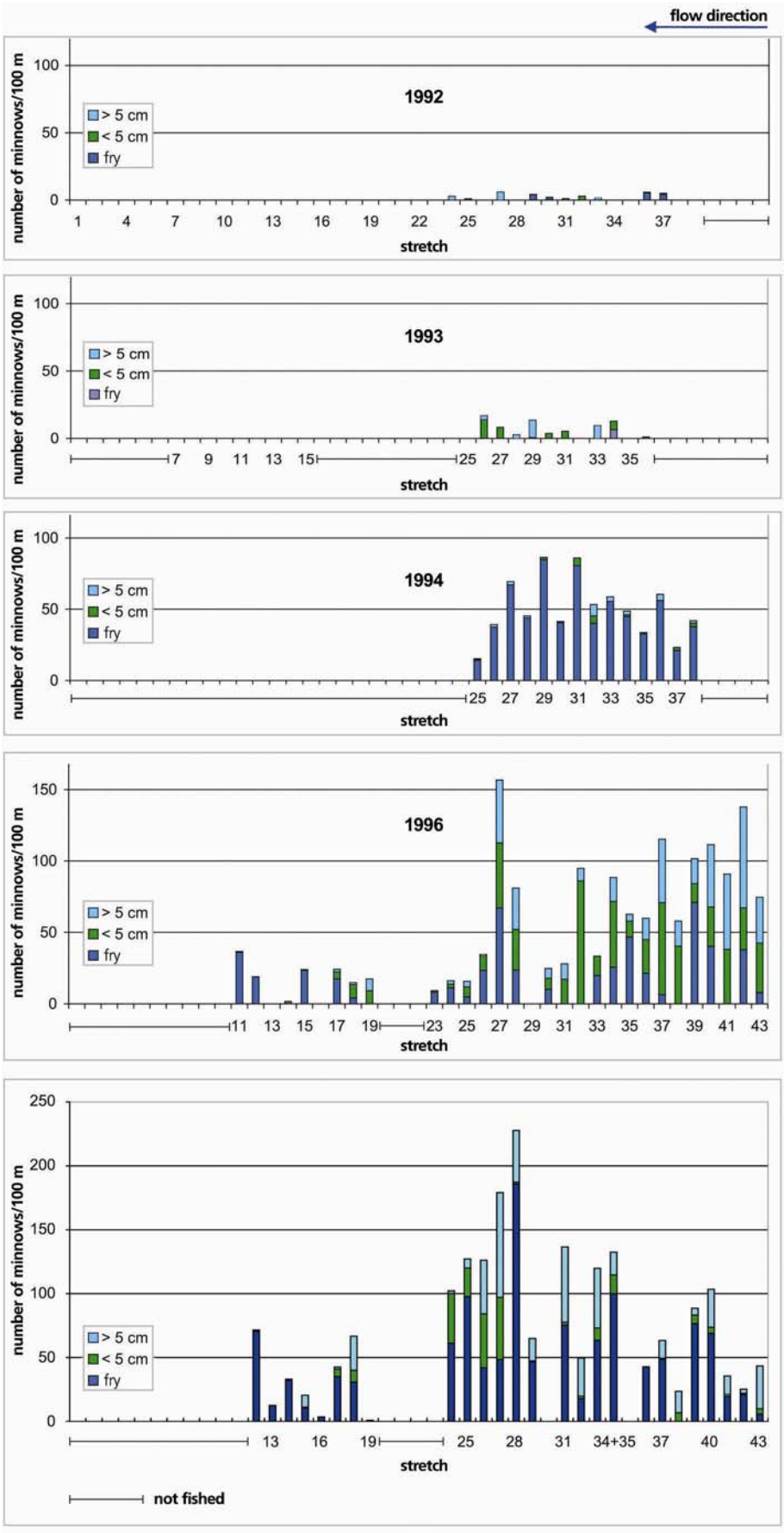

Fig. 16a-e: Development of the minnow population in the natural lower reaches of the river Lutter in the years 1992 - 1998. Sectors which were not investigated by electro fishing are shown by a line. Abschnitt = stretch; nicht befischte = not fished.

5.2 Example of the Freshwater Pearl Mussel

As the rate of growth of the FPM is very slow and the young mussels spend at least the first 5 years of their life hidden in the river bed substrate, the success of the measures for the species and biotope protection for the FPM (the target species), could only be shown after several years.

In the river Lutter the young FPM need to reach the age of about seven years before they are big enough to emerge from the gravel into the flowing water to get more water through their gills for better oxygen and food supply. It is only then that they can be seen by the investigator without destroying their habitat by dredging.

Fig. 17: River bottom of the Lutter with an adult FPM and three young mussels which are not easily seen between the gravel.

The first shells of young mussels were found in 1997, and the mussel population has been investigated by snorkelling annually since 2000.

The results of these investigations are shown in figure 18. In 2006 more than 83 % of the total of about 7,400 FPM in the river Lutter are younger than 20 years. This success is in great contrast to the fact that all other european freshwater pearl mussel populations in human settled regions are without successful reproduction and therefore they are threatened with extinction (GEIST 2005).

