# Chapter 5

# Description of the Construction Phase

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# 5 DESCRIPTION OF THE CONSTRUCTION PHASE

## 5.1 Landuse Requirements

### 5.1.1 Landtake

There will be approximately 43 hectares (ha) of land permanently acquired for the construction of the proposed road development. Within this required land, there will be the acquisition of three occupied private dwellings, one unoccupied dwelling at the proposed northern N2 roundabout tie-in, and one derelict gatehouse on the N51. In addition, approximately 7 ha of land will be temporarily acquired to facilitate construction activities including site compounds, stockpile areas, temporary access roads and temporary works areas. Further detail regarding the acquisition of land is outlined in the following sections.

## 5.2 Pre-Main Construction Works (Enabling Works)

### 5.2.1 Appointment of Project Site Environmental Team

Prior to commencement of any works, the following key environmental personnel will be appointed:

- **Environmental Clerk of Works (ECoW)** to ensure that the mitigation measures outlined in this EIAR and the NIS (including any conditions applied as part of the consent process) are implemented in full and to supervise works in sensitive locations. Both the contractor and the client (MCC) shall each appoint an ECoW.
- **Project Ecologist** to supervise all pre-construction ecological surveying, implementation and overseeing of ecological mitigation measures and ensuring that activities on site are conducted in accordance with the planning permission as they pertain to ecological matters and specifically any works that could have an effect on the River Boyne and River Blackwater SAC and/or SPA, their qualifying interests (QI) and special conservation interests (SCI) respectively. Both the contractor and the client (MCC) shall each appoint a Project Ecologist.
- **Project Archaeologist** to supervise the necessary archaeological mitigation, testing and monitoring throughout. This includes overseeing the conduct of any excavations and ensuring they are performed in accordance with any license conditions attached. Both the contractor and the client (MCC) shall each appoint a Project Archaeologist.
- **Landowner Liaison Officer (LLO)** appointed by MCC following the making of the Compulsory Purchase Order and granting of Planning Permission. During the construction phase, the LLO will work closely with the contractor to communicate with landowners potentially affected by proposed works, as well as communicate with landowners regarding any property access requirements. The LLO will act as the interface between the landowners and the Contractor/Local Authority and will be in regular communications with all parties (landowners, Local Authority and Contractor).

### 5.2.2 Enabling Works

Should the Proposed Scheme be confirmed, a number of advanced works contracts will be required to enable the main construction; these include:

- Ground Investigation Works;
- Ecological surveys and mitigation work;
- Archaeological Surveys and testing;
- Treatment and management of non-native invasive plant species; and
- Water quality monitoring.

### Ground Investigations for Detailed Design

Preliminary ground investigation works have been undertaken to inform the design of the works to date. Further intrusive ground investigation will be required to advance the design for construction and to provide further confirmation of the existing ground conditions. This will include but not be limited to the following along the length of the corridor:

- Hand dug inspection pits;
- Boreholes;
- Trial pits;
- Materials sampling and testing; and
- Geophysical survey.

The purpose of ground investigation works will be to gather information on existing ground conditions, rock quality, groundwater information, foundation conditions, make up of existing pavements and location of existing services.

To achieve this purpose, boreholes, consisting of a mix of percussion drilling and rotary coring will be undertaken to assess underlying ground conditions, groundwater regime, in-situ testing and the taking of samples for laboratory testing. Trial pits will also be excavated to assess ground conditions and for the taking of soil samples for further testing. The condition of existing pavements will be assessed by the taking of pavement core samples and testing. The presence of existing utilities will be assessed by the carrying out of slit trenches, which will also provide further information of existing ground conditions.

Considering the mostly greenfield location for the proposed bypass and the existing urban location for the proposed public realm works, a comprehensive ground/site investigation will consist of 150 boreholes, 260 trial pits, 120 slit trenches and 80 pavement cores.

As the proposed investigations will take place in a sensitive environment, especially proposed investigation works within the River Boyne and River Blackwater SAC and SPA, the proposed works will include for mitigation measures to prevent any environmental risk to the river and the qualifying interests of the SAC.

These mitigation measures will include the following:

- Silt barrier fencing will be used around excavations to prevent uncontrolled run-off.
- Each excavation will be backfilled as soon as possible to avoid prolonged exposure and to ensure sediment does not erode or wash away.
- Works will be carried out under the strict supervision of and to the approval of an ECOW appointed to supervise the works.
- When working within the flood plain of the river Boyne, weather conditions will be closely monitored and works will not be undertaken when periods of heavy rainfall are predicted, which could result in flooding of the area.
- Plant will not be left within the flood plain overnight and will be mobilised daily as required from locations outside the flood plain.
- Considering the nature of the existing soft ground within the flood plain area, access into the site will be a carefully controlled process. Access will be from the existing Boyne Canal towpath and bog mats will be placed over the existing ground in advance of machinery, such as borehole rigs and excavators entering into the area. At each location of an excavation, a silt barrier fence will be erected around the site to prevent any run-off reaching the river as the excavation takes place and excavated materials temporarily stored within the area protected by the silt fence. Each excavation will be backfilled as soon as practicable and vegetated topsoil reinstated on completion.
- All hydrocarbons will be stored remotely from the SAC, with refuelling taking place away from sensitive locations.

### Pre-construction Ecological Surveys

This phase of the construction stage will address any required pre-construction surveys. Non-intrusive ecological surveys in particular will be required at this stage, consisting of bat surveys, badger surveys, and bird nesting surveys. These will be undertaken by a qualified ecologist prior to any vegetation clearance, tree

felling, other demolition works and prior to any archaeological testing/ topsoil stripping as required and detailed in the mitigation measures included in this EIAR. Vegetation clearance will be programmed to avoid bird nesting season. Further detail on the required pre-construction surveys can be found in each specialist chapter and in **Chapter 27 – Schedule of Environmental Commitments**.

**Invasive Species Treatment and Management**

Invasive species have been identified within and adjacent to the Proposed Scheme corridor – see Chapter **15 – Biodiversity: Terrestrial Ecology** of this EIAR. Prior to commencing construction, a further invasive species survey will be undertaken within the lands made available and all stands will be taped off to prevent accidental spread. A treatment plan to include in-situ chemical treatment and/or excavation and disposal at a suitably licensed facility will be developed by a licensed professional.

Biosecurity measures will be put in place to ensure invasive species are not spread between sites or along the corridor. This will also include measures to limit any potential introduction or spread of Crayfish plague which has been noted in the Boyne previously. Good machinery hygiene will be practiced including steam cleaning machinery and disinfection of water pumps etc. Further mitigation is noted in the following chapters of the EIAR: **Chapter 15 – Biodiversity: Terrestrial Ecology**; **Chapter 16 – Biodiversity: Aquatic Ecology**; **Chapter 17 – Water**; **Chapter 18 – Land, Soils, Geology and Hydrogeology**; and summarised in **Chapter 27 – Schedule of Environmental Commitments**.

**Pre-construction Archaeological Surveys**

Pre-construction archaeological surveys will be required under Licence by the Department of Housing Local Government and Heritage prior to construction works commencing to mitigate risk of encountering unexpected archaeological remains during the main construction contract. A detailed programme of archaeological test excavation will be undertaken within the LMA. This will involve the excavation of a centreline test-trench, with off-sets placed at regular intervals. The quantity of testing will, where conditions allow, typically represent a 12% sample coverage of the area being tested. Archaeological testing will be carried out by a team (or teams) of suitably qualified archaeologists, under ministerial directions. Test trenching will involve a number of JCBs utilising a bucket excavator. Prior to commencing, the programme of archaeological test excavation, will be discussed with the ECOW to ensure that all ecological sensitivities have been resolved. The ECOW will provide supervision of the test excavation within the SAC/SPA boundary.

This process will enable any feature of archaeological significance to be identified and resolved prior to the commencement of the main construction contract.

**Pre-construction Water Quality Monitoring**

Water quality monitoring of the River Boyne and River Mattock has been carried out to inform the assessment of the potential impacts of the Proposed Scheme on water quality and to establish the baseline situation. Similarly, groundwater monitoring has been carried out as part of the initial ground investigation works. Pre-construction surface water quality monitoring will be carried out prior to construction. The measurement of suspended solids in water bodies and the taking of samples for further analysis will be carried out at the River Boyne and Mattock (Mooretown) Stream. Based on the conclusions of the impact assessment from **Chapter 18**, monitoring of groundwater quality is not considered necessary.

### 5.2.3 Site Preparation and Clearance Works

Other advance works are likely to be carried out to prepare the site for the main construction work and/or reduce construction stage risk. By their nature, these works must be complete before the main works start. Some will start well in advance of the main construction activities. Such works are likely to include:

- Fencing works;
- Site clearance and tree and hedgerow removal works;
- Demolitions;
- Earthworks for pond and access road construction;
- Drainage Attenuation Ponds, culverts and interceptor ditches;
- Site access enabling works;
- Some landowner access; and

- Advance Utility Diversions.

The land to be acquired for the proposed development boundary will be fenced and access across it restricted. Temporary access routes for local landowners will be provided so that lands are not severed until such time as the permanent access measures to and from public roads are implemented. Mammal-proof fencing will be installed where required, e.g. ecologically sensitive areas such as the River Boyne valley. Temporary construction fencing or hoarding will be required during construction prior to the installation of permanent fencing to secure the site and prevent unauthorised access.

Fencing in accordance with TII Publications will typically be used. Fence and boundary types vary across the proposed road development depending on different circumstances which may require, timber post and rail fencing, timber post and mesh fencing, masonry walls and may be temporary in nature. Where required, temporary crossing points for livestock and machinery will be allowed until accommodation works and permanent access roads are constructed.

Trees and other vegetation for protection will be clearly marked and protected from construction activities. Local soils and seedbank identified for re-use by the ecology/ landscape specialists will be removed and stored in a suitable location. Remaining vegetation will be removed. There are restrictions for site clearance in relation to breeding birds. Vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed, between the 1 March and the 31 August, to avoid direct impacts on nesting birds. Where this seasonal restriction cannot be met, areas to be cleared will be inspected and surveyed by a suitably qualified ecologist for the presence of breeding birds. Only areas assessed not to contain nests will be cleared. This clearance will be done within three days of the ecologist's survey otherwise the surveys will be repeated. There are also restrictions in relation to disturbance of badgers. The required mitigation is presented in **Chapter 15 – Biodiversity: Terrestrial Ecology** and **Chapter 16 – Biodiversity: Aquatic Ecology**.

All areas of the site required for construction of the proposed works will need to be cleared down to ground level, including the demolition of existing buildings. Existing buildings to be demolished and trees to be cleared which have medium or higher bat roost potential immediately prior to construction work commencing will be subject to a bat survey carried out by a suitably qualified ecologist prior to demolition/removal and, if necessary, in accordance with any derogation licence(s) in the event that derogation is required at that stage. Only areas clear of roosting bats will be removed. As bats are a protected species, removal of bat roosts and exclusion of bats will only be carried out under license by a suitably qualified bat specialist.

Additionally existing buildings will be surveyed for asbestos prior to demolition. Demolition work will not take place unless the structure has been safely cleared of asbestos.

In order that the proposed project water treatment proposals are fully functional in advance of the main construction, the proposed attenuation ponds, culvert crossings and pre-earthworks interceptor ditches will be constructed as enabling works. Both the attenuation ponds and the pre-earthworks interceptor ditches are required to be vegetated in order to function properly as run-off treatment facilities, which are required in advance on the main construction activities. These drainage works are further described in **Section 5.4.8.3 Phase 1 Drainage Works** and in **Section 5.12.10.5 Earthworks** below.

The ESB overhead powerline bordering the area for the Boyne bridge construction works will need to be diverted during construction of the bridge. The ESB diversion is required to enable the safe movement of construction plant and ensure the powerline is moved beyond the fall radius of the crane jibs and masts.

## 5.3 Sediment and Erosion Controls

There is potential for erosion to occur during the construction process and during the earthworks activities in particular. In this section, the potential sources of erosion are identified and a description of the methods to be employed to control sediment run-off during the construction is provided.

The proposed specific methodology in relation to the proposed earthworks operations is described in greater detail in **Section 5.13 Earthworks** below, together with a full description on the specific measures to be implemented to prevent erosion in the first place and secondly the particular measures to be put in place to control run-off and prevent uncontrolled sediment laden water entering the River Boyne and other watercourses (including the canal).

## 5.3.1 Potential Sources of Sediment Run-off

Potential sources of sediment containing run-off (in the absence of mitigation or designed-in measures) that are identified and described in the following sections.

### 5.3.1.1 Earthworks Slopes

The greatest source of sediment loaded run-off is likely to be from pluvial run-off on exposed earthworks slopes. Once earthworks slopes are exposed (cuts) or built up (embankments), rainfall landing on the slope and run-off from land falling towards the top of a cut travel uncontrolled down the slope – potentially at high velocities – causing suspension and resuspension of soil particles from the surface of the slope.

An additional impact of uncontrolled run-off on slope faces is that erosion channels (or gullies) may form in the cut slope due to the movement of water down the cut slope allowing water penetration into the slope face which may lead to slope stability issues.

### 5.3.1.2 Soil Stockpiles

Where topsoil and other soils are to be stored on site, stockpiles with significant side slopes can create another source of sediment laden run-off. As with the earthworks slopes above, once the slopes are built up, rainfall landing on the slope and run-off from the top of the stockpile travel uncontrolled down the slope (potentially at high velocities) causing suspension of soil particles from the surface of the slope.

### 5.3.1.3 Construction Traffic

When construction plant such as excavators, dumpers or trucks are travelling into and out of earthworks locations, soil may become attached to the wheels and then be tracked along haul routes. When rainfall lands on these roads the run-off resuspends the sediments and the polluted run-off may be directed to drains or watercourses without treatment.

### 5.3.1.4 Open Drainage Features

Open drainage features constructed as part of the works such as interceptor drains, and attenuation ponds can also contribute to sediment run-off. Where water is introduced to these features prior to a full vegetation cover, the water can result in suspension of soil particles as the water is conveyed through the feature. It is important that any run-off falling into un-vegetated drains or attenuation does not have a pathway to a receiving water environment until such time as the features are vegetated and are functioning as designed.

## 5.3.2 Erosion and Sediment Controls

### 5.3.2.1 Introduction

There are numerous methods used during road construction to prevent/ control sediment load in run-off prior to discharge into a receiving watercourse. The following is a description of the methods which will be utilised during the construction of the Proposed Scheme. Specific measures and construction methodology to be implemented are described in greater detail in **Section 5.13 Earthworks** below.

### 5.3.2.2 Erosion Control

Erosion controls will be carried out on all exposed earthworks slopes to limit the amount of sediment being initially suspended in rainfall or groundwater run-off. Typical erosion control methods are described in the following sections.

### 5.3.2.3 Seeding and Planting

The most effective way of naturally preventing erosion of exposed earthwork slopes is to provide sufficient vegetation cover on the soil. The vegetation itself reduces the velocity of the surface flow while the roots of the vegetation help to protect the soil from erosion. Hydraulic seeding (where a binder is mixed with the

seed) will be widely used on slopes to ensure a more even and speedier establishment of a vegetative cover. **Figure 5.1** illustrates the benefits of grassing and seeding of earthworks slopes.

**Figure 5.1: Before and after seeding. Erosion gullies visible on non-vegetated slope (Source: CIRIA C648)**

### 5.3.2.4 Geotextiles and Mats

Exposed soil faces (either sloped or flat) are often covered in a natural or artificial layer to protect the underlying soil from erosion. The geotextile fabric, mesh or mats can be utilised as a permanent or temporary feature. Mats made from organic materials, such as jute, coir or straw, can be installed prior to seeding and will not need to be removed as, over time, when the permanent vegetation has established, these mats will naturally degrade. Artificial geotextiles are also options. **Figure 5.2** illustrates the use of matting on an earthworks slope.

**Figure 5.2: Coconut matting on earthworks slope (CIRIA C648)**

As described in **Section 5.13** below, the key strategy of the proposed erosion and sediment control methodology for the Proposed Scheme is to limit the extent of exposed earthworks areas (maximum 200 m length specified) and to implement erosion protection measures quickly before earthwork operations move to expose further bare-earth areas. Therefore, all earthworks side slopes will be provided with a geotextile fabric, mesh or mat to protect against erosion and be hydroseeded before earthworks operations proceed to expose further surfaces.

## 5.3.3 Sediment Control

Following erosion controls, sediment controls will be implemented to reduce whatever sediment has become suspended despite the erosion controls. The following sections describe the sediment controls to be used on the Proposed Scheme.

### 5.3.3.1 Settlement Ponds

A settlement pond is a simple and effective sediment control technique. Site run-off will be pumped or diverted into a pond which allows suspended solids to settle out prior to discharge. These ponds can be either temporary ponds specifically constructed for the purposes of sediment control or the permanent attenuation ponds for a project can be used to provide sediment removal during construction. A combination of temporary settlement areas and use of the permanent attenuation pond for the control and treatment of run-off during construction will be implemented for the construction of the N2 Slane bypass as described in **Section 5.13 Earthworks** below in further detail.

When permanent ponds are used, restoration and remediation measures will be required during and post construction, so the ponds remain effective during the construction stage and are fit for purpose during the operational stage. All settlement ponds utilised during the construction phase will be inspected on a weekly basis for evidence of sedimentation and where the maximum sediment depth is found to be greater than 75 mm, all sediment will be removed from the pond.

Restoration and remediation will be undertaken during periods of dry weather and include the careful removal of all sediment deposited on the pond surface, taking care to ensure established vegetation is not damaged. Sediment removal will not remove pond topsoil or subsoil layers. Where damage to the pond vegetation is deemed to be likely, sediment will not be removed from more than 50% of the pond at any one time and sufficient vegetation will be retained to ensure rapid re-colonisation of any damaged areas.

The sediment removed from the pond may contain low levels of metals, hydrocarbons and other pollutants and therefore, will be dealt with and disposed of in accordance with the appropriate waste management legislation.

A settlement pond at construction stage is typically designed for the 10-year 24 hour rainfall event. Further treatment of the construction stage run-off will be provided at the outfall from the pond prior to discharge to the watercourse. This will be in the form of silt traps, filter socks or silt bags.

Silt bags are fitted to the outlet pipe(s) from the pond and the water discharges through the fabric of the bag prior to its terminal outfall to the watercourse (**Figure 5.3** illustrates an example). The tightly woven fabric traps sediment particles down to a size of 100 microns (µm). Once the bag is filled with sediment it will be removed from site and replaced, with the removed bag disposed of at a suitably licensed waste management facility.

**Figure 5.3: Silt Dewatering Bag**

### 5.3.3.2 Check-dams

Check dams are small temporary dams constructed across a swale or drainage ditch to reduce the velocity of the concentrated run-off, thereby reducing erosion of the swale or ditch and also trapping sediment behind the dam. Various materials can be used as a check dam. Sandbags or rock filter bunds are most commonly used as they are readily available natural materials. They will only be used where water volumes and sediment load are low. They are ideally suited for installation in pre-earthworks ditches that only cater for overland flow or groundwater. The spacing of the check-dams will be placed such that the crest of the downstream check-dam is at the same level as the channel at the base of the upstream check-dam.

### 5.3.3.3 Silt Barriers

Silt Barriers or silt fences comprise a geotextile filter fabric installed in the path of sheet flow run-off to filter out heavy sediments (CIRIA 648). Posts support the filter fabric and the fabric itself is buried in the ground to ensure sediment is trapped behind it and doesn't breach the fence. The selection of the type of filter fabric depends on the expected volume of run-off and the characteristics of the sediment. It is sized to retain sediment particles but also have openings large enough to permit water to drain though and avoid clogging. Silt fences are typically used around temporary stockpile areas, site perimeters and across ditches with low flows.

Silt fences are effective barriers to trap sediment, however structural integrity i.e. that they will not collapse or be breached in operation as run-off is filtered, has been shown to be an important component of design (Bugg et al. 2017). When silt fences are used as sediment control measures, they will be subject to regular rigorous inspections to ensure they remain well constructed and functional. Any silt trapped during rainfall events will be promptly removed and any damage to the fences will be repaired to ensure they continue to function as effective silt barriers. **Figure 5.4** illustrates a silt barrier fence.

**Figure 5.4: Typical Silt Fence**

### 5.3.3.4 Stockpile Locations

Stockpiles can be a significant source of erosion and sediment run-off. To minimise sediment run-off from stockpiles their locations have been carefully considered. Stockpiles will be:

- Located away from drains, water bodies and flood zones;
- Seeded or provided with other surface protection measures appropriate to the length of time the stockpile is in place;

- Provided with earth bunds or ditches on adjacent higher ground or slopes to prevent surface run-off reaching the stockpile; and
- Provided with silt fences around the toe of a stockpile to trap any sediment in run-off from the stockpile.

As outlined below in **Section 5.4.5.2 Material Processing**, temporary stockpile areas have been identified for the Proposed Scheme. These are located remote from existing watercourses, drains and flood zones and will be provided with measures to control sediment run-off. Topsoil stockpiles will be tamped down and grass-seeded and protected by a surrounding silt fence. Typically, other stockpiles will consist of rock to be processed and reused during the construction. Limited sedimentation is expected from rock, but fine particles will be generated during crushing and processing. Rock processing and storage areas will be protected from uncontrolled run-off by a perimeter protection consisting of either bunding and/or silt fences.

### 5.3.4 Groundwater Reduction

Where groundwater is encountered, it will be dealt with separately to rainfall and captured before it becomes contaminated with sediment. The following are methods which will be utilised on the Proposed Scheme as necessary when ground water is encountered during the construction.

#### 5.3.4.1 Slope Drains

It is not uncommon to encounter groundwater ingress through the side slopes of earthworks cuttings. The most common treatment of this source of water is to install slope drains, also known as herringbone drainage. These will be installed to remove groundwater from a cutting. These are constructed on the cut face of an earthworks cutting and are typically buried 600 mm into the cutting. The slope drains will collect groundwater prior to it reaching the surface where it can become contaminated with sediment.

These drains will form part of the permanent drainage system to ensure slope stability when the project is completed. During construction water from herringbone drains will be collected and pumped to the pre-earthworks drains as the water will be generally free from sediment or pollution.

#### 5.3.4.2 External De-watering

External dewatering is an expensive and time-consuming process and should only be used where significant groundwater ingress is expected or where no other means of groundwater control can be provided. The need for external dewatering on the Proposed Scheme is not expected.

## 5.4 Construction Works

**Section 5.2** above describes the Pre-Main Construction Works to be carried out in advance of the main construction works. This section provides a description of the Main construction works and the measures that will be necessary to enable and facilitate the construction.

### 5.4.1 Construction Compounds

A main construction compound will be required during the construction phase to provide office and welfare facilities for site construction staff. The construction compound will also provide facilities for material storage, laydown and maintenance of construction plant, and possibly material testing. An office for the Employer's Representative and assistant staff will also be located within the construction compound.

As the River Boyne will effectively split the construction site in two for the majority of the construction period and that majority of the Boyne bridge construction will take place from the southern bank of the river, a satellite compound will also be required at the southern end of the Proposed Scheme.

The project team have identified areas for the location of a temporary main construction compound and a satellite compound on southern side of the River Boyne as illustrated on **Figure 5.5.**

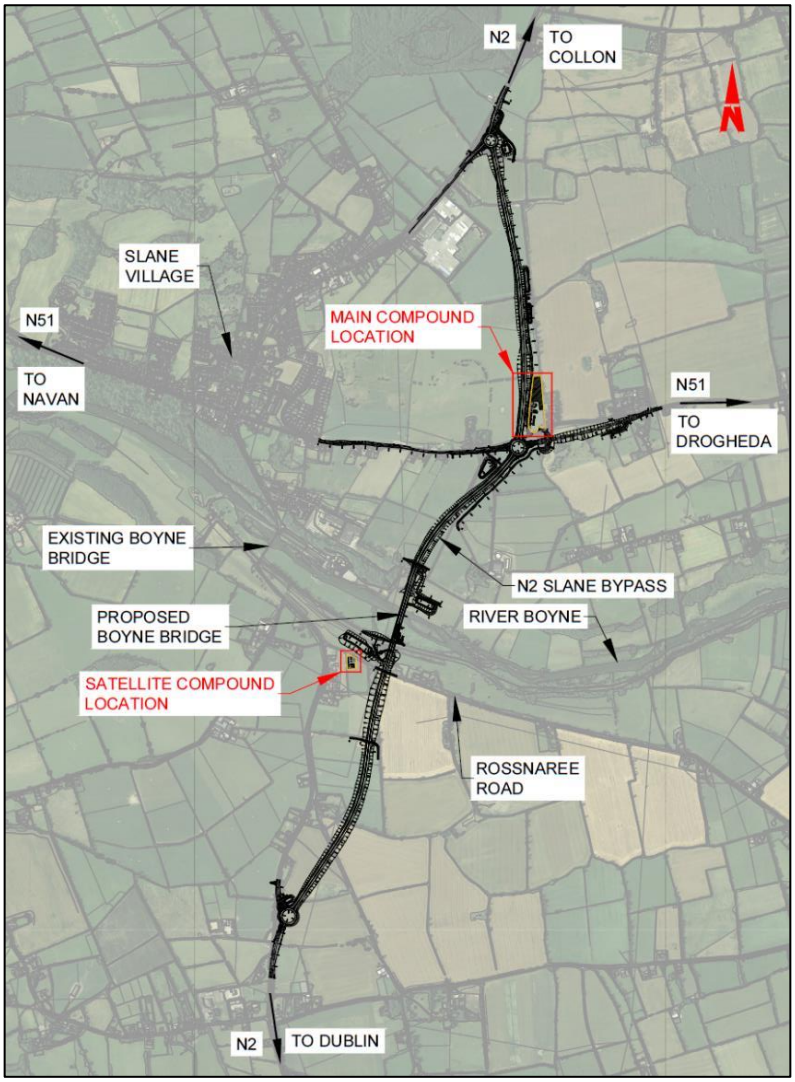


**Figure 5.5: Location of Construction Compounds**

The construction compounds will include stores, offices, welfare facilities, materials storage areas, material processing areas, plant storage and parking for site and staff vehicles, and temporary artificial lighting. The compounds are anticipated to remain in place for the duration of the works. The impact of dust generated by vehicles and at the construction compounds is assessed in **Chapter 10 – Air Quality**. The compounds will have appropriate levels of security. The Contractor will be required to manage parking and deliveries at the compounds and other areas in such a manner as to ensure that there is no obstruction to general traffic or sightlines during construction.

The sites for the proposed compounds have been selected to be located outside of watercourses, ecologically sensitive areas, areas of extreme vulnerability, and outside of potential floodplain areas and areas containing invasive species. The proposed main compound will be accessible from the N51 via a temporary access from the eastbound side, east of Slane. This access will also become the permanent maintenance access for Attenuation Ponds 5A and 5B via Access Track 2. The proposed satellite compound will be accessible from the Rossnaree Road via a temporary junction.

Access to utilities to service both compounds is facilitated by existing ESB, water supply and telecoms connections present on both the N51 and Rossnaree Road. However, there are no public foul sewers or surface water drainage pipes available at either location. As a result, grey and foul water will be managed via connection to sealed containment which will be pumped out as needed and removed to an appropriate facility for treatment/disposal. Building and carpark run-off will be managed via a petrol interceptor (PI) connected to the earthworks drainage.

An indicative layout of the site compound is presented in **Figure 5.6**. Areas for offices, storage and parking are illustrated. A similar outline of the likely design and layout of the satellite compound has also been prepared and is presented in **Figure 5.7**. Areas for offices, storage and parking are illustrated.

