N4 Collooney to Castlebaldwin, *Proposed Road Development*

APPENDIX NO. 4.5

Outline Erosion and Sediment Control Plan

PREPARED BY: **National Road Design Department, Sligo County Council;**

Document Control

Status	Issued For	Developed	Approved	On behalf of
FINAL	*Publication*	*FM*	*AS*	*NRDD SCC*

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1 Introduction

1.1 General

This Outline Erosion and Sediment Control (OESC) Plan has been prepared as a method of water quality mitigation to offset potential Construction Stage pollution impacts from the *Proposed Road Development* (PRD) to adjacent watercourses including the Unshin River cSAC/NHA and Lough Arrow cSAC/pNHA/SPA and their respective tributaries/inflow streams.

The Plan is intended to be a **working** document and has been prepared to inform the Construction Stage Erosion and Sediment Control Plan which, in turn, will form an integral part of the Environmental Operating Plan for the PRD. In particular, the **mitigation, control, monitoring and emergency measures** for the PRD in relation to Erosion and Sediment Control are described in this document. The Plan is also used to:

- Inform the Hydrological & Hydro-geological and in turn the Flora, Fauna & Fisheries Impact Assessments; and
- Ensure sufficient lands have been included on a permanent and temporary basis within the CPO to treat sediment runoff during the Construction Stage for the PRD;

Numerous references are contained herein. However, the main body of this report is guided by the technical guidance document, *Control of water pollution from linear road projects*, published by CIRIA (C648). Additionally plans prepared by other design offices for similar projects have been reviewed and in this regard acknowledgement is to Roscommon NRDO for their assistance.

1.2 Description of the *Proposed Road Development*

Chapter 4 of the EIS (Volume 2) provides a detailed description of the PRD.

In general terms the mainline realignment will comprise two separate forms of Road Type with the change in cross section defined by a roundabout in the townland of *Castlebaldwin*.

The main part (c. 13.82km of c. 14.71km) of the proposal consists of a Type 2 Dual Carriageway between the townland's of *Toberbride* and *Castlebaldwin.* The PRD will tie back into the existing N4 to the south of the aforementioned Roundabout with a Standard Single Carriageway alignment.

The Type 2 Dual Carriageway road consists of two lanes in both directions. For safety reasons a 4 lane undivided road is considered unacceptable on rural sections of the network where a 100kph speed limit applies. Therefore on this type of road it is proposed to use a segregating barrier within the paved median to separate the traffic streams.

On Type 2 Dual Carriageway road projects cyclists and pedestrians will be encouraged by signage to use an alternative route, for example the old national primary route. Nevertheless, for safety reasons, appropriate hard standings within verges will be provided for emergency breakdown usage. These hard standings will be a minimum of 1.0m wide and will be of light construction such as compacted granular material.

The road is designed so as to minimise the number of junctions and to provide drivers with straightforward junction layouts. There will be no gaps provided in the central reserve and there will be no direct access from land or houses onto the road.

The section of road which is proposed to be Standard Single Carriageway will be commensurate with the existing improved section of the existing National Primary route at *Cloghoge Lower Td*. This consists of a single carriageway and hard shoulder in each direction.

The main activities likely to give rise to sediment pollution include the construction of Earthworks and River/Stream/Drain crossings.

1.3 Contract Procurement

The Contract Procurement as outlined in Chapter 4 of the EIS is expected to be that of a Design/Build Contract. At the heart of the Design/Build approach is the concept that better value for money can be achieved through the utilisation of private sector enterprise due to the enhanced scope for innovation and by allocating the risk to the party best able to manage it. This type of contract places a responsibility on the appointed contractor to design and construct the project in accordance with the obligations of the EIS.

In this regard although this plan outlines various details of control measures etc., it should be considered a demonstration of the level of control which is required. The Construction Stage ESCP may incorporate alternative details provided it can be demonstrated that it provides the same performance criteria (or higher) than those outlined in this plan.

1.4 Consultations

This Plan has been prepared in ongoing liaison with the following specialists carrying out impact assessments for the EIS:

- Flora, Fauna & Fisheries: Ecofact Ltd.;
- Hydrology and Hydrogeology: Minerex Environmental;
- Soils & Geology: Minerex Environmental;
- Flood Risk: Hydro Environmental Ltd.

In addition consultation has taken place with the National Parks and Wildlife Services (NPWS) and the Inland Fisheries Ireland (IFI) and their comments/observations with regard to practical measures for water quality protected have been adopted within the Plan.

1.5 Principles of Erosion and Sediment Control

The principles of erosion and sediment control during the construction stage of a Roads Project as outlined in CIRIA C648 include.

(1) Erosion control (preventing runoff) is much more effective than sediment control in preventing water pollution. Erosion control is less subject to failure from high rainfall, requires less maintenance and is also less costly;
(2) Plan erosion and sediment control at the design stage, as far as practicable, so that requirements can be built into the design and land requirement for the project and to inform the details of the Construction Stage Erosion and Sediment Control Plan;
(3) Minimise erosion and potential for soiled water to be generated by minimising runoff;
(4) Install drainage and runoff controls BEFORE starting site clearance and earthworks;
(5) Minimise the area of exposed ground;
(6) Prevent runoff entering the site from adjacent ground, as this creates additional polluted water;
(7) Provide appropriate control and containment measures on site;
(8) Monitor and maintain erosion and sediment controls throughout the project;
(9) Establish vegetation as soon as practical on all areas where soil has been exposed.

This Outline ESC plan will initiate these principles for eventual incorporation and expansion in the Construction Stage ESC Plan.

1.6 Contents of Outline Plan

This plan contains the following information:

(1) An identification of existing land use, surface water features, low-lying areas and natural drainage ways;
(2) An outline of the main construction activities likely to be relevant in relation to erosion and sediment generation;
(3) An outline of the relevant S-P-R linkage which may cause potential for sediment pollution. S-P-R for this purpose can be described as:
    a. (S) Source: The construction activities which are likely to generate sediment runoff;

b. (P) Pathway: The potential pathways for the above mentioned pollution to reach sensitive areas;

c. (R) Receptor: Areas which are considered sensitive in terms of sediment laden runoff;

(4) An outline of available site information which allows for an appreciable understanding for the sediment runoff which is likely to be generated and particular risks which may be encountered in specific areas;

(5) An outline of the controls determined at the current plan stage for incorporation and expansion within the detailed ESCP;

(6) An overview of Monitoring and Audit Requirements; and

(7) Emergency Procedures.

2 Site Characteristics

2.1.1.1 General

The following gives a general overview of the Landscape Character and the main Natural Drainage ways which are relevant in terms of Erosion and Sediment Control.

2.1.1.2 Landscape Character[1]

The *PRD* passes through the margins of a drumlin zone, comprising a series of low interlocking hills aligned in a northwest to southeast direction. The area is relatively low lying, ranging in elevation from about 40m ASL to 100m ASL. Extensive wetland and peatlands and several small lakes are found throughout this area. A relatively low hill range can be found a few kilometres to the west at Carrickbanagher and Carrigans Upper, with higher hills at Bricklieve Mountains and Kesh Corran (5km southwest and south of Castlebaldwin).

Plate 2-1: Drumlin and wetland character of much of the study area

In terms of land use and landcover, the area is used primarily for agriculture. Land quality is marginal and much of the land is being infested by rush. A network of hedgerows and shelterbelts, often comprising conifers, covers much of this landscape extending over hill tops to the peatland fringes. Angular conifer plantations are also frequently located within the larger peatland basins. Hedgerows mostly comprise broadleaf mixed species, including thorn, ash, sycamore and willow species. There are some large areas of conifer afforestation close to the PRD. Lastly, dips in the drumlin landscape serving rivers and streams are mostly flanked by riparian vegetation.

Plate 2-2: Marginal farm land in inter-drumlin flats

[1] Information extracted from EIS Chapter 10

2.1.2 Natural Drainage Ways[2]

2.1.2.1 The River Unshin

2.1.2.1.1 *Unshin River Catchment*

The *Proposed Road Development* passes wholly through the Unshin River Catchment. Surface water land runoff discharges directly to the Unshin via land drains between circa Ch. -190m to c. Ch. 1,100m and between c. Ch. 2,100m to c. Ch. 3,000m. In other areas it discharges indirectly via various streams and rivers whose cathment areas are described below (See Fig. 14.1 of volume 3). A section to the south discharges to Lough Arrow which is the source of the Unshin.

The surface drainage within this catchment flows in a predominantly north-north easterly direction, before joining with the Owenmore River to form the Ballysadare River. The Office of Public Works (OPW) estimates the Unshin River catchment area to be 202km^2, inclusive of Lough Arrow and the Unshin River.

The proposed road realignment crosses one tributary of the Unshin River in these areas which is labelled as DX1. DX1 is a small stream (land drain) which flows east of the Unshin River near the townland of Mullaghnabreena. This crossing is located along the existing N4 alignment.

Table 2-1: Road crossings occurring directly with the Unshin River Catchment

Crossing ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX1	Ch. 450m	0.5 x 0.5	Silt

The following describes the various sub-catchments of the River Unshin which the *Proposed Road Development* intercepts.

2.1.2.1.1.1 *Markree Demesne Stream Catchment*

The proposed road realignment crosses two (2 no.) tributaries of the Unshin River, DX2 and DX3. DX3 is the outflow from the Toberscanavan Loughs. These crossings are located along the existing N4 alignment with a catchment which is known as the Markree Demesne Stream Catchment.