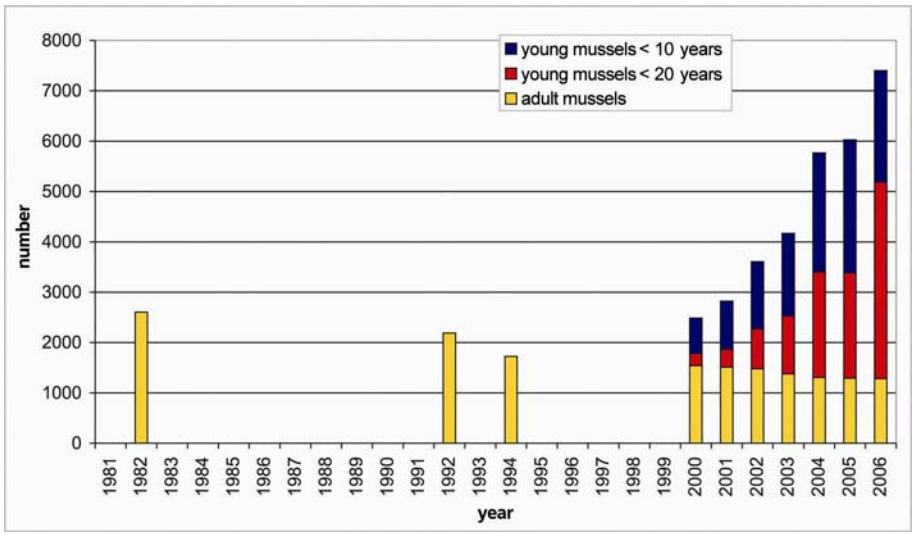

Fig. 18: Population development of the Freshwater Pearlmussels in the river Lutter. This positive trend is due to the reduction of the anthropogenic sand load since the upstream mill pond has not been drained off and therefore the sediments are no longer washed out of the mill pond.

The long term survival of the FPM population in the river Lutter was given additional hope with the verification of the presence of young brown trout (*Salmo trutta f. fario*) in 2005 and 2006, which were naturally infected with FPM glochidia. (Fig. 19). Since the year 2003 no brown trout have been artificially infected with larva (glochidia) of the FPM in the natural lower reaches of the river Lutter. Furthermore, given that the oldest of the young FPM came to mature age and in view of such a large number of young mussels, natural infection of brown trout should be possible. However, to be certain of this, the artificial infection of brown trout with FPM glochidia must be stopped. The young infected brown trout which were found in 2005 and 2006 live in reaches of the river Lutter where only a few old FPM can be found. These few individuals produce too few glochida to successfully infect brown trout. The high number of glochida necessary for an intensive infection can only come from the high number of young mussels which are maturing at present.

The age composition of the infected brown trout is very interesting. Most of the infected fish examined in May of 2006 were born the previous year. They had been infected at an age of only a few months old. During the periods of artificial infection, fish this young were not utilised as they are very sensitive and easily damaged.

Fig. 19: Young brown trout of 2005 with nearly ripe young freshwater pearl mussels in the gills (light points) (result of electro fishing for monitoring - 07.05.2006). The glochidia are derived from young mussels which have matured after successful species and biotope protection measures. They will build up the F2 generation, but any success cannot be proven for another 5 – 7 years.

6 Conclusion and outlook on the future

Unnaturally high sediment load, produced by human land use and other activities, considerably affects running waters and their biocoenosis. Most of the running waters of the northern german lowland are in this damaged condition.

Taking the example of the river Lutter and its ecologically very demanding resident population of freshwater pearl mussel, it has been shown that there are indeed opportunities for restoration and, within this, chances of survival even for very demanding species which once were typical and abundant. This is dependent upon water quality not being reduced by waste water or unnaturally high input of nutrients, that there is still the original or a near-natural river bottom, and no unnatural sediment input.

The nature conservation measures for the freshwater pearl mussel in the catchment of the river Lutter were only made possible by the considerable funds made available for the Lutter Project, and by the goodwill, trust and cooperation of everyone involved in the project (ALTMÜLLER 2005).

The experiences and knowledge from the Lutter Project should be used not only for freshwater pearl mussel conservation measures in other catchments, they should be used in general for river conservation, development and restoration measures.

Anthropogenically derived high sediment load clogs the lattice system (Interstitium) between sand, gravel and stones so that the typical animals living there die. Furthermore, sediment covers continously, in a rolling movement – like shifting sand dunes – even in a river bottom that was originally stable.

Each river bottom that is mainly stable is colonized by organisms almost on the surface. Where there is light and nutrient, algae may grow, but even small animals colonise a stable bottom in huge numbers or they live burrowed by themselves in the upper film. Even these less demanding surface organisms are suffocated by shifting sediment dunes, as well as those that live in the deeper interstitium.

As with the reduction of nutrient load, the reduction of fine sediment load must become a general requirement within running water restoration and protection work and a common goal of water and nature conservation.

In every case the place for reducing the unnaturally high load should be located as close as possible to the source of the problem. Erosion is harmful to a farmer’s business and, therefore, it is in every farmer’s interest to take all known and possible steps to reduce erosion and preserve economic viability. The most important measure is to have as complete a soil cover as possible. However in the course of a year their may be a phase without soil cover for arable farmland. For this period of time it is necessary to take precautionary measures on all sites which are at risk from erosion. For some farmers this precaution may seem to be excessive, because incidents of erosion are relatively few in number and with long periods between, and may even discourage some farmers from taking precautionary measures because of economic impact. However, even a single high erosion incident can bring major sediment input which can severely damage running waters and their very long lived biocoenosis.

Within the sphere of the Lutter project with maintenance of waters, especially management of drainage ditches, and the resultant sediment load, from an economic point of view it is indispensable to install sediment catchers in all drain ditches. In time it is possible to take out of the waters both the sediments which are mobilized by ditch management and those which are coming from erosion and/or other origins.