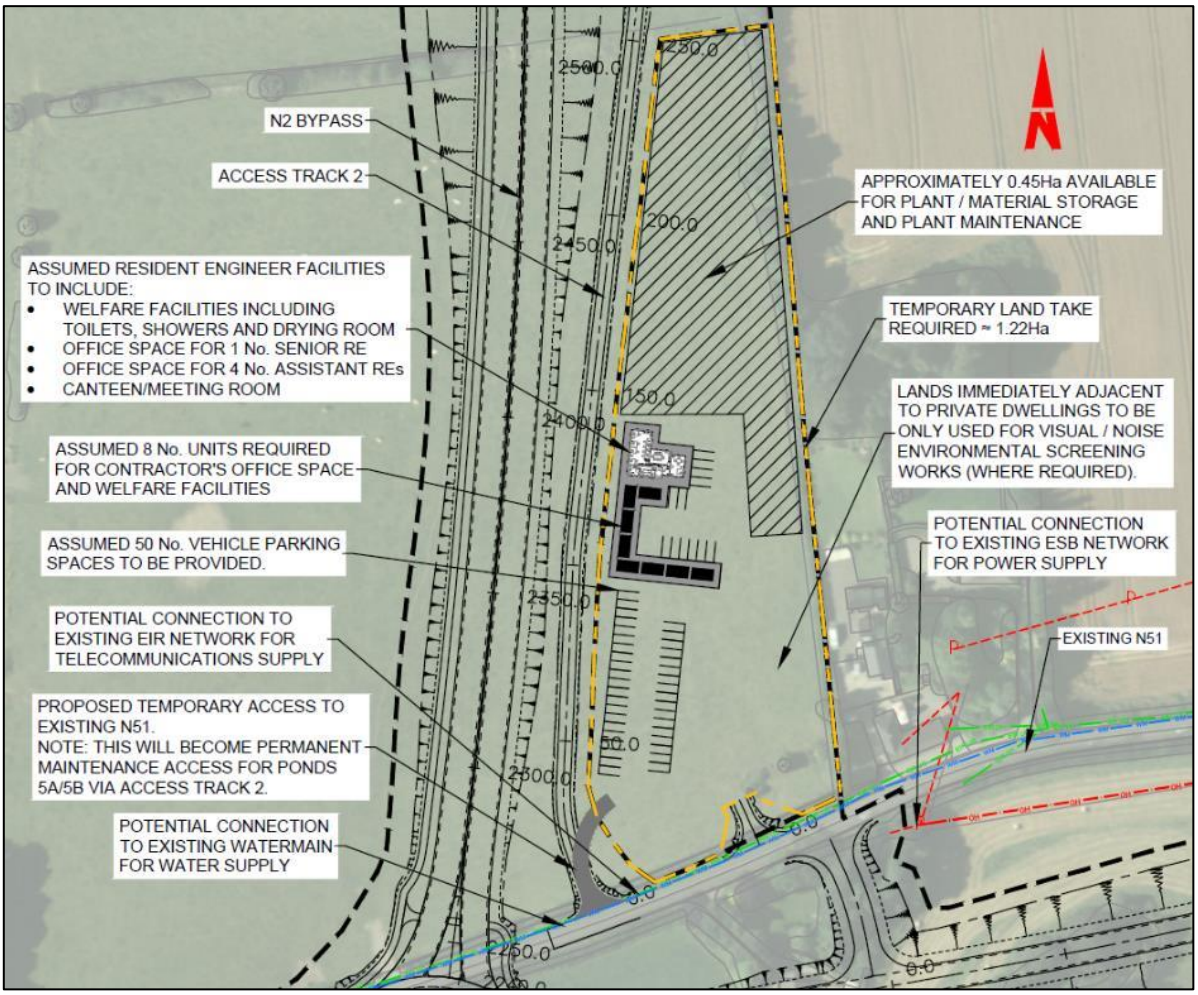


**Figure 5.6: Indicative Layout of Main Construction Compound**

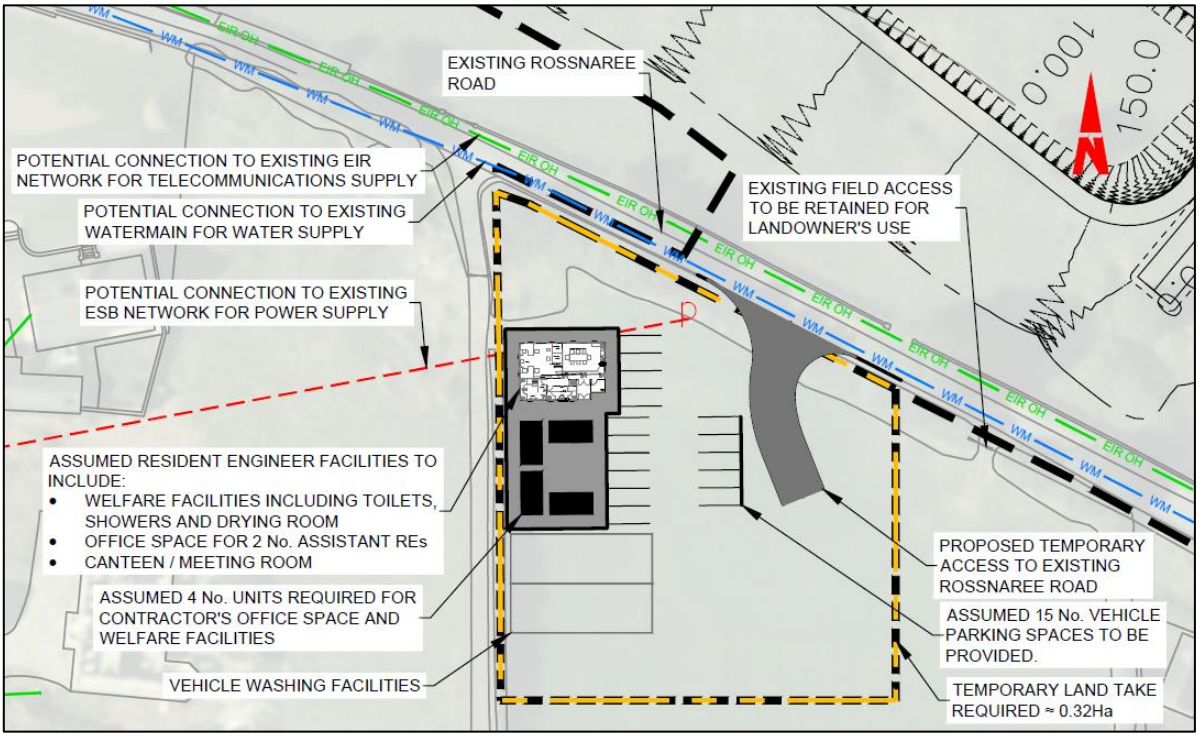


**Figure 5.7: Indicative Layout of Satellite Construction Compound**

The following measures will apply to the detailed design of temporary main and southern satellite construction compounds to mitigate against potential for adverse impact on the aquatic environment:

- Each temporary compound will have a dedicated Waste Storage Area for construction waste generated;
- To minimise impact on surface water and groundwater from material spillage, all oils, solvents, paints and other potential contaminants used during construction will be stored within suitably designed bunded areas in accordance with *CIRIA Report 163 - Construction of Bunds for Oil Storage Tanks*, and *Enterprise Ireland, Oil Storage Guidelines, BPGCS005*). All stored oils, fuel, chemicals, hydraulic fluids, etc. must be located in a secure, bunded and impermeable surfaced area and shall be appropriately secured. As a minimum, storage will be bunded to a volume not less than 110% of the tanks maximum capacity. If more than one container is stored the system must be able to contain 110% of the largest tank or drum within the bunded area or 25% of the total tank capacity within the bund, whichever is greater (plus an allowance of 30 mm for rainwater ingress);
- No concrete washout will be permitted outside of the construction compounds. If required at the construction compounds, concrete washout areas will be carried out at a dedicated impermeable surface and all wash-out water generated will be collected. This water will be tankered off-site for treatment at an appropriate licensed facility;
- Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards and guidelines, such as the *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (NRA 2008). All chemical and fuel filling locations will be contained within bunded areas; and
- As noted above, onsite facilities generating grey and foul water will be managed via connection to sealed containment which will be pumped out as needed and removed to an appropriate facility for treatment/disposal.

Other smaller satellite construction welfare facilities may be required at specific locations from time to time during the construction phase. These temporary facilities will be located within the lands made available for the construction at suitable places. These welfare facilities are likely to be served by temporary mobile sanitation units. Such welfare facilities will not be permitted within the River Boyne and River Blackwater SAC boundary.

Following completion of the Proposed Scheme, the site compounds will be decommissioned and all materials removed from the site. All decommissioning will be carried out in compliance with relevant regulations and legislation and under supervision of the Environmental Clerk of Works and the Project Ecologist.

### 5.4.2 Site Access Routes

The transport of material and people to and from the site will generate additional temporary traffic on the road network. In particular, there will be a large volume of earthworks to be removed off-site. Therefore, consideration has been given to the most appropriate locations for site access locations.

It is proposed that the site access points for the mainline works will be as summarised in **Table 5-1** and shown in **Figure 5.8** below. Haul roads and access roads will be constructed into the site from these locations. Site access routes will be kept clean and free of debris and will be inspected periodically to ensure there are no maintenance issues e.g. blocked drains resulting from the construction of the Proposed Scheme. The impacts of dust and construction traffic are assessed in **Chapter 9 – Noise and Vibration** and **Chapter 10 – Air Quality**.

**Table 5-1: Site Access Points**

| Access Point | Description of Access Location | Section of Scheme Works |
|---|---|---|
| **1** | Southbound side of N2 at southern end of proposed bypass | N2 South to Rossnaree Road |
| **2** | Westbound side of Rossnaree Road L16002 near local road crossing of proposed bypass | |
| **3** | Eastbound side of Rossnaree Road L16002 near local road crossing of proposed bypass | Rossnaree Road to Boyne bridge crossing |
| **4** | Westbound side of N51 near proposed N51 roundabout junction | Boyne bridge crossing to N51 |

| Access Point | Description of Access Location | Section of Scheme Works |
|---|---|---|
| 5 | Eastbound side of N51 near proposed N51 roundabout junction | N51 to N2 North |
| 6 | Southbound side of N2 at northern end of proposed bypass | |

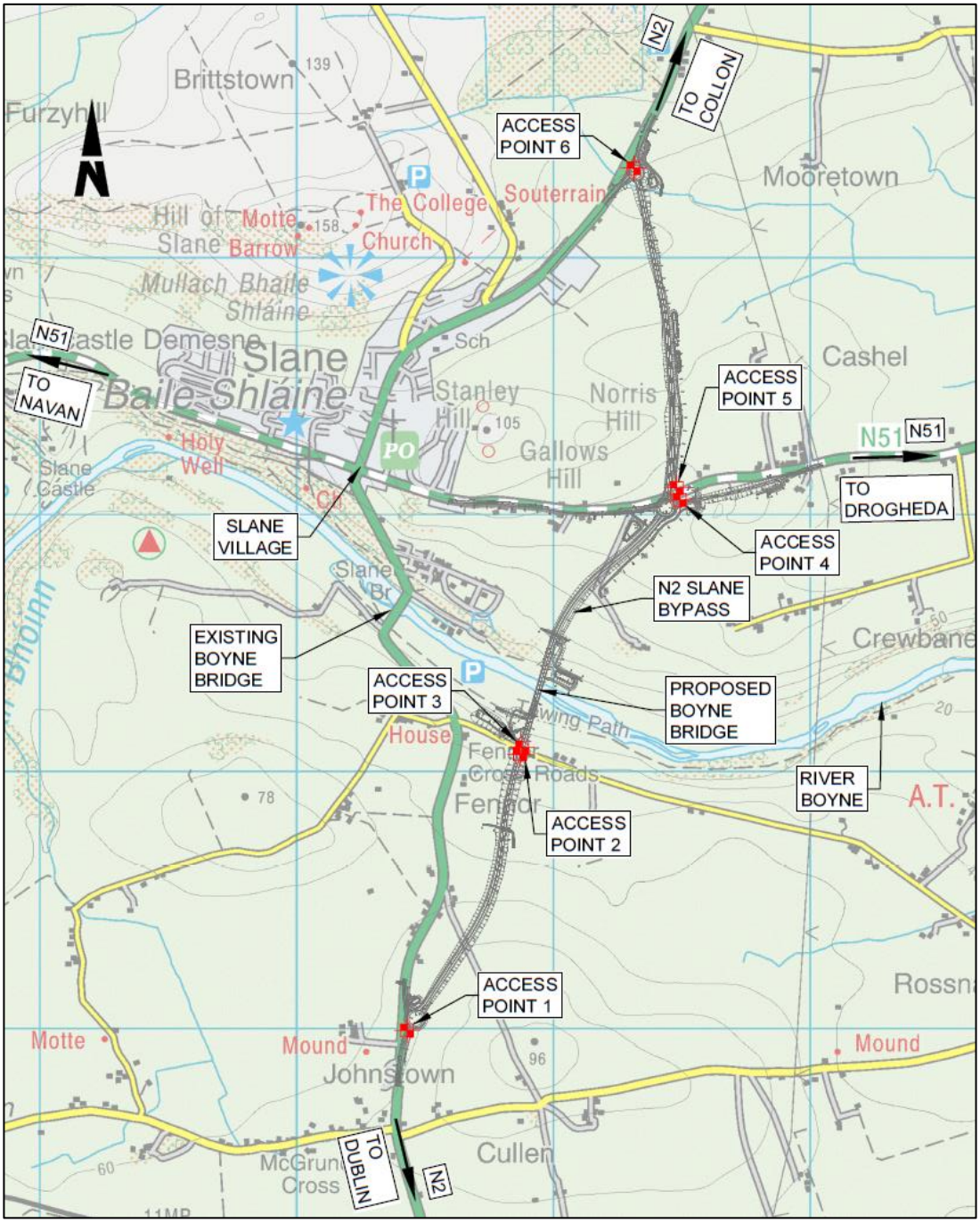


**Figure 5.8: Site Access Points**

As the location of Site Access points are on the national road network with the exception of site access points 2 and 3, which utilise a short section of the Rossnaree Road to link to the N2. As such, all construction traffic routes to and from the site will be via the national road network plus the short section of Rossnaree Road from the N2. Note construction traffic will not be permitted to utilise the section of the Rossnaree Road located to the east of site access points 2 and 3.

Compliance that construction traffic is restricted to the above routes will be closely monitored by the Meath County Council site supervision team.

### 5.4.3 Works to facilitate continued access and provision of services for landowners affected by the Scheme

Works required to maintain access to lands, reinstate property boundaries, and provide ducting for services, will be completed as early as feasible in the construction programme. The works series of drawings (**MDT0806-RPS-01-N2-DR-C-LO0000-LO0003**) illustrate the proposed works required in this regard. Particular consideration is given to the following:

- **Landowner 107/108:** Overbridge 1 and associated access tracks will be constructed and ready for landowner's use prior to severing lands for mainline construction. Temporary access across the construction site will be required until the overbridge is completed and ready for use by the landowner.
- **Landowner 118/119:**
  - Overbridge 3 and associated access tracks will be constructed and ready for landowner's use prior to severing lands for mainline construction. Temporary access across the construction site will be required until the overbridge is completed and ready for use by the landowner.
  - Existing access lane from N51 to be retained for landowner's use until the alternative access to N51 can be provided. Construction of the alternative access road from the N51 will be constructed early in the construction programme to minimise severance of the landholding.
- **Landowner 147:** Prior to severing lands for mainline construction, Access Track 6 will be constructed and ready for landowner's use to provide access from N2 to severed lands.

### 5.4.4 Utility Diversions

The scheme includes for local services diversions, including the proposed undergrounding of existing overhead utilities in the centre of Slane village. The scope of utility diversions required is described in **Chapter 4 – Description of the Proposed Scheme** and **Chapter 22 – Material Assets: Utilities**.

### 5.4.5 Earthworks

The general scope of the proposed earthworks is described below. Further details of the proposed construction methodologies and sequencing to be utilised is given in **Section 5.13** below.

#### 5.4.5.1 Scope of Earthworks Activities

The Proposed Scheme entails considerable earthworks. Due to the preferred alignment setting the scheme low in the landscape and providing for a proposed River Boyne crossing which is set at a relatively low level to reduce its impact on the receiving landscape and the World Heritage Property of Brú na Bóinne, the project is predominantly in cutting. Some fill is required, mainly at the northern end of the scheme.

The total quantity of cut has been assessed as some 700,000 $m^3$ with an assessment of 185,000 $m^3$ of fill, including some 66,000 $m^3$ of Class 6 (rock). This results in a significant surplus of material arising, which will need to be removed from the site to a suitable location to enable sustainable onward reuse. The material arising is expected to be inert and of a quality that can be used for earthworks construction.

Blasting is not expected to be necessary, and excavation of cuttings will be carried out by ripping.

#### 5.4.5.2 Stockpiles and Material Processing

The following need for temporary stockpiling for reuse of material during the construction phase has been identified:

- Stockpiles north and south of the River Boyne to store topsoil, excavated early in the construction phase for reuse to topsoil earthworks side slopes and verges later in the scheme. Two topsoil stockpiles either side of the River Boyne are proposed to avoid need to transport topsoil from either side of the river to the other.
- Stockpile south of the River Boyne to store surplus rock prior to transport for reuse on the northside of the river. Stockpile will need to store both processed and unprocessed rock.

- Area for processing of rock material including a crusher and grader.

The estimated earthworks quantities of topsoil to be placed, reusable rock to be excavated and Class 6 (rock) to be placed were ascertained for both the southern and northern sections of the scheme as set out in **Table 5-2** below.

**Table 5-2: Estimated Earthworks Quantities for Stockpile Assessment**

| Section of Scheme | Volume of Material ($m^3$) | | |
|---|---|---|---|
| | Topsoil Fill | Excavated Reusable Rock | Class 6 Fill |
| **Southern Section** | 5,780 | 48,330 | 19,950 |
| **Northern Section** | 9,370 | 13,440 | 46,430 |
| **Total** | **15,150** | **61,770** | **66,380** |

These quantities confirm the amount of topsoil to be temporarily stored for reuse. Also highlighted is the need for some 33,000 $m^3$ of rock excavated on the southern section to be processed and transported to the northside for reuse. It is proposed that rock from the southern section of the scheme will be processed prior to transport to the northern side. Therefore, an area to facilitate this processing, estimated at approximately 0.2 ha is required.

It is proposed that additional lands will be temporarily acquired to accommodate the proposed material stockpiles and processing area. Two locations have been identified where temporary acquisition is proposed as illustrated in **Figure 5.9**.

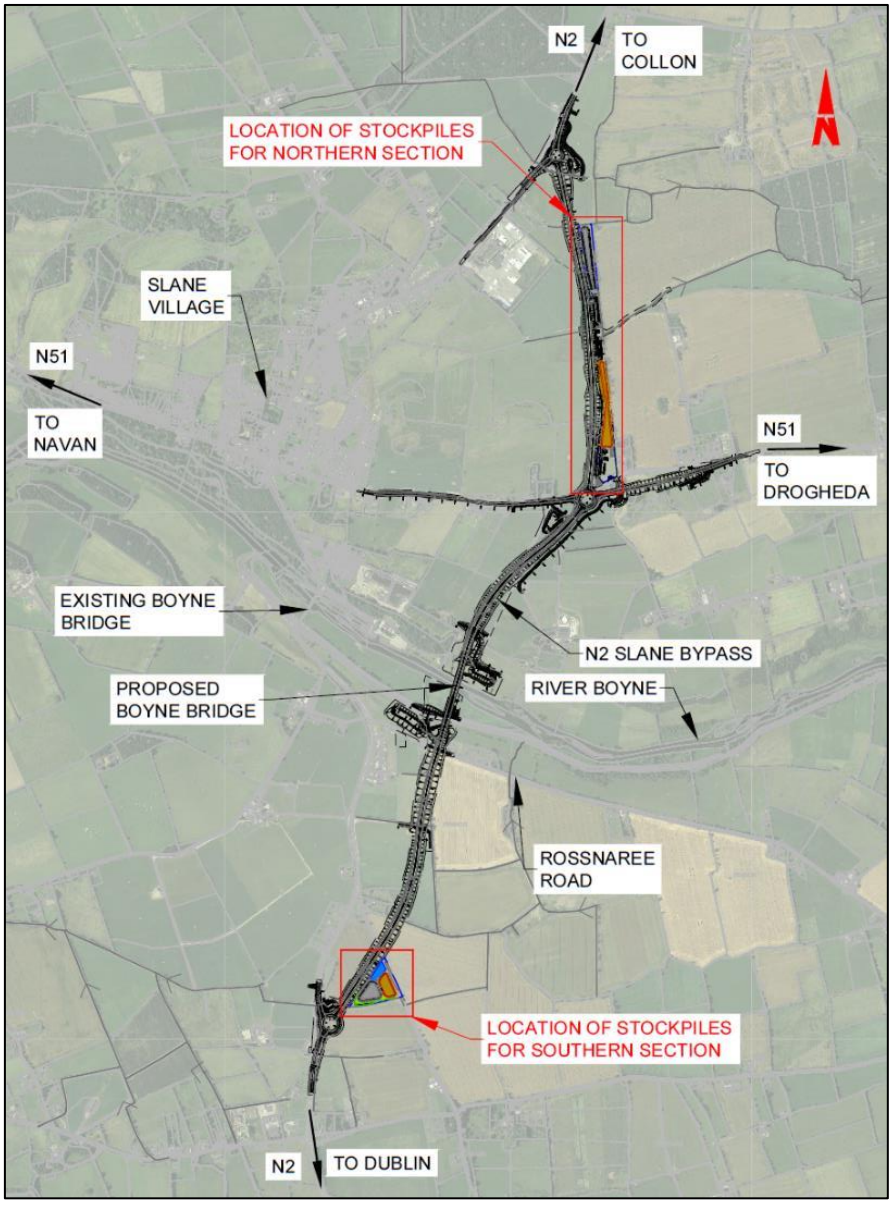


**Figure 5.9: Proposed Temporary Stockpile Locations**

Both proposed sites have been chosen for their remoteness from the River Boyne and suitability in terms of ease of access and proximity to the public road. The proposed locations are described as follows:

- **Southern Section of Scheme:** Approximately 1.69 ha of severed land to the east of the bypass mainline between Ch. 50 to Ch. 300 to be used for storage of stockpiled material. An existing mound will be removed and the area appropriately regraded prior to use during the construction.
- **Northern Section of Scheme:** Stockpiled material to be located within lands to the east of the bypass mainline between Ch. 2400 to Ch. 2725 north of the proposed site compound. A further stockpile area of approximately 1 ha to the east of the bypass mainline between Ch. 2975 to Ch. 3250 to be temporarily acquired for storage of stockpiled material.

The following constraints will apply to temporary stockpiles:

- Topsoil stockpiles will not exceed 2 m in height (as per Clause 602.11 of TII Specification for Road Works) and will have 1V:2H side slopes; and
- Rock stockpiles will not exceed 5 metres in height and will have 1V:2H side slopes.

Taking account of the above, an estimate of the available storage volume within each proposed site was carried out. **Table 5-3** below summarises the estimated storage volumes.

**Table 5-3: Estimated Material Storage Volumes Available**

| Section of Scheme | Volume of Material ($m^3$) | | Note |
|---|---|---|---|
| | Topsoil Stockpile | Rock Stockpile | |
| **Southern Section** | 5,990 | 19,120 | Topsoil and rock stockpiles located within additional lands to be temporarily acquired for storage of material. |
| **Northern Section** | 12,020 | 21,850 | Topsoil stockpile located within combination of lands temporarily acquired for main site compound and lands permanently acquired for scheme.<br>Rock stockpile located within additional lands to be temporarily acquired for storage of material. |
| **Total** | **18,010** | **40,970** | |

It is assessed that there is adequate capacity within the proposed lands to store the required volume of topsoil material for both the northern and southern sections of the scheme and that there is adequate capacity for the volume of unprocessed / processed rock that would need to be stockpiled at any time during the construction programme. **Figure 5.10** and **Figure 5.11** illustrate indicative layouts for the southern and northern stockpiles.

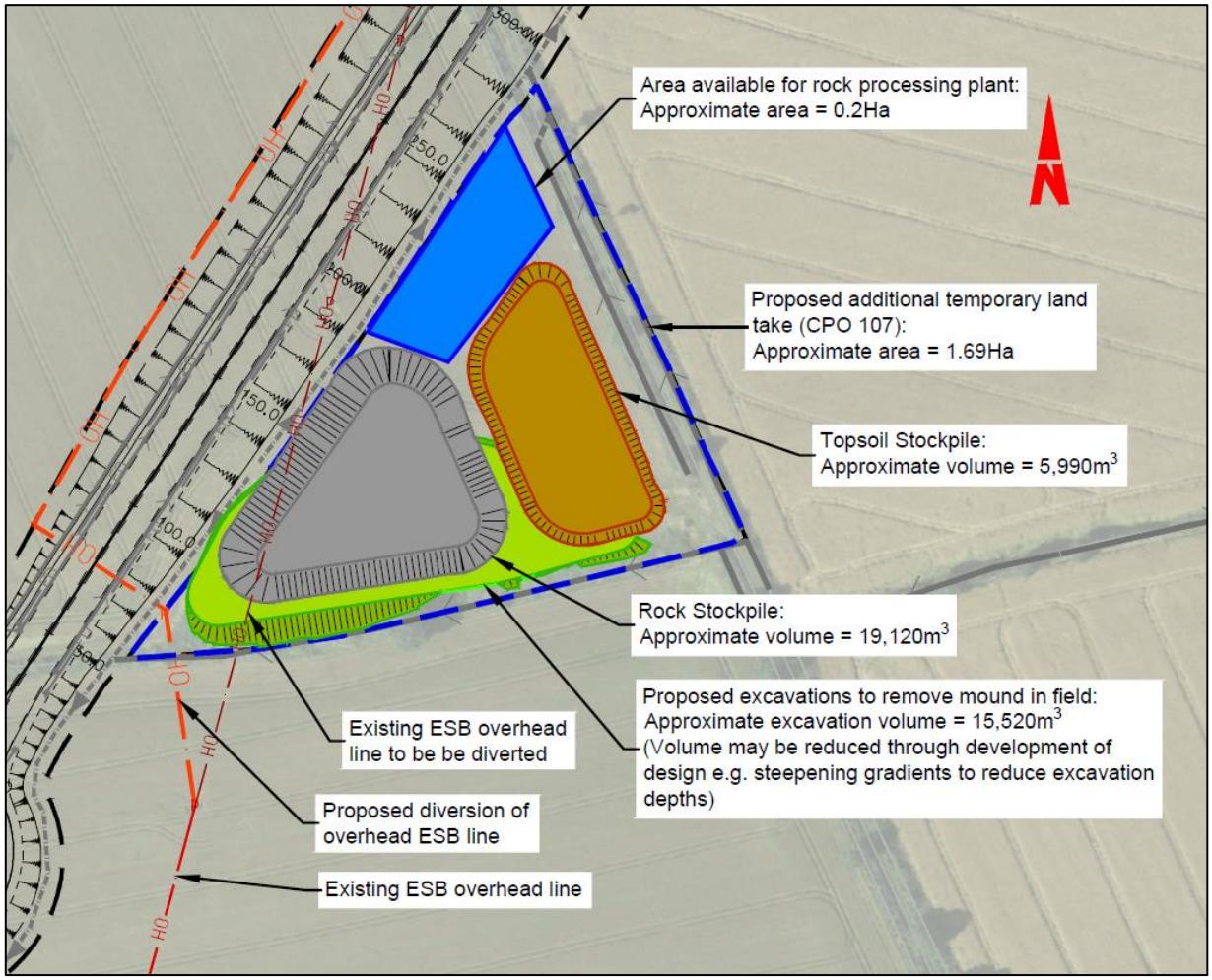


**Figure 5.10: Indicative Layout of Stockpile Area at Southern End of the Proposed Scheme**

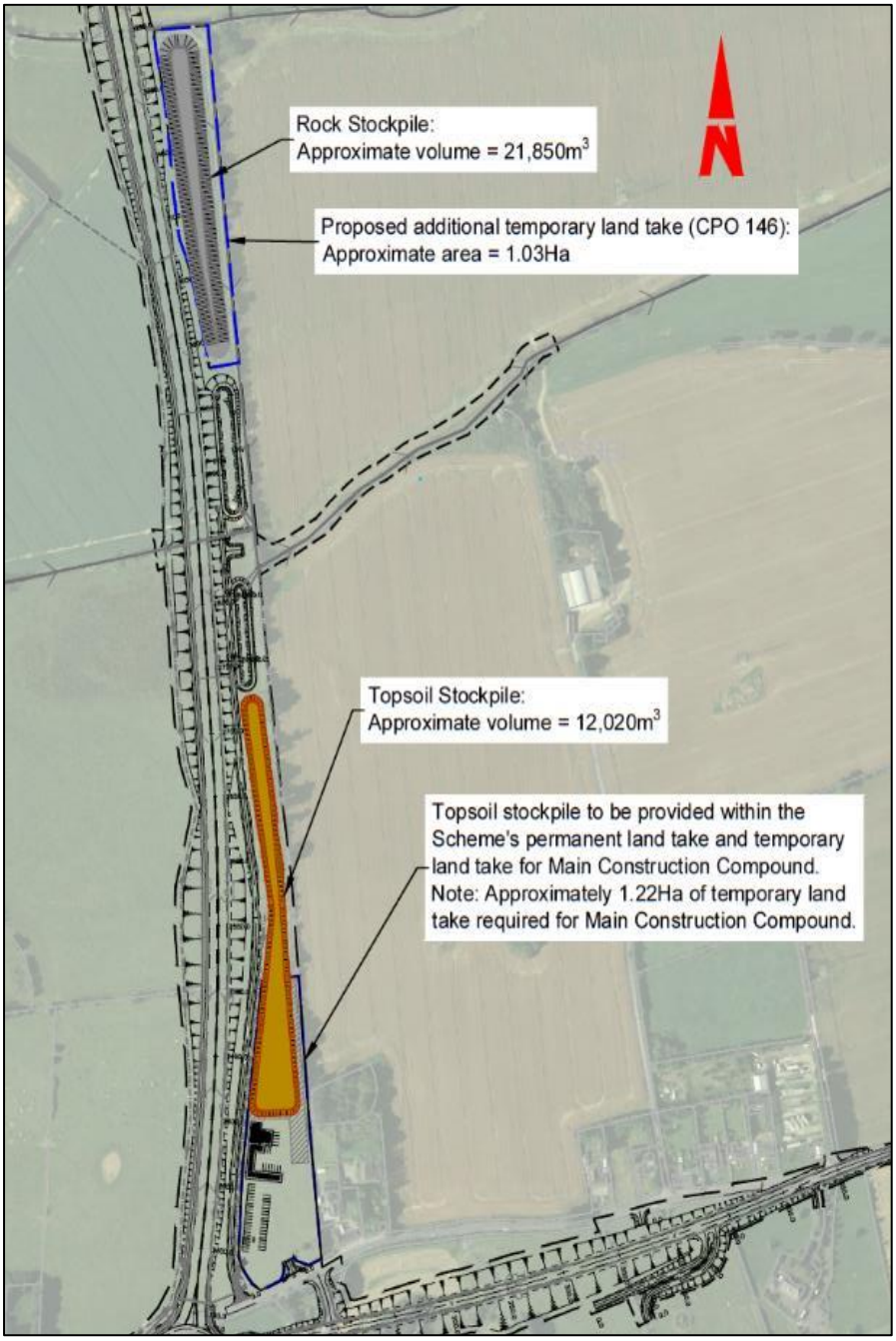


**Figure 5.11: Indicative Layout of Stockpile Area at Northern End of the Proposed Scheme**

### 5.4.5.3 Material Haulage

A large quantity of earthworks material will require to be removed from the site and transported to a licensed facility for reuse. In total, some 520,000 $m^3$ is expected to be removed from the site. It is intended that this material will leave the site directly upon excavation to the appropriate deposition area off-site. For further details, refer to **Section 5.5.2** (Construction Traffic Impact) below as well as **Chapter 23 – Material Assets: Resource and Waste Management**.

## 5.4.6 River Boyne Bridge

### 5.4.6.1 General Description

The River Boyne Bridge is required to carry the proposed N2 Slane Bypass primary route over the River Boyne, the River Boyne and River Blackwater Special Area of Conservation (SAC) and Special Area of Protection (SPA), and the Boyne Canal and associated towpath.

The structure comprises a four-span weathering steel plate girder bridge made composite with a reinforced concrete deck slab. The span arrangement of 53 m, 75 m, 77 m and 53 m gives a total bridge length of 258 m. The substructure consists of cast in-situ reinforced concrete columns and abutment walls supported by bored pile capped foundations. Following construction of the reinforced concrete sub-structure, the girders will be lifted into position in braced pairs by a large mobile crane operating within the Boyne Valley and one operating on the north side of the river, with approximate jib lengths of 60 m and 80 m respectively.

To construct the River Boyne bridge, it will be necessary to construct considerable temporary works. These include temporary access roads and temporary working platforms to support the plant necessary to carry out the construction. Construction of these works within the boundary of the SAC will be necessary and is unavoidable.

**Section 5.12.10 Construction of River Boyne Bridge** below describes the construction approach in more detail.

### 5.4.6.2 Piers & Abutments

Three piers and two abutments are required for the proposed bridge. Due to the extreme environmental sensitivity of the River Boyne, no works will be permitted within the river. Additionally, a further exclusion zone and set-back of 10 m from the riverbank is included in the design proposals to accommodate ecological sensitivities including free movement of otter. No work will be permitted within this exclusion zone.

## 5.4.7 Other Structures

### 5.4.7.1 Summary of Other Structures on the Scheme

Other than the proposed River Boyne bridge four principal structures are located on the proposed N2 Slane Bypass Scheme as follows:

- ST02 – Shared Use Cycle & Pedestrian Bridge adjacent to the mainline at Ch. 1220;
- ST03 – Accommodation Overbridge (Overbridge 1) at Ch. 800;
- ST04 – Rosnaree Overbridge (Overbridge 2) at Ch. 1100; and
- ST05 – Accommodation Overbridge (Overbridge 3) at Ch. 1575.

### 5.4.7.2 Shared Use Cycle and Pedestrian Bridge

The Shared Use Cycle and Pedestrian Bridge (ST02) is required to link the existing Boyne Canal towpath to the Shared Use Cycle and Pedestrian facility of the proposed N2 Slane Bypass. The bridge will span over the Boyne Canal and tie into the towpath.

The proposed new structure is a single span low profile steel arch with the deck supported directly from the arch via struts. The steel bridge will be fully assembled off-site, transported to the site and positioned into place by mobile crane following construction of the reinforced concrete sub-structure. Bored cast in-situ piles are required to provide adequate foundation for this bridge. Constraints associated with the construction of this bridge are discussed further in **Section 5.12.10.5.2.7** below.

### 5.4.7.3 Overbridges

The three overbridges on the scheme are required to carry two farm accommodation tracks and Local Road L16002 (Rosnaree Road) over the proposed N2 Slane Bypass primary route.