Table 2-2: Road crossings in Unshin River Catchment

Crossing ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX2	Ch. 950m	0.5 x 0.5	Gravel
DX3	Ch. 1200m	2 x 1.0	Gravel

2.1.2.1.1.2 *Turnalaydan Stream Catchment*

The *Proposed Road Development* passes through the Unshin River Catchment between c. Ch. 3,300m and c. Ch. 6,500m (Figure 14.1 contained within volume 3 of this EIS). The Turnalaydan Stream drains an area south, west and north of the Boathole Lough and Lough Corran. The stream flows first into the Boathole Lough before draining into Lough Corran and from there flows in a northeasterly direction for 2km before joining the Unshin River 0.5km east of the existing N4 road. The catchment drains an area of approximately 18km$^{2.}$

The *Proposed Road Development* crosses two (2 no.) tributaries of the Unshin River; these crossings are referenced as DX4 and DX5 in Figure 14.1 (volume 3). DX4 crosses the Turnalaydan Stream 400m downstream of Lough Corran to the west of the existing N4. DX5 crosses a small stream to the west of Drumfin crossroads. This stream flows into the Boathole Lough 1km northwest of DX5.

[2] Information extracted from EIS Chapters 12 and 14

Table 2-3: Road crossings in Turnalaydan Stream *Catchment*

Crossing ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX4	Ch. 4,450m	3.0 x 1.6	Marl
DX5	Ch. 5,550m	1.0 x 1.0	Peat

2.1.2.1.1.3 *Drumfin River Catchment*

The *Proposed Road Development* passes through the Drumfin River catchment between c. Ch 6,500m and c. Ch 8,400m (Figure 14.1, volume 3). The Drumfin River rises in the Bricklieve Mountains and flows in a predominantly north-north easterly direction, before joining with the Unshin River near the Drumfin crossroads. The catchment area is estimated to be 23km^2.

The *Proposed Road Development* crosses two (2 no.) tributaries of the Unshin River; these crossings are referenced as DX 6 & 7 in Figure 14.1 (volume 3). DX6 is a small stream which rises from several seepages or springs along the base of the topographical high of Doon Hill and Carrickbanagher. DX7 crosses the Drumfin River itself which rises from several seepages or springs along the northern slopes of the Bricklieve Mountains.

Table 2-4: Road crossings in Drumfin River Catchment

Stream ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX6	Ch. 6,600m	1.0 x 1.4	Marl/Till
DX7	Ch. 7,350m	3.5 x 0.5	Gravel

2.1.2.1.1.4 *Springfield Stream Catchment*

The *Proposed Road Development* passes through the Springfield Stream catchment between c. Ch 8,400m and c. Ch 11,300m (See Figure 14.1 of Volume 3 and appendix 12.2 of volume 4). The Springfield Stream catchment extends from the northern side of the Bricklieve Hills from where it drains into Loughymeenaghan and from there into a lake at Tawnagh. Springfield Stream then flows in a north easterly direction joining the Unshin River c. 2km north of the lake at Tawnagh. The catchment area is estimated to be in the region of 5.5m^2.

The *Proposed Road Development* crosses one (1 no.) tributary of the Unshin River (Springfield Stream); this crossing is referenced as DX8 in Figure 14.1 (volume 3). DX8 drains Loughymeenaghan in a northerly direction into the lake at Tawnagh.

Table 2-5: Road crossings in Springfield Stream Catchment

Stream ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX8	Ch. 10,800m	2.0 x 2.0	Gravel/Bedrock

2.1.2.1.1.5 *Lissycoyne Catchment*

The *Proposed Road Development* passes through the Lissycoyne catchment between c. Ch 11,300m and c. Ch 13,200m (See Figure 14.1 of Volume 3 and appendix 12.2 of volume 4). The Lissycoyne catchment flows north-northeast before joining the Unshin River 1km east of the lake at Tawnagh. The catchment area is estimated to be in the region of 3.5km^2.

The *Proposed Road Development* crosses one (1 no.) tributary of the Unshin River (Lissycoyne Stream); this crossing is referenced as DX9 in Figure 14.1 (volume 3). DX9 rises along the base of the northern slopes of the Bricklieve Mountains in the townland of Cleavry.

Table 2-6: Road crossings in Lissycoyne River Catchment

Stream ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX9	Ch. 12,250m	1.8 x 0.2	Marl/Till

2.1.2.1.1.6 *Drumderry Stream Catchment*

The *Proposed Road Development* passes through the Drumderry stream catchment between c. Ch 13,200m and the end of the *Proposed Road Development* (Figure 14.1 of volume 3). The Drumderry Stream rises from springs located in the townland of Cloghoge Upper and flows in a predominantly southeasterly direction, crossing the road at c. Ch 13,800m. The catchment area is estimated to be in the region of 4km^2.

The *Proposed Road Development* crosses two tributaries of Lough Arrow (Drumderry Stream and a tributary known as a tributary of the Drumderry Stream). The crossing point is referenced on the Drumderry Stream as DX 10 in Figure 14.1 (volume 3). A tributary of the Drumderry Stream (DX11) rises from a spring along the base of the eastern slopes of the Bricklieve Mountains.

Table 2-7: Road crossings in Drumderry Stream Catchment

Stream ID	Chainage (approx.)	Approx. dimensions Width x height (m)	Substrate
DX10	Ch. 13,800m	1.9 x 0.15	Gravel/Peat/Marl
DX11	Ch 14,220m	1.5 x 1.0	Gravel/Peat/Marl

2.1.2.2 Lakes

Additional water-bodies of note in the area include various lakes populated along the route, the most significant of these include those described below.

2.1.2.2.1 *Lough Arrow*

Lough Arrow is a large, limestone lake located at the head of the Unshin River system. It is a candidate SAC (Site Code 001673) and is one of the most important brown trout fisheries in Ireland. It is a spring-fed lake. Lough Arrow is located in the catchment of the *PRD*, with a hydrological connection between the PRD and the lake via the Drumderry Stream, but would not be directly affected by the proposal. At its nearest point the lake is over 1 km from the proposed road. It receives some drainage from the Drumderry Stream discussed above and would therefore be at risk from pollution via contaminated run-off / accidental spills.

2.1.2.2.2 *Toberscanavan Lough*

Toberscanavan Lough is located in the townland of Ardcurley/Mullaghnabreena/Cloonamahan, at the northern end of the PRD. The proposed road runs on-line with the existing N4 corridor at this location and crosses the outflow from Toberscanavan Lough (Markree Demesne Stream). The Proposed Road Development requires construction works along this area (including the replacement of an existing culvert from the outflow stream) along this section, directly adjacent to the Lough, giving rise to the potential for water quality impacts and downstream pollution in the absence of mitigation.

2.1.2.2.3 *Boathole and Lough Corran*

These loughs are located to the west of Drumfin village, they are connected to the Unshin River by an outflow river stream (Turnalaydan stream) and this is large enough to facilitate movements of fish into the lakes. Boathole and Corran Loughs would not be directly affected by the PRD. However, the PRD passes within 50m of this wetland complex.

2.1.2.2.4 *Aghalenane and Ardloy Loughs*

These loughs are connected to the Unshin River by a small stream that goes underground. This stream is approximately 0.5 m wide and has a mean depth of 0.3 m. The Aghalenane and Ardloy Loughs and their

efferent stream would not be directly affected by the *PRD*. However, the proposed road passes within 50 m of the loughs.

3 Source – Pathway - Receptor

3.1 General

In order to establish the main effects which runoff from the Construction Stage of the PRD will have on the receiving environment, it is important to establish the:

- Source of such pollution;
- Potential pathway for this pollution to migrate; and
- Key receptors which this pollution could cause effects to;

Where there is a link between these three criteria it is important that appropriate mitigation in the form of erosion and sediment control is provided.

3.2 Potential **Sources** of Pollution

The following paragraph outlines what are considered to be the main sources of pollution arising from the Construction Stage of the PRD.

3.2.1 Earthworks

The most significant area of concern regarding erosion and sediment control on any road construction project is those soil, subsoil and peat surfaces which are exposed during the earthworks operations.

Typically these surfaces are exposed during:

- The initial site clearance works;
- Excavation of cut slopes;
- Construction of fill slopes with acceptable glacial till material;
- Excavation and backfilling of soft spots underneath proposed embankments;
- The construction of borrow pits;
- The construction of spoil repositories;
- Construction of haul roads for earthworks operations;
- Stockpiling of acceptable and unacceptable earthworks material for reuse or removal offsite;

These sources of pollution have been reviewed through a detailed review of the project design.

3.2.2 Structures & Concrete

Concrete, grout and other cement-based products which would typically be used in the construction of structures are highly alkaline and corrosive and can have a devastating effect upon water quality. Cement-based products generate very fine, highly alkaline silt (11.5 pH) that can physically damage fish by burning their skin and blocking their gills. This alkaline silt can also smother vegetation and the bed of watercourses and can mobilise pollutants such as heavy metals by changing the water's pH. Concrete and grout pollution is often highly visible.

Particular risks are posed to water quality when construction is taking place over or near surface waters (eg bridges or headwalls).

3.2.3 Watercourse Crossings

There are numerous watercourse crossings associated with this Proposed Road Development including the construction of new culverts on off-line sections and amendment/ replacement of the existing crossing at on-line sections. Many of these are over minor watercourses, 10 are watercourses identified on the Discovery Series Mapping of which 4 are considered to be aquatically sensitive watercourses. Diversion or maintenance of these channels has the potential to generate sediment laden pollution.

3.2.4 Construction Compounds & Machinery Re-fuelling/lubrication

The location of construction compounds will be determined by the contractor during Phase 5 of the NRA PMG. Particular considerations in relation to the location of such facilities and their generation of pollution during the construction stage include:

- Sanitary Wastewater treatment;
- Hard-standing runoff;
- Potential for hydrocarbon pollution to groundwater and surface water;

3.3 Potential Pathways

The potential pathway link is the flow path from an area of exposed ground to an adjacent watercourse or sensitive habitat. This might include for example sheet flow over the edge of an exposed embankment which subsequently has a route via the ground topography to enter into adjacent land drains discharging to watercourses. Additionally there is potential for pathways to be exacerbated by the potential for flooding which has been identified in some areas.