The excavation of the sediment traps can be done within the yearly maintenance of waters without any significant increase in cost, provided that the sediment trap is located where it will have maximum effect and its dimensions are big enough. However, the emptying of the sediment traps has to be done with care or else they will refill very quickly and then overflow. Special responsibility for the correct management of the sediment traps has to be taken by the association that also maintains the waters and manages the ditches.

The measures of nature and water protection that are described in this article especially apply to the preservation and recovery of the freshwater pearl mussel. But all measures together already contribute towards fulfilling targets set within several Directives of the European Parliament. So the restoration work on the lower reaches of the river Lutter are very successfull species and habitat conservation projects within the European Habitats Directive but also within the European Water Framework Directive to achieve good ecological conditions:

- Within the European Habitats Directive the habitat 3260 „Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation " have been brought into favourable conservation status (Annex I, Directive 92/43/EWG)
- the populations of the freshwater pearl mussel, the Green Club-tailed Dragonfly (*Ophiogomphus cecilia*) and the Bullhead (*Cottus gobio*) has been brought into favourable conservation status (Annex II, Directive 92/43/EWG).

Within the European Water Framework Directive (Directive 2000/60/EC) the recovered stretch of the river Lutter, or rather the condition of it, was brought into a good status, i.e. the hydromorphological characteristics and the physico-chemical quality elements.

In addition to the above, the special feature of this water protection, water conservation and nature conservation project is that there are only small follow-up costs and also no costs to manage a specific state of cultural landscape.

7 Table of the colleagues involved in the species protection measures for the freshwater pearl mussel

The results of electrofishing and the success of the species protection measures that are described here has been achieved by enthusiastic friends of nature, generally in their free time. The spawning time of the FWP-♀ is not predictable. Therefore in summer from mid-July all private appointments had to be subordinate to the life history of the mussels. In the following all attendees of the species protection measures for the freshwater pearl mussel in Lower Saxony (also in the rivers Lachte and Bornbach) are listed in alphabetic order.

Reinhard Altmüller, Wolf-Dietrich Bischoff, Dietrich Blanke, Ulli Brandt, Rainer Dettmer, Frauke und Heiner Drögemüller, Christian Gietz, Otto Golze, Günter Grein, Roger Günsel, Stefan Heitz, Iris Herrmann, Thomas Herrmann, Matthias Holsten, Renate und Stefan Hölter, Lennart, Manuel und Norbert Horny, Gerd Hübner, Thomas Kaiser, Heinrich Klaholt, Andreas Knoop, Ernst und Ole Kohls, Henning Köneke, Gabi Kremming, Jens Kubitzki, Peter Lorz, Hans-Jürgen Löther, Sonja Lüßmann, Christian Makala, Anna, Hans und Moritz Menneking, Lars und Wolfgang Mosel, Annette Most, Dirk Mundt, Matthias Olthoff, Sören Ostermann, Ulrich Pittius, Gabriele Potabgy, Anke Preiß, Manfred Rasper, Günter, Ronja und Vigdis Ratzbor, Dierk Rischbieter, Thomas Schick, Gudrun Schmal, Daniel Schneider, Burkhard und Ulrich Schnepper, Peter Sellheim, Brigitte Steinhardt, Egon Steinkraus, Agnes Steinmann, Andreas Thiess, Frank, Hans-Hermann und Holger Trumann, Wieland Utermark, Günther Wilkens.

In addition to the young men listed an page 3 who made their civilian service (ZDL) were the following ZDL involved in the species protection measures and the surveys:

Thomas Clavier, Carsten Dettmann, Michael Friese, Thorben Fründt, Michael Geilke, Manfred Grenz, Günther Hansen, Horst Hildebrandt, Markus Kietz, Thomas Klug, Andreas Nitschke, Ulrich Söffker und Alexander Wiebe.

8 Summary

The freshwater pearl mussel was formerly abundant in running waters of the „Lüneburg Heath“, a north eastern landscape in Lower Saxony in the North of Germany. Using the example of the remaining freshwater pearl mussel population in the river Lutter it has been shown that good water quality alone is not enough for its survival. The unnaturally high amounts of load (sand and silt) are harmful substances for the river biocoenosis. Only after the reduction of these high amounts of load could typical fish such as minnows (*Phoxinus phoxinus*) naturally reproduce. Also, it is only after the reduction of the huge load that the relief measures which focused on artificially infecting wild living brown trout (*Salmo trutta* f. *fario*) with glochidia became successful with young mussels surviving and growing. Currently the next mussel generation has started to grow up without any artificial help.

With the installation of sediment traps in all drainage ditches a method has been developed and used, which can help to reduce the problems with unnaturally high load of fine sediment and which may be applied across Europe.

Some targets of the European Habitats Directive and of the European Water Framework Directive are shown to be achievable.

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Dr. Reinhard Altmüller, born 1948, studied biology and read for his doctorate at the Georg-August-Universität at Göttingen. Since 1976 he has been responsible for Invertebrates at the Lower Saxony Specialist Agency for Nature Conservancy. One focus of his job has been to investigate the organisms of running waters, especially the freshwater pearl mussel, and the development of ways to improve their habitats.

Rainer Dettmer, born 1955, studied biology at Hanover. In his dissertation he investigated the biology of the freshwater pearl mussel (1982). Since then he has worked on the biology and conservation of naiads and other limnological questions, especially electro fishing, funded by different institutions (TiHo Hannover, Lower Saxony State Agency for Ecology, NLWKN, Nature Conservation Organisations, Nature Conservation Council).