Each structure is a three-span integral bridge. The bridge decks are formed from precast prestressed concrete W-beams acting compositely with a cast in-situ reinforced concrete deck slab. The end supports will take the form of reinforced concrete bank-seats founded on reinforced concrete spread footings. The intermediate pier supports will take the form of reinforced concrete bearing shelves supported by two circular columns founded on reinforced concrete spread foundations.

#### 5.4.7.4 Minor Structures

Three culverts to provide crossing of an existing watercourse is required as per **Table 5-4** below. These structures are likely to be constructed as enabling works in advance of the main construction contract. Their construction will be carried out in consultation with NPWS and IFI. Construction will be carried out in compliance with IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters and TII (2015) Standard DN-DNG-03065 Road Drainage and the Water Environment.

**Table 5-4: Minor Structures – Culverts**

| Culvert Ref. | Watercourse | Location | Type | Approx. Length (m) | Approx. Width x Height (m) |
|---|---|---|---|---|---|
| **6A** | Mattock (Mooretown) Stream | North Roundabout – N2 South Link: Ch. 105 | Box Culvert | 41 | 2.4 x 2.4 |
| **6B** | Mattock (Mooretown) Stream | N2 Mainline: Ch. 3450 | Box Culvert | 56 | 1.8 x 1.5 |
| **6C** | Mattock (Mooretown) Stream | Access Track 6: Ch. 250 | Box Culvert | 10 | 1.8 x 1.5 |

### 5.4.8 Drainage

The drainage design for the scheme includes for both measures to mitigate any interference with the existing hydrology and to convey run-off from the proposed road to proposed treatment and attenuation facilities prior to outfall to existing watercourses. Drainage has been designed in compliance with TII (2015) Standard DN-DNG-03065 Road Drainage and the Water Environment.

The proposed road drainage system will incorporate a carriageway drainage system, together with a system of bridges and culverts to accommodate watercourses that intersect the scheme.

Where the proposed carriageway is not on an embankment, surface water run-off from the proposed carriageway, verges and cut slopes on the mainline will be collected by a network of grassed channels. These grassed channels will collect stormwater run-off from the mainline including the road, footpath and cycle path, as well as the run-off from the cut slopes where necessary. The channels discharge to a sealed pipe network at regular intervals to prevent water building up in the channels. The proposal includes a grassed channel on either side of the road carriageway, with another in the verge at the base of the cutting slope. The channel at the base of the slope and the roadside channel will drain into the same sealed carrier pipe network, located beneath the roadside grassed channel.

The grassed channels will help to promote the settlement of sediment as the water velocity is reduced and the vegetation itself helps to capture suspended particles and heavy metals. This reduced velocity also helps to attenuate the surface water flow in the channel, thereby increasing the time of concentration and reducing the peak discharge flow from the network.

On embankments, surface water run-off from the proposed carriageway will be collected by a system of carrier drains with concrete surface water channels.

To cater for groundwater, the proposed design includes an impermeable liner under the grassed channels, which is wrapped under the capping layer of the road. This aims to prevent contaminants from the road run-off entering the groundwater. Where required to control groundwater levels at an acceptable level, a separate filter drain system will be installed under the grass verge, to collect and convey groundwater to the nearest suitable discharge point i.e. a watercourse or drainage ditch. This filter drain will have access chambers located within the grass verge at required intervals.

Standard open vegetated ditches will act to intercept water from adjoining lands both at the top of cut slopes and at the toe of embankments. It is envisaged that ditches will be trapezoidal in shape, 1 m wide at the base with 1:1 side slopes.

#### 5.4.8.1 Outfalls

The majority of the scheme drains towards the River Boyne valley. Outfalls are proposed to the river and also to the existing Boyne canal navigation channel. Other outfalls are located at the northern end of the scheme, where other local watercourses are present. These other local watercourses confluence with the Delvin stream, which eventually outfalls to the River Boyne. Drawing series **MDT0806-RPS-01-N2-DR-C-DR1003-DR1004** illustrate the locations and plans for each of the outfalls.

As noted above in **Section 5.4.6.2**, under normal-flow conditions there are no in-stream works permitted. The scour protection to the outfalls will run up to the riverbank edge, however this scour protection comprises geotextile mats which are pinned to the ground surface between the outfall and the riverbank, with the area revegetating over time.

#### 5.4.8.2 Attenuation

To assist with the proposed treatment of surface water run-off and to provide measures to reduce peak water flows to outfalls, six attenuation ponds together with vortex grit separators and petrol interceptors are proposed as part of the Proposed Scheme. The attenuation pond capacity is designed to accommodate the 1% AEP event plus 20% allowance for climate change.

The drainage layouts are illustrated on drawing series **MDT0806-RPS-01-N2-DR-C-DR0000-DR0008**, the typical mainline drainage cross-section is shown on drawing **MDT0806-RPS-01-N2-DR-C-DR1001**, and the typical details for an attenuation pond are illustrated on drawing **MDT0806-RPS-01-N2-DR-C-DR1002**; refer to **Volume 3**, **Technical Drawings**.

#### 5.4.8.3 Phase 1 Drainage Works

Phase 1 will be constructed initially. Phase 1 includes the construction and seeding of all permanent pre-earthworks ditches (PED) and attenuation ponds and the construction of all culverts.

Attenuation ponds will be utilised to provide facilities for settlement of sediment from site run-off prior to discharge to any watercourse during construction. Channelling and treatment of site run-off during construction will be necessary to ensure no untreated or uncontrolled discharges to watercourses takes place. The permanent attenuation ponds will be utilised as a key part of this treatment process.

Interceptor ditches and culverts will be constructed prior to earthworks construction to prevent overland run-off encroaching on to adjacent lands and divert existing land drainage away from proposed earthworks.

Culvert construction and associated channel diversion works on the Mattock (Mooretown) Stream will be included in the Phase 1 Drainage Works.

#### 5.4.8.4 Phase 2 Drainage Works

Phase 2 of the proposed drainage works consists of the construction of the run-off collection systems for the project. This work will take place in order, following earthworks operations.

### 5.4.9 Road Works

In total, the Proposed Scheme includes for some 100,000 $m^2$ of road paving.

### 5.4.10 Public Realm Enhancement in Slane

#### 5.4.10.1 General

The scheme includes for the construction of traffic management measures and public realm enhancement works within Slane village. The proposed works in Slane comprise predominantly on-street works in addition to the construction of the proposed off-street carpark and cycle/pedestrian link.

The proposed public realm enhancement works will take place after the proposed N2 Slane bypass is constructed and is open to traffic. Therefore, this work will be undertaken as a separate construction contract after the bypass has been completed.

This section considers the constructability of the proposed works and also the general traffic management provisions that will be needed to construct the works safely and with minimum disruption to both road users and residents.

To construct the proposed works, it is envisaged that temporary traffic management measures including the operation of stop/go one-way shuttles will be utilised. Some night-time works are expected to be required intermittently over the construction period, albeit it of a temporary and short-term nature. Also, there will be short-term road closures during the works for critical activities, such as pavement rehabilitation. All traffic management plans will be subject to the approval of Meath County Council.

The nature of the proposed works is such that they will be carried by relatively small work teams, specialist craftsmen and supervisors. Typically, the plant utilised will be suitable for small congested urban sites. Site compounds will not be required and welfare facilities will be provided using small mobile units.

Activities will include the removal or existing road pavement and footpaths, utility diversion, installation of new road pavements and footpaths, and construction of an off-street car park. Equipment includes excavators, dumpers, planners, rollers and pavers.

Works will include road planning and paving. Road planning will be limited, where possible to a period from 19:00 – 22:00 hrs and road paving will occur primarily during night-time periods.

Access to the works will be from the existing N2 and N51.

Construction noise and vibration will be subject to the limitations described in **Chapter 9**.

### 5.4.10.2 Works on the Existing N2

With the bypass and HGV bans in place, the traffic utilising the existing N2 is expected to reduce very significantly. This will allow the proposed works on the existing N2 in Slane be constructed with less disruption. However, local residents and local businesses will nonetheless be affected in the short term.

The proposed works on the existing N2 in Slane generally consist of carriageway narrowing, rearrangement of kerbing, footway construction and resurfacing. Undergrounding of utilities, installation of new public lighting, removal of overhead gantries, and some drainage works are also included.

It is envisaged that the majority of the proposed works on the existing N2 will be constructed under stop/go shuttle working with some night working with temporary short-term road closures are also envisaged for critical works. These critical works are likely to include the undergrounding of utilities crossing the existing road, mainline planning and resurfacing, removal of existing gantries and works on the existing Boyne bridge. Local traffic diversions, likely utilising the bypass route, will be in place to facilitate road closures.

The implementation of temporary traffic management measures, including any proposed road closures and night-time working will be notified in advance to the general public and affected residents and businesses. Local access will be maintained during the works, albeit via diversionary routes for some locations.

### 5.4.10.3 Works on the N51

When the bypass is built, there is expected to be an increase in traffic utilising the N51 between the village and the bypass. Therefore, the proposed works on the N51 will need particular careful planning and implementation of temporary traffic management measures to be constructed safely and with minimal disruption. As for the existing N2, there will be some disruption to local residents and businesses during the works.

The proposed works mainly comprise the installation of new kerbs, footway paving and road planning and resurfacing. Undergrounding of utilities, installation of new public lighting, and some drainage works are also included.

It is assessed that the existing N51 through the village is sufficiently wide to accommodate one-way shuttle systems to facilitate new kerb and footway construction. During the daytime and in order to minimise disruption to the travelling public, it is envisaged that only one shuttle system will operate at any one time on the N51.

Night-time full road closures will be required for short durations to facilitate pavement works and re-construction of the junction arrangement at The Square and likely some service diversion works. Local access will be maintained during road closures and diversions will be in place. It is envisaged that the L5606 would be utilised for short-term road closures of the N51 on the East side of Slane. Local roads via the R163 and L5603 would be utilised to facilitate short-term road closures on the N51 on the west side of the village.

#### 5.4.10.4 Off-line Works

Off-road works will be required to construct the proposed carpark off the N51 on the east side of the village and the proposed pedestrian /cyclist link from the carpark to the existing N2. Access to this site will be from the existing N51. Temporary traffic management measures will be required to manage site traffic access to and from the N51.

Works for the car-park and link will be carried out during normal working hours.

## 5.5 Traffic Impact During Construction

### 5.5.1 Traffic Management During Construction

A Construction Traffic Management Plan (CTMP) will be prepared by the appointed Contractor(s) to deliver the traffic and transport related mitigation measures included in this EIAR.

The plan shall incorporate and elaborate on site specific delivery of the stated mitigation measures in the following section and shall address temporary disruption to traffic signals, footpath access, management of pedestrian crossing points at the time of construction, provision of appropriate temporary signage to direct road users to alternative routes / car parking arrangements etc.

The CTMP will detail the implementation of the following mitigation measures from the EIAR to ensure disruption to economic amenities and residential properties is minimised and access is maintained along haulage routes and in vicinity of the construction site(s) for vehicles, pedestrians, cyclists, and economic operators at all times.

These measures shall be implemented by the appointed contractor as part of a Construction Traffic Management Plan (CTMP):

**N2:** A reduction in speed limit and appropriate warning signage will be required on the approaches to Access Points 1 and 6 as listed above. The design of N2 South and North roundabouts allows for offline construction; however, temporary traffic management will be needed for construction of the links to the existing road.

**N51:** A reduction in speed limit and appropriate warning signage will be required on the approaches to Access Points 4 and 5. The design of N51 roundabout allows for offline construction, however, temporary traffic management will be needed for construction of the links to the existing road.

The proposed works on the N51 link between the bypass and Slane village entails on-line improvement works. The majority of this work will be completed under temporary traffic management arrangements whereby the road will be maintained open, albeit with single way shuttle systems at varying locations to enable the construction works to be completed in a safe manner. During these temporary traffic management phases, the road will remain open to traffic. However, some works, such as pavement construction may be carried out under a temporary road closure. It is envisaged these closures will be at night and alternative routes will be made available to accommodate travellers. Closures of the N51 will likely be short-term. Abnormal loads are likely to deliver large plant (cranes) and bridge girders for works to be done on the north side of the River Boyne. These abnormal loads will be routed via the M1 and N51 for access to the site and will be subject to statutory process and management in accordance with the Road Traffic Regulations (S.I. No. 190 of 1963) as amended.

**Rossnaree Road L16002:** The section of Rossnaree Road between the N2 and Access Points 2 and 3 is a critical site construction route. The existing road is narrow and a manned traffic controlled one-way system is proposed along the 245m length of existing road in order to manage and cater for the anticipated construction stage traffic demand. As Access Point 3 facilitates construction of the River Boyne bridge, abnormal loads are likely to deliver large plant (cranes) and bridge girders. Abnormal loads will be subject to statutory process and management.

Temporary closure of the Rossnaree Road will be necessary late in the construction programme to facilitate the construction of the mainline in the area and also the proposed Rossnaree Road overbridge. The closure is expected to last for a period of eight to nine months. Diversions via McGruder's Cross will be in place in order to maintain local access during this temporary closure.

Abnormal loads are likely to deliver large plant (cranes) and bridge girders for works to be done on the south side of the River Boyne. These abnormal loads will be routed to the site access on Rossnaree Road via the N2 and will be subject to statutory process and management in accordance with the Road Traffic Regulations (S.I. No. 190 of 1963) as amended.

**Slane village:** The proposed public realm works within Slane village involve considerable works to reconfigure existing roads and footways. All works in the village can only take place after the proposed bypass is operational and traffic volumes will have reduced through the village. The works will be constructed with temporary traffic management arrangements in place. Works areas will be isolated using one-way shuttle systems for the most part during the construction. However, temporary road closures are also anticipated to facilitate critical works. These road closures are likely to be at night and local diversions will be in place.

All temporary traffic management plans will be prepared in accordance with the Traffic Signs Manual and will be subject to detailed review by Meath County Council. Local access will be maintained during periods when traffic management measures, including any road closures are in place. Meath County Council procedures concerning public notice and consultation with affected property owners will apply in relation to all temporary traffic management plans.

A Project Supervisor Construction Stage (PSCS) will be appointed by MCC to manage and coordinate health and safety, including traffic management.

## 5.5.2 Construction Traffic Impact

### 5.5.2.1 General

During the construction phase, there will be a need to generate additional traffic trips to enable site staff and plant/materials access to and from the construction site. This will temporarily increase traffic in the locality of Slane. Traffic generation during construction will typically come from differing sources, summarised as:

- **Heavy Goods Vehicles (HGVs):**
  - Plant/Materials being delivered to/from the site
  - Material disposal, i.e., soil & stone as a result of earthworks
  - Abnormal Loads
- **Passenger Cars (PCs):**
  - Site Workers
  - Supervision staff
  - Site visitors

As traffic generation will vary significantly across the construction period (low in the beginning and the end of the Proposed Scheme, high in the middle), it is important to not only calculate construction traffic volumes but also to consider the construction programme as to the likely time when these trips will be generated. It is also important to consider the likely origin/destinations of the construction related trips. The construction stage traffic impact assessment will give consideration as to the likely impact this traffic will have on the road network and associated towns and villages.

### 5.5.2.2 Construction Traffic Generation

HGV traffic will be generated in the delivery of construction materials to the site and the removal of surplus excavated materials from same. This will vary throughout the construction period, depending on the particular construction activities underway at any given time. Construction activities which are likely to generate the higher volumes of HGVs delivering materials include activities to construct the various structures, drainage and pavement.

As noted, the scheme generates a significant surplus of earthworks materials, circa 520,000m$^3$. Ground investigation, sampling and testing has indicated this material will be inert and suitable for reuse as a construction fill material. For the purposes of this traffic impact assessment, it is assumed that the material will be transported to licensed facilities with by-product notifications being used in accordance with Article 27 of the EC Waste Directive Regulations 2011. These notifications allow the opportunity for the soil and stone generated by the scheme to be reused by other construction activities.

A detailed assessment of potential facilities that may be used has been prepared in **Chapter 23 – Material Assets: Resource and Waste Management**. In order to identify the licensed facilities most suitable for receipt of the material arising from the construction site, an exercise of screening was carried out. Factors considered include material type suitability, location suitability, and licensed annual facility intake (m$^3$).

Soil recovery facilities (SRFs), located in reasonable proximity to the site with significant licensed annual intake limits and with primary access routes available from the national road network are the most likely facilities to cater for the surplus material.

Once the facilities that are suitable for waste disposal have been chosen, the routing from northern and southern areas of the Slane Bypass to the facility can be determined so they can be assigned to the national transport network. The preference is to keep HGVs out of towns/villages, and onto national roadway systems. Initially, eight potential facilities were short-listed as set out in **Table 5-5** and illustrated in **Figure 5.12**.

**Table 5-5: Shortlist of EPA Licensed Facilities in the Meath/Fingal Area**

| Facility Name / Licensee | Licence No. | Status | Location | Annual Authorised Intake / Total Capacity (t) |
|---|---|---|---|---|
| Clashford Recovery (Clashford Recovery Limited) | W0265-01 | Licensed | Meath | Annual: 190,000 t<br>Total: 2,618,000 t |
| Kiernan Sand & Gravel (Kiernan Sand & Gravel Ltd.) | W0262-01 | Licensed | Meath | Annual: 187,400 t<br>Total:1,105,500 t |
| Mullaghcrone [Donore] Quarry (Roadstone) | W0278-01 | Licensed | Meath | Annual: 100,000 t<br>Total: 1,800,000 t |
| Murphy Concrete Manufacturing Limited | W0151-01 | Licenced | Meath | Annual: 750,000 t<br>Total: 3,800,000 t |
| Kilsaran Concrete Unlimited Company | W0296-01 | Licenced | Meath | Annual: 400,000 t<br>Total: *Unknown* |
| GLV Bay Lane | W0301-01 | Applied | Fingal | Annual: 532,833 t<br>Total: 1,332,084 t |
| Huntstown Inert Waste Recovery Facility (Roadstone Ltd.) | W0277-03 | Licensed | Fingal | Annual: 1,595,000 t<br>Total: 9,450,000 t |
| IMS Hollywood (Integrated Materials Solutions Limited Partnership) | W0129-02 | Licensed | Fingal | Annual: 500,000 t<br>Total: *Unknown* |


**Figure 5.12: Location of Shortlisted Facilities (Circled)**

Facilities licensed as landfills appear less likely to engage in material recycling and so are least favoured, i.e. IMS Hollywood (Integrated Materials Solutions Limited Partnership) and Murphy Concrete Manufacturing Limited and so would be least favoured. At the time of this assessment, it is not known if GLV Bay Ltd would be successful in their license application and so were ruled out of further consideration in this assessment. However, if successful in their license application at the actual time of construction, this may be a suitable sized facility, mostly accessible via the M1.

Consideration is given to the locations of the construction site where the bulk of the surplus material will be generated i.e. on the southern section of the scheme (route will be onto the Rossnaree Road and N2) and to a lesser extent the section between the River Boyne and the N51 (route will be onto the N51 and M1). Routes to Kilsaran and Kiernan Sand and gravel are considered significantly less suitable as there would be a need to travel through Slane village and/or use considerable lengths of the local/regional road network.

Taking the above into account, the most likely facilities suitable for receipt of the materials arising are Huntstown Inert Waste Recovery Facility (Roadstone Ltd.) and to a much lesser extent, Mullaghcrone [Donore] Quarry (Roadstone). The main advantage of Mullaghcrone is its proximity to the construction site, though it is limited by its annual authorised intake and the adverse environmental impact of transporting HGVs through the village of Donore. Huntstown is accessible from the N2 and has a significantly higher annual authorised intake, albeit the facility is approximately 40 km from the site.

A certain number of vehicles carrying abnormal loads are also expected. This will be specifically related to the River Boyne bridge construction, where transport of the large cranes to lift the bridge steel girders in place and transport of the bridge girders themselves are anticipated to be abnormal loads. These trips will be

required to access both the north and south side of the River Boyne. The transport of abnormal loads will be subject to the statutory processes associated with the transport of such loads in Ireland. Typically, such loads are carried by night under garda escort and the routes to from the site will be national primary roads insofar as possible.

Car trips will be generated throughout the construction period. The peak daily worker numbers engaged on the site is likely to be when the higher labour-intensive work is being undertaken simultaneously e.g. bridge deck construction, drainage construction, footway construction.

Car trips generated by management and supervisory staff will occur throughout the construction period. These will typically be employment related trips to and from work. These trips will be to the two proposed site compounds. An amount of visitor trips to and from the site compounds can also be expected.

### 5.5.2.3 Assessment of Construction Related Traffic Volumes

#### 5.5.2.3.1 HGV Trip Generation

Taking account of the likely construction programme, described in **Section 5.14** below, the quantity of materials required to construct the Proposed Scheme and the quantity of surplus earthworks material to be removed from the site, the number of daily HGV trips can be calculated and spread across the construction programme.

The locations on the site where these trips are generated to and from on the site can also be taken into consideration in this exercise. For this purpose, the site is considered to be characterised in four separate areas: works from N51 to River Boyne, works from N51 to N2 North Tie-in, River Boyne Bridge and works to South of the River Boyne. Considering the four areas of the site outlined above, the respective indicative earthworks surpluses are indicated as follows:

- **N51 to N2 North** – Material balance between excavation and fill;
- **N51 to River Boyne** – Two periods of earthworks:
  - Section F – 7 months, 160,000 $m^3$ to be disposed of;
  - Section E – 2 months, 2,500 $m^3$ to be disposed of; and
  - River Boyne Bridge – minimal surplus earthworks.
- **South of River Boyne** – Two periods of earthworks:
  - Section A – 10 months, 243,000 $m^3$ to be disposed of; and
  - Section C – 4 months, 70,000 $m^3$ to be disposed of.

The description above represents the majority of the bulk earthworks material to be removed from the site. The remaining proportion is spread (circa 45,000 $m^3$), is associated with elements such as attenuation pond, access roads and is sufficiently spread across the construction period to not have an influence on the identification of the peak period for HGV movements.

Each earthworks section is assigned a respective recycling facility, note the annual capacity of Mullaghcrone is 66,667 $m^3$, and Huntstown is 1,063,333 $m^3$. The assumptions are outlined as follows:

- Section F (between the River Boyne and the N51) – 100,000 $m^3$ transported to Huntstown (F2) over 7 months, 60,0000 $m^3$ transported to Mullaghcrone (F1) over 7 months;
- Section E (between the River Boyne and the N51) – All 2,500 $m^3$ transported to Mullaghcrone over 2 months;
- Section A (south of the River Boyne) – All 243,000 $m^3$ transported to Huntstown over 10 months; and
- Section C (south of the River Boyne) – All 70,000 $m^3$ transported to Huntstown over 4 months.

It is reasonable to propose that 13% of the material surplus goes to Mullaghcrone (62,500 $m^3$), and the rest goes to Huntstown (413,000 $m^3$).

Considering the removal of surplus earthworks material quantities, the construction programme and the areas of the site where the surplus is generated and the most likely destination, it is possible to derive a profile of daily HGV trips to and from the site. **Figure 5.13** below illustrates the profile of HGV trips generated

through the construction programme to deliver surplus earthworks material to either Huntstown or Mullaghcrone.

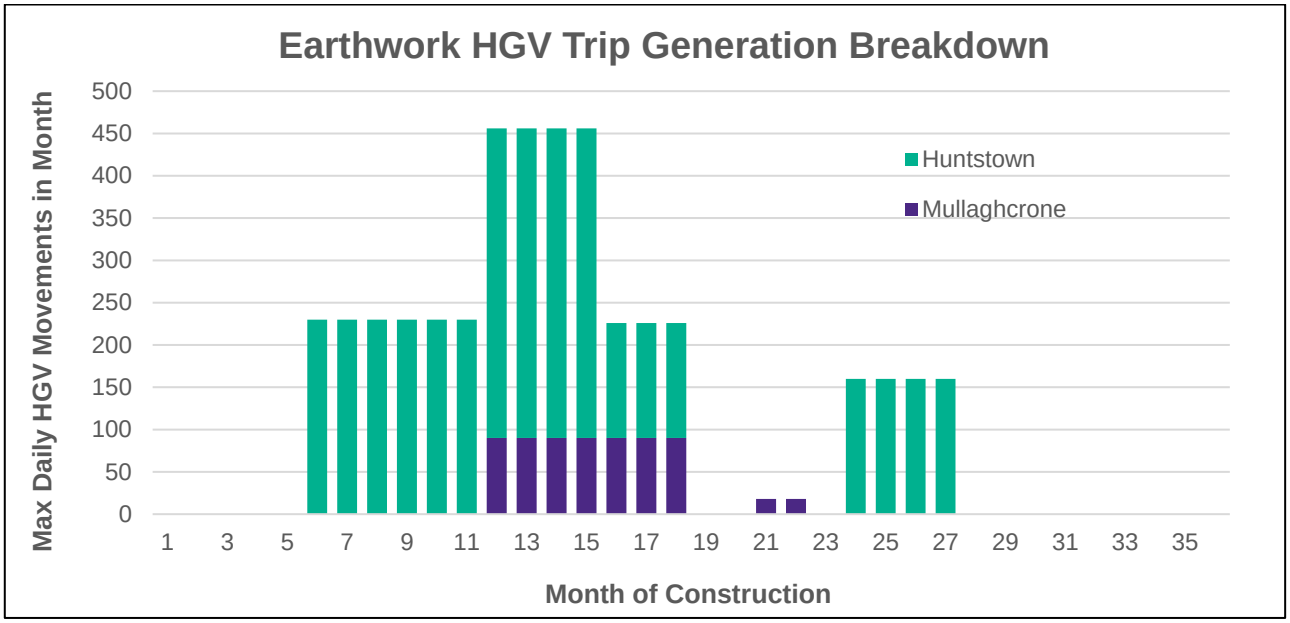


**Figure 5.13: Typical Daily Earthworks HGV Trips to/from Huntstown and Mullaghcrone**

Taking account of the quantities of materials required for the construction and the construction programme indicating when various activities are likely to be taking place, it is feasible to calculate typical daily HGV trips generated by materials brought to the site. Key material volumes considered include concrete, sub-base, base, binder course and surface course.

Taking account of the typical capacity of an HGV (20 t), HGV movements to transport materials to the site can be calculated and these are assigned to the relevant construction periods in the outline construction programme, taking account of where and when the activities are likely to take place.

**Figure 5.14** below is a representation of construction related HGV trips generated that do not include major earthwork activities.

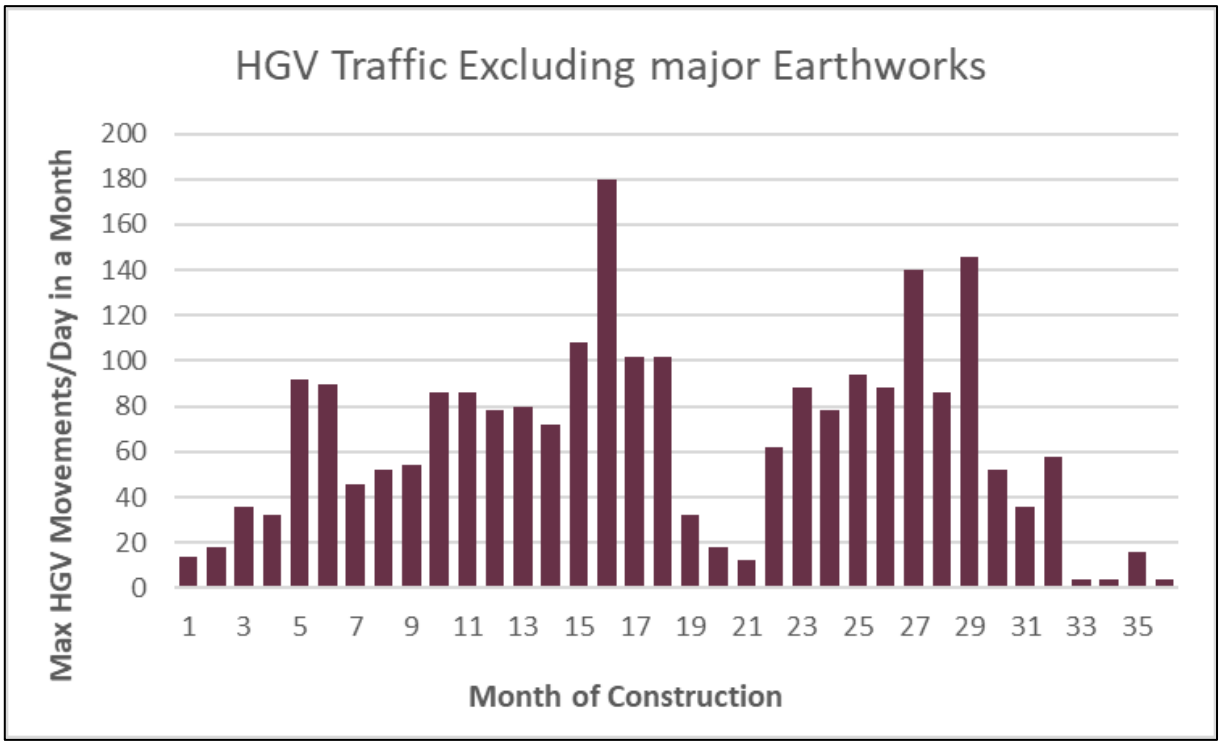


**Figure 5.14: Non-Earthwork HGV Construction Generated Traffic**

Note the non-earthworks HGV assessment includes for activities such as concrete deliveries for bridge reinforced concrete activities. These are not ongoing activities for each day of any given month. As a representation of a worst-case scenario, it is assumed that concrete activities will take place on that day.

Combining the assessments described above, the profile shown in **Figure 5.15** below shows the total HGV generation profile through the construction period. It is noted that the peak of daily HGV movement is predicted to be in month 15, with over 564 HGV movements in a day.