In general, potential pathways have been examined based on:

- An examination of watercourses mapped on the EPA Envision website;
- Reference to watercourses mapped on the OSi mapping;
- Additional ditches mapped in the Digital Terrain Model (DTM);
- An examination of the topography of the area in the vicinity of the PRD using detailed Digital Terrain Model (DTM) information;
- An examination of the Flood Risk Assessment (FRA) carried out for the PRD;
- An examination of karst features in the area;

3.4 Key Receptors

The key receptors as a result of sediment laden runoff are generally considered to be those relating to aquatic ecology and fisheries as outlined below.

3.4.1 Aquatic ecology and fisheries[3]

3.4.1.1 Protected Aquatic Fauna (Annex II species)

The status and occurrence of aquatic fauna listed on Annex II of the EU Habitats Directive (1992) in the study area are discussed as follows:

3.4.1.1.1 *White-clawed crayfish*

The white-clawed crayfish is the only freshwater crayfish recorded in Ireland. Populations of the species in the rest of Europe have declined dramatically and Ireland is seen as a unique stronghold for this species in a European context (Reynolds 1998). It is classified as vulnerable and rare in the IUCN Red List and is protected in Ireland under the schedules of the Wildlife Act 1976. It is also listed in Annexes II and V of the Habitats Directive (1992). It is generally considered to be widespread in lakes and rivers which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998). According to Reynolds (1998) crayfish occur in Hydrometric Area 35, which includes the Ballysadare catchment. One white-clawed crayfish was recorded on the Turnalaydan Stream (Lough Corran outflow) during the aquatic survey undertaken in 2006; however, crayfish were not recorded during the 2013 survey of the study area.

3.4.1.1.2 *Brook lamprey*

The brook lamprey is the smallest of the three lamprey species native to Ireland and it is the only one of the three species present within the study area. This species is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992). The brook lamprey is listed both in Appendix II of the Habitats Directive and Appendix III of the Bern Convention. Kurz and Costello (1999) reported Brook lamprey ammocoetes in a

[3] Information extracted from EIS Chapter 12

tributary of the Unshin River. Juvenile lamprey populations were recorded at the Turnalaydan Stream (Lough Corran outflow).

3.4.1.1.3 *Atlantic salmon*

The Atlantic salmon is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It an economically important species and the Ballysadare catchment is of international importance to salmon. Salmon spawning and nursery areas are present within the study area. Juvenile salmon were present at both sites investigated on the Drumfin River and also on the site surveyed on the Turnalaydan Stream (Lough Corran outflow).

3.4.1.2 Existing environment at individual aquatic areas

The main rivers directly affected are the Drumfin River and the Turnalaydan Stream, which is the Lough Corran outflow stream. A number of other minor streams / drains would also be crossed. A summary description and evaluation of the aquatic habitats at these locations is provided in Table 3-1. Total macroinvertebrate groups and aquatic macrophyte plants recorded at the selected aquatic areas are presented as species lists in Appendix 12.6, Volume 4 of the EIS.

As already mentioned, the Unshin River will not be crossed by the *PRD*, but could be indirectly affected, as the main line of the road would run within 300m of this river and run-off from the construction site could enter this river via affected minor watercourses. No aquatic areas designated as Natura 2000 sites under the EU Habitats Directive (1992) would be directly affected by the proposal.

Table 3-1: Description and evaluation of aquatic habitats within the zone of influence of the N4 Collooney to Castlebaldwin Realignment.

Waterbody	Aquatic habitat and evaluation	Fisheries value and evaluation	Presence of protected aquatic fauna	Overall evaluation of aquatic habitats
Toberscanavan Lough	Important habitats with a high botanical diversity	Maybe of local fisheries value	Otters likely to occur, crayfish may occur	*County importance*
Markree Demesne Stream	Small modified stream with generalised aquatic flora community	Spawning nursery area and tributary of the Unshin River cSAC	Salmon, Brook lamprey, White clawed crayfish, otter may also occur	*Local importance (higher value)*
Boathole and Lough Corran	Ecologically sensitive areas with a diverse array of habitats.	Maybe of local fisheries value	Otters likely to occur, crayfish may occur	*County importance*
Turnalaydan Stream (Lough Corran Outflow)	Small drained river with gravel substrate and moderate naturalness	Spawning / nursery habitat within this watercourse downstream. This river is a tributary of the Unshin River SAC.	Salmon, otter, brook lamprey, White clawed crayfish	*County Importance*
Drumfin River (Behy Bridge)	Small river with cobble/gravel bottom and a high degree of naturalness. Good water quality.	Spawning / nursery habitat within this watercourse downstream. This river is a tributary of the Unshin River SAC.	Salmon, otter, brook lamprey	*County Importance*
Drumfin River tributary	Small stream with generalised aquatic flora community.	No fisheries value.	None.	*Local importance (lower value)*
Aghalenane and Ardloy Loughs	Important habitats with a high floral diversity.	No fisheries value.	None	*Local importance (higher value)*
Lissycoyne Stream (Cleavry Lough outflow)	Minor drain with generalised flora community	No fisheries value.	None	*Local importance (lower value)*
Springfield Stream	Small stream with impoverished	No fisheries value.	None	*Local importance*

Waterbody	Aquatic habitat and evaluation	Fisheries value and evaluation	Presence of protected aquatic fauna	Overall evaluation of aquatic habitats
	aquatic flora.			*(lower value)*
Drumderry Stream and its tributary	Minor drain with generalised flora community	High fisheries value. Spawning tributary for trout in Lough Arrow SAC.	Otter and maybe brook lamprey	*Local importance (higher value)*
Lough Arrow	Large limestone lake with important aquatic flora community; lake habitat corresponds to Annex I 'Hard oligo-mesotrophic waters'	High fisheries value as a brown trout fishery	Otter, possibly brook lamprey within the afferent streams.	*International importance (designated cSAC)*

3.4.2 **Other**

In addition to the above, there are also instances where the route passes adjacent to habitats which are considered to be of importance in terms of the Annex I habitats or Annex II species which they might contain, the most significant of these in terms of value and proximity include:

- Toberscanavan Loughs;
- Lackagh Fen;
- Boathole Lough and Lough Corran;
- Cuileencroobagh Lough;
- Springfield Swallow Hole Complex; and
- Ardloy & Aghalenane Loughs;

4 Investigation and Survey Information

4.1 Soils and Geotechnical

A considerable amount of geotechnical information is available for the site including two number Ground Investigation Factual Reports, 3 number Geophysical Reports and a Preliminary Geotechnical Interpretive Report. These allow for an appreciable understanding of the:

- Soil Geology;
- Subsoil Geology;
- Areas of soft ground which require excavation; and
- Potential sensitive locations in terms of aquifer vulnerability and karst features;

4.1.1 Soils Geology[4]

According to the soil geology mapping compiled by Teagasc, the *PRD* and study area are underlain predominantly by acid brown earths and brown podzolics (AminDW) derived chiefly from non-calcareous sandstone/ shale till parent material, interspersed with pockets of surface and groundwater gleys (AminPD), peaty gleys (AminPDPT), basin peats and blanket peats (Cut), renzinas and lithosols (BminSW) and alluvium type soils (A).

Table 4-1: Soil Types

Code	Soil type	Drainage characteristics	Parent material
AminDW	Acid brown earths & brown podzolics	Deep well-drained mineral soil	Non calcareous sandstone/ shale till
AminPD	Surface & groundwater gleys	Deep poorly-drained mineral soil	Non calcareous sandstone/ shale till
AminPDPT	Peaty gleys	Peaty gleys	Non calcareous sandstone/ shale till
Cut	Basin peats & blanket peats	Cutaway/ cutover peat	Cutaway/ cutover peat
BminSW	Renzinas & lithosols	Shallow well-drained mineral soil	Calcareous - limestone till
AlluvMin	Alluvium	Variable	Variable

The results of site investigations conducted by Priority Geotechnical recorded the soil type as brown CLAY, slightly sandy to sandy to slightly gravelly to gravelly in places, with numerous roots and rootlets or dark brown slightly sandy to sandy PEAT or peaty/ organic CLAY with numerous roots and rootlets. The 'topsoil' depths range from 0.1m to 0.3m.

This indicates that sediment generation may be quite variable ranging from heavier particles in the sandy/gravelly clays which will settle out more readily to lighter particles which may be exhibited by the PEAT material.

4.1.2 Subsoil Geology[5]

The subsoil classification map for the scheme is shown in Figure 4-1 with the route plotted in black. The alignment passes through 4 No. distinct subsoil regions:

- TNSSs - Shale and sandstone till (Namurian);
- Cut – Cutover Peat;

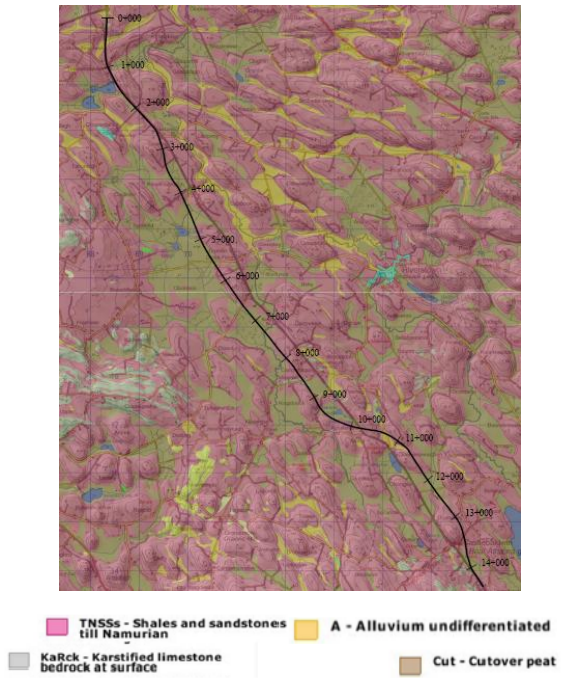
[4] Information extracted from EIS Chapter 13

[5] Information extracted from Preliminary Geotechnical Interpretive Report (AGL)

- A - Undifferentiated Alluvium (Localised);
- KaRck – Karstified Limestone bedrock at surface;

The shale and sandstone till is the most prominent subsoil in the area, with all of the drumlins along the alignment comprising of it. Where the route crosses the lower lying areas peat is generally found except for a section at Ch. 500m and a watercourse at Ch. 10,850m which show alluvium. Alluvium is also shown at the start of the route. Karstified limestone rock at the ground surface is shown near the road alignment in 3 No. locations.