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Fig. 13 u. 14 (page 13) from „BLESS, R. (1992): Einsichten in die Ökologie der Elritze *Phoxinus phoxinus* (L.). Praktische Grundlagen zum Schutz einer gefährdeten Fischart. – Schr.-Reihe für Landschaftspflege und Naturschutz 35“ kindly allowed by the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz), Bonn.

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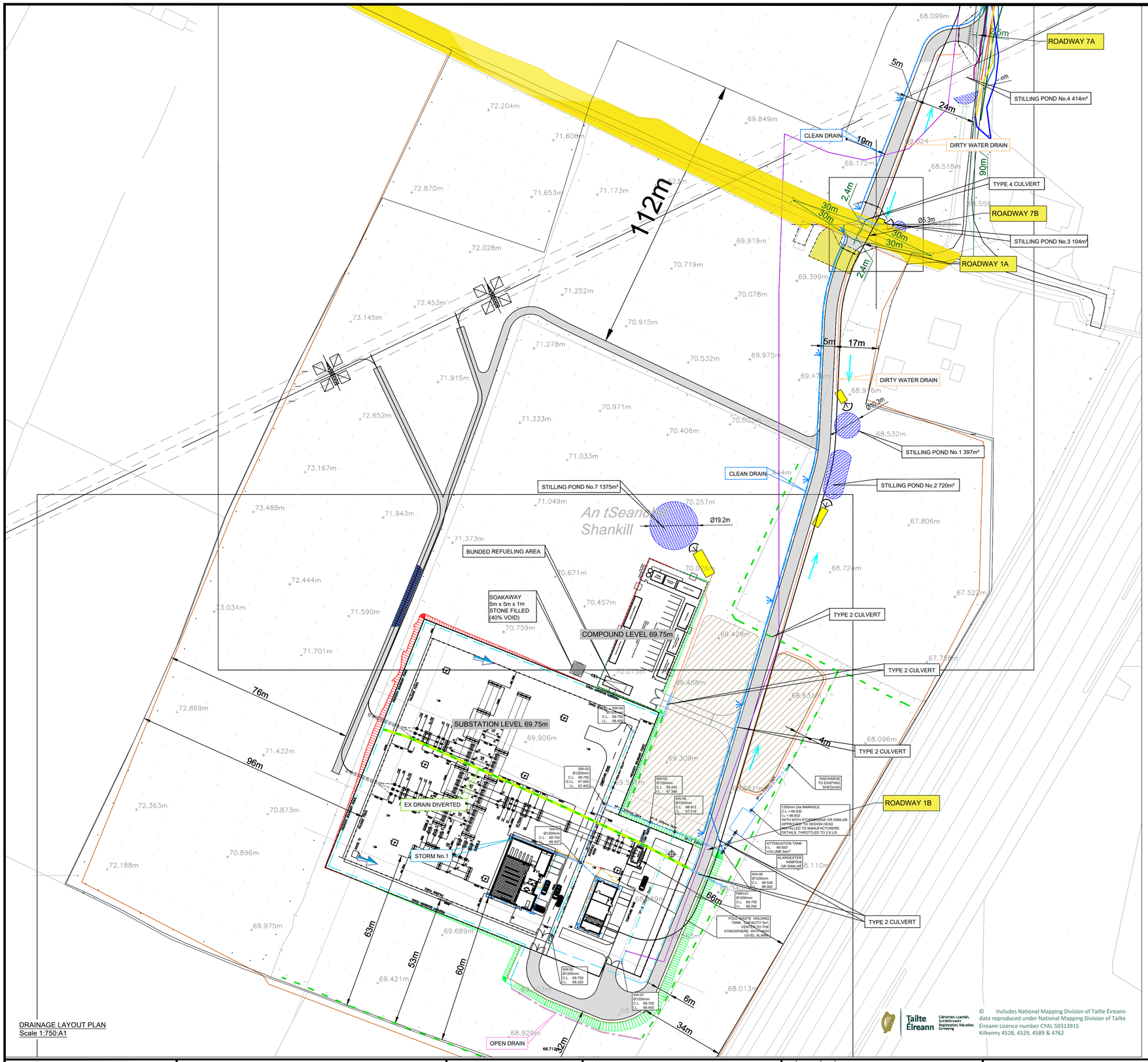
Annex 2 –

Planning-Stage Drainage/Surface Water Management System



DRAINAGE LAYOUT PLAN
Scale 1:750:A1

N

TABLE FOR PROPOSED STILLING PONDS

Pond Ref. SP	Development Area (m^2)	Dim. length (m)	Dim. Width (m)	Dim. Depth (m)	Overall Volume of Attenuation Pond (m^3)	Settling Velocity m/s < 0.0016	Settling Duration Hours > 4hrs
1	397	5	2.8	0.75	10.5	0.0002	8.12
2	720	8	2.8	0.75	16.8	0.0003	7.16
3	104	2	2.8	0.5	2.8	0.0001	8.26
4	414	4.6	2.8	0.75	9.7	0.0002	7.16
5	308	3.4	2.8	0.75	7.1	0.0001	7.12
6	866	9.6	2.8	0.75	20.2	0.0004	7.15
7	1375	10.7	4	0.75	32.1	0.0004	7.17