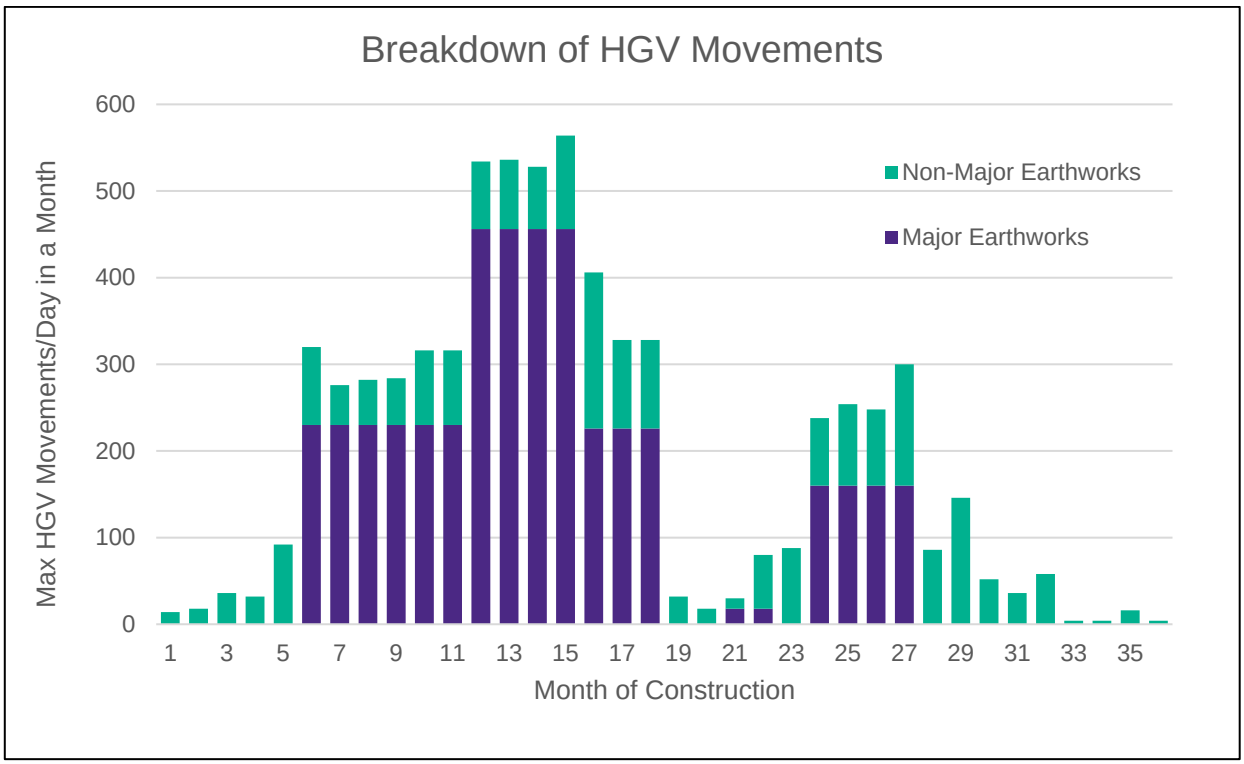


**Figure 5.15: Total Daily HGV Trip Profile**

### 5.5.2.3.2 Abnormal Loads

Albeit not coincident with the worst-case scenario identified for traffic impact assessment, abnormal loads are expected to be required to transport both the large lifting cranes and also the bridge girders to the site.

To carry out bridge girder lifting operations, a large mobile crane (1,200 t) will require to be situated on the temporary working platforms both north and south of the River Boyne. It is assumed that abnormal loads will be generated to bring the cranes to site and also to remove them upon completion of the works. Therefore, this will generate two abnormal loads to each side of the river.

The anticipated bridge construction process includes for sections of paired/braced girders to be lifted into place and bolted together in situ. The majority of this work will be done from the south side of the river where 5 sets of paired girders are to be lifted into place. Each set comprises of three paired girders. Given the scale and size of the paired girders it is assumed that each section will be an abnormal load when transported prefabricated to site. Thus 15 abnormal loads are anticipated to the south side of the river.

On the north side of the river, two sets of paired girders are expected to be erected, giving six sections of paired girders in total. Therefore, six abnormal loads are expected to access the north side of the river.

It is not possible at this stage of the Proposed Scheme to have certainty as to the location of the prefabrication facility from where each section of paired girders will start it journey but there are not likely to be many suitable facilities located on the island of Ireland. If suitable facilities are available in Ireland, journeys to Slane will be via the national road network. Alternatively, if the girders are prefabricated abroad, the most likely scenario is that they will be imported via Dublin Port as the most likely point of entry to the country.

From Dublin Port, there are designated national primary routes via the M50, including the Port Tunnel. Abnormal loads to the north side of the River Boyne would be expected to take the M50, M1 and N51 to gain access to the site. Abnormal loads destined for the south side of the river would be expected to route via the M50, M2/N2 and finally Rossnaree Road to access the site. Routes from any other part of the island if Ireland will use similar roads to access Slane.

Under Garda escort, it is anticipated that Rossnaree Road would be temporarily closed for a short period to allow the abnormal load access to the site. It is likely that pavement strengthening works will be necessary on the short section of Rossnaree Road from the N2 to ensure that the abnormal loads do not cause structural failure of the existing pavement. As it is the length of the loads which is likely to generate abnormal status, issues around the existing road width, damage to adjacent vegetation and turning circles are not likely to arise to a problematic extent.

### 5.5.2.3.3 Passenger Car Trip Generation

Passenger car generated trip as a result of construction will generally come from the following three sources:

- Construction workers and suppliers;
- Construction management and supervisory staff; and
- Visitors.

#### Construction Workers and Suppliers

It is estimated that between 150 and 200 people will be employed during the construction stage of the proposed scheme. However, not all will be working on the site, e.g. some will work at material suppliers and prefabrication facilities remote from the site.

The numbers of workers on the site will vary throughout the construction period as different elements of the works are carried out. For the purposes of this assessment a peak period when the more labour-intensive activities are underway is considered. The likely peak in site workers will be when drainage works, concrete footway works, and River Boyne bridge deck construction are underway at the same time. It this regard the peak in workers is likely to comprise of:

- Southern Section (N2 south to river Boyne):
  - 2 No. Drainage gangs – 10 workers to/from access from N2 south;
  - 1 No. concrete pavement gang – 5 workers to/from access from N2 south;

  - 15 No. others, machine drivers, other workers to/from access from N2 south; and
  - 20 No. River Boyne bridge construction workers to/from the Rossnaree Road.
- Middle and Northern Section:
  - 2 No. Drainage gangs – 10 workers to/from access from N51;
  - 1 No. concrete pavement gang – 5 workers to/from access from N51; and
  - 15 No. others, machine drivers, other workers to/from access from N51.

As a worst-case scenario, it is assumed each worker travels to/from work in their own vehicle and parks at temporary parking areas provided near their point of access to the site; all such car parking will be accommodated within the lands made available. The provision of temporary car parking areas will be managed by the main contractor, to suit his methods of work. The temporary car parks will typically be constructed as stone finished areas of ground and will be transitory in nature. They will be relocated from time to time as the works progress.

Therefore, in this worst-case scenario the following trips will be generated:

- 60 daily trips are made to/from the N2 south;
- 40 daily trips are made to/from Rossnaree Road; and
- 60 daily trips are made to/from the N51.

### Construction Management and Supervisory Staff

A typical project like the Proposed Scheme will require management and supervisory staff to be full-time employed on the site. These staff will be based at the site compounds. For the purposes of assessment, it is assumed that there will be eight full-time supervisors employed by Meath County Council based on the site, five are based at the Main Site Compound and three are based at the Satellite Site Compound. Correspondingly, it is assumed that the Contractor will typically have:

- 12 No. management and supervisory staff based at the Main Compound; and
- 10 No. management and supervisory staff based at the Satellite Site Compound.

Each employee will generate work trips to/from the compounds each day, 17 AM trips and 17 PM trips to/from the main site compound and similarly 13 AM and 13 PM trips at the Satellite Site Compound. It may be assumed that some staff will make further trips to/from the compound during any given day.

For the purposes of this assessment, it is assessed that a total of 50 supervisory and management related daily car trips will be generated at the Main Compound and a total of 40 similar trips at the Satellite Site Compound.

### Visitors

Visitors to/from the site will vary throughout the construction period. They will typically park at either of the two site compounds. As a representation of a potential peak and worst case scenario and for the purposes of this assessment, it is assumed that ten visitors access the Main Compound and ten access the Satellite Site Compound during a typical one-day period.

## 5.5.2.4 Construction Traffic Distribution

### 5.5.2.4.1 Non-earthworks HGVs and car passenger traffic

At this stage of the scheme, it is not possible to know precisely where staff and workers originate before their trips to site. Neither is it possible to state with any certainty where materials will be sourced and hence their origin for transport to site.

However, Slane is centrally located in the North-East section of the country and so it is reasonable to assume, traffic will generate proportionally around the site. Therefore, for the purposes of traffic impact assessment it is assumed that:

- 35% of trips originate from South of Slane;

- 35% of trips originate from North of Slane;
- 20% of trips originate from West of Slane; and
- 10% of trips originate from East of Slane.

#### 5.5.2.4.2 Surplus Earthworks Removal

As outlined above, the surplus earthworks removal HGV distribution will be to Huntstown Inert Waste Recovery Facility (Roadstone Ltd.) and to a much lesser extent, Mullaghcrone [Donore] Quarry (Roadstone).

### 5.5.2.5 Traffic Impact Worst Case Scenario

To represent a worst case scenario for the purposes of construction stage traffic impact assessment, the following is assumed:

- Predicted daily HGV traffic movements from month 15 of the construction programme; and
- Peak passenger car movements ('PC trips') as described above.

In this scenario, a total of 564 daily HGV movements and 270 passenger car movements are considered as described in **Table 5-6** below.

**Table 5-6: Matrix for Month 15 – Worst Case Construction Daily Traffic Impact Scenario**

| Month 15 Worst Case Assignment | | | | | |
|---|---|---|---|---|---|
| | **Mullaghcrone (North)** | **Huntstown (South)** | **Huntstown (North)** | | **Total** |
| HGV Earthwork Movements | 90 | 230 | 136 | | 456 |
| | **North** | **South** | **East** | **West** | |
| HGV Non-Earthwork Movements | 38 | 38 | 11 | 22 | 108 |
| **Total HGVs** | | | | | **564** |
| | **Rossnaree** | **N2 South** | **N51** | | |
| PC Worker Movements | 90 | 60 | 120 | | 270 |

### 5.5.2.6 Worst Case Traffic Assignment to Road Network

As noted in **Section 5.4.2**, all construction traffic routes to and from the site will be via the national road network plus the short section of Rossnaree Road from the N2. Construction traffic will not be permitted to utilise the section of the Rossnaree Road located to the east of site access points 2 and 3.

#### 5.5.2.6.1 Assigning HGV Earthwork Trips to Preferred Recycling Facility

It shall be a specific contract requirement to ensure the use of the following haul routes and not to not permit access through the village; this will be policed by the MCC site supervision team.

#### Earthworks Traffic from South of River Boyne to Huntstown

Earthworks trips from the southern end of the scheme will use the N2 to access Huntstown. **Figure 5.16** indicates the most appropriate route. The journey is approximately 40.3 km with an approximate 34-minute one way journey time.

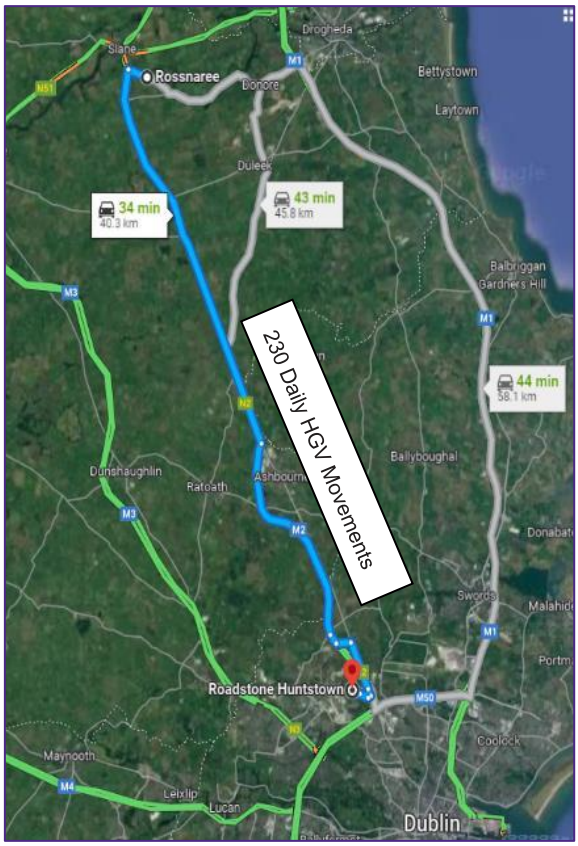


**Figure 5.16: Proposed Route – From Rossnaree Road to Huntstown**

## Earthworks traffic from North of River Boyne

It is important that construction traffic through Slane be minimised insofar as possible. Thus, for earthworks HGV traffic coming from the north side of the River Boyne it is proposed that this traffic will be directed to travel on the N51 and M1/M50 to access Huntstown Recycling facility. **Figure 5.17** indicates the proposed route, which is approximately 59.3 km with a one-way journey time of approximately 41 minutes.

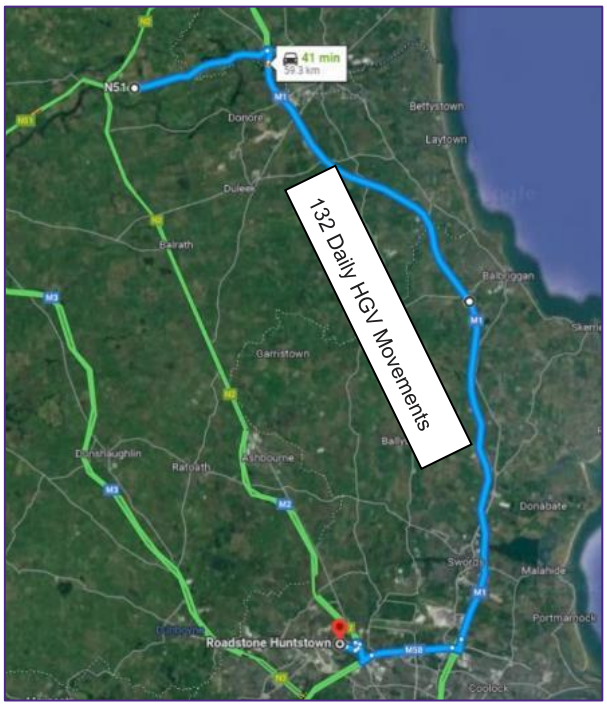


**Figure 5.17: Proposed Route – North of Scheme to Huntstown**

A lesser amount of surplus earthworks material will be transported from north of the River Boyne to Mullaghcrone. This lesser quantity is commensurate with the limited annual authorised intake at the recycling facility. This is included in the scheme as the route from the north of the river to Huntstown is onerous and limited utilisation of Mullaghcrone is a likely option to minimise the impact of the longer journey times to Huntstown.

The route from the north of the scheme towards Mullaghcrone is straightforward as indicated in **Figure 5.18** below. Approximate distance is 14 km with an approximate one-way journey time of 14 minutes.

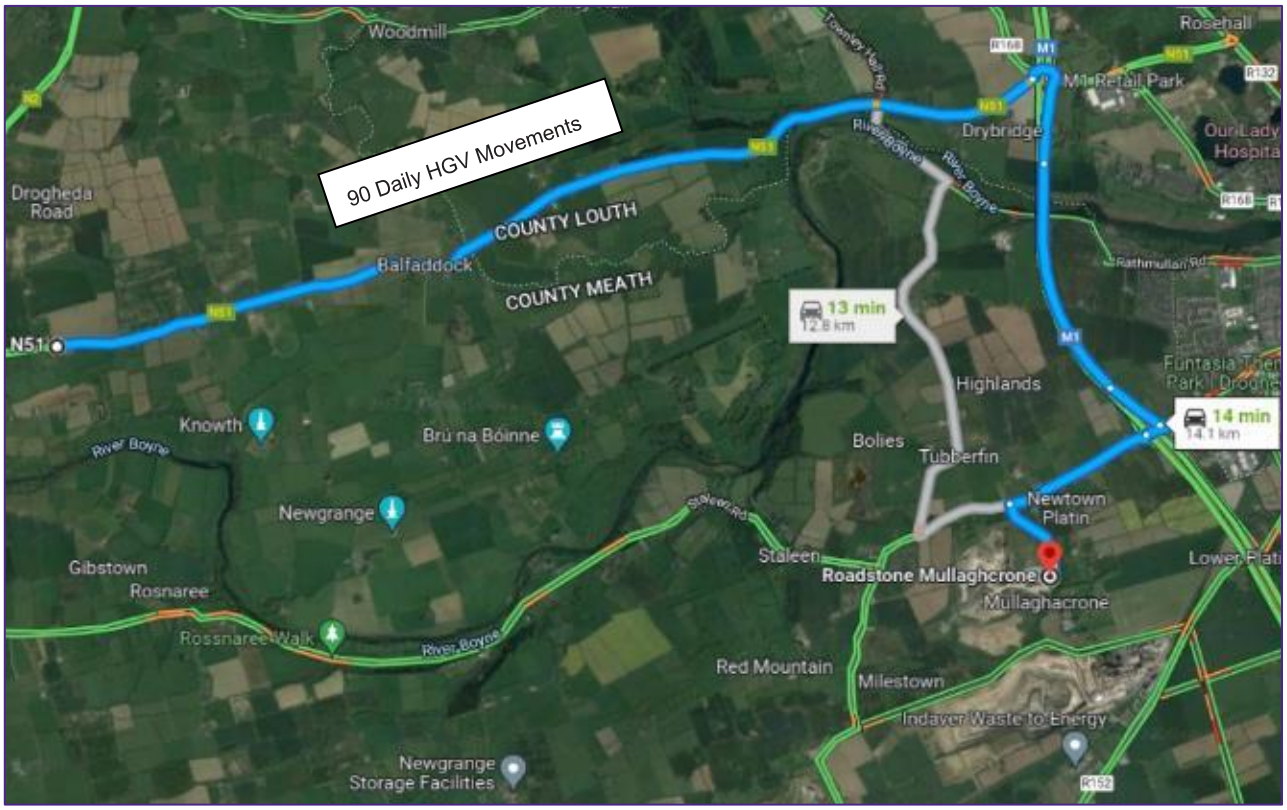


**Figure 5.18: Proposed Route – North of River Boyne to Mullaghcrone**

Combining the above trip distribution, the assignment of earthworks HGV traffic to the road network is summarised in **Figure 5.19** below.

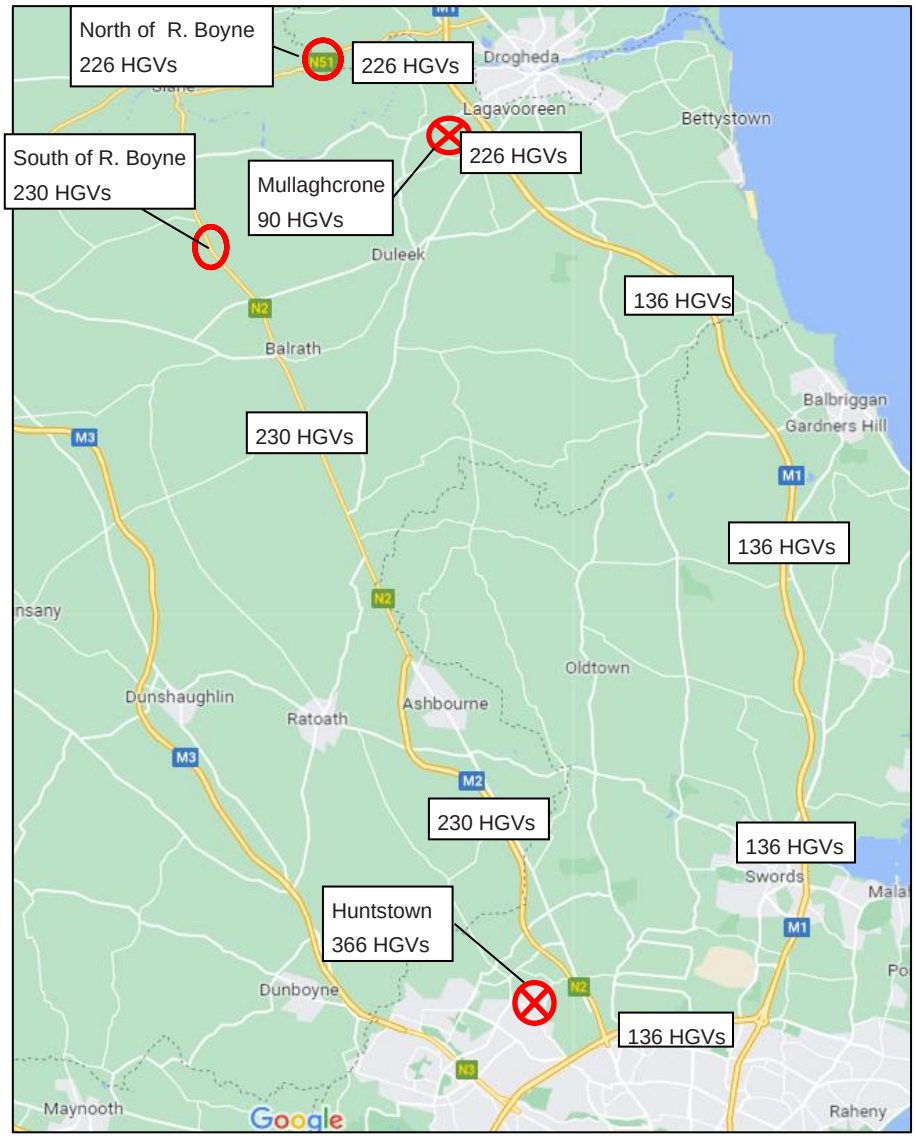


**Figure 5.19: Assigning Earthwork HGV Volumes to Wider Road Network**

### 5.5.2.6.2 Assigning Non-earthworks HGVs and PC Trips

In the worst-case scenario, it is assessed that 108 non-earthworks daily trips are generated. This is a conservative assessment and considers that major concrete operations are taking place at the River Boyne Bridge and lesser concreting activities at Farm Accommodation Bridge No. 3. For the purposes of traffic assignment, it is assumed that 20% of the non-earthworks HGV trips access the site at the N51, 75% access the site at Rossnaree Road and 5% access the site at the N2 south. Based on the proposed distribution of trips, 38 trips come from north of Slane, 38 trips come from south of Slane, 22 trips come from west of Slane and 11 trips come from east of Slane. These HGVs will use the national road network, i.e. N2 and N51 to access the site.

**Figure 5.20** below illustrates the assignment of daily non-earthworks HGV traffic to the road network around Slane. In this conservative scenario, approximately 70 construction related HGVs pass through the centre of Slane in a worst-case scenario.

In relation to PC trips, 60 are to/from the main compound, 50 are to/from the satellite compound and worker trips are 60 to/from the N2 south, 60 to/from the N51 and 40 are to/from Rossnaree Road. For the purposes of this assessment, these trips are proportionally distributed in accordance with the assumed distribution around Slane. **Figure 5.20** below illustrates the assignment of these PC trips to the local road network around Slane.


**Figure 5.20: Non-Earthworks HGV and PC Trips**

### 5.5.2.6.3 Combined Construction Stage Traffic Impact

**Figure 5.21** below shows the average daily trip volumes for PCs, Earthwork HGV trips and non-earthwork HGV trips in the vicinity of Slane, for a peak period of activity from month 15 of the construction programme**.**

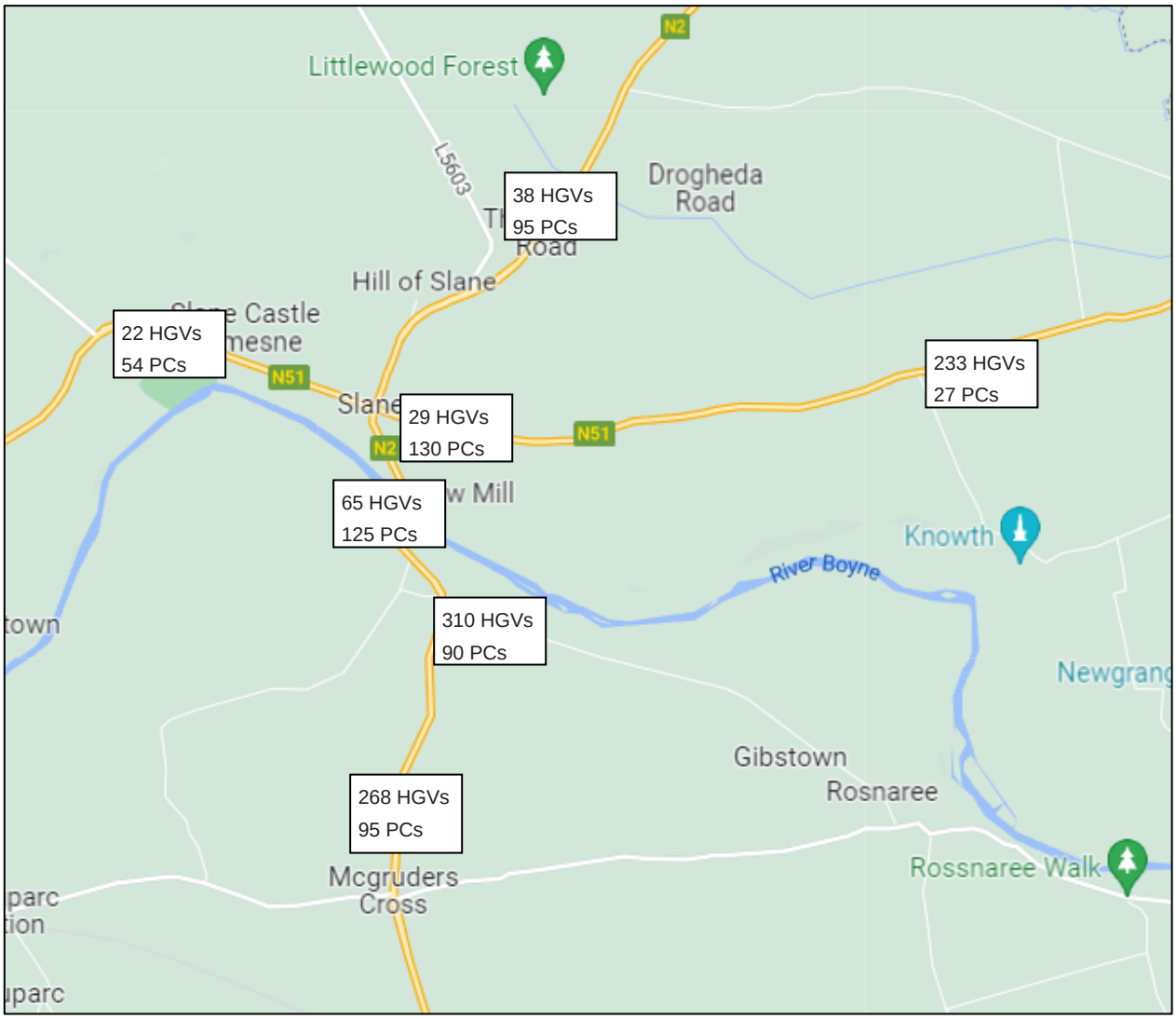


**Figure 5.21: Combined HGVs and PCs per Day, for the Worst-case Scenario**

### 5.5.2.7 Summary of the Construction Traffic Impact

The assessment of construction stage traffic demonstrates there will be a temporary increase in traffic volumes, particularly HGV traffic on the road network in the study area. The majority of additional traffic in the form of HGVs and particular earthworks related HGVs will utilise the national road network, minimising adverse environmental impact as these roads are designed for such traffic.

It is conservatively assessed that there will be an increase of some 38 HGVs passing through the centre of Slane during construction on some days when particular activities are being carried out on site. This is primarily due to materials being brought to the site and will ultimately depend on the actual source of these materials. All earthworks removal HGV traffic will be routed to avoid any need to access through the centre of Slane.

The assessment of the earthworks material haulage includes for limited use of the recycling facility at Mullaghcrone, access to which will be directed via the N51 and the M1. Traffic leaves the M1 at junction 9 and takes the L1601 to access the recycling facility at Mullaghcrone.

The baseline traffic assessment of the existing road network in the study area is reported in **Chapter 7 – Traffic and Transport**, **Section 7.3**. The additional temporary HGV traffic which will assign to the N2 and the M1/M50 constitutes less than 5% of the existing baseline traffic and will therefore not have a significant impact on the operation or safety performance of these national roads.

As a worst-case scenario, some 310 HGVs and 90 passenger cars will utilise the section of the Rossnaree Road between the N2 and the site access points. This section of Rossnaree Road is narrow and a manned

traffic controlled one-way system is proposed along the 245m length of existing road to manage and cater for the anticipated construction stage traffic demand. Analysis confirms the controlled one-way system is feasible and that it can operate efficiently and satisfactorily. The anticipated construction stage traffic plus local traffic is not of a magnitude for such a traffic management system to result in traffic queues or any other road safety issues. Additionally, the proposed scheme includes for the cost of strengthening/renewing the road pavement on this section of the Rossnaree Road.

Construction traffic will not be permitted to access the site via the section of Rossnaree Road to the east of the site.

## 5.6 Dust, Debris and Noise Management

### 5.6.1 Dust

It is unavoidable that there will be dust generated during earthworks and construction. Control measures will be implemented to reduce the generation of airborne material, including:

- Water spraying of exposed earthworks and site haul roads during dry weather;
- Early implementation of erosion control measures to protect exposed side slopes as described in **Section 5.13.3 Phase 2 Earthworks** below i.e. the implementation of erosion control mats and hydroseeding of side slopes early in the construction process;
- Provision of wheel washes at site exit points;
- Limitation of site vehicle speeds to minimise the dust re-suspension; and
- Regular sweeping of hard surface roads.

Extraction of water from watercourses for the purposes of dust suppression shall not be allowed. Water supply will be from Irish Water mains adjacent to the site compound areas. Bowsers will be filled at the compounds. Disposal of run-off at wheel washes will be controlled on the site as per the general drainage control measures described in **Section 5.13**.

Monitoring of dust generation will be part of the management of construction activities. Dust monitoring locations will be established on site. A baseline dust measurement will be made in advance of works and an ongoing system of monitoring will be implemented during the construction. Particular mitigation measures will be implemented when significant increases in deposition above baseline are measured.

### 5.6.2 Debris

Measures will be implemented to maintain a clean and uncluttered site, including;

- Daily inspections and program of site tidying;
- Debris netting will be attached to scaffolding to prevent debris materials and equipment from falling from a height as both a debris matter and for health and safety reasons;
- Food waste will be strictly controlled to prevent litter and/or attraction of vermin;
- Wheel wash facilities will be provided for vehicles exiting the construction site. Wheel wash run off will be stored in an onsite storage tank and will be disposed of by permitted waste haulage company at a permitted or licensed facility;
- Regular inspection and sweeping of public roads; and
- Covering will be applied to loaded lorries and skips, if necessary.

### 5.6.3 Noise and Vibration

Construction noise will be kept to a minimum in accordance with BS 5228 (2009+A1:2014). There will be a specific contract requirement that construction activities comply with specified construction noise and vibration limits. Construction noise will impact on neighbouring residences during certain activities. Acceptable construction noise levels at the façade of dwellings and thresholds for night-time noise are outlined in detail in **Chapter 9 Noise and Vibration**, **Section 9.2.4.2** (Construction Noise Criteria).

To monitor compliance with the specified construction noise level limits, environmental noise monitors will be installed at the selected locations prior to the construction works commencing on site.

As noted above, construction generated vibration at sensitive receptors will be subject to specified upper limits. These limits are set so as to ensure vibrations are such as to minimise personal discomfort and also so that structural damage will not be caused to buildings. Prior to the construction works commencing on site, environmental vibration monitors will be installed at the selected locations.

Drilling and blasting is anticipated to not be necessary in areas of excavation. However, some rock breaking is likely to be necessary. Rock breaking methods which minimise noise and vibration will be used.

Construction of driven sheet piles is anticipated to be necessary to construct the River Boyne bridge foundation. This piling will utilise methods that will minimise the risk of vibration being generated (i.e. piling will be via drilling auger and bucket) and will only be undertaken in daytime to limit noise disturbance.

## 5.7 Resource and Waste Management

An estimate of the materials and waste arising from the Proposed Scheme is presented in **Chapter 23 – Waste**.