Figure 4-1: EPA Subsoil Map (with proposed route shown in black), (GSI, online 2012)



The alignment crosses zones of shale and sandstone till at the following locations:

- C. Ch. 150m – Ch. 450m;
- C. Ch. 550m – 3400m;
- C. Ch. 3900m – 4200m;
- C. Ch. 4800m – 5050m;
- C. Ch. 5600m – 6650m;
- C. Ch. 7500m – 8500m;
- C. Ch. 8600m – 9300m;
- C. Ch. 9700m – 10700m;
- C. Ch. 10900m – 11800m;
- C. Ch. 12750m – 13800m;
- C. Ch. 14125m – 14510m;

It crosses numerous areas of soft ground encountering peat and organic subsoil's as described below:

Table 4-2: Indicative locations of soft ground conditions anticipated to be encountered

Chainage location (indicative limits only)		Preliminary Ground Investigation/Preliminary Geotechnical Interpretive Report observations
From	To	
1,280m	1,600m	Potentially soft material underneath the existing road foundation. However, the design process assumes that this will be left in place.
2,120m	2,360m	Indicates a localised area of c. 2m at c. Ch. 2,300m Potentially soft material underneath the existing road. Excavation may be required for the south bound embankment in this area.
3,430m	3,730	Indicates a localised area of c. 2m at c. Ch. 3,510m

Chainage location (indicative limits only)		Preliminary Ground Investigation/Preliminary Geotechnical Interpretive Report observations
From	To	
4,250m	4,770	Indicates a maximum depth of c. 5m between c. Ch. 4,590m and 4,690m
5,000m	5,760	Indicates a maximum depth of c. 4.1m at c. Ch. 5,400m
6,760m	7,690	Indicates a maximum depth of c. 4.5m at c. Ch. 7,250m
9,480m	9,500m	Indicates a localised area of a maximum of 1m underneath the south bound embankment.
9,590m	9,630m	Indicates a localised area of a maximum of 1m underneath the south bound embankment.
10,080m	10,270	Indicates a depth of c. 1m throughout
10,620m	10,900	Indicates a maximum depth of c. 6.3m between c. Ch. 10,290m and 10,790m
11,900m	12,420	Indicates a maximum depth of c. 3m at c. Ch. 12,280m
13,670m	13,980	Indicates a maximum depth of c. 4.5m at c. Ch. 13,920m
Eastern Parallel Link (c. Ch. 500m to 800m)		Indicates a depth a maximum depth of c. 2.5m throughout
Eastern Parallel Link (c. Ch. 2,220m to 2,480m)		Indicates a depth a maximum depth of c. 2m throughout
Sections of the L-55016-0 at Knocknagroagh		Indicates a depth of c. 1.5m throughout
Sections of the L-5502-0 at Drumfin		Indicates a maximum depth of c. 6m
Sections of the realigned L-1404-0 at Castlebaldwin and Cloghoge Upper		Indicates a depth of c. 1m throughout

The 3 No. areas of karstified limestone are shown in the following locations;

- C. Ch. 100m – 150m;
- C. Ch. 8500m – 8600m;
- C. Ch. 14100m – 14125m;

This gives an appreciation of the areas of soft ground which will require to be excavated from underneath proposed embankments and an indication of the sensitivities of the bedrock geology in the area.

4.2 Water Quality[6]

Similar to the above a significant body of information has been compiled in order to describe the existing environment as part of the Hydrological and Hydrogeological Chapter of the EIS. The following outlines information which is relevant in terms of the general environment which the outfalls along the PRD will be discharging into.

4.2.1 **Water Quality**

Water quality in the Unshin River is generally good, rated as 'Good Status' (Q4) throughout the study area, with the exception of the most upstream section, at the Lough Arrow outflow which was rated 'Moderate Status' (Q3-4) by the EPA during the 2012 monitoring survey. The downstream stations on the Unshin, below the study area of the PRD, and the lower reaches of the Ballysadare River were rated 'High Status' (Q4-5) during the EPA's monitoring in 2012. The Drumfin River was rated as 'Good Status' (Q4) during the 2012 EPA monitoring at Closkeybeg Bridge (St. 0800), this site is approximately 1.5 kilometres downstream of Behy Bridge, where biological sampling was undertaken for the current report. The upstream monitoring station on the Drumfin River at Kilmorgan Bridge was most recently surveyed by the EPA in 2006 and was found to be 'Moderate Status' (Q3-4). None of the additional minor watercourses within the study area are monitored by the EPA, however site specific test results are outlined in chapter 14 of the EIS and referred to below.

[6] Information extracted from EIS Chapter 12 and 14

4.2.1.1 Surface Water Hydrochemistry

Baseline surface water quality monitoring was carried out downstream of all drainage outfalls and at the inflow and outflow points of all lakes or wetlands with the potential to be impacted by the PRD. The water samples were submitted to an accredited laboratory for analysis of the test parameters as recommended in the NRA guidance: Temperature, pH, Conductivity, Dissolved Oxygen, Biochemical Oxygen Demand, Ammoniacal Nitrogen, Suspended Solids, Nitrate, Orthophosphate, Total Hardness, Zinc (Total), Copper (Dissolved) and Petroleum Hydrocarbons. In addition, the water samples from lakes were submitted for analysis of Chlorophyll and Transparency. The analytical results of winter and summer sampling in 2011 are detailed in Appendix 14.3 contained within volume 4 of the EIS.

The significance is that the baseline water quality at various locations to which road runoff is to discharge are contaminated with respect to Ammonia, EPH, Dissolved Oxygen, pH, Phosphate and Total Suspended Solids; the majority of outfalls are discharging to waters classified as having good or moderate status.

4.2.1.2 Flow Measurements

Baseline flow measurements were taken at previously ungauged watercourses where it is proposed to discharge road runoff. These measurements were taken in January 2011 and in June 2011, using an EM flow meter where possible. The monthly rainfall totals recorded at the nearest operational meteorological station at Claremorris, Co. Mayo for January and May /early June (1st – 3rd) are 88.6mm and 123.0/0.1mm respectively, suggesting that flow measurements in June represent relatively dry conditions, while flow measurements in January represent relatively wet conditions due to the much lower evapotranspiration which occurs in winter months which means a much higher proportion of rainfall becomes runoff during winter months compared to summer months. The following table summarises these flow measurements.

Table 4-3: Flows in previously un-gauged water courses

Stream ID	Chainage (approx.)	Flow (m^3/s) (January 2011)	Flow (m^3/s) (June 2011)
DX1	Ch. 600	0.0	0
DX2	Ch. 1,100	0.02	0.01
DX3	Ch. 1,300	0.08	0.05
DX4	Ch. 1,500	0.06	0.03
DX4	Ch. 4,450	0.2	0.2
DX5	Ch. 5,550	0	0
DX6	Ch. 6,600	0.005	0.005
DX7	Ch. 7,350	0.273	0.230
DX8	Ch. 10,800	0.02	0.015
DX9	Ch. 12,250	0.012	0.012
DX10	Ch. 13,800	0.01	0.018

4.2.1.3 Flooding

According to the flood mapping compiled by the OPW, there are several locations within the study area prone to recurring flooding. The following table summarises these locations, of which the majority are along the existing N4 road (Figure 14.1 contained within volume 3). Computer-based flood risk modelling carried out as part of this PRD has identified two areas where the proposed road crosses through extensive flood plains. One area is located at the outflow of Lough Corran (Turnalaydan Stream) and the other is located around Carrowkeel Wet Woodland at the point where the road alignment crosses the Drumfin River. The PRD also passes through small flood plain areas at the Springfield Stream, Lissycoyne Stream and at the tributary of the Drumderry Stream (downstream of N4) crossings.

Table 4-4: Recorded areas of recurrent flooding

Stream/ River	Location	Chainage (approx.)	Location relative to proposed road
DX1	Lackagh	Ch 4,200m	500m to east
Unshin River	Coolbock Bridge	Ch 5,700m	1.5km to east
Unshin River	Bellarush Bridge	Ch 13,100m	1.4km to east

The significance of flooding is that streams and rivers which are crossed by the *Proposed Road Development* are prone to recurring flooding in places. The flooding in itself is not considered to be particularly sensitive, apart from the Turnalaydan Stream and Drumfin River potentially. The flood risk to the road associated with the existing crossings of Markree Demesne Stream, Springfield Stream, Lissycoyne Stream and the tributary of the Drumderry Stream will be alleviated following the replacement of the culverts as part of the PRD.