TABLE FOR PROPOSED LAGOON - TYPE SEDIMENT TRAP

Pond Ref Number	Development Area (m^2)	10-Day Rainfall (m)	"C"	Volume (m^3)	Depth (m)	Area (m^2)	Diameter (m)
1	397	0.1867	0.85	63.00	0.75	84.00	10.3
2	720	0.1867	0.85	114.26	0.75	152.35	13.9
3	104	0.1867	0.85	16.50	0.75	22.01	5.3
4	414	0.1867	0.85	65.70	0.75	87.60	10.6
5	308	0.1867	0.85	48.88	0.75	65.17	9.1
6	866	0.1867	0.85	137.43	0.75	183.24	15.3
7	1375	0.1867	0.85	218.21	0.75	290.94	19.2

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PROPOSED FOUL MANHOLE — F=No. C.L. =Cover Level I.L. =Invert Level
PROPOSED FOUL SEWER — Øxxmm@1:xx
PROPOSED STORM SEWER — Øxxmm@1:xx
PROPOSED STORM MANHOLE — SW=No. C.L. =Cover Level I.L. =Invert Level
PALISADE FENCE
POST AND RAIL FENCE
SHEOUGH EXISTING
SHEOUGH DIVERTED
PROPOSED OPEN DRAIN
Ø150mm PERFORATED LAND DRAIN WRAPPED IN NON-WOVEN GEOTEXTILE LAYER — SP-?? 150mm Dia
CUT MATERIAL
FILL MATERIAL
FLOATED ROAD
PROPOSED CLEAN WATER DRAINAGE
PROPOSED DIRTY WATER DRAINAGE
STILLING POND NUMBER, CATCHMENT AREA & FLOW DIRECTION — SP ? ?m²
PROPOSED CULVERT TO EXISTING OPEN DRAIN
SPOIL DEPOSITION AREA
PROPOSED LAGOON – TYPE SEDIMENT TRAP

SEE DRAWING
6607-JOD-SS-ZZ-DR-C-1001 LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1002 CROSS SECTION
6607-JOD-SS-ZZ-DR-C-1003 CUT AND FILL
6607-JOD-SS-ZZ-DR-C-1004 CONTROL BUILDING LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1005 FOR ROAD LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1006 FOR ROAD SECTIONS
6607-JOD-SS-ZZ-DR-C-1007 FOR ROAD WIDENING
6607-JOD-SS-ZZ-DR-C-1010 FOR DRAINAGE OVERALL LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1011 FOR DRAINAGE LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1012 FOR DRAINAGE SECTIONS
6607-JOD-SS-ZZ-DR-C-1020 FOR COMPOUND LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1051 to 1054 FOR DRAINAGE DETAILS

Civil Designer
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Jennings O'Donovan & Partners
Jennings O'Donovan

Client
WHITE HILL WIND LTD.

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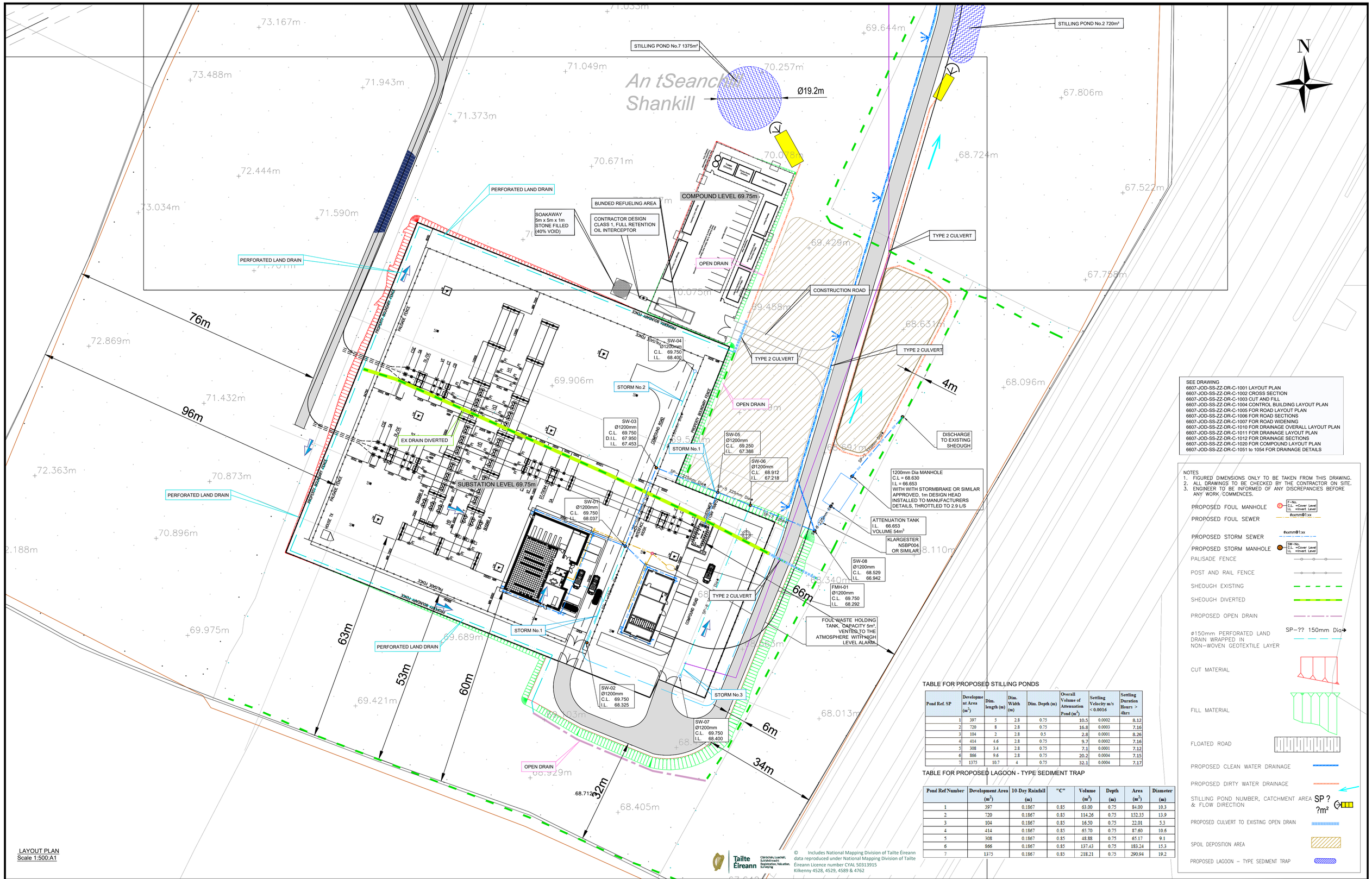
Rev	Date	By	Amendments
P05	03/03/25	N.C	Revised Site Layout
P04	29/10/24	N.C	Comments Addressed
P03	02/10/24	N.C	Comments Addressed
P02	02/09/24	N.C	Comments Addressed
P01	31/08/24	N.C	Issue for Review