A Resource and Waste Management Plan (RWMP) will be prepared by the contractor in advance of construction to ensure that the materials and waste arising during the construction and demolition phase of the Proposed Scheme will be managed and disposed of appropriately. The preparation of the RWMP will follow the EPA guidance (Best Practice Guidelines for the preparation of resource & waste management plans for construction & demolition projects, EPA 2021); refer to **Chapter 23 – Material Assets: Resource and Waste Management** for further details.

## 5.8 Construction Health and Safety

The requirements of the Safety, Health and Welfare at Work Act 2005, the Safety, Health and Welfare at Work (Construction) Regulations, 2013 and other relevant Irish and EU safety legislation will be complied with at all times.

As required by the Regulations, a Health and Safety Plan will be formulated which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will follow the requirements of the Regulations.

In accordance with the Regulations, a ‘Project Supervisor Design Process’ and ‘Project Supervisor Construction Stage’ will be appointed as appropriate.

The Project Supervisor Construction Stage will assemble the Safety File as the project progresses. The safety file will be incorporated into the overall technical record system at the end of project.

## 5.9 Employment and Welfare

It is anticipated that there will typically be some 150 to 200 people employed on the construction site across the Proposed Scheme, rising to circa 230 staff at peak construction. The numbers of people employed directly on the site will vary throughout the construction period as the various activities are undertaken.

Temporary office accommodation and other construction facilities will be installed at the proposed site compounds for the construction phase as described above.

The site start time will ensure that construction workers arrive to site prior to the morning peak hour for traffic on the local network. Permitted working hours[1] during the construction phase will be:

- 07:00 –19:00 Monday – Friday; and
- 08:00 – 16:30 Saturday (if required).

[1] These are the hours within which working is permitted. The actual work hours undertaken by workers are those required by their respective employers and working time legislation.

Night-time working has been identified as being necessary to carry out specific works, particularly on the N51 improvement between the bypass and Slane village and during the construction on the proposed public realm works in Slane village. There may be some periods where 24-hour work and supervision are required for other critical construction activities including night working. Over the expected 30-month construction phase, a number of isolated instances of night-time working (typically 23:00 – 07:00) are expected to be required intermittently over the construction period. Such night-time works will be predominantly associated with pavement works along the N51 and for the public realm enhancements, as well as for critical lifts associated with the bridge construction.

It will be necessary to work overtime (including weekends) during the Proposed Scheme. Consideration of safety, weather or sub-contractor availability is likely to necessitate working outside normal hours.

Noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Meath County Council consent will be required for proposed work outside normal hours and as part of procedures to be followed, the Contractor will be required to notify affected residents in good time of upcoming planned works.

## 5.10 Environmental Management During Construction

Construction impacts are generally of a short-term duration over the construction period and are often localised. The works will nonetheless be carried out in compliance with:

- Mitigation measures for the construction phase as described in the Erosion and Sediment Control Plan and as may arise from environmental assessments, NIS and any approval/consent as may be granted;
- Construction industry guidelines (such as CIRIA (2009) Environmental Good Practice on site (C502));
- CIRIA (2001) Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532);
- CIRIA (1997) Construction of Bunds for Oil Storage Tanks, and Enterprise Ireland, Oil Storage Guidelines, Report 163 (BPGCS005);
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects. Technical guidance (C648);
- PPG 6 Working at Demolition and Construction Sites (Environment Agency, 2012);
- PPG 26 Safe Storage - Drums and Intermediate Bulk Containers (Environment Agency, 2012);
- PPG 7 Safe Storage – The Safe Operation of Refuelling Activities (Environment Agency, 2011);
- BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* and BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part2: Vibration* (together referred to as B.S. 5228); and
- Control of Dust from Construction and Demolition Activities *(BRE 2003)*.

The works will nonetheless be carried out in compliance with TII's Standard and Technical documents related to the environment as contained within TII's publications systems (various dates) as follows:

- Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Water (IFI, 2016);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev.2;
- Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme;
- Guidelines on Provisions for the Conservation of Bats during the Planning and Construction of Roads;
- Best Practice Guidelines for the Treatment of Bats during the Construction of National Road Schemes;
- Guidelines for the Crossing of Watercourses during the Construction of National Road Scheme;
- Guidelines on Procedures for Assessment and Treatment of Geology Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes;
- Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes;

- Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes;
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub prior to, during and post-construction of National Schemes;
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;
- Guidelines on the Management of Noxious Weeds and non- native Plant Species on National Roads;
- Technical Guidance on the Management of Invasive Alien Plant Species on National Roads;
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes;
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes;
- Guidelines for the Treatment Otters Prior to the Construction of National Road Schemes;
- Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland;
- A Guide to Landscape Treatments for National Road Schemes in Ireland;
- Guidelines for the Management of Waste from National Road Construction Projects; and
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

Every reasonable effort will be made to ensure that any negative environmental effects will be avoided, prevented or reduced during the construction phase.

This relevant guidance and best practice requirements will be further detailed in the outline Environmental Operating Plan (EOP), which has been prepared in accordance with the *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* published by TII as part of an overall mitigation strategy and the implementation of conditions attached to any approval/consent as may be granted; the EOP is appended to this EIAR as **Appendix 5.6**.

MCC will ensure that all mitigation and monitoring committed to in the EIAR and NIS and planning conditions, will be enforced on the contractor through express terms of the contract, and will be overseen by an official engaged by the Council.

## 5.11 Environmental Emergency Procedures/Contingency

As set out in **Section 5.12** below, the construction methodology has been developed in order to ensure there will not be any uncontrolled run-off or spillage to the River Boyne or its tributaries, or the SAC and SPA. However, in the unlikely event that some accidental spillage occurs, it will be critical that an emergency procedure is in place.

Therefore, prior to commencing works, the contractor shall prepare an Environmental Emergency Response Plan/Contingency Plan, which fully incorporates the mitigation requirements outlined in **Chapter 15 – Biodiversity: Terrestrial Ecology**, **Chapter 16 – Biodiversity: Aquatic Ecology**, and **Chapter 17 – Water**, **Chapter 18 – Land, Soils, Geology and Hydrogeology** and the NIS (available under separate cover).

## 5.12 Detailed Construction Methodology and Sequencing

The purpose of this section is to describe the construction processes required to construct the Proposed Scheme. The necessary order and sequence are described so that the Proposed Scheme's constraints are taken into account. The construction methodologies described are the methods required to construct the works, including temporary works and include description of the measures necessary to control run-off during construction to ensure that sediment laden run-off does not have a pathway to the River Boyne.

### 5.12.1 Site Constraints

In considering the order and sequence in which the construction of the Proposed Scheme will take place, it is important to set out the particular key site constraints to be taken into account.

## 5.12.2 Key Sensitive Receptors

The sensitive receptors that could be impacted by run-off containing high levels of sediment from a construction project are generally considered to be those that are water-dependent, namely aquatic ecology and fisheries, terrestrial ecology such as otters, sensitive habitats, and water quality.

With respect to this scheme, the primary receptor is the River Boyne. The River Boyne in the vicinity of the works area is included within the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA. The entire surface water catchment of the works are located within the River Boyne Catchment.

The River Boyne represents a significant salmonid system and the main channel is a designated salmonid water under S.I. No. 293 of 1988. Atlantic salmon run the River Boyne in almost every month of the year. The River Boyne and River Blackwater SAC is a designated European site under the EU Habitats Directive and the QIs identified for the River Boyne and River Blackwater SAC are listed as follows with their QI code:

- Alkaline fens [7230],
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0],
- *Lampetra fluviatilis* (River Lamprey) [1099],
- *Salmo salar* (Salmon) [1106], and
- *Lutra lutra* (Otter) [1355].

In addition, the River Boyne and River Blackwater is also a designated SPA under the EU Birds Directive with the common kingfisher identified as the SCI for the site.

The Mattock (Mooretown) Stream, which is located at the proposed northern tie-in with the existing N2, is also a sensitive receptor for the Proposed Scheme. It will require an extension to the existing culvert under the N2 to be constructed as part of the proposed works. This stream is also considered as a sensitive receptor as it is known to support fish populations.

The construction is to be carried out at the River Boyne such that no works are allowed within the river itself nor within a minimum 10 m exclusion zone along both river banks. The construction and permanent works have been designed accordingly.

## 5.12.3 River Boyne

Given the ecological sensitivity of the river, there is no potential to construct a temporary bridge across the river during construction. The river effectively splits the construction into two distinct sites, north and south of the river. Additionally, the construction of the River Boyne bridge is a significant element of the construction and therefore the construction can be considered as three effectively separate areas of construction.

The construction of the River Boyne bridge is a major operation, and it will be a significant part of the construction programme; therefore works to enable this construction take place will commence as early as possible in the construction programme.

## 5.12.4 Flooding

The location of the proposed River Boyne bridge is within the floodplain of the river; refer also to **Chapter 17 – Water**. The construction methodology has taken this into account as there is a likelihood that the river will flood at some point during the construction period. This is considered in further detail in **Section 5.12.10.5 Working Platforms**, and in **Chapter 17 – Water**, and the FRA (refer to **Appendix 17.2 – Flood Risk Assessment**).

## 5.12.5 Works to facilitate ongoing access and services for landowners affected by the proposed road development

Works required to maintain access to lands and continued provision of services to landowners affected by the road development are described in **Section 5.4.3** above.

## 5.12.6 Site Accesses to Works Areas

Site access points to access the construction site are described in **Section 5.4.2** above; refer also to **Figure 5.8**.

A key access to be constructed early in the construction programme is the access arrangements from Rossnaree Road to the River Boyne bridge construction site south of the river (Access Point 3). Significant temporary works will be required to construct an access road, including a temporary bridge to cross the Boyne Navigation Canal. This temporary access road will need to provide access to Attenuation Pond No. 2.

Similarly, access to the proposed works located on the north side of the River Boyne will also be an early construction activity. This will be needed early to facilitate early construction of Attenuation Pond No. 3 and also for the construction of the River Boyne bridge piers and abutment located on the north side of the river. The existing steep sides to the Boyne valley at this location poses a particular challenge in relation to this proposed access road.

Both of these provisions are described in more detail in **Section 5.12.10.2** of this report.

## 5.12.7 Temporary Closure of Public Roads

Temporary traffic management including temporary closure of public road is described in **Section 5.5.1** above.

Rossnaree Road will form a key access road during construction, particularly as it is necessary to access the River Boyne bridge construction site on the south side of the river from this road. Constraints associated with the design of a temporary access road to the bridge construction site require that this road remain in place until the works to erect the bridge girder construction are completed. Therefore, it is expected that this road will remain open to traffic until a relatively late stage of the construction programme. Additionally, retaining this road in place effectively blocks any pathway for sediment laden run-off reaching the river.

As a result, the temporary closure of the road and construction of the Rossnaree Road overbridge will be one of the later activities in the construction of the Proposed Scheme.

## 5.12.8 Impact on the Public during Construction

It is envisaged that access as normal for the public during the construction stage will be maintained for the majority of the construction stage. Local impacts may occur for short durations to facilitate construction of the works. Affected persons will be notified in advance of any disturbances necessary to facilitate the works.

## 5.12.9 Site Characteristics

### 5.12.9.1 Topography

The topography varies across the proposed site. From the southern tie-in at the existing N2 to the proposed crossing at Rossnaree Road, the topography falls at a gradient of approximately 3% from south to north. Between Rossnaree Road and the southern banks of the Boyne Navigation Canal, the land falls steeply at a gradient of approximately 20%; the land rises at a similar gradient in a northernly direction from the northern banks of the Boyne River for approximately 100 m. The land continues to rise from here in a northerly direction to the location of the proposed N51 roundabout at approximately 4%. Between the N51 roundabout and the N2 northern tie-in, the topography continues to rise to a high point 350 m north of the N51 roundabout at approximately 3.5%. From there the existing ground undulates before it reaches the N2 northern tie-in.

### 5.12.9.2 Watercourses

There are two EPA water bodies along the proposed route i.e. the River Boyne and Mattock (Mooretown) Stream (a tributary of the River Mattock). A number of minor land (field) drains also intercept the proposed route. All drainage is towards the to the Boyne Navigational Canal, the River Mattock and ultimately the River Boyne.

From the southern tie-in at the N2 to Rossnaree Road, the proposed bypass route crosses a number of land drains flowing towards the proposed alignment from a westerly and an easterly direction. Many of these drains were dry during site investigations. It will divert these land drains into the pre-earthworks ditches (PEDs) to be constructed and subsequently into the Boyne Navigational Canal as part of the permanent works for the Proposed Scheme.

The route then spans the Boyne Navigation Canal and the River Boyne and its associated floodplain and banks. Both watercourses flow in an easterly direction and the canal flows into the river 1.8 km downstream of the proposed crossing point.

The route crosses further land (field) drains south of the proposed N51 roundabout. These drains flow towards the road from the east and will be diverted into the PEDs to be built as part of the permanent works; these PEDs flow south and discharge into the River Boyne.

As the proposed route runs northwards from the N51 roundabout, it crosses one EPA water body, the Mattock (Mooretown) Stream, an upper tributary of the River Mattock. A number of insignificant land (field) drains are crossed near the N2 tie-in. One minor field drain is also crossed (at approximately Ch. 2860) that leads toward the Slane Stream. This is a small tributary of the aforementioned Mattock (Mooretown) Stream, meaning that all minor land drains discharge to the Mattock (Mooretown) watercourse which, in turn, discharges into the Mattock River approximately 4 km downstream. The Mattock River joins the River Boyne after a further 3 km. It will divert these land drains into the pre-earthwork ditches (PEDs) to be constructed and subsequently into the Mattock (Mooretown) Stream. The field drain upstream of the Slane Stream the Mattock (Mooretown) Stream (trout stream) will be piped and culverted respectively beneath the proposed works to maintain existing flow regimes; refer to **Table 5-4** for the culvert details for the Mattock (Mooretown) Stream.

A temporary diversion of the Mattock (Mooretown) Stream is proposed in order to minimise in-stream work to construct Culverts 6B and 6C. After Culverts 6B and 6C are constructed and operational, the stream will be diverted to the permanent alignment in order to allow works for Culvert 6A be carried out. The culvert works for the western end of Culvert 6A and the removal of the existing culvert under the N2 will require in-stream works. Removal of the culvert under the existing N2 can only take place after the bypass is fully constructed and open to traffic. Plant, equipment, machinery and/or personnel will be in contact with water, meaning pathogens that can affect aquatic life could potentially be transferred, therefore careful disinfection/ steam cleaning of all equipment and machinery prior to contact with water will be required.

### 5.12.9.3 Geotechnical Investigation Results

Following ground investigation works carried out, the general make-up of the ground materials was found to be as set out in **Table 5-7**.

**Table 5-7: Ground make-up summary**

| Material | Extent | Thickness (m) | Description |
|---|---|---|---|
| **Topsoil** | Whole of the site, except for roads and residential areas | Up to 0.5 m | Brown, slightly sandy, slightly gravelly clay with roots |
| **Made ground** | In existing roads and earthworks | Up to 2 m | Bitumen products over sandy clay or gravel with cobbles or concrete |
| **Alluvium** | At the base of the Boyne River Valley | Up to 2 m | The geophysical reports describe the alluvium as soft clay and silt |
| **Glaciofluvial terrace gravel** | On the steep slope on the south side of the Boyne River Valley | – | Published surficial geology maps describe the glaciofluvial terrace gravel as derived from sandstones and shale |
| **Glacial till** | Whole of the site, except for rock outcrops | Up to 25 m (Typically, 2 m to 10 m) | Soft to very stiff, brown, slightly sandy, slightly gravelly clay or silt with cobbles. Low to medium plasticity |
| **Coarse soil** | Intermittent within and below the glacial till | Up to 5 m (Typically, 1 m to 2 m) | Clayey, sandy gravel with cobbles. Sand is fine to coarse. Gravel is subangular, fine to coarse and of various lithologies |
| **Rock** | Whole of the site, generally underlying then surficial | – | Strong, grey, limestone. Thinly laminated |

| Material | Extent | Thickness (m) | Description |
|---|---|---|---|
| | deposits, except where exposed in rock outcrops | | |

Groundwater monitoring standpipes were installed at 6 No. borehole (BH) locations. At most locations, the groundwater was measured below the proposed road level. Near the southern tie-in to the existing N2, the groundwater was measured between 1.6 mBGL and 3.37 mBGL in an area where the proposed road level is 7 mBGL. As a result, ground water can be expected to be encountered during earthworks excavations and measures will be required to deal with water inflows. Refer to **Section 5.13.3** below for further details of proposed collection and treatment.

## 5.12.10 Construction of River Boyne Bridge

### 5.12.10.1 General Overview

The construction of the River Boyne bridge will be a significant part of the overall construction of the Proposed Scheme and therefore works to enable this construction take place will commence as early as possible in the construction programme.

Access to the south side of the river is proposed from Rossnaree Road. Access to the north side of the river will be from the N51. A temporary site access road will be necessary from the N51 to the site, including negotiation of the steep slopes into the Boyne valley. See **Section 5.12.10.2** below.

Given the nature of the proposed River Boyne bridge, most of the sub-surface works will take place on the south side of the river, with three of the four bridge spans located in this area. However, works will also take place on the north side of the river to construct the northern pier and abutment and their foundation together with the lifting in of the proposed northern span bridge beam girders.

Works within the SAC boundary are unavoidable. Given the sensitivity of the environment, the extent of necessary works have been minimised to limit any risk to the QIs of the SAC and SPA. In-stream works are not required or permitted for the construction of the River Boyne crossing.

A description of the proposed works, temporary and permanent to construct the bridge foundations and sub-structure is set out below in **Section 5.12.10.3**. The process of lifting and placing of the proposed structural steel bridge girders is described below in **Section 5.12.10.4**. The construction and operation of the temporary Works Platforms is described in more detail in **Section 5.12.10.5**.

The descriptions of the bridge construction processes should also be read in conjunction with Drawings **MDT0806-RPS-01-N2-DR-C-DG5000 – DG5005** and **MDT0806-RPS-01-N2-DR-C-DG5101 – DG5105**, contained in **Volume 4**, **Appendix 5.1**.

### 5.12.10.2 Access for Boyne Bridge Construction

#### 5.12.10.2.1 Access to South side of the River

Access to the south side of the river is proposed from Rossnaree Road. A temporary access road and junction are required early in the construction programme to facilitate access to the works site. In order to safely cater for the expected HGV traffic, this road will be provided on a maximum gradient of not greater than 10% and the proposed junction with Rossnaree Road has been designed to cater for the anticipated construction traffic, including the potential for abnormal loads (to transport the steel girders and mobile cranes brought to site). This access road will also need a temporary bridge structure to be constructed over the Boyne Navigation Canal. Additionally, it is likely that Rossnaree Road, from its junction with the N2 to the site access road junction, will need to be strengthened in order to cater for the anticipated construction traffic.

Within the floodplain, access tracks will utilise reno design (clean hardcore material). It should be noted that the access track coming off the Rossnaree Road and the northern track access are both above flood levels. Silt fences will be utilised on these tracks to reduce silt washing off.

Details of the order and sequence and the proposed mitigation measures to be implemented during the construction of the proposed access road are described below in **Section 5.12.10.5.2.1 First Phase of**

**Construction**. **Volume 3**, **Drawing MDT0806-RPS-01-N2-DR-C-DG** (Boyne Crossing Temporary Works - Phase 1) illustrates the following proposals in more detail.

**Figure 5.22** and **Figure 5.23** illustrate the access roads required to construct both Attenuation Pond No. 2 and the River Boyne Bridge.

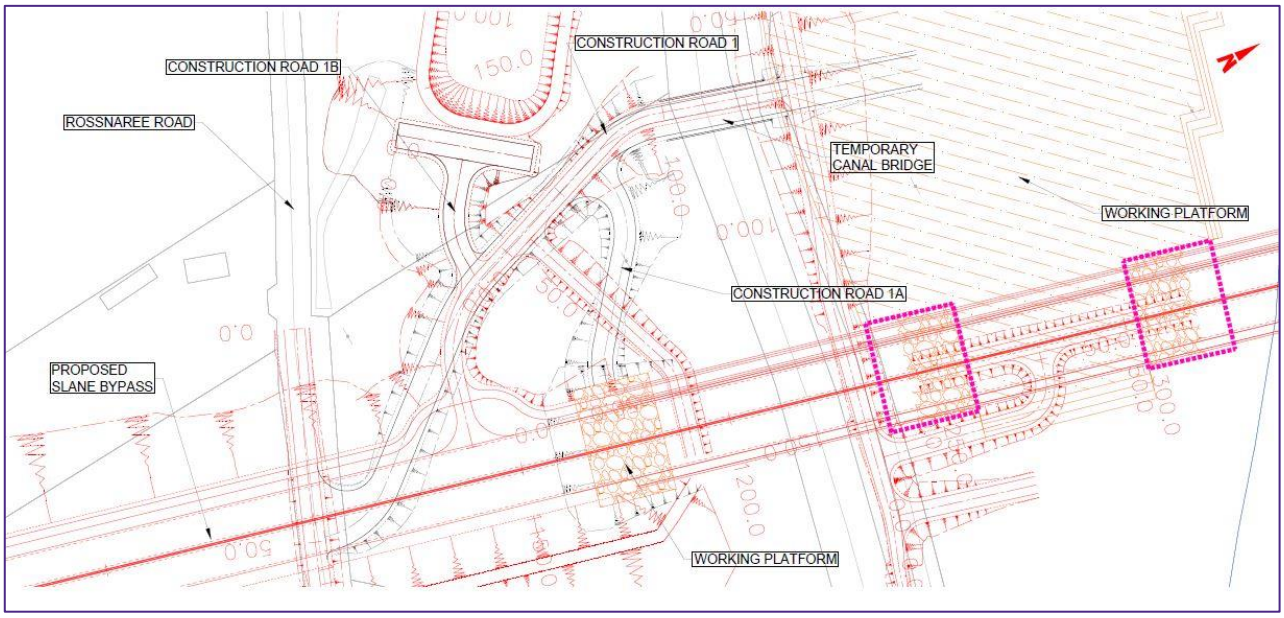


**Figure 5.22: Initial Access Road from Rossnaree Road**

It is envisaged that the access illustrated in **Figure 5.22** above will be in place until all of the girders for the bridge have been erected and construction of the deck (which will take place at the higher level) has been commenced. During this period, the need for access to the working platforms at the lower level is expected to reduce significantly and that there will be very little need, if any, for HGV access. It is proposed the access route will be amended to the arrangement illustrated in **Figure 5.23** at that point in the construction programme. In this arrangement a section of the access road will be relocated on Rossnaree Road and a higher gradient will be utilised. Removal of the section of the initial access route will enable the completion of earthworks on the south side of the bridge and for the construction of the Rossnaree overbridge.

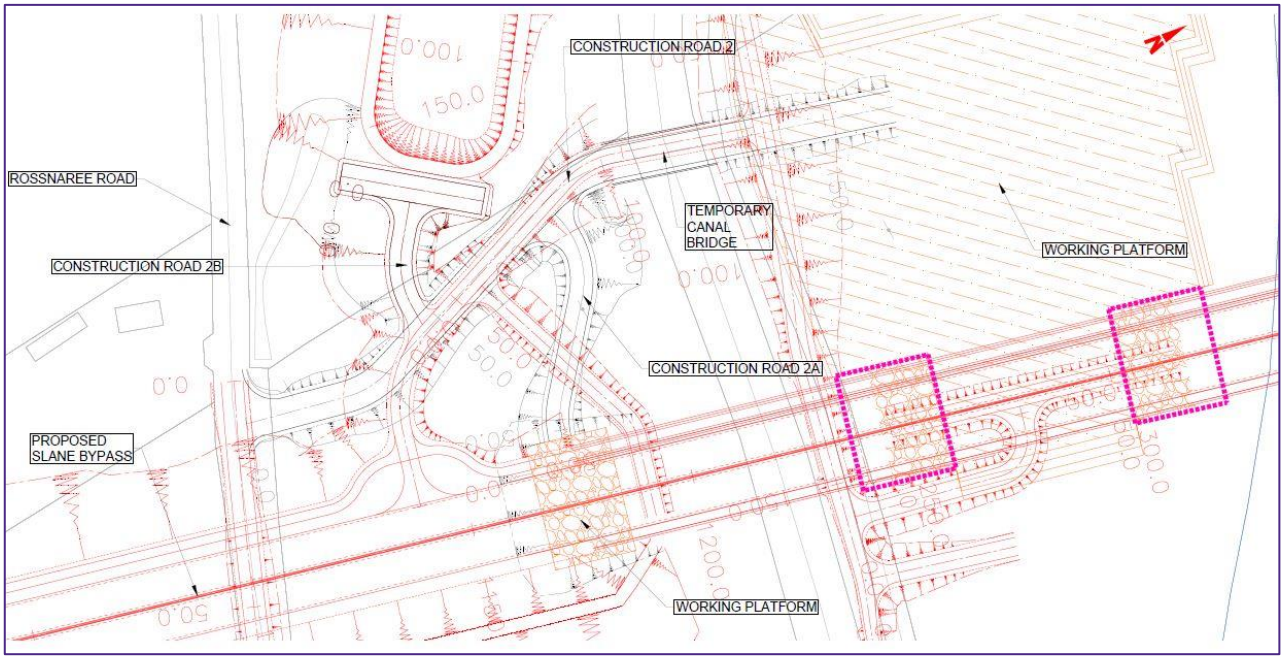


**Figure 5.23: Re-orientation of Access Road after bridge girders have been constructed**

### 5.12.10.2.2 Access to North side of the River

To gain construction access to the areas of work on the north side of the River Boyne, a temporary access/haul road will be necessary. It is proposed that the first significant construction activity will be to construct the permanent access road for Landowner 118/119, albeit via a temporary link to the existing N51. This can take place as the site is being fenced.

This will enable the existing access road to this property to be used for construction traffic. To gain access to the southernmost works areas this access will be extended southwards. The topography is such that this temporary road will in itself generate significant earthworks. This access road will provide access for the Boyne bridge northern pier and abutment to be constructed. It will also provide access for the construction of Attenuation Pond No. 3 and Farm Accommodation Overbridge No.3. When earthworks commence, this access road will be used for material haulage until the point when earthworks advance to the existing property access for Landowner 118/119 at which time other temporary access routes to the N51 will need to be implemented.

Landowner severance across the construction site is not permitted and a route must always be available for the use of Landowner 118/119.

A key element of the proposed enabling works will be to construct the PEDs and their outfalls together with Attenuation Pond No. 3. These elements will control run-off towards the construction site and the attenuation ponds will be used during the construction to treat run-off collected. A further constraint is that the PEDs and attenuation ponds be fully vegetated as early as possible so these facilities will act as effective run-off treatment measures.

To facilitate the works on the northern bank of the river, a silt fence and run-off collection trench will be constructed to protect the river during works adjacent to the bank.

Details of the order and sequence and the proposed mitigation measures to be implemented during the construction of the proposed access road are described below in **Section 5.12.10.5.2.1 First Phase of Construction**. **Volume 3**, **Drawing MDT0806-RPS-01-DR-C-DG5101** (Boyne Crossing Temporary Works - Phase 1) illustrates the proposals in more detail.

The proposed enabling works on the north side of the river are illustrated in **Figure 5.24**.

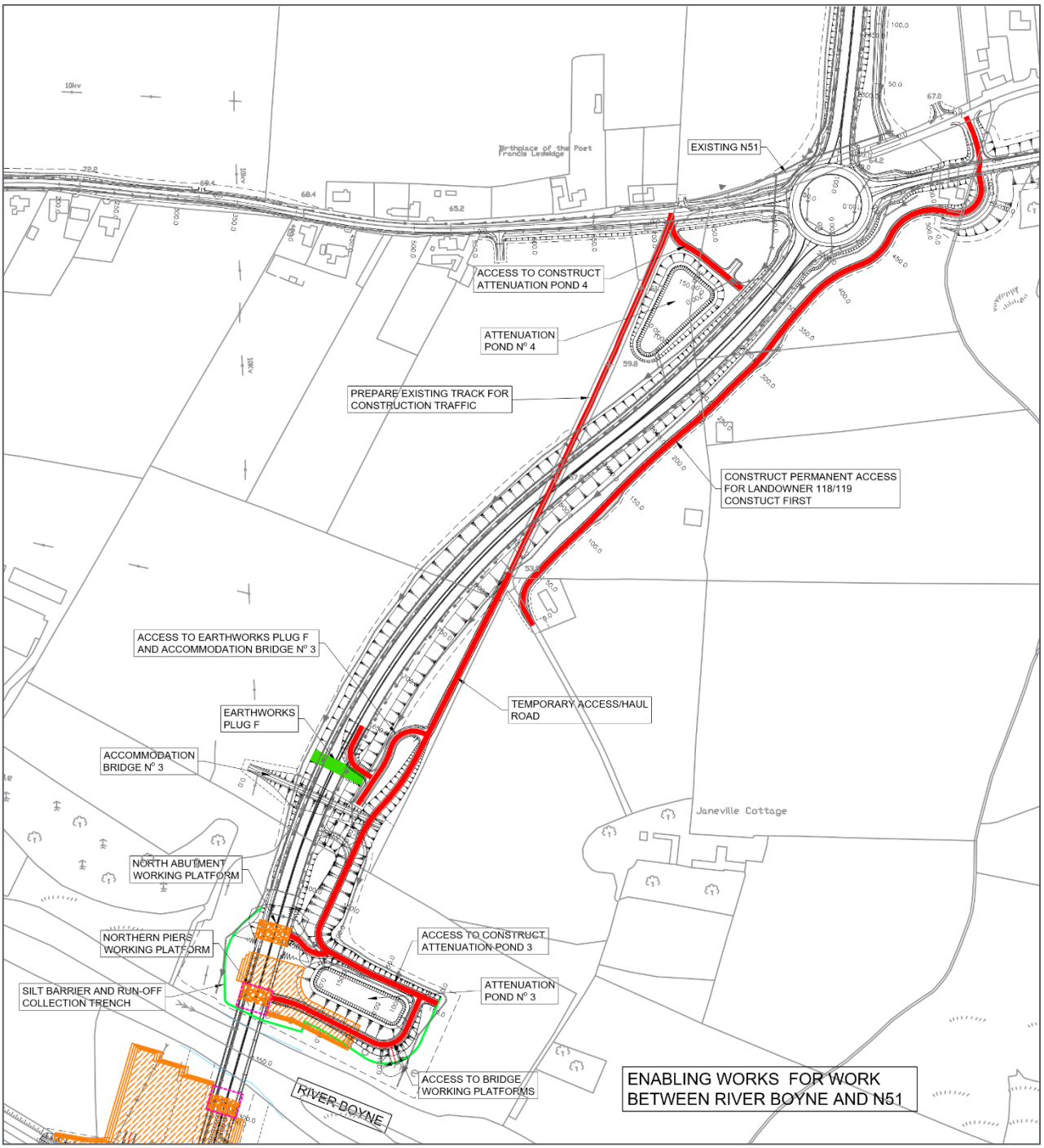


**Figure 5.24: Illustration of Access Road to North side of River Boyne**

## 5.12.10.3 Foundations and Sub-structure

The bridge will require bored pile foundations down to rock. This will require a large piling rig and crawler crane to access each section of the valley; south of the canal, between the canal and the river and north of the river. Access routes will be as described above.

Areas of hardstanding (temporary working platforms) will be required across the valley at each bridge support location to facilitate the piling, foundation and abutment/pier construction processes and will need to be maintained throughout the bridge construction stage.