5 Erosion and Sediment Controls

5.1 General

The principal objectives in relation to erosion and sediment control during the earthworks operation as already outlined in section 1.5 will be:

- To keep the area exposed to the elements to an absolute minimum;
- To minimise the amount of runoff from the site;
- To organise the work so that it progresses from the low point towards the high point within each outfall catchment;
- To have an efficient earthworks operation to ensure that fill is placed as material is removed;
- To ensure that the unacceptable material is removed and placed in controlled repository areas in an efficient manner;

5.2 Principal Avoidance Measures

The protection of watercourses from pollution from construction works is achieved by avoidance in the first instance. In this regard, the following measures will be implemented during the construction phase:

(1) Site clearance involving topsoil stripping will progress with the earthworks and will not be carried out over large areas in advance resulting in these areas being exposed for long periods of time;

(2) It is estimated that there will be approximately 790,000 m^3 of soft subsoil, organic clays and peat material excavated during the course of the earthworks operation. The *Spoil Management Report* included as appendix 4.3 to the EIS estimates that almost all of this material is likely to remain on site whether that be for:

a. Embankment Construction following processing;
b. Landscaping Measures;
c. Identified Spoil Repositories;

Overall the spoil repository sites are generally located within circa 2k radius of the areas where the *spoil* material is expected to be generated. This will facilitate:

a. An earthworks construction period that is as short as possible thus minimising the period during which open ground is exposed
b. Minimisation of the transportation/journey lengths involved thus minimising the opportunity for material to be spilled on haulage rotes and enter the water system via road runoff;
c. Efficient earthworks operations by providing that material can be removed and replaced with fill in the minimum amount of time thus reducing the ingress of water into the construction works and limiting the amount of dewatering of the works;
d. Identification of appropriate control and mitigation measures for the these spoil repository sites;

(3) Haul Roads will be limited to the confines of the Land Made Available (LMA). Haul roads outside the limits of the site or permanent earthworks are not anticipated;

(4) As far as is practicable, construction works shall proceed within predetermined Construction Areas on a phased basis. These areas will be determined by the contractor during Phase 5 of the NRA PMG. The areas will be developed so that that bulk of the soft ground materials arising during the earthworks process can be deposited at predetermined Spoil Repositories in a progressive manner. This will allow the earthworks to be carried out in phases and is an integral part of 1 to 2 above.

5.3 Principal Control Measures

5.3.1 **General**

The mitigation measures for specific construction tasks and in relation to particular features are outlined in the following sections. General mitigation measures for the protection of the water environment are included in Chapter 14 Hydrology & Hydrogeology, of Volume 2 of the EIS.

(1) The Local Authority shall employ an Environmental Assurance Officer (EAO) (see section 6.2.4) who will be based on-site for the duration of the construction works and will form part of the Employer's Site Representative Team. The EAO shall have suitable qualifications and report directly to the Local Authority. The Local Authority will ensure that the EAO is delegated sufficient powers under the construction contract so that he/ she will be able to instruct the contractor to stop works and to direct the carrying out of emergency mitigation/ clean-up operations. The EAO will also be the Client's Liaison for the purposes of consulting environmental bodies including the National Parks and Wildlife Service and Inland Fisheries Ireland. The EAO shall be responsible for carrying out regular Audits of the Contractor's EOP on behalf of the Local Authority. In addition, the EAO shall be the primary person involved in the Client monitoring role described in detail in Section 6 of this plan.

(2) Before works commence on site, the contractor will be required to prepare an Environmental Operating Plan in accordance with the NRA guidance document. The contractor will be required to incorporate a fully developed construction stage Erosion and Sediment Plan for the proposed works based on this Outline Plan. The contractor will be required to incorporate all of the avoidance and mitigation measures outlined in this Plan in the Construction Stage Plan. In addition, the Contractor shall consult with the NPWS and IFI in relation to the final detail of the Plan and shall include their requirements in this regard.

(3) Before earthworks commence on site and before they are needed - drainage, erosion control and sediment control measures must be in place and functioning.

(4) Silt Fences will be erected along or just in front of the permanent land acquisition boundary in the following cases (sited inside any separate land drainage systems conveying land runoff from the lands outside the CPO (pt. 5 below) and in accordance with the manufacturer's recommendations and in compliance with the Design Criteria outlined in CIRIA C648 Control of Water Pollution from Linear Construction Projects:
    a. At all sections of road construction where the works are at or above existing ground level and to extend linearly 50m along the adjacent cut section;
    b. Along any other identified surface pathways for sediment laden runoff;

(5) Where land drains intersect the site boundary or where the adjacent land falls towards the construction site – temporary cut-off drains will be provided to intercept this clean runoff water and divert to the nearest watercourse. Small check dams will be constructed in these cut-off drains to trap any sediment and prevent erosion. Silt fences will be provided immediately before the outfall to existing watercourses as a precaution and to allow a response time in the event of an emergency.

(6) All minor watercourses (those not identified on the Discovery Series Mapping but that are not identified as sensitive in terms of key aquatic ecological receptors downstream) will be fenced off with silt fences set back at least 5m from the bank until the road crossing is constructed. Watercourses identified as sensitive (see section 5.3.3.1.3) will be fenced off with double silt fences located at least 10m back from the watercourse bank.

(7) All silt fences at watercourse crossings will be inspected on a daily basis and repairs or replacements carried out as required. A record of such inspections/ repairs/ replacements will be maintained as part of the Environmental Operating Plan.

(8) Dewatering and surface water runoff discharges from the construction site, including any advance works, during and for the duration of the construction works will be controlled, collected and routed via appropriate treatment measures. These measures will be in accordance with the CIRIA publication Control of Water from Linear Construction Projects. As a minimum, the measures will include appropriately sized settlement ponds (providing at least 24 hours retention time for the 1 in 100 year flood flow). The settlement ponds may include the permanent constructed wetlands ponds preceded by a temporary construction stage settlement pond to provide sufficient capacity. Each pond will be provided with a double silt curtain at the outfall from the pond and a further double silt fence located before the discharge point. These facilities will be inspected/ maintained at least on a daily basis and the maintenance record will be available for inspection by the Client and other statutory organisations as part of the EOP.

(9) As far as is practicable, where treatment measures (e.g. settlement ponds) are being provided they shall be located at the locations identified for the operational constructed wetlands at each of the proposed road drainage outfalls. There are areas where it has been identified through an examination of the topography that this may not be possible, in these instances sufficient lands within the CPO have been identified to be available and shall be utilised by the appointed contractor.

(10) Haul roads shall be constructed so that the natural contour is followed as clearly as possible, so that the slope does not exceed 15% and so that runoff is diverted to a treatment area
(11) Check dams and sediment traps shall be placed along constructed drains to reduce the velocity of concentrated runoff;
(12) Direct connections between the settlement pond outfalls and the watercourse will not be allowed. Instead, the outfall will be allowed to disperse across at least 3m of undisturbed vegetated ground, covered with a coir mesh or similar matting prior to reaching the watercourse.
(13) Where these ponds cannot be constructed in the dry, then they shall be formed by constructing bunds and placing an appropriate geotextile liner on top. Alternative methods of ensuring that the temporary settlement ponds are constructed in a manner that prevents sediment reaching the water environment may be included in the Construction Erosion and Sediment Control Plan providing this can be demonstrated to achieve the same or better level of treatment. Any/ all materials arising from the construction of the temporary settlement ponds shall be removed to the Spoil Repository Areas or removed offsite to a licensed facility.
(14) Locations associated with the proposed main watercourse crossings that are at risk of flooding, based on the 1 in 100 year flood event, have been identified in the PRD Flood Risk Assessment– and are summarised in Table 5-1 below. The proposed Settlement Ponds and associated treatment measures have been as far as practicable located outside these flood areas. The settlement ponds constructed adjacent to these areas will be bunded so that the top of the bund is at least 500mm above the 1 in 100 year flood event. This will prevent the control facility for being inundated during periods of exceptionally high river levels.

Table 5-1: Potential Flood Locations

Watercourse Ref	Chainage	1:100yr Flood level (mOD Malin)	Chainage	1:100yr Flood level (mOD Malin)
Markree Demesne Stream and Toberscanvan Lakes	1+100	30.42	1+400	30.52
Turnalaydan Stream	4+250	42.00	4+850	42.06
Drumfin River	6+650	51.14	8+100	51.81
Springfield Stream	10+700	61.40	10+900	62.50
Lissycoyne Stream	11+950	63.75	12+350	65.10
Drumderry Stream and its tributary	13+830		14+250	63.60

(15) Landscaping of the constructed road will be carried out in stages as the works progress and will commence as soon as is practicable in each of the outfall catchment areas. The Spoil Repository Areas will be reseeded with a seed mix as prescribed in chapters 10 & 12 of the EIS which will encourage rapid re-colonisation. In relation to the areas where peat is being spread on the surface, it is proposed to mulch the cleared surface vegetation and distribute same over the finished peat surface or alternatively consider the use of mulched straw, wood chips etc.;
(16) If seeding of cut/fill slopes is not practical, the use of roughened slope surfaces shall be considered by the contractor which will encourage water infiltration, and decrease runoff velocity;
(17) Silt fencing shall remain in place until ground vegetation has recovered. Any accumulated silt will then be removed and disposed of to a licensed facility.
(18) Ensure that control measures are correctly installed and adequately sized prior to commencing site clearance and earthworks;
(19) Develop a maintenance checklist for control measures and inspect controls measures regularly throughout the project, particularly after heavy rainfall;
(20) Maintain controls through project such as removing sediment in silt traps once half full.

5.3.2 Earthworks[7]

5.3.2.1 Cuts and Embankment Excavation

The material excavated during the earthworks operation has been estimated to be approximate to:

- circa 307,000m^3 of PEAT requiring transport (this allows a factor of safety of 20% in recognition of the preliminary nature of the GI);
- circa 234,000m^3 of soft alluvial clay requiring transport;
- circa 195,000m^3 of unsuitable subsoil will require transport;
- circa 600,000m^3 of suitable subsoil will require placement embankment sites;
- circa 1,100,000m^3 of fill sourced from adjacent borrow pits (or sourced offsite) will require placement in embankment and excavated sites;

The following principal controls will be put in place:

(1) The area of the earthworks operation will be kept to an absolute minimum at any one time. Earthworks operations will be as self-contained as is practicable within the predefined Construction Areas having regard to the locations of Spoil Repository sites and environmental constraints. The importation and placement of road foundation fill will be carried out in an integrated operation such that fill will be placed as soon as practicable after excavation.

(2) The excavation of peat and other soft materials will be carried out in a manner that minimises the amount of water entering the face of the works. This will be achieved by placing fill in the excavated area as soon as is practicable (generally the same day).