Project
WHITE HILL WINDFARM

Title
LAYOUT PLAN OF
PROPOSED WHITE HILL
WINDFARM SUBSTATION
DRAINAGE OVERALL LAYOUT PLAN

Issue Details			Office Use Only
Designed: N.C	Information		Drawing Number: 6607-JOD-SS-ZZ-DR-C-1010
Drawn: N.C	Approval	X	
Checked: J.McE	Tender		
Approved: J.McE	Construction		Date: AUG 2024 Rev. P05
Scale: AS SHOWN (A1)	Record		



LAYOUT PLAN
Scale 1:500:A1

SEE DRAWING
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6607-JOD-SS-ZZ-DR-C-1002 CROSS SECTION
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6607-JOD-SS-ZZ-DR-C-1011 FOR DRAINAGE LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1012 FOR DRAINAGE SECTIONS
6607-JOD-SS-ZZ-DR-C-1020 FOR COMPOUND LAYOUT PLAN
6607-JOD-SS-ZZ-DR-C-1051 to 1054 FOR DRAINAGE DETAILS

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PROPOSED CULVERT TO EXISTING OPEN DRAIN
SPOIL DEPOSITION AREA
PROPOSED LAGOON – TYPE SEDIMENT TRAP

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Tailte Éireann — Clárúcháin, Luachálú, Suirbhéireacht, Registration, Valuation, Surveying

Civil Designer
JENNINGS O'DONOVAN
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Client
WHITE HILL WIND LTD.

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P02	02/09/24	N.C	Comments Addressed
P01	31/08/24	N.C	Issue for Review

Project
WHITE HILL WINDFARM

Title
LAYOUT PLAN OF PROPOSED WHITE HILL WINDFARM SUBSTATION DRAINAGE LAYOUT PLAN

Issue Details				Office Use Only
Designed: N.C	Information		Drawing Number:	
Drawn: N.C	Approval	X	6607-JOD-SS-ZZ-DR-C-1011	
Checked: J.McE	Tender			
Approved: J.McE	Construction		Date: AUG 2024	Rev. P05
Scale: AS SHOWN (A1)	Record			

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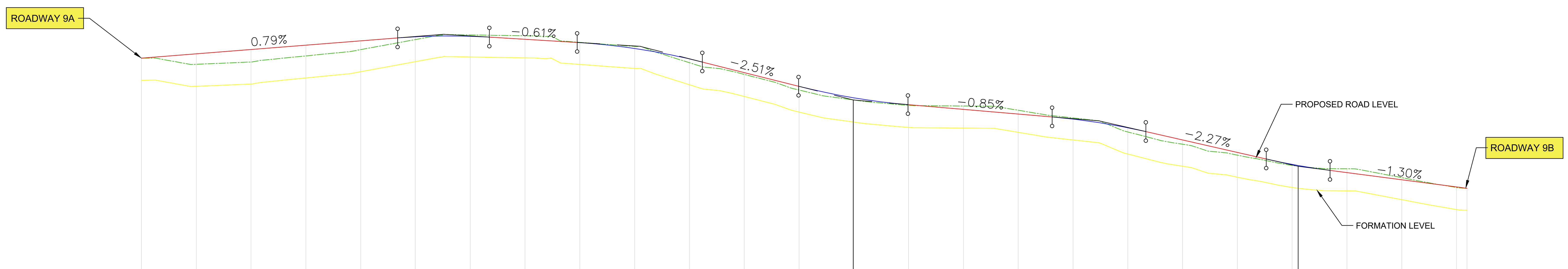