Conventional construction of the reinforced concrete substructure will require plant such as concrete lorries and pumps to operate within the valley. It is estimated that this work will take approximately 14 months.

The intermediate pier foundations are a minimum 2.29 m back from the 10 m setback zones on both sides of the River Boyne. Temporary works will be required to ensure excavations for the foundations do not encroach on the setback zones. See **Section 5.12.10.5.1.2** below and **Drawings MDT0806-RPS-01-N2-DR-C-DG5000 – DG5005** for the description of proposals.

The construction and operation of the temporary working platforms require careful design to ensure that the proposed works will not cause any negative impacts on the QIs of the SAC or the SCI of the SPA and will also account for the potential for flood events to occur during the construction phase. The design and operation of the proposed temporary working platforms will take these constraints into account. **Section 5.12.10.5 Working Platforms** below and **Drawings MDT0806-RPS-01-N2-DR-C-DG5000 – DG5005** describe the proposed methodology in detail.

## 5.12.10.4 Bridge Superstructure

The bridge deck comprises steel girders in composition with a reinforced concrete deck.

The steel girders will be lifted into place in sections by crane, operating from the temporary working platforms described in **Section 5.12.10.5** below. A very large mobile crane will be required to allow the central sections of the main span over the River Boyne to be lifted into position without temporary intermediate supports. It is assumed that girders will be lifted in braced pairs. In order to minimise the size of the temporary working platforms required for the lifting and placing of the bridge girders, the cranes will be located on one side of the bridge at each lifting platform. The optimal location for the main central girder lifts is on the west side of the bridge, which will necessitate the diversion of the existing ESB powerline to a location outside of the potential 'fall zone' of the crane jib. A limited number of crane set-ups will be required to lift in the various sections of girders. Areas of hardstanding will be required to facilitate the crane set ups and girder assembly on the valley floor. It is likely that some intermediate temporary supports will be required (outside of the Boyne exclusion zone) during the lifting operation, to support one end of the pier sections prior to lifting in the central sections. A smaller mobile crane could be used to lift in the northern and southern back span sections from outside the SAC.

The construction of steel plate girders is relatively straight-forward, and although the steel girders are large and a very large crane will be required, it is a relatively well understood construction methodology.

To reduce the potential impact on the SAC and SPA during the construction stage, certain items and methods will be stipulated to the contractor such as the use of precast concrete rather than in-situ concrete where possible (noting that precast elements will still need to be stitched together with in-situ concrete). It will be a specific contract requirement that, following steel superstructure installation, the reinforced concrete deck is constructed completely from on top of the bridge rather than from the valley floor. This could be done with precast or in-situ concrete and would involve starting at the ends of the bridge and lifting or pouring one section at a time, allowing it to come up to sufficient strength before moving further along to repeat the process. This will add significantly to the programme but could be done from north and south concurrently with a fast-setting concrete mix design to reduce construction time as much as possible.

The bridge is considered to be readily constructible by a contractor suitably experienced in bridge construction of this scale and form. No issues have been identified that would not be inherent in comparable bridge projects completed elsewhere in Ireland or the UK. Following the site preparation and foundation and substructure construction it is estimated the bridge superstructure will take approximately ten further months to construct. Details of the temporary works required to construct the bridge piers and girders is described in further detail in **Section 5.12.10.5.1.2.1** below and **Drawings MDT0806-RPS-01-N2-DR-C-DG5000 – DG5005**.

## 5.12.10.5 Working Platforms

As described above, a series of temporary working platforms will be necessary to carry out the River Boyne bridge construction. These will be located within the boundary of the highly ecologically sensitive River Boyne and River Blackwater SAC. Great care has been taken to determine the most appropriate form of construction for these platforms and to the methodology to be utilised to ensure that they will be constructed in such a manner as to avoid negative environmental impacts. The key concern is the management of contaminated or sediment-laden run-off from the working areas during their construction, operation and decommissioning. In the following sections the design of the platforms is described including their construction, operation and decommissioning. Additionally, the order and sequence of their construction and

decommissioning is also set out to clearly demonstrate the run-off control measures that will ensure that neither contaminant nor sediment laden run-off to the river will occur.

### 5.12.10.5.1 Design and General Arrangement of the Working Platforms

A comprehensive assessment of options for the construction of the necessary temporary working platforms has been carried out. This assessment considers all of the particular site constraints relating to ecological sensitivity, flood risk and engineering requirements and recommends preferred options for each of the four working platforms:

- WP1 – Working Platform for south abutment construction.
- WP2 – Working Platform for works on the south side of the river.
- WP3 – Working Platform for works on the north side of the river.
- WP4 - Working Platform for north abutment works.

The general arrangements for the proposed working platforms are illustrated on Drawings **MDT0806-RPS-01- N2-DR-C-DG5000 – DG5005** contained in **Volume 4**, **Appendix 5.1**.

The following sections describe the construction, operation and decommissioning of each working platform (WP1 to WP4) and the measures required to avoid negative environmental impacts.

#### 5.12.10.5.1.1 Working Platforms WP1 – Bridge South Abutment

WP1 is located within the SAC and approximately 160 m from the River Boyne. The canal, the well-vegetated fields, hedgerows, ditches, and the topographic rise in ground levels towards the river act as additional buffers between the site and the river. The working platform will be located on a slope of between 5 to 10 degrees and require partial excavation and filling to create a suitable platform. Following a thin topsoil strip, rock is anticipated at shallow depth and will require heavy excavation and breaking. If suitable (and in line with TII specifications for earthworks), the excavated rock may be used to create the embankment.

Platform WP1 is required to facilitate plant and labour engaged in constructing bored piles, foundation and abutment bankseat. The key run-off control measures during the construction and operation of Platform WP1 are illustrated in **Figure 5.25**. Drawings **MDT0806-RPS-01- N2-DR-C-DG5000** and **DG5001** show the detail of the general arrangement of WP1.

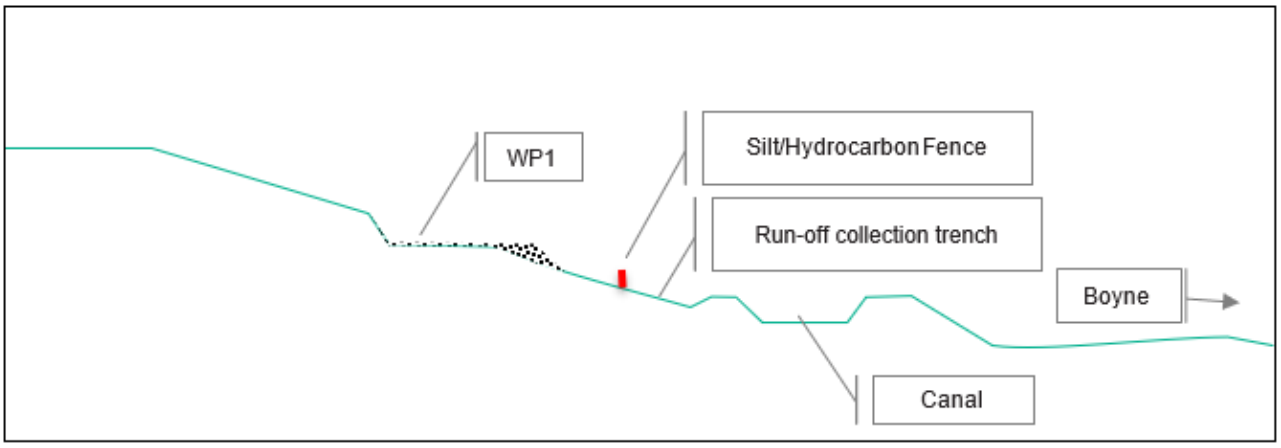


**Figure 5.25: WP1 General Arrangement**

##### 5.12.10.5.1.1.1 Platform Construction

Silt and hydrocarbon barrier fences and a run-off collection trench are installed down-slope of the proposed platform prior to any excavation works commencing. The vegetation and canal embankment further down-slope will provide a secondary containment and attenuation to any run-off. The ends of the fence will turn up-slope to ensure sediment doesn't escape out the sides.

Topsoil stripping and rock excavation will be required to bench into the side slope. Where suitable, the excavated rock shall be reused (i.e. Class 6).

As this platform is above the predicted flood level and the scale of the construction is quite limited and easily protected from uncontrolled run-off, the platform will be formed using clean washed rockfill placed on a basal separation geotextile with a geogrid placed between each 300 mm lift.

The timing of the proposed works is not critical as the platform is located outside of the floodplain. However, where possible, construction will be timed to coincide with periods of dry weather.

Surface water running off the platform will be collected in a run-off trench located near the bottom of the hill and south of the embankment forming the Boyne Canal Navigation channel. This run-off will be either pumped to Attenuation Pond No. 2 or collected by tanker and removed from the site.

#### 5.12.10.5.1.1.2 Operation

While machines are stationary on the working platform, a contaminant containment tray will be placed beneath them. These trays must be removed from the working platform at the end of each day and any contaminants they have collected disposed of accordingly.

Machine plant will be checked regularly for evidence of hydrocarbon leaks. In the event of a leak, the offending machine will be removed off site. Any drip that is not caught by the containment trays will be cleaned from the surface. The run-off measures described above remain in place throughout the operation phase. **Figure 5.26** illustrates typical examples of containment trays and mats.

**Figure 5.26: Contaminant Containment Trays and Mats**

#### 5.12.10.5.1.1.3 Decommissioning

The WP1 platform will for the most part be incorporated into the permanent works, as structural fill will be placed behind the bridge abutment.

Those mattresses not incorporated as part of the permanent works will be removed and the natural ground reinstated and re-vegetated.

The reinstatement work will be programmed for early spring, where feasible, to provide optimal conditions for the reestablishment of vegetation prior to winter. The re-establishment of vegetation will be encouraged using hydro-seeding, where decommissioning occurs in the optimal season (spring or autumn), as this can offer a growing medium for seed while also reducing surface erosion from rain and wind. Alternatively, the exposed areas will be re-sodded with vegetated sod. The seed mix will be designed to re-establish the mix of vegetation that is present currently or enhance the biodiversity and habitat potential of the area. Temporary measures to control run-off as described above will remain in place during this operation, until such time as re-vegetation has established.

The silt fences and run-off trenches will be the final element of the works to be decommissioned. This will be carried out under the supervision of the appointed ECoW. Any material collected by the silt fences will be removed off site prior to decommissioning the fences.

#### 5.12.10.5.1.2 Working Platforms WP2 and WP3 – South and North of River Boyne

Working platforms WP2 and WP3 are located within the floodplain and may be flooded during their service life. Due to the major constraints and potential knock-on flood impacts associated with constructing a platform which is higher than the 1% AEP (1 in 100 year) flood level, it will construct the platforms to the minimum thickness required to provide stability for machinery and plant operating from them.

WP 2 and WP3 will comprise 4 layers of reno-mattress filled with washed clean rockfill placed on a basal separation geotextile. A geogrid will be placed between each layer of reno-mattress. Following the placement of each mattress layer, the surface will be proof-rolled to level peaks and troughs. Locally, clean rockfill can be placed and sandwiched between and upper and lower mattresses to level out hollows and provide a suitably level platform surface for piling rigs and crane operations. The construction and filling of the reno-mattresses will be done off-site.

The rockfill will have a particle size no less than a 100 mm diameter and will be washed to remove any residual rock dust and other fines before being transported to site. The minimum size of rockfill used to construct the platforms has been specified to eliminate silt fines and eliminate the potential of the material being transported by floodwaters as per the anticipated peak flows modelled for a 1% AEP flood event or from other rainfall events during construction and operation. The upper most reno mattress will use rock fill with a particle size weighted towards the smaller sizes but not <100 mm. This will reduce the surface roughness of the platform and improve trafficking.

The rockfill will be confined by the cage of the reno-mattress. Each mattress will be tethered to the next with lacing wire. The rockfill will have 40% voids to allow the passage of water through it in the event of flooding. The typical dimensions for the proposed mattresses are 6 m (length) x 2 m (breath) and 0.3 m (thickness). When building up the layers of mattresses, each new layer of mattress shall overlap the joints between individual mattresses present in the previous layer. In this way, no continuous joints between mattresses shall be formed that extend between layers of mattresses.

**Figure 5.27** and **Figure 5.28** below illustrate the context of WP2 and WP3.

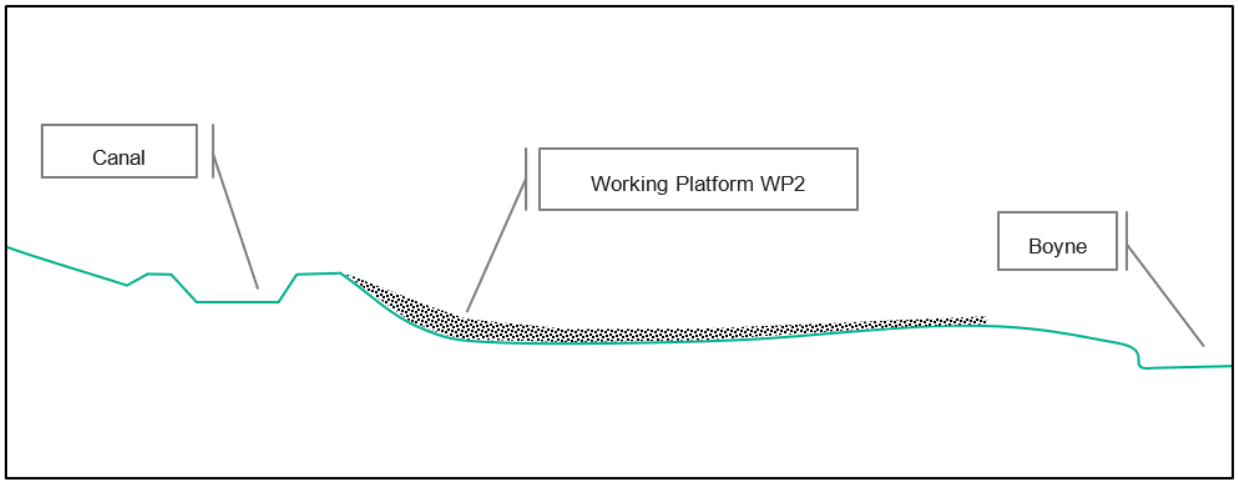


**Figure 5.27: WP2 General Arrangement**

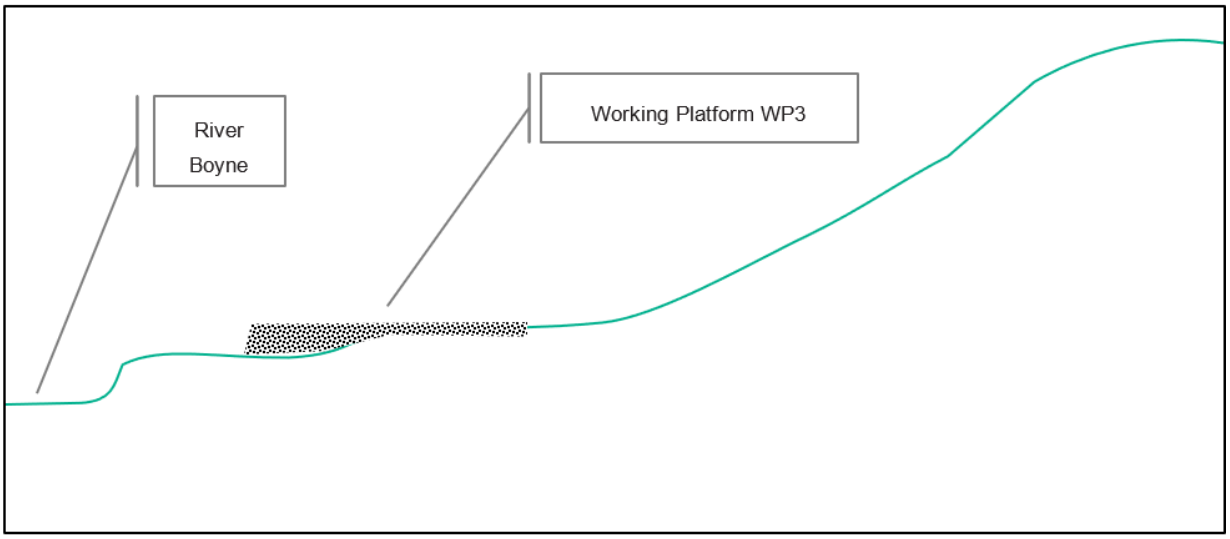


**Figure 5.28: WP3 General Arrangement**

#### 5.12.10.5.1.2.1 Platform Construction

Reno mattresses are to be filled outside of the SAC to eliminate any potential to generate fines (silt/sand) that may subsequently wash-out into the river and adversely impact the QIs. The platform will advance from the temporary access road with each section of reno mattress placed in front of the first. This will ensure that machinery only operates from the platform. The construction of the platforms is anticipated to take approximately 2 months.

As illustrated on Drawings in **Appendix 5.1 – Working Platform Design**, **MDT0806-RPS-01- N2-DR-C-DG5000 – DG5005** (Boyne Crossing Temporary Works – Plan and Sections 1-5), the construction of the proposed large diameter piles and bridge support pilecaps that are located within the floodplain are proposed to be constructed within cofferdams. The cofferdams will be constructed from the reno mattress working platform. A low noise piler will hydraulically press sheet piles (typically on the order of 100 mm thickness) into the ground. This approach will not produce spoil and will also reduce noise that would otherwise be typical of percussion piling rigs. The cofferdam walls will comprise interlocking sheetpiles that will be driven into the ground to a founding depth that provides sufficient embedment to support the above-ground cantilever. The top of the sheetpiles will extend to a height above the ground surface which is above the peak 1% AEP (plus 20%, plus freeboard) flood level.

The cofferdam will therefore provide an almost watertight working environment preventing flood waters from entering so that the work can be carried out safely, as the height of the cofferdam will be above the predicted maximum flood level. The cofferdam will contain any spoil or silt laden water arising from the work while also prevent the inrush of flood waters should a flood occur. Furthermore, the cofferdam will enclose the proposed excavation and piling works preventing any uncontrolled run-off during construction from reaching the River Boyne. However, rainwater will enter the cofferdam at times and some groundwater may also ingress from the base of the cofferdam. As such any groundwater ingress and rainwater will be pumped out via bowser and taken off-site to a suitably licensed facility for treatment/ disposal.

The cofferdams will be rectangular in shape and of sufficient size to allow excavators, piling rigs, workers and materials to operate safely.

Within the base of the cofferdam a temporary working platform will be constructed to enable the safe operation of excavators and piling rigs. As the sides of the cofferdam will extend to a height above that of the adjoining working platform, the piling rigs and excavators will be craned in and out.

Once the piles are installed and the piers are constructed, any spoil or water within the cofferdam will be removed or pumped out. The removal of the cofferdam will involve backfilling the inside to reinstate the ground. Pre-vegetated sod utilising a native species mix will be placed to accelerate the rehabilitation of the ground. Once the root structure of the sod has re-established and knitted back into the ground, only then will the sheet piles be removed. the sheet piles are then slipped out of the ground by pulling them out vertically.

#### 5.12.10.5.1.2.2 Operation

While machines are parked-up on the working platform, a contaminant containment tray will be placed beneath them. These trays must be removed from the working platform at the end of each day and any contaminants they have collected disposed of accordingly.

Machines will be checked regularly for evidence of hydrocarbon leaks. In the event of a leak, the offending machine will be removed off site. Any drip that is not caught by the containment trays will be cleaned from the surface of the platform.

An early warning system will be implemented to monitor rainfall and upstream river levels in real-time. Once set thresholds are exceeded all materials, plant and equipment must be removed from the platform and the cofferdams. Remobilisation onto the platform will not be permitted until such time flood waters have receded and there is a favourable weather window ahead.

#### 5.12.10.5.1.2.3 Decommissioning

As with the placement of the reno mattresses, the last mattress put in place will be the first one lifted out so that machines are always working from the platform. Decommissioning is expected to take less than one month.

The vegetation beneath the platform will die during operation of the platform rendering the soil vulnerable to erosion from flooding and surface run-off. To reduce the potential for erosion, the platform will be removed in

sections. Once the first section is removed, the underlying soil will be hydro-seeded where decommissioning occurs in the optimal season (spring or autumn). Where hydro-seeding is not appropriate, i.e. decommissioning is required to be done outside optimal season, the area will be re-sodded utilising a native species mix. Only when the original ground has been fully re-sodded will the next section of the platform be removed. Re-sodding the ground with already established vegetation will greatly reduce the length of time that the ground is left exposed and vulnerable to erosion.

#### 5.12.10.5.1.3 Working Platform WP4

Working platform WP4 is located to the north of the River Boyne. It will be located on a slope which is approximately 28 degrees (> 1V:2H). This will require the excavation of a bench and filling to create a suitable platform. Following a thin topsoil strip, rock is anticipated at shallow depth and will require heavy excavation and breaking. If suitable, the excavated rock may be used to create the embankment. **Figure 5.29** illustrates the general arrangement of WP4. **Appendix 5.1** Drawings **MDT0806-RPS-01- N2-DR-C-DG5000** (Boyne Crossing Temporary Works – Plan), **DG5004** (Boyne Crossing Temporary Works - Sections 4) and **DG5005** (Boyne Crossing Temporary Works - Sections 5) show the detail of the general arrangement of WP4.

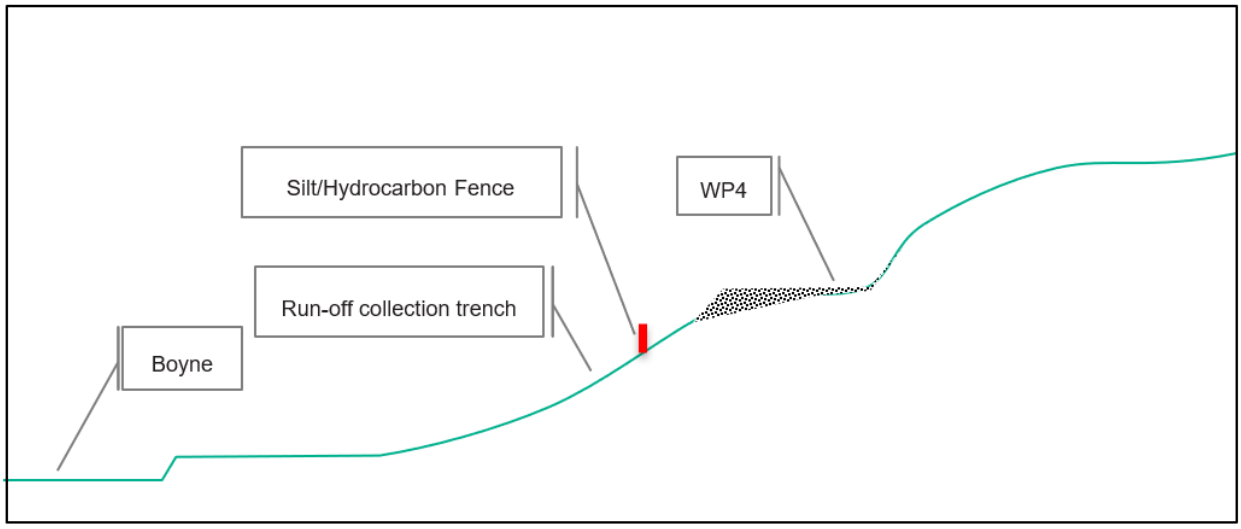


**Figure 5.29: WP4 General Arrangement**

#### 5.12.10.5.1.3.1 Platform Construction

Silt and hydrocarbon barrier fences and interceptor ditches are to be installed down slope of the proposed platform prior to any excavation works commencing. The ends of the fence will turn up-slope to ensure sediment doesn't escape out the sides. Run-off collected by the interceptor ditch will be pumped back into the grit separator, petrol interceptor and Attenuation Pond No. 3 before outfall.

Topsoil stripping and rock excavation will be required to bench into the side slope. Where suitable, the excavated rock (i.e. Class 6) shall be used to create the side-long embankment, which will be required at this location to support the working platform. The fill embankment will be covered with organic geotextile/mat, topsoiled and seeded immediately after earthworks operations are completed.

As this platform is above the predicted flood level and the scale of the construction is quite limited and easily protected from uncontrolled run-off, the platform will be formed using clean washed rockfill placed on a basal separation geotextile with a geogrid placed between each 300 mm lift.

The seasonal timing of the proposed works is not critical as the platform is located outside of the floodplain. However, where possible, construction will be timed to coincide with periods of dry weather.

Surface water running off the platform will be collected in the run-off trench located on the existing slope towards the river. This run-off will be either pumped to Attenuation Pond No. 3 or collected by tanker and removed from the site.

#### 5.12.10.5.1.3.2 Operation

While machines are stationary on the working platform, a contaminant containment tray will be placed beneath them. These trays must be removed from the working platform at the end of each day and any contaminants they have collected disposed of appropriately.

Machine plant will be checked regularly for evidence of hydrocarbon leaks. In the event of a leak, the offending machine will be removed off site. Any drip that is not caught by the containment trays will be cleaned from the surface of the platform.

#### 5.12.10.5.1.3.3 Decommissioning

The WP4 platform will for the most part be incorporated into the permanent works as structural fill will be placed behind the bridge abutment. Those mattresses not incorporated as part of the permanent works will be removed and the natural ground reinstated and re-vegetated.

The re-establishment of vegetation will be encouraged using hydro-seeding, where decommissioning occurs in the optimal season (spring or autumn), as this can offer a growing medium for seed while also reducing surface erosion from rain and wind. Alternatively, the exposed areas will be re-sodded with vegetated sod. The seed mix will be designed to re-establish the mix of vegetation that is present currently or enhance the biodiversity and habitat potential of the area. Temporary measures to control run-off as described above would remain in place during this operation.

The silt fences and run-off trenches will be the final element of the works to be decommissioned. This will be carried out under the supervision of the appointed ECoW. Any material collected by the silt fences will be removed off site prior to decommissioning the fences.

#### 5.12.10.5.1.4 General Control Measures

General control measures to be implemented by the appointed contractor will comprise the following:

- Machinery that can, will be returned to the site compound located outside the SAC boundary at the end of each working day.
- Machinery will be either pressure hosed or required to drive through a wheel wash to remove loose sediment and contaminants prior to entering the SAC boundary.
- Regular checks and maintenance of machinery will be carried out.
- Refuelling will not be carried out within the SAC boundary or within 50 m of a watercourse.
- Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using.
- Plant nappies or absorbent mats will be placed under refuelling point during all refuelling to absorb drips (only to occur outside of the SAC boundary).
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water.
- Continuous weather monitoring will be carried out so as to time works within favourable weather windows, where this is feasible and also to predict when river flood events might occur. As part of this, river level gauges will be monitored with an early warning system which is triggered once the water level passes a critical threshold. In such instances, all people, plant and machinery will be removed from the platform.

### 5.12.10.5.2 Works around the River Boyne – Construction Order and Sequence

Drawings **MDT0806-RPS-01-N2-DR-C-DG5101 – DG5105** showing the phasing of the construction in the vicinity of the River Boyne are contained in **Volume 4**, **Appendix 5.2 – Order & Sequence of the Boyne Bridge**.

#### 5.12.10.5.2.1 First Phase of Construction

To access the working platforms and Attenuation Pond No. 2, it will be necessary to construct access roads as described in **Section 5.4.2 Site Access Routes** above.

**Site Compound:** A site compound will be established off the Rossnaree Road to the south of the River Boyne and outside the SAC boundary. The compound will not have a direct drainage pathway to the SAC or the SPA. A bunded containment area will be provided within the compound for the storage of fuels, lubricants, oils etc. Drainage within the site compound will be directed to an oil interceptor to prevent pollution if any spillage occurs. Wheel washes will be constructed at the ingress and egress points to remove silt from construction vehicles. The compound will be in place for the duration of the construction phase and will be removed once commissioning is complete. This will be done under the supervision of the ECoW.

The ESB overhead powerline crossing the works at the proposed Boyne bridge will need to be diverted. This is required to enable the safe movement of construction plant and ensure the powerline is moved beyond the fall radius of the cranes' jibs and masts.

The first phase of the construction in the vicinity of the River Boyne includes the construction of mammal protection boundary fencing, interceptor ditches, the temporary access roads to construct Attenuation Ponds No. 2 and 3, ESB diversion and to provide access to construct the earthworks for temporary working platforms WP1 and WP4.

In **Appendix 5.2 – Order & Sequence Boyne Bridge**, Technical Drawing **MDT0806-RPS-01-N2-DR-C-DG5101** (Boyne Crossing Temporary Works - Phase 1) illustrates the scope of the proposed works together with the erosion prevention measures to be provided during the first phase of construction. Measures include the installation of silt and hydrocarbon barrier fences and run-off collection trenches to be constructed in advance of any other works in the area; any run-off to these trenches will be tankered away from the site to a suitably licensed facility for treatment/disposal. These preventative measures will be installed on the down-stream edge of the proposed works and will prevent any uncontrolled run-off from the site reaching the river during the construction of the first phase of the works.

Existing ditches and scrub will be cleared, and interceptor ditches will be constructed up-slope of the silt fences. These will act as a further mitigation measure to intercept and capture silt that may be contained in surface water run-off. The excavated spoil from these ditches will not be stockpiled but removed immediately from the SAC area to the specified stockpile locations (which are located a minimum of approx. 800 m from the SAC). The ditches will be lined with an erosion control geotextile and filled with clean and washed stone to lower flow velocities, reduce erosion potential and promote the deposition of sediment. A filter bag or sock will be installed on the outfall from the ditch. This will be installed at a high level to maximise retention times within the ditch. The filter bag/sock will act as a further mitigation measure to intercept and capture silt and release filtered water before the ditch overtops in the event of extreme weather.

The works include earthworks to complete access track and attenuation pond construction. Excess earthworks material will be immediately hauled from the construction areas and disposed/stored at suitable locations away from the SAC area. Immediately on completion of earthworks, all side slopes will be protected by organic geotextile erosion control mats and will be topsoiled and seeded. Hydro-seeding will be applied to encourage quick establishment of vegetation. Capping and road surfacing will be constructed as soon as possible upon completion of earthworks. These provisions will limit the time when sediment laded run-off might be generated from the construction.

Fill earthworks will be necessary to construct the working platform for the northern abutment. The earthworks will need to bench into the existing steep slope on the Boyne valley and will be brought up to the level necessary to access the abutment construction. This operation will not take long to construct as the quantities of material required are relatively small. Finished side slopes will be treated as described in the paragraph above upon completion to limit an exposure to uncontrolled run-off.

On the south access road, a temporary bridge is required over the Boyne Navigation Canal. The northern abutment for the temporary bridge is located within the flood plain of the river. Other initial works in the flood plain is completion of the temporary access track.

To construct these works a temporary access is proposed from the canal towpath. This access track and the temporary access track to WP2 will be constructed by installing reno-matrasses as per the construction of WP2. The mattresses will be transported to site and craned into place from the tow path. The build-up of mattresses will form an access ramp from the tow path down into the floodplain to the south of the River Boyne. Each successive mattress will be lifted into place working from the leading edge of the constructed platform. This will ensure that heavy plant does not traffic directly over the natural ground. The mattresses in

this location will also form the basal layers of the permanent tow path embankment. This will ensure that fines are not placed below the 1% AEP flood level. As an additional precaution, it is proposed that the initial works area will be bounded by silt and hydrocarbon barrier fences.