(3) Where pumping out of the excavation is necessary, this will be carried out using appropriately sized pumps. A clean stone filled perforated pipe (or similar) will be used as a sump for the pump intake. The pumped out water will be directed to the earthworks drainage system and to the settlement pond (or other) treatment system. The outlet from the pump shall be designed so as not to mobilise additional sediment – e.g. shall discharge onto plastic sheeting, rock pile, etc.

5.3.2.2 Subsoil Stabilisation

Given the surplus volumes of unsuitable subsoil generated it is likely (as described in the Spoil Management Report) that the contractor will seek to stabilise some of this material through the use of lime application. This activity involves spreading powdered lime evenly over the surface of thin loose lifts (150-350 mm) of the Class U1 material, mixing it with the clay by rotavating, and then allowing the mix to dry or cure over a short period of time prior to compaction. In terms of water quality protection the following controls will be applied to this activity:

(1) The activity shall only be carried out under calm, clear and dry metrological conditions. Lime application shall not be exposed to wind and where any risk occurs will be misted/sprayed down immediately. Other handling systems shall be carried out with regard to the mitigation measures set out in the Air Quality Impact Assessment Chapter of this EIS;

(2) The activity will not take place within 25m of any of the minor watercourses;

(3) The activity will not take place within 100m of any of the aquatically sensitive (see section 5.3.3.1.3) watercourses;

(4) Following mixing (which should take place generally within 15 minutes of spreading the lime on the surface) the material shall be compacted within 1 hour and appropriately sealed. In no case will this material be allowed to be left unsealed overnight;

5.3.2.3 Borrow Pit Excavation

Water discharged into the surface water system must be within the limits set out in the second schedule to the European Communities (Quality of Salmonid Waters) Regulations, 1988, measured at the point of discharge to the nearest watercourse. If groundwater inflows are encountered which are greater than this, then recharging

[7] The following is in addition to those points outlined under 5.3.1 and in volume 2 of the EIS

this groundwater to the ground outside the borrow pit via recharge wells or pits could be carried out. If such groundwater recharging was not possible and if it was then impossible to keep discharges to the surface water system within acceptable limits then the cell in question shall be closed at that point for commencement of the repository stage;

It would also be possible if required to use a combination of groundwater recharge and discharge to surface waters. Groundwater recharging methods and locations should be chosen and overseen by a suitably hydro-geologist with the relevant experience.

5.3.2.4 Transportation

The transportation of materials will be carried out in an efficient manner so as to minimise the number of trips, minimise the length of individual trips, minimise the escape of material from the trucks. The following principal controls will be put in place:

(1) The construction operation will be managed so as to minimise journey lengths;
(2) The *Spoil Management Report* appended as Appendix 4.3 to the EIS has identified that the majority of spoil material generated by the PRD will remain on site, this will reduce the transportation of material off site;
(3) Where any excavated material is "sloppy" and presents a risk of splashing over the top of the trucks the capacity of the trucks will be limited to 75% of the height of the lowest side of the truck;
(4) Trucks leaving and entering the site will do so via a stabilised construction entrance;
(5) Road cleaning will be carried out at least daily to ensure that there is no build-up of sediment on the public road;
(6) In the unforeseen event of a substantial quantity of spoil material being required to be exported offsite, or, in the event of unforeseen access being required to the spoil repository areas from the public road network, then a proprietary mobile truck wheel wash system shall be installed at the relevant locations. All trucks leaving such sites will be required to pass through this facility. The water from the sediment tanks shall be discharged via the site runoff treatment system (i.e. settlement ponds, etc.) and the sediment portion shall be removed to the Repository Areas.

5.3.2.5 Spoil Repositories

The PRD includes:

- 3 No. Spoil Repository/Land Infill sites
- 4 No. Type 1 Spoil Repository/Borrow Pit sites;
- 3 No. Type 2 Spoil Repository/Borrow Pit sites;

These areas are within the land acquisition boundary (See Chapter 4 (Volume 2) and appendix 4.3 (volume 4) of the EIS for more details).

These areas have been established following a detailed assessment as outlined in the aforementioned appendix (*Spoil Management Report*), and a detailed assessment of the anticipated earthworks quantities, the environmental constraints and in particular with the overall objective of minimising the environmental impacts of the PRD. Consultation has been undertaken with the NPWS and IFI in the selection and specification of these sites.

5.3.2.5.1 *Spoil Repository/Land Infill Sites*

(1) The material in each area will be retained either by natural contours of the ground or by bunds constructed from suitable material of adequate engineering properties. All bunds will be extended 500mm above fill level and where natural contours provide containment a similar allowance will be provided;
(2) Existing vegetation in the repository areas shall be left in place where that area is not being used to win additional road fill material;
(3) Existing minor watercourses shall be either piped through the area where appropriate (pipes to be sealed), diverted or setback at least 5m and a bund constructed to contain the deposited material. A silt fence shall be installed at least 3m from the watercourse before deposition works commence and shall be maintained in place until vegetation has re-established.
(4) A setback of at least 5m to be maintained from existing watercourses identified on the Discovery Series Mapping and a bund to be constructed to contain the deposited material. A silt fence shall be

installed at least 3m from the watercourse before deposition works commence and shall be maintained in place until vegetation has re-established;

(5) Each Repository will be provided with a runoff collection and treatment system (which may be an adjacent permanent Constructed Wetland location). The runoff system will consist of a shallow swale (approx. 2m wide by 0.25m deep); to enhance sediment control the surface of the swales shall be constructed from well vegetated turfs cut in rolls and sourced from elsewhere on site. In addition check dams shall be placed at 50m centres to encourage settlement.

(6) . The surface of the repository will be shaped to drain towards the perimeter swale and shallow surface drains will be installed to accommodate this. The perimeter swale will discharge to a surface drain which will discharge temporarily to the closest adjacent Constructed Wetland Pond (provided for the operation stage). A treatment system will remain in place until such time as the operational stage drainage treatment system requires to be established, at that time a grass sward shall have established itself on the repository and the constructed wetland shall be carefully dredged if required.

5.3.2.5.2 *Type 1 Spoil Repository/Borrow Pit Sites*

(1) In general these repositories are an extension of the road cuts therefore application of the points outlined in sections 5.3.1 and 5.3.2 are deemed adequate;

5.3.2.5.3 *Type 2 Spoil Repository/Borrow Pit Sites*

(1) The material is generally contained below ground level, any protrusion above ground level shall be to maintain the existing topography and shall be retained by bunds constructed from suitable material of adequate engineering properties;

(2) Existing minor watercourses shall be diverted or setback at least 5m from the edge of the repository. A silt fence shall be installed at least 3m from the watercourse before deposition works commence and shall be maintained in place until vegetation has re-established.

(3) A setback of at least 5m to be maintained from existing watercourses identified on the Discovery Series Mapping and a bund to be constructed to contain the deposited material. A silt fence shall be installed at least 3m from the watercourse before deposition works commence and shall be maintained in place until vegetation has re-established;

(4) Each Repository will be provided with a runoff collection and treatment system. This will consist of a shallow swale which will discharge to the watercourse via a sedimentation pond which will be provided for the specific purpose of treating the runoff from these sites. To enhance sediment control the surface of the swales shall be constructed from well vegetated turfs cut in rolls and sourced from elsewhere on site. In addition check dams shall be placed at 50m centres to encourage settlement.
The settlement system will be designed to facilitate settlement of suspended solids. It will provide 24hours settlement time for the 1 in 100 year 1 hour rainfall event (33.9mm) and will include control devices, at the discharge from the swale and from the pond, to ensure this is achieved.

(5) These areas will be monitored (bi annually) for a period of 3 years from the date of completion of the filling operation. The results of the monitoring will be made available to the NPWS and IFI. Where the results indicate that any further remedial or other measures are required then these shall be carried out following consultation with IFI and NPWS.

5.3.2.6 Stockpiles

It is envisaged that topsoil will be the main material which will require to be stockpiled during the course of the PRD; that said, it is likely, although on a more temporary basis that spoil material (including soft subsoil, peat and organic clays) may require stockpiling while they await deposition in the relevant repository.

(1) Topsoil stripping over large areas in advance of main excavation works will not be permitted. It will be restricted to the minimum required for efficient earthworks operations and in any case will only be carried out in Construction Area Units where earthworks is on-going.

(2) Each construction area unit will be topsoiled as the works proceeds thus limiting both the amount and the length of time for which materials have to be stockpiled.

(3) Stockpiles will not be located within 10m of a watercourse or land drain or within 25m of a sensitive watercourse (i.e. those with Atlantic Salmon downstream of the crossing) and shall be surrounded with a continuous silt fence.

(4) Runoff from a stockpile will be collected via a shallow toe drain, located outside the silt fence, which will have check dams at regular intervals and will be designed to have a retention time of at least 5

hours. Prior to outfall straw wrapped in geotextile bags and inset into the base of the drain by at least 100mm shall be provided followed by a silt fence upstream of the outlet.

(5) Stockpiles of non-granular materials shall be limited in height to not more than 2.5m.

(6) Where stockpiling of peat or organic clays is required they shall be limited in height to 1m (with 1V:5H side slopes) or fully contained within an appropriately designed bund;

5.3.3 Waterbodies and Sensitive Habitats[8]

5.3.3.1 Introduction

As outlined in section 3.4, some of the rivers and lakes in the vicinity of the PRD are sensitive with respect to fisheries and or habitat. The following outlines the control measures that will be put in place to protect these water bodies from sediment ingress during the construction stage – these are in parallel to the measures outlined above and elsewhere in this document and in Volume 2 of the EIS.

(1) Preserve natural vegetation near watercourses and along the perimeter of the site as much as practically possible;

(2) Leave a 5m grassed strip next to river banks when stripping topsoil or place grassed soil bunds along river banks to prevent site runoff directly entering watercourses;

(3) Place straw bales or sand bags along the sides of temporary or existing bridges to prevent runoff entering the watercourse.