Chainage	Existing Ground Level	Proposed Road Levels	Level Difference
0m	283.929	283.929	0.000
10m	283.818	284.008	0.190
20m	283.859	284.087	0.228
30m	283.971	284.166	0.195
40m	284.085	284.245	0.160
50m	284.269	284.319	0.050
60m	284.353	284.329	-0.024
70m	284.338	284.273	-0.065
80m	284.218	284.212	-0.005
90m	284.144	284.106	-0.038
100m	283.847	283.916	0.069
110m	283.635	283.667	0.033
120m	283.351	283.416	0.066
130m	283.168	283.208	0.039
140m	283.072	283.082	0.010
150m	283.059	282.997	-0.061
160m	282.982	282.913	-0.069
170m	282.842	282.822	-0.020
180m	282.587	282.663	0.077
190m	282.363	282.441	0.078
200m	282.163	282.213	0.050
210m	281.978	281.995	0.018
220m	281.916	281.845	-0.070
230m	281.754	281.715	-0.040
240m	281.574	281.585	0.010
242m	281.560	281.560	-0.001

Horizontal Geometry: L =10.383 | L =15.406 | L =167.746 | R: 12.329 L: 18.849 | L =29.535

Vertical Geometry: G =0.788% L =46.742 | R =1200.000 K =12.000 L =16.757 | G =-0.608% L =16.025 | R =1200.000 K =12.000 L =22.832 | G =-2.511% L =17.567 | R =1200.000 K =12.000 L =19.954 | G =-0.848% L =26.318 | R =1200.000 K =12.000 L =17.099 | G =-2.273% L =21.978 | R =1200.000 K =12.000 L =11.635 | G =-1.303% L =25.013

ROADWAY 9

LAYOUT PLAN
Scale 1:500:A1

CONTROL BUILDING ROAD NO.9
SCALE: H 1:200,V 1:20
DATUM: 280.000

Civil Designer

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P02	02/09/24	N.C	Comments Addressed
P01	31/08/24	N.C	Issue for Review

Project

WHITE HILL WINDFARM

Title

LAYOUT PLAN OF PROPOSED CONTROL BUILDING FOR WHITEHILL WINDFARM

Issue Details

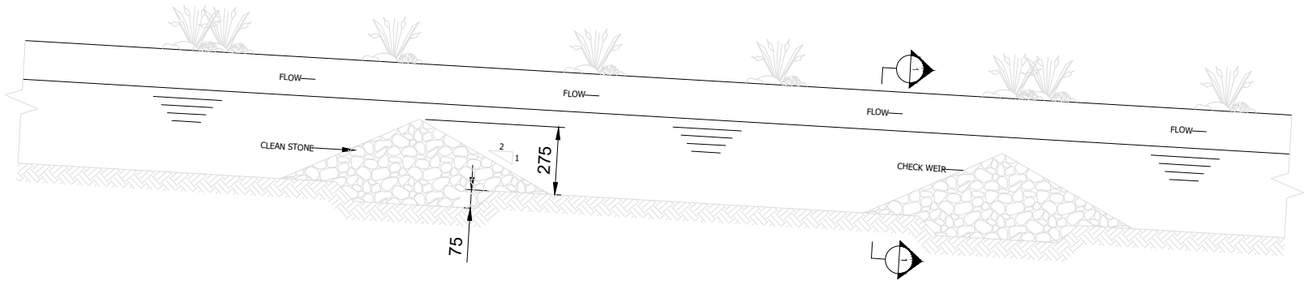
Designed:	N.C	Information	
Drawn:	N.C	Approval	X
Checked:	J.McE	Tender	
Approved:	J.McE	Construction	
Scale:	AS SHOWN (A1)	Record	

Office Use Only

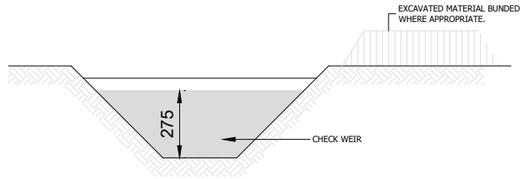
Drawing Number: 6607-JOD-SS-ZZ-DR-C-1004