By using reno-mattrasses for construction and access to construct the northern abutment of the temporary bridge, there will be no risk of sediment washout occurring from the works, should a flood event occur during this phase of the works.

The temporary bridge structure proposed is a prefabricated Bailey bridge type construction which will be lifted into place from the south side of the canal.

On completion of this first phase of the works, fencing, interceptor ditches, ESB diversion, access tracks, fully operational Attenuation Ponds No. 2 and 3 and earthworks for WP1 and WP2 will be completed.

#### 5.12.10.5.2.2 Second and Third Phase of Construction

This phase of the construction includes the construction of the bridge large diameter bored piles and pilecaps, bridge piers and abutments and removal of the temporary cofferdams. **Appendix 5.2**, **Drawings MDT0806-RPS-01-N2-DR-C-DG5102** (Boyne Crossing Temporary Works - Phase 2) and **MDT0806-RPS-01-N2-DR-C-DG5103** (Boyne Crossing Temporary Works - Phase 3) illustrate the scope of the proposed works together with the erosion prevention measures to be provided during these phases of construction.

The proposed interceptor ditches and silt protection fences bounding the works site constructed in the first phase will remain in place and be operational during this phase of construction.

Once the access tracks are sufficiently far advanced, construction of the working platforms WP1, WP2, WP3 and WP4 may commence. WP1 and WP4 will comprise clean washed rockfill placed on a basal separation geotextile with a geogrid placed between each 300 mm lift. WP 2 and WP3 will comprise 4 layers of reno-mattress filled with washed clean rockfill placed on a basal separation geotextile.

Cofferdams will be constructed to construct the bridge foundations and piers within the floodplain. Once the sheet piled cofferdams are in place (installed via hydraulic press), excavations within the cofferdams may commence. Following excavation, clean washed rockfill will be placed within the cofferdams to form the working platforms for the piling rigs and other plant. This will allow the abutment piles, reinforced concrete works and abutments to be constructed. The excavation and piling at each pier location will be carried out from within the cofferdams. As the sides of the cofferdam will extend to a height above that of the adjoining working platform, the piling rigs and excavators will be craned in and out. The cofferdam will enclose the proposed excavation and piling works preventing water or sediment from entering or escaping. Spoil returns will not be stockpiled but loaded directly into dumper trucks and transported away. Any spills within the cofferdam will be contained. Should any spills occur, these will be pumped out and transported off-site to an appropriate hazardous waste treatment facility. Rainwater may also enter the cofferdam at times and some groundwater may also ingress from the base of the cofferdam. As such any groundwater ingress and rainwater will be pumped out via bowser and taken off-site to a suitably licensed facility for treatment/ disposal.

With completion of the abutments the piling rigs and excavators will be removed. The removal of the cofferdam will involve backfilling the inside to reinstate the ground. Pre-vegetated sod utilising a native species mix will be placed to accelerate the rehabilitation of the ground. Once the root structure of the sod has re-established and knitted back into the ground, only then will the sheet piles be removed by pulling them vertically out of the ground.

**Section 5.12.10.5** above describes the construction process for the working platforms and cofferdams and the controls to be implemented during the operational phase to construct the permanent works.

Upon completion of the bridge support, it will be feasible to commence the construction of the bridge deck.

#### 5.12.10.5.2.3 Fourth Phase of Construction

**Appendix 5.2** Drawing **MDT0806-RPS-01-N2-DR-C-DG5104** (Boyne Crossing Temporary Works - Phase 4) illustrates the scope of the proposed works together with the erosion prevention measures to be provided during this phase of construction. This phase of the construction includes for the Bridge Girder Installation.

Following completion of the bridge piers and abutments the larger crawler cranes will mobilise onto the working platforms. The main access road has been designed with a maximum tolerable gradient of 10% to enable these lorries access the platforms while reducing the extent to which they extend into the floodplain

and SAC. The cranes will be delivered in sections on a flatbed lorry and constructed on site. The working platforms are sized to enable lorries to access the platform, unload, turn, drive out and allow the dis/assembly of the cranes and the bridge girders.

To reduce the overall footprint of the working platforms the large cranes will be located to one side of the mainline. This is due to the constraint that once the bridge girders are in place, they would block the disassembly of the cranes without significantly increasing the platform area on both sides of the mainline alignment. Assembly of the crane's 80 m long jib will require it to be laid flat across the platform to allow each section to be connected before being hoisted. The lifting locations for the cranes must be level and of sufficient bearing capacity to support the crane and the load of the bridge girders. As such, crane pads will be constructed at each lift location. These generally comprise timber mats which spread the load and are crucial to the safety of the lifting operations. The timber mats will be either secured to the working platform to prevent them floating away in the unlikely event of a flood or removed in advance of adverse weather that risks floodwater overtopping the platforms. Furthermore, the lifting operations will be programmed in advance of a favourable weather window of sufficient duration to complete the works.

Scaffold, cherry pickers or similar will be established as necessary at each pier and abutment. These will be used to construct and access the bridge's bearings for each girder. It is also likely that some intermediate temporary supports will be required (outside of the Boyne exclusion zone) during the lifting operation, to support one end of the pier sections prior to lifting in the central sections. These temporary intermediate supports will consist of scaffolding erected from the working platform to provide support to girder sections placed over the bridge piers.

The bridge girders will be delivered to site in sections on a flatbed lorry. These will be lifted off, placed on the working platform and coupled to each other before being lifted on to the abutments. Once all girders are in place the cranes will be demobilised. This will require laying the jib out flat on the working platform before each section is decoupled, loaded onto a flatbed and removed off site.

Drawing **MDT0806-RPS-01-N2-DR-C-DG5104** illustrates the key locations within the proposed WP2 and WP3 for rigging/lifting and derigging of the cranes.

**Section 5.12.10.5 Working Platforms** above describes the general controls to be implemented during the operational phase to construct the permanent works.

Abnormal loads are likely to be required for the delivery/removal of the cranes and also the delivery of the bridge girders. The operation of any abnormal loads will be subject to statutory permit requirements, carried out with the consent and approval of the relevant local authorities and An Garda Síochána.

#### 5.12.10.5.2.4 Fifth Phase of Construction

**Appendix 5.2** Drawing **MDT0806-RPS-01-N2-DR-C-DG5105** (Boyne Crossing Temporary Works - Phase 5) illustrates the scope of the proposed works together with the erosion prevention measures to be provided during this phase of construction.

Once the bridge girders are in place, construction of the bridge deck will commence. To reduce the potential impact on the SAC and SPA during the construction stage, certain items and methods will be stipulated such as the use of precast concrete rather than in-situ concrete where possible. It will be a specific contract requirement that, following steel superstructure installation, the reinforced concrete deck is constructed completely from on top of the bridge rather than from the valley floor. This will be done with precast concrete elements with in-situ concrete stitches and would involve starting at the ends of the bridge and lifting or pouring one section at a time, allowing it to come up to sufficient strength before moving further along to repeat the process.

Following the installation of the bridge girders, the larger crawler cranes and plant will be demobilised from site. Upon removal of the heavy plant from the site, the temporary access road from Rossnaree Road, across the canal and onto WP2 will be realigned to allow work to commence on the mainline and the Rossnaree underbridge. The new temporary access will be constructed off Rossnaree Road to the west of the mainline as shown in **Appendix 5.2** drawing **MDT0806-RPS-01-N2-DR-C-DG5105** (Boyne Crossing Temporary Works - Phase 5). This will maintain access for any construction work including removal of the working platforms to follow.

At an appropriate stage in the programme, the working platforms can be removed. Prior to working platform removal, a temporary silt fence will be erected around the perimeter of the platform as added protection against sediment run-off. Each reno-mattress will be lifted out starting at the furthest point before retreating out of the site across the remaining platform. To reduce the potential for erosion, the platforms will be

removed in sections. Once the first section is removed, the underlying soil will be re-sodded utilising a native species mix. This will be programmed for early spring and in advance of a favourable weather window of sufficient duration to complete the works. This is to allow sufficient time for the vegetation and its root structure to re-establish. Once a section of the platform is removed, the ground has been re-sodded, and vegetation is established, the next section of the platform can be removed, and the process repeated. By adopting this approach, it minimises the time the foundation soils are vulnerable to erosion during the summer months when flooding is least likely to occur.

The reno-mattresses used to construct WP2 will be repurposed to construct, the lower levels of the tow-path embankment, the permanent farm access, and the bridge maintenance access to the south of the River Boyne. Construction of these lower levels to above the predicted maximum flood level will ensure these works will not result in sediment laden run-off to the river. In order that the towpath embankment, the permanent farm access and the bridge maintenance access will be protected from erosion from both run-off and flood events and that they will blend into the local environment, exposed surfaces of reno mattrasses will be covered with organic geotextile/mat, topsoiled and seeded. Landscape planting will also be established as appropriate.

Removal of the temporary access roads will follow removal of the platforms and following their removal the temporary interceptor ditches will be backfilled and revegetated and finally the silt fences will be removed.

#### 5.12.10.5.2.5 Mainline Works to the South Abutment

This phase of the construction takes place when it is appropriate to remove Earthworks Plug A at Rossnaree Road (refer also to the description of Earthworks Zone EWC-C under **Section 5.13.3 Phase 2 Earthworks**) and the amended access to WP2 has been constructed as described above. This will allow for the removal of the existing Rossnaree Road under a temporary road closure, and the progression of the mainline works to the south abutment of the River Boyne bridge.

As the existing ground falls steeply towards the canal in this area, there is no practical way of providing an earthworks plug to prevent run-off towards the canal. Prior to works in this area, interceptor ditches and a silt barrier fence will be constructed between the proposed works area and the Boyne Canal. As the scale of works required is modest, this provision will provide adequate control of any run-off that might occur during this phase.

The cutting will commence with the removal of Earthworks Plug A and the progression of the cut into the Boyne valley. As this earthwork proceeds the pathway for run-off towards the canal will be blocked until such time as the cutting is complete. Prior to final breakthrough of the cut into the valley, it is proposed that all of the slopes will be topsoiled, covered with organic geotextile/mat and planted/seeded and all road areas will be overlaid by road build-up. This will limit the risk of any uncontrolled sediment-laden run-off from the works.

As the cut progresses, run-off will be directed to longitudinal channels running at the base of the earthworks cut slopes from where it is directed into the temporary chamber upstream of the vortex grit separators (VGS) at Attenuation Pond 2 and through the VGS, petrol/hydrocarbon interceptor (PI) and pond for treatment. There should be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams (as described in **Section 5.3.3.2 Check-dams and Silt Barriers** above) will be provided in these channels where the longitudinal slope exceeds 1%. If groundwater ingress through the side slopes is encountered during excavation, it will be collected before it becomes contaminated with sediment and kept separate from surface water run-off.

When the cut breaks through into the valley, any run-off from the site will be collected in the proposed interceptor ditch and any overflow from this will be sifted by the proposed silt barriers located on the northside of the works area. Run-off from the ditch will be pumped to Attenuation Pond 2 and through the VGS, PI and pond for treatment.

In areas of earthworks fill, surface water run-off will be captured by PEDs at the bottom of the earthworks embankment and directed to the proposed run-off collection trench. The fill embankments will be topsoiled, covered with organic geotextile/mat and planted/seeded and all road areas will be overlaid by road build-up immediately after the earthworks operations are completed.

At this stage, the permanent cross carriageway road drainage carrier pipes to the VGS and the groundwater filter drains to the proposed culvert will be installed. This will allow a speedy connection to the permanent works for the drainage infrastructure installed south of this area. At this stage the permanent PEDs will also come into operation in terms of collecting run-off from embankment slopes.

#### 5.12.10.5.2.6 Mainline Works to the North Abutment

This phase consists of the permanent earthworks and road construction to the north abutment of the River Boyne bridge from Earthworks Plug F at Ch. 610 (refer also to the description of Earthworks Zone EWC-E under **Section 5.13.3 Phase 2 Earthworks**).

The mainline construction works in this zone will be in the latter stages of the construction programme as the earthworks and road construction north of earthworks plug F will need to be substantially advanced and also the construction of the north abutment of the River Boyne bridge will to have been completed. Also included in this section is the construction of Accommodation bridge No 3, which is envisaged to be constructed as early as possible in the construction programme to facilitate local landowner permanent access across the site.

The enabling works to access the north side of the River Boyne are described above in **Section 5.12.10.2 Access for Boyne Bridge Construction.**

The accommodation bridge construction work can commence soon after the temporary access road from the N51 is in place. The accommodation bridge is located south of earthworks plug F. It is proposed that a local cut be made at the bridge location to enable access to foundation level and allow for foundation, pier and abutment construction. This will be in advance of mainline earthworks to the north abutment of the River Boyne bridge.

During the construction of the accommodation bridge any run-off during the construction will be contained in the excavation for the bridge construction and will not have a pathway for uncontrolled run-off to the river. Run-off collected in the excavation will be channelled to a sump from where it will be pumped to Attenuation Pond No. 3 for treatment prior to final discharge.

During the construction of Accommodation Bridge 3, temporary access arrangements for Landowner 118/119 to cross the site must be maintained. Before the mainline earthworks advancing in the northern direction reach the access route from the N51, the accommodation bridge must be available for use by the landowner. At this stage, an access for the landowner to use along the access road to Earthworks plug F will need to be made available. This access road would connect to the access road on the overbridge for landowner use. Refer to **Figure 5.24** above (Illustration of Access Road to North side of River Boyne).

The mainline earthworks construction in this area takes account of the existing ground which falls steeply towards the river in this area. There is no practical way of providing an earthworks plug to prevent run-off towards the river. However, given the modest scale of the earthworks required, providing silt barriers interceptor ditches as in as described in **Section 5.12.10.5.2.1 First Phase of Construction** above with a run-off collection trench at the bottom of the existing slope along with the slope protection measures outlined below will provide comprehensive sediment control in this area.

The cutting in this zone will commence with the removal of earthworks plug F and the progression of the cut into the Boyne valley. As these earthworks proceed, the pathway for run-off towards the river will be blocked until such time as the cutting is complete. Prior to final breakthrough of the cut into the valley, it is proposed that all of the earthwork slopes will be covered with organic geotextile/mat, topsoiled and planted/seeded and all road areas will be overlaid by road build-up. This will limit the risk of any uncontrolled sediment laden run-off from the works as the work proceeds into the fill area.

As the cut progresses, run-off will be directed to longitudinal channels running at the base of the earthworks cut slopes from where it is directed into the temporary chamber upstream of the VGS at Attenuation Pond 3 and through the VGS, PI and pond for treatment. There should be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams (as described in **Section 5.3.3.2** above) will be provided in these channels where the longitudinal slope exceeds 1%.

When the cut breaks through into the valley, any run-off from the site will be collected in the proposed interceptor ditch and any overflow from this will be sifted by the proposed silt barriers and located on the southside of the works area. Run-off from this trench will be pumped to Attenuation Pond 3 and through the VGS, PI and pond for treatment.

In areas of earthworks fill, surface water run-off from the fills will be sifted through silt barriers and captured by PEDs at the bottom of the earthworks embankment and directed to the proposed run-off interceptor drain. The fill embankments will be covered with organic geotextile/mat, topsoiled and planted/seeded and all road areas will be overlaid by road build-up immediately after the earthworks operations are completed.

The silt barriers will protect the river from any sediment laden run-off that may arise during construction of the earthworks in the area. The silt barriers will be installed between the base of the earthworks

embankment slopes and between the works area and the river. The proposed run-off collection trench will be located upstream of the silt barrier.

Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the cross-carriageway road drainage carrier pipes to the VGS and the groundwater filter drains will be installed. This will allow a speedy connection to the permanent works for the drainage infrastructure installed to the north. At this stage the permanent PEDs will also come into operation in terms of collecting run-off from embankment slopes.

#### 5.12.10.5.2.7 Cycle Link from Mainline to Canal Towpath

As temporary access to the river valley and bridge construction working platforms is required until the river bridge is completed, the construction of the proposed cycle bridge over the canal and associated pedestrian/cyclist link cannot be constructed until the temporary access on the south side is no longer necessary. Therefore, this construction will take place after the River Boyne Bridge, including construction up to the southern abutment is completed and the temporary access and working platforms have been removed.

During construction of this link, temporary interceptor ditches and silt trap fences will be installed below the proposed works area to intercept any run-off that might occur during construction.

Works include the permanent works for the cycle bridge over the Boyne Navigation Canal and associated towpath. An efficiency to be gained at this location will be designing the foundations of the temporary Bailey bridge to be adapted at this stage for the foundations for the permanent cycle bridge.

Off-site prefabrication of the cycle bridge is proposed. This will be transported to site and lowered into place from the south side via the constructed cycle/pedestrian link. This work will also require the mainline to be accessible to traffic, which will be facilitated by the necessity that this work can only be carried out late in the construction programme.

## 5.13 Earthworks

### 5.13.1 Introduction

To reduce the risk of sediment laden run-off entering the River Boyne and River Blackwater SAC and SPA, either directly or indirectly via smaller watercourses, the construction sequencing of the earthworks has been analysed and divided into phases and zones with the proposed construction sequencing set out in the following sections.

The phasing and earthwork zones (EWZ) and sequencing are shown on the following drawings:

- **Volume 4, Appendix 5.3 – Earthworks Strategy, Drawing MDT0806-RPS-01-N2-DR-C-DG2100 - 2108** (Earthworks Phase 1);
- **Volume 4, Appendix 5.3 – Earthworks Strategy, Drawing MDT0806-RPS-01-N2-DR-C-DG2200 - 2208** (Earthworks Phase 2); and
- **Volume 3, Drawing MDT0806-RPS-01-N2-DR-C-DG2300** (Stream Diversion - Long Section).

### 5.13.2 Drainage Phase 1

Phase 1 will be constructed initially. Phase 1 includes the construction and seeding of all permanent pre-earthworks ditches (PEDs) and attenuation ponds and the construction of all culverts. Seeding these areas immediately after construction may require the removal of typical construction contract clauses defining allowable planting seasons from the project contracts.

All watercourses near the proposed works in Phase 1 will be protected from sediment run-off by providing double silt barriers or fences around the perimeter of the works.

Refer also to **Section 5.12.10.2** above in relation to the construction of Attenuation Ponds No. 2 and No. 3 located in the SAC and adjacent to the SPA around the River Boyne.

### 5.13.2.1 Pre-Earthworks Ditches (PEDs) and Drain Diversions

All PEDs are to be constructed as part of Phase 1. Constructing the PEDs will reduce the water entering the large earthworks areas during subsequent phases. Any existing land drain diversions will also be carried out during Phase 1 works.

Once these PEDs and land drain diversions are constructed, they will intercept any surface water run-off from adjoining lands or upstream sections of land drains and direct it to an existing watercourse for outfall. There will be little or no sediment in the run-off that enters the PEDs. To prevent suspension of sediment within the PEDs it is proposed that the channels will be vegetated prior to commencing operation. Should programme constraints dictate insufficient time for vegetation to be established, erosion control measures such as a geotextile or natural matting laid in the PED will be implemented. Check-dams will be provided where the longitudinal slope of the PED exceeds 1%.

A stilling pool and check-dam with a level spreader will be constructed in all PEDs at the upstream side of all outfalls to receiving watercourses as a final run-off treatment facility prior to outfalling to the receiving watercourse.

### 5.13.2.2 Culverts

Some PEDs and existing streams will need to be culverted as part of the permanent works and these crossings will be needed to ensure that the watercourses function correctly after the completion of Phase 1 construction works. The PEDs need to be culverted beneath farm or domestic accesses, proposed and existing side roads and the mainline itself. The existing Mattock (Mooretown) Stream needs to be culverted beneath the mainline and the field drain upstream of the Slane Stream will be piped.

A temporary diversion of the Mattock (Mooretown) Stream will be implemented in advance of the proposed culvert works to minimise the extent of in-stream works. **Drawing MDT0806-RPS-01-N2-DR-C-DG2300** illustrates the proposed temporary diversion.

### 5.13.2.3 Attenuation Ponds & Drainage Infrastructure

As part of the permanent mainline drainage works 6 No. attenuation ponds are to be constructed. The ponds are designed to attenuate the 1% AEP storm discharge to the equivalent $Q_{bar}$ run-off rate of a greenfield site. The ponds are also designed to contain a wetland/retention area (i.e. permanently submerged) at the base of the pond to aid water treatment and reduce pollutants in the discharge.

It will construct the earthworks of all attenuation ponds during Phase 1. Construction of the ponds and providing sufficient time for vegetation establishment on the base and sides of the ponds prior to the commencement of the main earthworks will allow the permanent attenuation ponds to be utilised as temporary settlement ponds for the treatment of construction run-off during the earthworks phases of the Proposed Scheme. The vegetated ponds can receive run-off from the site (either via pumped discharge or gravity fed) with sufficient volume in the ponds to cater for the critical temporary works design storm (10% AEP or 1 in 10-year event) and allow sufficient retention time prior to outfalling to the receiving watercourse.

As with the PEDs and drains diversions above, the vegetation in the ponds will be planted as part of Phase 1 works. This will be done by traditional seeding and/or hydraulic seeding where suitable and allowing sufficient time for establishment prior to the main earthworks commencing.

The permanent VGS, PI and pond inlet headwalls for Pond 2, Pond 3, Pond 4, Pond 5a and Pond 5b are to be constructed as part of the Phase 1 works for use as part of the temporary works. These will be installed at the correct levels to allow for use during the operational phase of the road when construction work is completed. Temporary chambers will be installed upstream of the VGS to receive any pumped surface water allowing the flow via gravity through the VGS, PI and into the pond. The temporary chamber upstream of the VGS will also correctly align the pipework through the VGS and PI as per manufacturer's guidelines.

Permanent pond outlet headwalls will not be operational during the temporary works as the lower level of the permanent outlet might increase the risk of accidental discharge of contaminated water to the receiving watercourses. The permanent outfall headwall may be constructed during Phase 1 but would need to be sealed or bunged to prevent any discharge through them.

## 5.13.3 Phase 2 Earthworks

Phase 2 of the earthworks construction involves the main earthworks of the Proposed Scheme. The earthworks of the proposed mainline and side roads have been divided into zones based on existing and proposed topography, and existing and proposed road layouts. The construction of the zones will be carried out in the sequence set out below to reduce the risk of sediment-laden run-off entering the SAC/SPA directly or indirectly.

At the low-point of all earthwork cut areas, an earthworks plug will be maintained until such time that the earthworks side slopes are topsoiled, covered with organic geotextile/ mat and planted/ seeded and initial layers of permanent road construction (capping and/or sub-base) and pipes and chambers for the drainage have been installed; only after this will the earthworks plug be removed.

All earthwork slopes will be overlaid by organic geotextile or mat before seeding. There will be no more than 100 linear metres of uncovered completed earthworks slopes in any one earthworks zone (EWZ). Once every 100 linear meters of earthworks slopes has been completed, the slopes will be immediately covered and seeded. This will limit the amount of exposed earthworks slopes at any one time and reduces the potential volume of sediment laden run-off to be treated.

Where the groundwater filter drains and surface water carrier pipes are ultimately to continue through the earthworks plug, the drains will be terminated in a chamber constructed upstream of the plug and any water collected in the system pumped to the nearest attenuation pond for treatment. Once the earthworks plug is removed, pipes can continue downstream, via gravity, to their permanent outfall from this chamber. During the operational phase of the Proposed Scheme, the groundwater filter drains will not capture surface water run-off; however, during the construction phases, it is possible that some surface water run-off will enter these filter drains. Therefore, all groundwater filter drains will be wrapped in a drainage geotextile to reduce the sediment entering the pipes.

The vortex grit separators and petrol/hydrocarbon Interceptors will require constant daily monitoring during the construction phase to determine when they require to be cleaned and sediment/ hydrocarbons removed. The capacity of both is determined by the manufacturer's guidelines and capacity limits will be adhered to during the temporary works. The material removed from both will be disposed in adherence to waste management guidelines.

Earthworks relating to the public realm element of the Proposed Scheme will occur after the proposed bypass is open to traffic. The construction works associated with the public realm are detailed under **Section 5.4.10** above.

### 5.13.3.1 Earthworks Zone-A (EWZ-A)

EWZ-A starts at the proposed Rossnaree Road crossing and runs south for approximately 1 km and is the largest EWZ in the Proposed Scheme. The earthworks in this zone consist of a large cutting of approximately 242,000 $m^3$ of material. The direction of earthworks in EWZ-A is in a southerly direction i.e. against the fall of the proposed road. EWZ-A finishes where the proposed levels begin to fall in a southerly direction (approximately Ch. 20).

Access to EWZ-A will be from Rossnaree Road; a temporary haul road will be required for access and egress from EWZ-A from the base of the earthworks excavation up to Rossnaree Road. **Figure 5.30** below shows a longitudinal section through the southern end of EWZ-A.

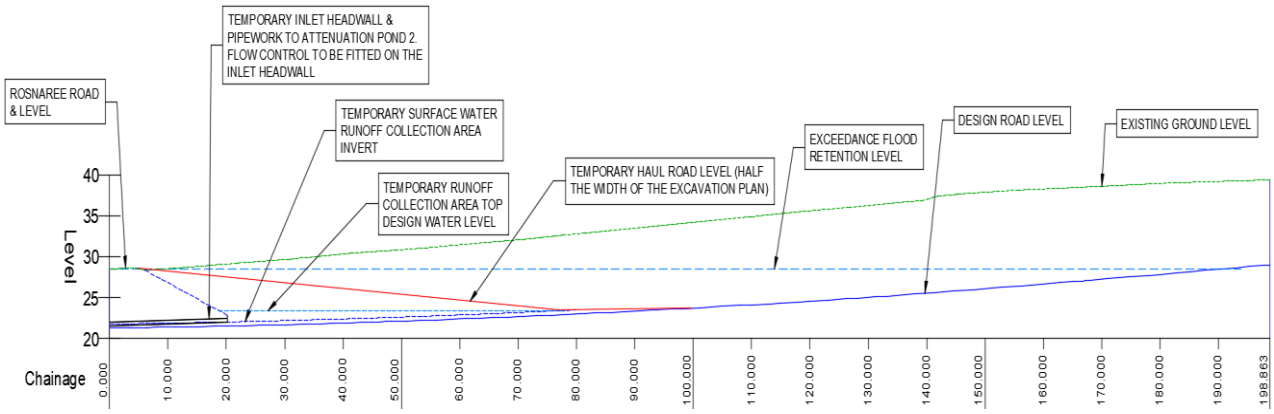


**Figure 5.30: Longitudinal section through Rosnaree Road and EWZ-A interface**

The temporary haul road, located to the east of the earthworks plan area, allows sufficient room for the temporary collection of the surface water run-off from the earthworks site. The surface run-off from the site will be directed to the temporary collection area via longitudinal channels running at the base of the earthworks cut slopes. There will be crossfall constructed at the base of the excavation to direct the run-off into these channels quickly once it falls – this will ensure that the amount of sediment the run-off picks up before being controlled in the channels is reduced. Check-dams are to be provided in these channels where the longitudinal slope exceeds 1%.

It is proposed that the run-off from the temporary collection area will be discharged though gravity to the temporary chamber upstream of the permanent VGS where it will continue via gravity through the VGS, PI and into Attenuation Pond 2 via temporary pipework beneath Rossnaree Road – directional drilling techniques will be used for this run to avoid excavation of Rossnaree Road early in the works. On the inlet to the pipework at the temporary collection area, an orifice or similar flow control device will be placed to limit the discharge to Attenuation Pond 2 to a rate such that the minimum retention time for sediment removal is achieved in the pond. This flow control device will ensure that any rainfall event in excess of the design event will be retained behind the earthworks plug and will not inundate Attenuation Pond 2.

After a retention time is reached in Attenuation Pond 2 to achieve sufficient sediment settlement, the treated water will be discharged through silt bags and outfall across the vegetated banks into the Boyne Navigational Canal.

As the earthwork progresses in the southerly direction, all earthwork slopes will be topsoiled, covered with organic geotextile/mat and planted/seeded once 100 m of earthworks excavation is completed. The vegetation does not have to be established before the earthworks start on the next 100 m. Similarly, there will be no more than 100 m of final excavation level exposed without initial road build-up constructed to reduce the suspension of sediment from completed earthwork areas.

Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed with progression in a southerly direction in tandem with the earthworks. Any water collected in the drainage systems will be directed to controlled temporary pipe under the Rossnaree Road to the temporary chamber upstream of the permanent VGS and continue through the VGS, the PI and Attenuation Pond 2 for treatment.

The construction of Overbridge No. 1 and associated access tracks will be constructed early in EWZ (Ch. 700) to avoid land severance. Earthworks operations may need to be phased to ensure severance doesn't occur prior to the overbridge and access tracks being completed

If groundwater ingress through the side slopes is encountered during excavation, it will be collected before it becomes contaminated with sediment and kept separate from surface water run-off.

### 5.13.3.2 Earthworks Zone B (EWZ-B)

EWZ-B is located at the proposed roundabout at the southern tie-in to the N2 (i.e. south of EWZ-A). Access to EWZ-B can be achieved through EWZ-A or a temporary access off the existing N2. Earthworks in this zone is a relatively minor amount of cut and fill, with a requirement for approximately 8,000 $m^3$ cut and 6,000 $m^3$ fill.

The existing land drain that runs along the eastern verge of the N2 will be protected from sediment run-off for the duration of works in EWZ-B using silt barriers as previously described. However, while this drain is to be diverted as part of the permanent works, this cannot be completed until the existing N2 is made redundant.

All surface water run-off in EWZ-B will be directed to Attenuation Pond 1 for treatment via longitudinal channels running at the base of the earthworks slopes. Silt barriers will be installed both at the base of all earthwork embankment slopes (before discharge to these channels) and at the perimeter of the site. After a retention time is reached in Attenuation Pond 1 to achieve sufficient sediment settlement, the treated water will be discharged through silt bags and discharged to the existing land drain that runs along the eastern verge of the N2 as is currently the case with overland flow in the area.

All earthwork slopes will be topsoiled, covered with organic geotextile/mat and planted/seeded and all road areas will be overlaid by road build-up immediately after the earthworks is completed.

Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and filter drains will be installed. Any water collected in the drainage systems will be allowed to continue through the network via gravity to the VGS and continue through the PI and Attenuation Pond 1 for treatment.

If groundwater ingress through the side slopes is encountered during excavation, it will be collected before it becomes contaminated with sediment and kept separate from surface water run-off.

### 5.13.3.3 Earthworks Zone C (EWZ-C)

EWZ-C is located between Rossnaree Road and the banks of the Boyne Navigational Canal to the north. Mainline earthworks comprise the completion of the mainline cut into the Boyne valley with some fill on the approach to the southern abutment of the River Boyne crossing, consisting of approximately 73,000 $m^3$ of cut and 3,000 $m^3$ of fill. Other earthworks include cut/fill for the construction of Attenuation Pond No 2 and the proposed pedestrian/cyclist link to the canal towpath.

The constraints associated with this area of work, together with the proposed run-off control measures and order and sequence of the works, are described in **Section 5.12.10.5.2.5 Mainline Works to the South Abutment** above.

The completion of earthworks within EWZ-C is dependent on the construction programme for both the River Boyne bridge and the works in EWZ-A and therefore will be constructed at the latter end of the construction programme.