5.3.3.1.1 *Minor Watercourses*

(1) All of these watercourse crossings will be replaced by piped (or box) crossings of at least 900mm diameter;

(2) The works will be programmed so that where watercourses are dry for a portion of the year then the crossing will be constructed "in the dry" during that period;

(3) Crossings in wet watercourses will be provided with a silt trap and a sedimat immediately downstream of the crossing point;

(4) The silt trap shall be left in place for at least 6 weeks following completion of the work and shall be inspected and maintained at least 3 times per week;

(5) The area of disturbance of the watercourse bed and bank shall be the absolute minimum required for the installation of the crossing;

(6) Only precast Concrete pipes/ units will be used in the installation of these crossings

5.3.3.1.2 *Watercourses identified on the OSi Discovery Series Mapping*

(1) All of these watercourse crossings will be maintained by piped crossings of at least 900mm diameter;

(2) Crossings will be provided with a silt trap and a sedimat immediately downstream of the crossing point;

(3) The silt trap shall be left in place for at least 6 weeks following completion of the work and shall be inspected and maintained at least 3 times per week;

(4) The area of disturbance of the watercourse bed and bank shall be the absolute minimum required for the installation of the crossing;

(5) Only precast Concrete pipes/ units will be used in the installation of these crossings or a clear-span structure in the case of the Turnalaydan Stream and the Drumfin River.

5.3.3.1.3 *Sensitive Watercourses*

There are 4 crossings on what is considered to be aquatically sensitive watercourses – which include:

5.3.3.1.3.1 *Markree Demesne Stream (Toberscanavan Lough Outflow)*

This is a high flood risk stream – the predicted 1:100 year flood level is approx. 30.42mOD. It is proposed to replace the existing 1200mm diameter pipe culvert with a 3.0m x 1.9m box culvert. This culvert replacement will involve in-stream works. Where this is required a temporary channel will be provided using plastic sheet lined channel or other non-sediment producing method.

[8] The following is in addition to those points outlined under 5.3.1 and in volume 2 of the EIS

5.3.3.1.3.2 *Turnalaydan Stream (Lough Corran Outflow)*

This is a high flood risk stream (located in a flood plain) – the predicted 1:100 year flood level is approx. 42.0mOD. It is proposed to realign the watercourse channel at the crossing and construct a 20m clear span bridge. It is proposed to undertake the works in the dry. In-stream works will be required to connect the realigned section to the existing channel. Section 5.3.3.4 in relation to stream diversions will apply to this crossing.

5.3.3.1.3.3 *Drumfin River*

This is a high flood risk river – the predicted 1:100 year flood level is approx51.2mOD. It is proposed to construct a 20m clear span bridge at the proposed crossing. This construction method proposed avoids in-stream works; however, the proposed bridge site is in a flood plain.

5.3.3.1.3.4 *Tributary of the Drumderry Stream*

This is a high flood risk stream – the predicted 1:100 year flood level at the upstream end of the existing N4-crossing is approx. 63.60mOD. It is proposed to replace the existing 900mm diameter pipe culvert with a 2.1x2.1m box culvert. This culvert replacement will involve in-stream works. it is proposed to construct the N4-crossing in parallel to the existing culvert to allow the culvert to be constructed in the dry . At both culvert sites the stream flow will be temporarily diverted around the works using plastic sheet lined channel or other non-sediment producing method.

5.3.3.1.3.5 *Principal avoidance and control measures*

The principal avoidance and control measures to be adopted at these crossings include:

(1) No in-stream works will be carried out between 1st October and 1st May;
(2) All works will be carried out under the supervision of the EAO;
(3) In-stream working will be kept to an absolute minimum, will be carried out in the close season only, NPWS and IFI will be informed at least 2 weeks prior to commencement, in-stream works will be allowed on a Permit-to-Work basis that must be signed by the EAO at the commencement of the works and on a weekly basis thereafter;
(4) Where in-stream or bank side works is for the purpose of constructing a structural element that requires the placing of concrete then a cofferdam shall be constructed and made as water tight as possible. Pumping out from the cofferdam shall be to a settlement tank of sufficient capacity to allow solids to settle prior to discharge;
(5) Sand bags shall be double bagged and use washed sand only. Each bag shall be marked with a reference number and a record of placing and removal shall be maintained in the EOP;
(6) Where concrete is required for foundations, blinding, and bridge deck the controls outlined in Chapter 14 Hydrology will be strictly followed in full;
(7) There will be no machinery working in-stream. Where excavation, breaking, etc. is required at the bank, it will be carried out with machinery operating from the bank;
(8) Machinery operating from the bank will work on "bog mats" to minimise damage to the vegetated banks;
(9) A silt trap and a double sedimat shall be placed immediately downstream of the works. The sedimats shall be replaced as per the manufacturer's recommendations with that mat closest to the works being removed first;
(10) Precast structural elements shall be used for all structures thus generally minimising the use of fresh concrete to the placement of foundations, bridge cover slabs and such works.

5.3.3.2 Lakes & Seasonal Waterbodies

The PRD passes adjacent to or crosses inflow streams to the following lakes:

- Toberscanavan Lough (including its periphery habitats) ;
- Boathole and Lough Corran (including its periphery habitats);
- Cuileencroobagh Lough(including its periphery habitats);
- Ardloy and Aghalenane Loughs (including its periphery habitats);

- Swallow Holes complex (inflow stream and seasonal waterbody)

The following are the principal control measures:

(1) A double silt curtain on the side of the PRD which is closest to the Lakes for the duration of the works in this area. These will be inspected on a daily basis and maintained as required.

5.3.3.3 Sensitive Habitats

The PRD passes adjacent to the following sensitive habitats:

- Lackagh Fen;
- Ardloy and Aghalenane Loughs.

The following are the principal control measures:

(1) A double silt curtain on the side of the PRD which is closest to the habitat for the duration of the works in this area. These will be inspected on a daily basis and maintained as required;

5.3.3.4 Diversions

A permanent diversion is proposed on the Turnalaydan, Springfield and Lissycoyne Streams as outlined in Chapter 4 and 12 of the EIS. The channels shall be free of any erosion potential prior to their opening, this may include fully established vegetation or the use of sediment control mats which are biodegradable. The opening shall be carried out in a carefully controlled manner and under the supervision of the EAO and an IFI representative.

Some additional minor drains and other minor channels will be diverted or cut-off drains will be constructed to divert water away from the construction site. Small check dams will be constructed in these cut-off drains to trap any sediment and silt fences will be provided immediately before the outfall to existing watercourses.

5.3.4 **Concrete Works**[9]

5.3.4.1 Introduction

The use and management of concrete in or close to watercourses must be carefully controlled to avoid spillage which has a deleterious effect on water chemistry and aquatic habitats and species. Where the use of concrete near and in watercourses cannot be avoided the following control measures will be employed:

(1) Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used to promote the early set of concrete surfaces exposed to water;
(2) When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used;
(3) Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters;
(4) Placing of concrete in or near watercourses will be carried out only under the supervision of the EAO;
(5) There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately and runoff prevented from entering the watercourse;
(6) Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses;
(7) On- site concrete batching and mixing activities shall only be permitted following a considered site selection process which shall consider the contents of this plan. Site Selection shall require the approval of the Environmental Assurance Officer, the NPWS and the IFI;
(8) Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the batching plant (or other appropriate facility designated by the manufacturer);

[9] The following is in addition to those points outlined under 5.3.1 and in volume 2 of the EIS

Chute washout will be carried out at designated locations only. These locations will be signposted. The Concrete Plant and all Delivery Drivers will be informed of their location with the order information and on arrival on site.

Chute washout locations will be provided with appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the contractor's Waste Management Plan included in the EOP.

5.3.5 **Construction Compounds**[10]

5.3.5.1 Introduction

It is likely that there will be a number of site construction compounds including main and ancillary compounds. While the exact location of these will be determined by the contractor, same will be subject to the controls outlined below.

Construction compounds may include stores, offices, materials storage areas, materials processing areas, plant storage, parking of site and staff vehicles, and other ancillary facilities and activities.

5.3.5.2 Location

Construction compounds shall be located on dry land and set back from lakes, river and stream channels, ecological sensitive areas (internationally and nationally important habitats, wet areas such as wetland habitats, marshes and fens, etc.) and away from potential floodplain areas.

Construction compounds shall not be located in European Sites or within 50m of the boundary of same.

Construction compounds shall not be located within other designated environmental sites or other ecologically sensitive sites.

The storage of fuels, other hydrocarbons, and other chemicals within the construction compounds will not be permitted within 50m of a sensitive watercourse or lake and 10m from other watercourses.

Compounds shall not be located within 75m of an inhabited dwelling house.

5.3.5.3 Other Controls

All compounds will have appropriate levels of security to deter vandalism, theft and unauthorised access.

Surface runoff from compounds will be minimised by ensuring that the paved/ impervious area is minimised. All surface water runoff will be intercepted and directed to appropriate treatment systems for the removal of pollutants prior to discharge.

All site compounds will be fenced off and a silt fence erected and maintained on the site boundary. Where a site boundary is near a non-sensitive watercourse the fence/ silt fence shall be located at least 5m from the watercourse.

Wastewater drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent water pollution and in accordance with the relevant statutory requirements.

The storage of fuels, other hydrocarbons and other chemicals within the construction compounds shall be in accordance with relevant legislation and with best practice. In particular:

- All fuel/ Hydrocarbon/ Chemical (fluid) storage areas shall be bunded to 110% of storage capacity;
- Storage of these materials shall not be within 50m of a sensitive watercourse and the storage location within the compound shall be organised so as to be as far away from all water bodies as is practicable;
- The Emergency Response Plan shall include arrangements for dealing with accidental spillage and relevant staff shall be trained in these procedures;

[10] The following is in addition to those points outlined under 5.3.1

5.4 Runoff Estimation

For the purposes of the current stage of the design and in order to determine landtake requirements as per section 5.5, runoff from the exposed surfaces has been calculated using the Rational Method and applying extreme rainfall information obtained from Met Eireann and specific to the area.