Date: JULY 2024

Rev. P05



LONGITUDINAL SECTION THROUGH DRAINAGE WITH CHECK WEIRS
SCALE 1:25



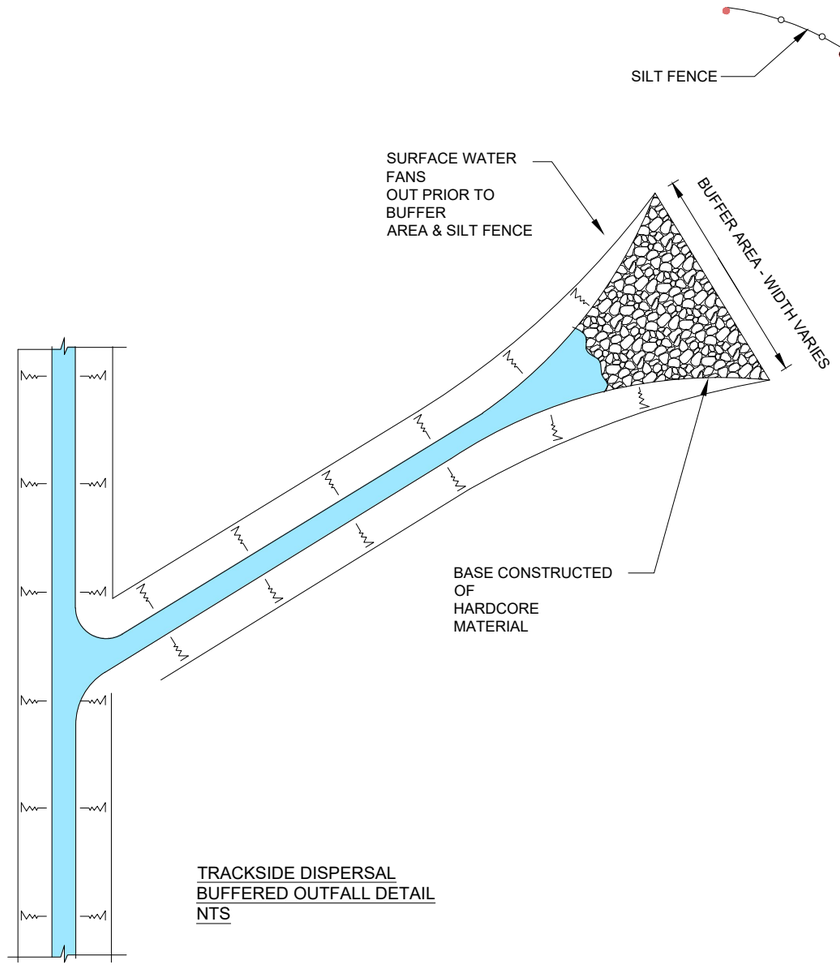
SECTION 1-1
SCALE 1:25

DRAINAGE NOTES

CONSTRUCTION AND MAINTENANCE
- ROADSIDE DRAIN SHOULD NOT INTERCEPT LARGE VOLUMES OF WATER FROM THE GROUND ABOVE.
- ROADSIDE DRAINS LIKELY TO CARRY HIGH SEDIMENT LOADS AND MUST DISCHARGE INTO A BUFFER OF ADEQUATE WIDTH.
- DRAINS ON THE UPPER SIDE OF THE ROAD MAY NEED CULVERTS TO THE LOWER SIDE.
- REGULAR INSPECTIONS, CLEANING AND REPAIRS WHERE NECESSARY.

DRAINS:
- DRAINS SHALL BE DESIGNED AND CONSTRUCTED TO MITIGATE CHANNEL EROSION, E.G. BY INSTALLATION OF PERFORATED PIPE WITH DRAINAGE STONE SURROUND. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SYSTEM OF STILLING PONDS AND BUFFERED OUTFALLS.
- DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL BE CONVEYED THROUGH A BUFFERED OUTFALL WITHIN AN UNDISTURBED STABILISED AREA AT NON-EROSIVE VELOCITIES.
- ALL OBSTRUCTIONS WITHIN A DRAINAGE CHANNEL SHALL BE REMOVED AND DISPOSED OF, SO AS NOT TO INTERFERE WITH THE PROPER FUNCTION OF THE DRAINAGE SYSTEM.
- CHECK DAMS SHALL BE CONSTRUCTED USING WELL GRADED 150mm DOWN ANGULAR GRAVEL PLACED OVER A GEO-TEXTILE LAYER. SEE DETAIL 1.
- THE SPACING OF CHECK DAMS SHALL BE SUCH THAT THE PEAK OF THE DOWNSTREAM DAM IS NO LOWER THAN THE FOOT OF THE UPSTREAM DAM.
- THE USE OF STRAW BALES WITHIN THE DRAINAGE SYSTEM SHOULD BE CONSIDERED ON A TEMPORARY BASIS DURING CONSTRUCTION AND MAINTENANCE WORK.
- STRAW BALES SHOULD, HOWEVER, ONLY BE USED TO INTERCEPT SEDIMENT-LADEN RUNOFF FROM ALL DRAINAGE AREAS OF DISTURBED SOIL.
- BALES SHOULD BE ANCHORED IN PLACE BY THE USE OF TIMBER STAKES OR RE-BARS DRIVEN THROUGH THE BALE. WHERE BALES ARE TO BE PLACED IN POSITION ADJACENT TO OTHER BALES (EG WITHIN A STILLING POND), THE FIRST STAKE IN EACH BALE SHOULD BE DRIVEN TOWARDS THE PREVIOUSLY LAID BALE AT AN ANGLE. THIS HAS THE EFFECT OF FORCING THE TWO BALES TOGETHER.
- BALES SHALL BE REPLACED AS REQUIRED
- BALES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS.

OUTFALLS:
- ALL DRAINAGE CHANNELS SHALL FAN/TAPER OUT BEFORE ENTERING THE BUFFER ZONE. PRIOR TO ENTERING THE TAPERED ZONE, THE BASE OF THE DRAINAGE CHANNELS TO BE CONSTRUCTED OF A HARDCORE MATERIAL TO AID THE SETTLEMENT OF SUSPENDED SOLIDS.
- NON-DEVELOPMENT RUN-OFF SHALL BE RETURNED TO A SURFACE FLOW CONDITION E.G. BY USE OF LEVEL SPREADERS.



TRACKSIDE DISPERSAL
BUFFERED OUTFALL DETAIL
NTS

LAYOUT PLAN
Scale 1:500:A1

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P03	02/10/24	N.C	Comments Addressed
P02	02/09/24	N.C	Comments Addressed
P01	31/08/24	N.C	Issue for Review

Project
WHITE HILL WINDFARM

Title
PROPOSED WHITE HILL WINDFARM SUBSTATION DRAINAGE DETAILS

Issue Details			
Designed: N.C	Information		
Drawn: N.C	Approval	X	
Checked: J.McE	Tender		
Approved: J.McE	Construction		
Scale: AS SHOWN (A1)	Record		

Office Use Only
Drawing Number: 6607-JOD-SS-ZZ-DR-C-1051
Date: AUG 2024
Rev. P03