Modified Rational Formula: $Q = C \times i \times A$

Where

Q = the peak discharge (m^3/hour);

C = Coefficient of permeability taken conservatively at 0.6 for a stripped construction site

i = rainfall intensity (m/hour);

- *The depth of rainfall constituting a 1 in 100 year (1 hour) flood event is 33.9 mm/hr*

A = the contributing area (10,000m^2);

Resulting in:

$Q = 0.6 \times 0.0339$ (m/hour) $\times$ 10,000m^2

$Q = 203.4\ m^3$/hour for a 1Ha site

5.5 Land Availability

The PRD has been examined in terms of suitable locations for sediment control treatment points. In the main these locations can be sited on the sites of the proposed Constructed Wetlands for the operational stage road runoff. Additional areas are however required and have been provided for in the landtake of the PRD.

6 Monitoring and Audit

6.1 Introduction

This Outline Erosion and Sediment Control Plan will be developed by the contractor into the Construction Erosion and Sediment Control Plan (CESCP) and will form part of the Environmental Operating Plan (EOP). While the final details of the CESCP will require agreement with the NPWS and IFI, the minimum requirements of same shall include all of the controls, measures, mitigations and monitoring described in this document. The monitoring of all aspects of the EOP, including the CESCP, will be carried out by the contractor as the responsible party. The responsibilities of the Employer will be discharged by the Employer's Site Representative staff and in particular the Environmental Assurance Officer (EAO).

6.2 Monitoring and Audit

6.2.1 General

The avoidance, control and mitigation measures outlined in this document will ensure that erosion and sediment arising from the works is controlled. They have been developed in accordance with best practice, in consultation with environmental organisations including NPWS and IFI, and have been shown to work on other projects. As with all systems, there is a requirement to have monitoring, audit and feedback loops to demonstrate the operation of the system. The following describes the framework Pre-construction Monitoring and Construction Monitoring regime and the detailed construction stage monitoring by the Contractor and the EAO are described in the subsequent paragraphs.

6.2.2 Pre-Construction and Construction Stage

Permanent continuous monitoring for Turbidity will commence 6 months in advance of construction and will continue through to completion of same. Monitors will be placed on the Markree Demesne Stream, the Turnalaydan Stream, the Drumfin River and the Drumderry Stream (downstream of the junction with its tributary) at locations determined following consultation with IFI and NPWS. In addition, the suspended solids concentration in the watercourses will be measured at each location on a weekly basis.

This monitoring will be reviewed on an ongoing basis during construction. Should investigatory levels (a breach of the limits set out in the second schedule to the European Communities (Quality of Salmonid Waters) Regulations, 1988, measured at the point of discharge to the nearest watercourse) be reached then corrective action shall be taken.

The downstream turbidity monitors will be equipped with a means of sending a message to the EAO if investigatory levels are reached.

6.2.3 Contractor

The procedures and monitoring and audit regime outlined in this section shall be used by the contractor to ensure and demonstrate the effective operation of the avoidance, control and mitigation measures for Erosion and Sediment control. It will facilitate use as a feedback loop to target any issues that may arise.

The following are the main procedures that will be followed:

(1) The contractor will be obliged to hold a full day training course for all site staff immediately before works commence on site on the EOP and in particular the CESCP. The subject of this course shall be the measures that have been put in place to protect the environment and the procedures and monitoring and recording that is to be undertaken in accordance with the EOP.

(2) Environmental Checklists shall be prepared for each operation. Responsibility for completion of these checklists will be assigned to individual members of the contractor's staff. The following operations will also require a Permit-to-Work before operations can commence each of which must be counter signed by the EAO:

- (a) Any in-stream works;
- (b) Placing of concrete in or within 50m of watercourses;

(c) Completion of sediment removal facilities prior to initial discharge to watercourse
(d) Restart of works following any pollution incident

(3) All environmental monitoring and checklists shall be recorded and added to the EOP on a daily basis;
(4) The EOP shall assign particular responsibility and monitoring duties to particular named staff and the Site Agent/ Manager shall ensure that this is implemented in full. Training for each member of staff on their specific area of responsibility shall be carried out before the commencement of that operation. A record of all training carried out shall be maintained in the EOP and a further copy issued to the EAO;
(5) Monitoring for Turbidity shall be undertaken as described at section 6.2.2. The results shall be relayed to the EAO and to the Local Authority's website;
(6) All other watercourses in the vicinity of the works shall be monitored on a daily basis and turbidity readings taken. The results shall be issued to the EAO on a daily basis;
(7) All mitigation/control measures shall be inspected daily by designated contractor staff and maintenance and repairs carried out immediately;
(8) Any direct release of sediment to a watercourse causing plumes or exceedance's of the turbidity investigatory level shall trigger an investigation commencing with notification to the EAO who shall determine the appropriate course of action which may involve the cessation of works, the initiation of emergency procedures and the notification to the NPWS and the IFI. In such a case of cessation, works shall not recommence until appropriate corrective measures to avoid any repetition are put in place. Such measures shall be agreed with the EAO following consultation with the NPWS and IFI.

6.2.4 Environmental Assurance Officer (EAO)

Separate from the on-going and detailed monitoring carried out by the contractor as part of the EOP, the EAO shall carry out the inspection/ monitoring regime described below on behalf of the employer. The results will be stored in the EAO's Monitoring file and will be available for inspection/ audit by the Client, NPWS or IFI staff. All inspections/ monitoring/ results will be recorded on standard forms.

(a) Inspect the Principal Control Measures outlined in this plan on a weekly basis. Report findings to the Contractor;
(b) Inspect surface water treatment measures (ponds, tanks, mini-dams, sandbags, etc.) on a daily basis and obtain turbidity readings;
(c) Inspect all outfalls to watercourses on a daily basis and obtain turbidity readings. Where excavation, deposition, pumping out or concreting works are on-going in the vicinity obtain turbidity readings three times per day;
(d) Daily visual inspection of watercourses to which there is a discharge from the works and those where there is construction works in the vicinity;
(e) Wheel wash facilities shall be inspected on a weekly basis;
(f) Borrow Pits shall be inspected on a daily basis while in operation and on a weekly basis thereafter;
(g) Spoil Repositories shall be inspected on a daily basis while in operation and on a weekly basis thereafter;
(h) Stockpiles shall be monitored on a daily basis while being filled or emptied and otherwise on a weekly basis;
(i) Control measures for works at or near water bodies shall be inspected on a daily basis;
(j) Concrete operations at or near watercourses shall be supervised and designated chute washing out facilities shall be inspected on a daily basis;
(k) Site Compounds and satellite compounds shall be inspected on a weekly basis;
(l) The Contractor's EOP monitoring results shall be audited on a frequent basis (6 times per quarter at a minimum);
(m) Any and all exceedance of the investigatory level for turbidity shall be reported where deemed necessary to the NPWS and IFI and shall be investigated thoroughly by the EAO and the Contractor. Where the works are identified as the source causing the exceedance, the procedure outlined in Item "n(i) to n(iv)" below shall be followed;
(n) Any direct release of sediment to a watercourse causing plumes or exceedance of the turbidity investigatory levels shall result in:
    (i) the relevant NPWS and IFI staff being notified immediately;
    (ii) the contractor will be required to take immediate action and to implement measures to ensure that such discharges do not re-occur;

(iii) Works if stopped shall not recommence until appropriate corrective measures to avoid any repetition are put in place. Such measures shall be agreed with the EAO following consultation with the NPWS and IFI;

(iv) Works and/ or discharges from the works shall not recommence until written consent is received from the EAO

(o) Where the EAO considers that the risk of a sediment release is high, he/she shall inform the contractor and request protective action to be taken. Where the contractor does not take immediate action the EAO shall instruct the contractor to take action and same shall be reported to the Contract Manager and the Client;

(p) The EAO will be delegated powers under the contract sufficient for these instructions to be issued and for an instruction

7 Emergency Procedures

7.1 Introduction

Prior to commencing works, the Contractor shall prepare an Emergency Response Plan based on a thorough risk assessment. The plan shall detail the procedures to be undertaken in the event of the release of any sediment into a watercourse, serious spillage of chemical, fuel or other hazardous wastes (e.g. concrete), non-compliance incident with any permit or license, or other such risks that could lead to a pollution incident, including flood risks.

7.2 Resources

Relevant staff, including cover staff, shall be trained in the implementation of the Emergency Response Plan and the use of any spill kit/ control equipment as necessary. The contractor shall provide a list of all such staff to the Employer's Site Representative detailing the name, contact number, and training received, and the date of that training.

The Contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment to the Employer's Site Representative. All such plant and equipment shall be maintained in place and in working order for the duration of the works.

7.3 Spill Response

The Emergency Response Plan shall include a simplified Spill Response with the following as a minimum:

(1) Instruction to stop work;
(2) Instruction to contain the spill;
(3) Details of spill clean-up material location;
(4) Name and contact details of responsible staff;
(5) Measures particular to the location and the activity;
(6) Instruction to contact the EAO (including Name and Contact Details).

This Spill Response shall be displayed at several locations throughout the site and at all sensitive locations.

The EAO shall be responsible for notifying the IFI/NPWS and shall also determine if and when works may proceed once corrective actions have been completed.

7.4 References

Control of water pollution from linear road projects: CIRIA (C648);

Guidelines for the Crossing of Watercourses during the Construction of Road Projects: National Roads Authority (2006);

Preliminary Soils and Geology Report for the N4 Realignment - Collooney to Castlebaldwin road scheme: AGL Consulting Engineers, 2012

NRA Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan: National Roads Authority (2007);

N4 Collooney to Castlebaldwin PRD EIS: Sligo County Council and various sub-consultants;

Other EIS's for similar projects;