The measures described in **Section 5.12.10.5.2.5** ensure the proposed mainline earthworks and roadworks on the approach to the River Boyne Bridge are constructed in a way that controls run-off and provides treatment prior to discharge to the canal. Other construction within this zone includes the permanent pedestrian and cyclist link from the mainline to the Canal tow-path, including the realignment of the tow-path. This work will take place separately in the programme, when the River Boyne bridge is completed and working platform WP2 have been removed.

### 5.13.3.4 Earthworks Zone D (EWZ-D)

EWZ-D is located between the northern banks of the Boyne Navigational Canal and banks of the River Boyne. Earthworks consists of the provision of permanent access and an area to facilitate future bridge maintenance plus access provision for the adjacent landowner. Also included in the realignment of the towpath and the completion of the proposed cycle/pedestrian link.

The constraints associated with this area of work, together with the proposed run-off control measures and order and sequence of the works are described in **Section 5.12.10.5.2.4 Fifth Phase of Construction** above.

### 5.13.3.5 Earthworks Zone E (EWZ-E)

EWZ-E is located between the northern banks of the River Boyne and Earthworks Plug (F) at chainage Ch. 1610 to the north. Mainline earthworks comprise approximately 10,000 $m^3$ of cut and approximately 7,500 $m^3$ of fill. Also in this area is the construction of Overbridge 3 and associated access tracks.

The constraints associated with this area of work, together with the proposed run-off control measures and order and sequence of the works are described in **Section 5.12.10.5.2.6 Mainline Works to the North Abutment** above.

### 5.13.3.6 Earthworks Zone F (EWZ-FC)

EWZ-F is located between Earthworks Plug F at chainage Ch. 1610 and the existing N51 to the north including the N51 tie-ins and realignments. The access to EWZ-F will be via a temporary haul road from the N51 to Earthworks Plug F. The earthworks quantum in this zone comprises approximately 160,000 $m^3$ of cut. The earthworks progression in EWZ-F is in:

- A northerly direction from Earthworks Plug F to the proposed N2/N51 roundabout i.e. against the fall of the road;
- A westerly direction from the proposed N2/N51 roundabout to the N51 western tie-in i.e. against the fall of the road; and
- An easterly direction from the proposed N2/N51 roundabout to Ch. 325 on the N51 eastern realignment i.e. against the fall of the road.

In areas of cut, such as on the mainline and on the N51 eastern realignment, the surface water run-off will be directed to longitudinal channels running at the base of the earthworks cut slopes. There will be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams will be provided in these channels where the longitudinal slope exceeds 1%.

Sumps will be provided at regular intervals in these channels throughout EWZ-F to facilitate pumping out from the channels to a temporary chamber upstream of the VGS at Attenuation Pond 4. From here the surface water will continue via gravity through the VGS and PI and into Attenuation Pond 4 for treatment. As all proposed surfaces on the N51 realignments in EWZ-F fall towards the roundabout and pond area, it may be possible to use temporary pipework to discharge surface water via gravity for part of the EWZ to the temporary chamber upstream of the VGS.

In areas of earthworks fill such as from the N51 western realignment and tie-in, surface water run-off will be captured by PEDs at the bottom of the earthworks embankment. The PEDs which capture construction run-off in EWZ-F will be temporarily redirected (for the duration of construction works) into the temporary chamber upstream of the VGS and Attenuation Pond No. 4, through the VGS, PI and into Attenuation Pond 4 for treatment. After a retention time is reached to achieve sufficient sediment settlement in Attenuation Pond 4, the treated water will be pumped through the silt bags and discharged across the vegetated banks into adjacent PED, which in turn discharges to the River Boyne.

As the earthwork progresses, all earthwork slopes will be topsoiled, covered with organic geotextile/mat and planted/seeded once 100 m of earthworks excavation is completed. Similarly, there will be no more than 100 m of final excavation level exposed without initial road build-up being placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed with progression in a similar direction to the earthworks. Any water collected in the drainage systems will be pumped from the most downstream chamber (i.e. just upstream of Earthworks Plug F) to the temporary chamber upstream of the permanent VGS and continue through the VGS, the PI and Attenuation Pond No. 4 for treatment.

If groundwater ingress through the side slopes is encountered during excavation, it will be collected before it becomes contaminated with sediment and kept separate from surface water run-off.

### 5.13.3.7 Earthworks Zone G (EWZ-G)

EWZ-G is located between Ch. 325 on the N51 eastern realignment and the N51 eastern tie-in. The access to EWZ-G will be through EWZ-F. The earthworks progression for EWZ-G is in an easterly direction i.e. with direction of the fall of the road. The earthworks quantum is approximately 12,000 $m^3$ of cut.

The surface water run-off will be directed to longitudinal channels running at the base of the earthworks cut slopes. There will be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams will be provided in these channels where the longitudinal slope exceeds 1%. As the earthworks progresses in the same direction of the fall of the road, there will the need for surface water pumping during rainfall events from the cut face back to the western boundary of EWZ-G

where the surface water will be discharged into the longitudinal channels running at the base of the earthworks cut slopes in EWZ-F from where they will continue to the VGS, PI and Attenuation Pond 4 for treatment.

As the earthworks progresses, all earthworks slopes will be immediately topsoiled, covered with organic geotextile/mat and planted/seeded. Similarly, initial road build-up will be placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes will be installed. Any water collected in the drainage system will be pumped from the most downstream chamber to the longitudinal channels running at the base of the earthworks cut slopes in EWZ-F. There are no groundwater filter drains proposed for EWZ-G.

### 5.13.3.8 Earthworks Zone H (EWZ-H)

EWZ-H is located between Earthworks Plug H at Ch. 2310 and the upper Slane Stream drain piped crossing at Ch. 2860 to the north. The access to EWZ-H will be via a temporary haul road from the N51 to Earthworks Plug H. The earthworks quantum is approximately 41,000 $m^3$ of cut. The earthworks progression in EWZ-H is in:

- A northerly direction in the area of cut from Earthworks Plug (G) for approximately 330m to Ch. 2640 i.e. against the fall of the road;
- A northerly direction in the area of fill from Ch. 2640 to Ch. 2800 i.e. in the same direction as the fall of the road; and
- A northerly direction in the area of fill from Ch. 2800 to Ch. 2860 i.e. against the fall of the road

In areas of cut, the surface run-off from the site will be directed to a temporary collection area near Earthworks Plug H via longitudinal channels running at the base of the earthworks cut slopes for the length of EWZ-H. There will be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams will be provided in these channels where the longitudinal slope exceeds 1%.

From Ch. 2640 to Ch. 2860 on the eastern earthworks embankment, temporary PEDs will be installed to capture run-off from the embankment slope and half of the carriageway.

The surface water collected from cut areas will be pumped from the temporary collection area to these temporary PEDs at the eastern earthworks embankment. From these temporary PEDs the surface water will be directed, via gravity through the VGS, PI and into Attenuation Pond 5a for treatment.

After a retention time is reached to achieve sufficient sediment settlement in Attenuation Pond 5a, the treated water will be pumped through silt bags and discharged across the vegetated banks into the adjacent drain upstream of the Slane Stream.

From Ch. 2640 to Ch. 2860 on the western earthworks embankment, the permanent PEDs will be utilised to capture run-off from the embankment slope and the western half of the carriageway.

Silt barriers will protect the nearby watercourses from sediment laden run-off that may arise during construction of the earthworks in the area. Silt barriers will be installed at the base of all embankment slopes between the slope base and the PED to filter the water before it enters the PED. Silt barriers will also be installed at the perimeter of the site and will remain in place until all works in the EWZ are completed and the Earthworks Plug H has been removed.

As the earthwork progresses, all earthwork slopes will be immediately topsoiled, covered with organic geotextile/mat and planted/seeded once 100 m of earthworks excavation is completed. Similarly, there will be no more than 100 m of road area exposed without initial road build-up being placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed with progression of the installation of the groundwater filter drains in the same direction as the earthworks. Any water collected in the groundwater filter drainage system will be pumped from the most downstream chamber at the Earthworks Plug H to the temporary PEDs at the eastern earthworks embankment and onto Attenuation Pond 5a for treatment.

It is expected that acceptable material excavated between Ch. 2310 and Ch.2640 will be utilised for earthwork embankments between Ch. 2640 and Ch. 3070. This material could be transported to the fill areas from Earthworks Plug H along the ponds access track or from the top of the cut face directly to the fill areas.

### 5.13.3.9 Earthworks Zone J (EWZ-J)

EWZ-J is located between Earthworks Plug H at chainage Ch. 2310 and existing N51 to the south. The access to EWZ-H will be via a temporary haul road from the N51 to Earthworks Plug H. The earthworks quantum is approximately 1,700 $m^3$ of cut.

EWZ-J is an area of shallow earthworks cut. The earthworks progression in EWZ-J is in a northerly direction i.e. against the fall of the road in all areas.

Work in EWZ-J includes removing Earthworks Plug H and therefore will not commence until such time that the construction sequencing allows for Earthworks Plug H to be removed.

Given the reduced size of this EWZ, silt barriers together with a direct outfall incorporating check-dams and a flow spreader will be provided to ensure sufficient sediment control in this area. The silt barriers will protect the PED from sediment laden run-off that may arise during construction and will be installed between the edge of earthworks and the PED to the eastern side of the EWZ.

As the earthwork progresses, all earthwork slopes will be immediately topsoiled, covered with organic geotextile/mat and planted/seeded once the earthworks excavation is completed. Similarly, the initial road build-up will be immediately placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed with progression of the installation of the groundwater filter drains in the same direction as the earthworks. The permanent outfalls of the groundwater filter drains to the adjacent PED and culvert will be installed and the connection made to the groundwater filter drains installed in EWZ-H.

Any water collected in the road drainage system will be temporarily directed from the most downstream (southerly) chamber in EWZ-J to the adjacent PEDs.

### 5.13.3.10 Earthworks Zone K (EWZ-K)

EWZ-K is located between the upper Slane Stream drain piped crossing at Ch. 2860 and Ch. 3330. The access to EWZ-K will be via a temporary haul road from the N51 to Earthworks Plug (H) through EWZ-H. EWZ-K has been divided into three areas:

- EWZ-K(i) – the area of earthworks fill between Ch. 2860 and Ch. 3070, approximately 32,000 $m^3$;
- EWZ-K(ii) – the area of earthworks cut between Ch. 3070 and Ch. 3125, approximately 12,000 $m^3$; and
- EWZ-K(iii) – the area of earthworks cut between Ch. 3125 and Ch. 3330, approximately 18,000 $m^3$.

The earthworks progression in EWZ-K is in a northerly direction i.e. against the fall of the road in all areas.

From Ch. 2860 to Ch. 3070, for EWZ-K(i), on the eastern earthworks embankment, temporary PEDs will be installed to capture run-off from the embankment slope and that may come from the carriageway; the carriageway is in super-elevation in this area and mostly falls to the west. From Ch. 2860 to Ch. 3070 on the western earthworks embankment, the permanent PEDs will be utilised to capture run-off from the embankment slope and the carriageway.

Silt barriers will protect the nearby watercourses from sediment-laden run-off that may arise during construction of the earthworks in the area. Silt barriers will be installed at the base of all embankment slopes between the slope base and the PED to filter the water before it enters the PED. Silt barriers will also be installed at the perimeter of the site and will remain in place until all works in the EWZ are completed.

The small area of cut from Ch. 3070 to Ch. 3125 for EWZ-K(ii) will not be carried out until the large earthworks cut from Ch. 3125 to Ch. 3330 for EWZ-K(iii) has been completed. This small area of cut will form Earthwork Plug K and will protect the upper drain system of the Slane Stream from run-off of sediment-laden material.

In the area of cut to the north of Earthwork Plug K from Ch. 3125 to Ch. 3330 for EWZ-K(iii), the surface run-off from the site will be directed to a temporary collection area near Earthworks Plug K via longitudinal channels running at the base of the earthworks cut slopes. There will be sufficient crossfall on the base of the excavation to direct the run-off into these channels quickly once it falls. Check-dams will be provided in these channels where the longitudinal slope exceeds 1%.

The surface water collected from the cut area will be pumped from the temporary collection area to the temporary PEDs at the eastern earthworks embankment. From these temporary PEDs, the surface water will be directed via gravity flow through the VGS and PIs and into Attenuation Pond 5b for treatment.

After a retention time is reached to achieve sufficient sediment settlement in Attenuation Pond 5b, the treated water will be pumped through silt bags and discharged across the vegetated banks into the adjacent drain system upstream if the Slane Stream.

As the earthwork progresses, all earthwork slopes will be immediately topsoiled, covered with organic geotextile/ mat and planted/seeded once 100 m of earthworks excavation is completed. Similarly, there will be no more than 100 m of proposed road area exposed without initial road build-up being placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed with progression of the installation of the groundwater filter drains in the same direction as the earthworks. Any water collected in the groundwater filter drainage system will be pumped from the most downstream chamber at the Earthworks Plug K to the temporary PEDs at the eastern earthworks embankment and onto Attenuation Pond 5b for treatment.

Once all earthwork slopes are completed, covered and seeded and all drainage carrier pipes and filter drains installed north of Earthworks Plug K, Earthworks plug K can be removed and the area excavated down to design levels. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes and groundwater filter drains will be installed in the area and the permanent outfalls of the groundwater filter drains to the adjacent PED will be installed and the connection will be made to the groundwater filter drains installed to the north.

It is expected that acceptable material excavated between Ch. 3070 and Ch. 3330 would be utilised for earthwork embankments north of Ch. 3330. This material could be transported to the fill areas from the top of the cut face directly to the fill areas.

#### 5.13.3.11 Earthworks Zone L (EWZ-L)

EWZ-L covers the area from Ch. 3330 to the roundabout at the proposed northern tie-in to the existing N2 and associated realignments of the existing N2. The amount of fill required for these earthworks is approximately 45,000 $m^3$.

Access Track 6 will be constructed before mainline earthworks takes place in EWZ-L to ensure land severance does not occur.

As EWZ-L is an area of significant earthworks fill, the earthworks access to EWZ-L will be from EWZ-K to the south. Allowing for access to EWZ-L from EWZ-K will provide a route for the fill material to be brought to EWZ-L, potentially from the cut volumes in EWZ-F, without the requirement to travel extensively on public roads.

Silt barriers will protect the nearby watercourses from sediment laden run-off that may arise during construction of the earthworks in the area. Silt barriers will be installed at the base of all earthwork fill slopes/embankments between the slope base and the PED to filter the water before it enters the PED. Silt barriers will also be installed on all banks of the Mooretown (Mattock) Stream and also at the perimeter of the site and will remain in place until all works in the EWZ are completed.

As the earthwork progresses, all earthwork slopes will be immediately topsoiled, covered with organic geotextile/mat and planted/seeded. Similarly, the initial road build-up will be placed to reduce the suspension of sediment from completed earthwork areas. Once earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted, the road drainage carrier pipes, VGS and PI will be installed.

### 5.13.4 Earthwork Zone Sequencing

The Proposed Scheme can be viewed as containing three main Earthworks sections, namely:

1. Southern Section: N2 Southern tie-in to the River Boyne crossing;
2. Mid-Section: River Boyne crossing to the N51 roundabout; and
3. Northern Section: N51 roundabout to the N2 Northern Tie-in.

From an earthworks construction viewpoint, the three sections could feasibly be constructed either partially or wholly simultaneously. For example, if the Northern Section was commenced before the Mid-Section, excavated acceptable suitable fill material could be immediately transported to fill areas in the Northern Section once excavated from the Mid-Section.

The speed of construction of the Southern Section is dependent on haulage productivity as the majority of the excavated material is required to be moved off site. Some of the rock excavated from the Southern Section will be required in the other two sections for road foundation build up. The Southern Section construction period has the most impact on the overall programme and will be progressed as soon as possible in the construction programme.

If the three earthworks sections progress simultaneously there is no increased risk of sediment run-off as long as the mitigation measures and proposed sequencing are followed.

### 5.13.5 Removal of Earthworks Plugs

Restrictions associated with the removal of the proposed earthworks plugs include:

- The removal of Earthworks Plug A and associated construction of the Rossnaree Overbridge will not take place until such time that all earthworks slopes within EWZ-A have been topsoiled, covered with organic geotextile/mat and planted/seeded and the vegetation established, initial road construction layers have been placed and all road drainage pipes and chambers, and groundwater filter drains and chambers have been installed throughout EWZ-A excluding areas around the plug itself.
- The removal of Earthworks Plug F will not take place until such time that all earthworks slopes have been topsoiled, covered with organic geotextile/mat and planted/seeded and the vegetation established, initial road construction layers have been placed and all road drainage pipes and chambers, and groundwater filter drains and chambers have been installed throughout EWZ-F excluding areas around the plug itself.
- The removal of Earthworks Plug H and associated earthworks construction in EWZ-J will not take place until such time that all earthworks slopes have been topsoiled, covered with organic geotextile /mat and planted/seeded and the vegetation established, initial road construction layers have been placed and all road drainage pipes and chambers, and groundwater filter drains and chambers have been installed throughout EWZ-H excluding areas around the plug itself.
- The removal of Earthworks Plug K and associated earthworks construction in EWZ-K(ii) will not take place until such time that all earthworks slopes have been topsoiled, covered with organic geotextile /mat and planted/seeded and the vegetation established, initial road construction layers have been placed and all road drainage pipes and chambers, and groundwater filter drains and chambers have been installed throughout EWZ-K excluding areas around EWZ-K(ii) and the plug itself.

The removal of the various earthworks plugs as described above open up the potential pathways for run-off to reach the sensitive receptors. The removal of Earthworks Plugs A and F pose the greatest risk to the River Boyne and its SAC, while the removal of Earthworks Plugs H and K pose a minor risk to the unnamed field drain at Ch. 2860 and Mooretown (Mattock) Stream via local field drains. The earthworks sequencing has been designed to reduce these risks significantly.

The proposed treatment of Earthworks Zones C, D and E above describe the proposed measures on either side of the Boyne Navigational Canal and the River Boyne. The sizes of the earthworks plugs have been reduced to be as small as possible so the works involved in removing them and construction of the final profiles can be done as quickly as possible. Mitigation measures and proposed order and sequence are as described above in **Section 5.12.10.5.2.4 Fifth phase of construction**, **Section 5.12.10.5.2.5 Mainline works to south abutment** and **Section 5.12.10.5.2.6 Mainline work to north abutment**.

All earthwork slopes within the plug areas, will be topsoiled, covered with organic geotextile/mat and planted/seeded immediately once the plugs have been removed.

### 5.13.6 Other Sediment Control Measures

Other general sediment control measures will be used on site during the construction period. These are best practice guidelines to reduce sediment run-off and to keep pollution risk to an absolute minimum. These measures will include:

- Vehicle wheel washing in controlled zones prior to leaving the site.
- Early vegetation establishment on stockpiles to prevent erosion of topsoil.
- Protection of stockpile locations with ditches and silt fences to prevent run-off towards the stockpile and the run-off of sediment from the stockpile.
- Weather monitoring to avoid exposing earthworks slopes and the temporary protection of earthworks slopes prior to forecasted large rainfall events.

## 5.14 Construction Phase Programme

### 5.14.1 Construction Phase Hours of Operation

Normal working times will be 07.00 to 19.00 hours Monday to Friday and 08.00 to 16.30 hours on Saturdays. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the local authority. This permission, if granted, can be withdrawn at any time should the working regulations be breached.

Site working hours may vary throughout the duration of the construction period and will also depend on weather and seasons. Subject to Local Authority approval, working times outside these normal hours, including Sundays, may be permitted. Example of works that may be required outside the normal working hours include diversion of utilities or working on existing roads outside of peak traffic periods to avoid or minimise traffic congestion; refer also to **Section 5.9**.

Acceptable construction noise levels as summarised in **Chapter 9 – Nosie and Vibration**, **Section 9.2.4.2** (Construction Noise Criteria) will be adhered to throughout the duration of the construction of the scheme by the Contractor.

### 5.14.2 General

Given the constraints associated with the Proposed Scheme, the construction programme, order and sequence of the works is considered in three separate areas:

- Works in the area around the River Boyne Bridge;
- Works North of the river; and
- Works South of the river.

The following is an overview description of the key sequence of the works within these separate areas of the site. A full description of the constraints applying to each area and the full description of the order and sequence of construction is described above.

### 5.14.3 Pre-Main Construction Works (Enabling Works)

**Section 5.2** above describes the pre-construction works (enabling works) anticipated to be carried out prior to the main construction works. It is likely that a considerable amount if not all of these activities will take place before a main construction contract commences for the Proposed Scheme.

### 5.14.4 Advance Works

These advance works are key early stage works which, if carried out as an advance contract before the main construction works contract, will reduce both cost and programme risk to the main construction. If these works are carried out under a separate advance contract to the main construction works the works are likely to take six to nine months to construct. Included in this package would be:

- Fencing;
- Invasive Species Management/Removal;
- Site clearance and hedge/tree removal;
- Demolitions;

- Phase 1 of the Earthworks as described in **Section 5.13.2 Drainage Phase 1** above;
- Drainage attenuation ponds, culverts and interceptor ditches;
- Temporary Access Road from Rossnaree Road to Attenuation Pond No 2;
- Permanent access from N51 for Landowner 118/119; and
- Temporary Access Road from N51 to Attenuation Pond No. 3.

## 5.14.5 Main Construction Works

A final decision has not yet been made in respect of whether or not there will be a separate Advance Works contract as described above. The following description assumes that an Advance Works contract is not implemented.

### 5.14.5.1 Programme Implications for Area around River Boyne Bridge

The following order and sequence will be required in the area between Rossnaree Road and the north abutment of the Boyne Bridge:

a. **Enabling Phase of the Programme**:

i. Traffic Management Plan and approval;

ii. Construct temporary site access to attenuation pond No. 2. Construct fencing and silt fences around pond and proposed works area;

iii. Construct attenuation pond No. 2 incl. petrol interceptor and grit separator and outfalls;

iv. Design and construct temporary bridge over canal for access to flood plain area;

v. Complete temporary access to facilitate bridge construction on south side of the river and fence off the works area;

vi. Provide permanent access for landowner 118/119 on north side of the river;

vii. Site access route to north side of river from N51;

viii. Install sediment fence and run-off collection trench between the proposed works area and the River Boyne on the north side of the river;

ix. Fence off the site;

x. Construct hard standings at South abutment and in flood plain area (WP1 and WP2);

xi. Construct hard standings for bridge Piers on north side of the river (WP3);

xii. Construct temporary sheet piles to enable bored piling for bridge foundations; and

xiii. Construct fill earthworks and hard standing for North abutment (WP4).

**b. Permanent Works at River Boyne Bridge:**

i. Construct bridge bored pile foundations;

ii. Construct bridge reinforced concrete pad foundations, piers and abutments;

iii. Off-site prefabrication of steel girders;

iv. Set up site for erection of steel girders, including specialist cranes and install bridge bearing plates;

v. Lift in girders;

vi. Relocate temporary access to working platforms;

vii. Reinforced concrete deck construction (utilising precast elements), working predominantly at bridge deck level; and

viii. Apply waterproofing, road surfacing, parapets, finishes.

**c. Decommissioning of Temporary Works:**

i. Remove temporary access and hard standings;

ii. Reinstate working areas; and

iii. Construct permanent accesses.

**d. Construction of Other Works:**

i. Close Rossnaree Road;

ii. Removal of earthworks Plug A;

iii. Construction of mainline earthworks south of the River Boyne bridge;

iv. Pre-fabrication of proposed pedestrian/cyclist bridge off-site;

v. Construction of permanent pedestrian/cyclist link to towpath, including re-alignment of towpath;

vi. Erection of proposed pedestrian/cyclist bridge;

vii. Removal of Earthworks Plug F; and

viii. Construction of mainline earthworks north of the River Boyne bridge.

The phases of the above construction are illustrated in Drawings **MDT0806-RPS-01-N2-DR-C-DG5101 – DG5105** in **Volume 4, Appendix 5.2**. These illustrations include a description of proposed measures to minimise erosion and provide sediment control during the construction phase.

## 5.14.5.2 Works to Construct the Remainder of the Scheme

### 5.14.5.2.1 General

A key provision of this Proposed Scheme is the implementation of sediment and erosion controls to protect from uncontrolled run-off to the River Boyne. A comprehensive description of the erosion and sediment control measures to be provided is given in **Section 5.3** above. The specific methodology to be adopted in the earthworks construction is described in **Section 5.13** above.

A cornerstone of the proposed methodology is the formation of earthworks plugs. These are unexcavated areas of cut forming a block to any pathway to the river. In this area, north of the River Boyne. Normal road construction consists of a sequence of activities (typically taking place in order) consisting of:

- Enabling works;
- Accommodation works;
- Pre-earthworks drainage;
- Site clearance;
- Topsoil strip;
- Earthworks, including capping;
- Drainage and verge-works;
- Sub-base;
- Kerbs and paved areas;
- Pavement; and
- Side slope topsoiling and seeding/landscaping typically takes place late in the sequence.

For this Proposed Scheme it will commence topsoil strip and earthworks at the proposed earthworks plugs and to advance the works in 100 m sections. This means that in each 100 m section, topsoil strip, earthworks and capping and possibly sub-base as well as erosion protection and vegetation of side slopes will take place before proceeding to the next section. The intention is to minimise the areas of exposed soil and earthworks which could be subject to erosion and sediment laden run-off during rainfall events. As this work progresses, installation of drainage, kerbs and paved areas and road pavement will take place behind the advancing earthworks face.

#### 5.14.5.2.2 North of the River Boyne

The existing constraints on this section of the Proposed Scheme are such that the proposed order and sequence that applies to both south and north of the existing N51 are described separately.

##### 5.14.5.2.2.1 Works North of the River Bridge

In this section of the works, this process will commence from Earthworks Plug F and work northwards. The proposed sequence will impact progress, as will the time constraints associated with material haulage off-site. This will result in lower productivity levels than might otherwise be expected for a scheme like this. As a result, it is expected that the earthworks alone from Earthworks Plug F to the N51 will take approximately seven months to complete on the assumption that the majority of the material arising in this cut will be disposed off-site. As the sections progress in 100 m section, the remainder of the road construction will follow in series to the earthworks.

Construction of Farm Accommodation Bridge No. 3 will start as early as possible in the construction programme so that the landowner can access each side of the construction site.

To complete the works between the north bank of the river and the N51, the remaining construction from Earthworks Plug F and the north abutment of the River Boyne bridge will follow when the earthworks slopes have been covered and seeded and the initial road layers have been placed and compacted.

##### 5.14.5.2.2.2 Works between the N51 and the Northern N2 tie-in

The earthworks north of the N51 is less onerous and it is assumed the majority of the work will be cut to fill as the earthworks in this area are near a balance. On this basis, a construction period for the earthworks of 4 months is assessed, taking account of relatively low productivity levels. For programming purposes, a stagger with the earthworks south of the N51 is assumed.

#### 5.14.5.2.3 Works to Construct the Bypass South of the River Boyne

As described earlier, an Earthworks Plug A will be established at the Rossnaree Road and earthworks will proceed in a southerly direction from this plug.

On this section of the scheme, it is envisaged that all rock arising will be set aside for reuse on the Proposed Scheme but that virtually all other materials arising will be managed off-site. This suggests some 300,000 $m^3$ of material will need to be hauled from the site.

The proposed sequence will impact progress, as will the time constraints associated with material haulage off-site will result in lower productivity levels than might otherwise be expected for a scheme like this. As a result of this, it is expected that the earthworks from Earthworks Plug A to the N2 south Roundabout will take about ten months to complete on the assumption that the majority of the material arising in this cut will be disposed off-site. As the sections progress in 100 m section, the remainder of the road construction will follow in series to the earthworks.

Construction of Farm Accommodation Bridge No. 1 will start as early as possible so that the landowner can access each side of the construction site.

To complete the works between Rossnaree Road and the southern abutment of the River Boyne bridge, the remaining construction from Earthworks Plug A will follow. This is constrained by both the access road to the bridge construction site and the constraint to have earthworks slopes covered and seeded and the initial road layers placed and compacted in EWZ-A. Closure of Rossnaree Road is dependent on the relocation of the temporary access to the bridge construction site following completion of the girder construction.

This is a significant constraint on the programme and it is likely to push the works at Rossnaree Road and EWZ-C close to the critical path for the construction of the Proposed Scheme.

### 5.14.5.3 Outline Construction Programme

Taking account of the methodologies, order and sequence described above, an outline Construction Programme for the full scope of the works has been developed and is contained in **Volume 4**, **Appendix 5.4 – Full Construction Programme. Appendix 5.5 – Advanced & Reduced Works Programmes** describes the option where a separate Advance Works contract is implemented prior to the Main Works contract.

Indicative durations for each activity have been assessed and applied to this programme. This assessment takes into consideration the strict methodologies set out to minimise erosion and to control sediment and the logistics associated with the haulage of materials from the site.

The critical path for the Proposed Scheme is assessed to run through the construction of the works around the River Boyne bridge. However, the reduced productivity associated with general earthworks (due to the proposed order and sequence and limitations imposed by the need to haul large volumes of materials off-site suggest that the works north and south of the river do run close to the critical path.

Overall, the construction period is assessed to be 36 months. Noting also that the proposed works on the north side of the river up to the N51 is assessed to be 27 months duration and works on the south side of the river to be 33 months.

The construction assessment has identified key site preparation and clearance works, including the proposed Phase 1 Drainage construction and the implementation of temporary works to access and construct the River Boyne bridge as described in **Section 5.14.3** above. To realise the benefit of the Phase 1 Drainage construction during the main construction works, it is essential that the proposed vegetating of the attenuation ponds and pre-earthworks ditches is established, so that these measures will function as key sediment control measures.

Considering the timescales required for the vegetation to establish and also the Proposed Scheme construction programme risk associated with the construction of the enabling works for the River Boyne bridge, there is considerable added benefit if these works are carried out in an advance works contract.

The potential works to be separated for an Advance Works contract are described in more detail in the following section.

#### 5.14.5.3.1 Construction Phase 1

Due to the importance of sediment and pollution control on this Proposed Scheme in relation to protection of the River Boyne and River Blackwater SAC and SPA, it is key that the Drainage Phase 1 construction works described in **Section 5.13.2** above be implemented and be operational in advance of the main construction.

The items outlined in the Phase 1 Construction can be brought forward as advance works without any detriment to the main works package. This will involve the construction of the permanent attenuation ponds, pre-earthworks ditches and culverts and crucially will facilitate the time necessary for the pre-earthworks ditches and attenuation ponds becoming fully vegetated and functional as sediment control measures. This means having these sediment control facilities in place, fully vegetated and ready to treat construction run-off from Day 1. It also enables greater control over the seasonal timing of this construction so as to limit exposure to the worst weather conditions.

Ideally, the attenuation ponds will be constructed during Spring or early Autumn when growing conditions are optimal to ensure quick vegetation establishment (depending on method used).

PEDs are best constructed in late Spring or early Summer when rainfall amounts are at their lowest therefore giving them time to vegetate and achieve soil cover prior to the winter season when flows will be larger in the PEDs.

In-stream culvert construction will be timed around relevant fisheries working seasons which will not be permitted between 1 October and 1 July. Installation of culverts 6A, 6B and 6C on the Mattock (Mooretown) Stream, a fish-bearing stream, can only be carried out during the fisheries open season which is from 1 July to 30 September in any year (to avoid impacting on aquatic habitat during the spawning season). Installation of the pipe culvert on the drain upstream of Slane Stream is not subject to this timing restriction as it has no fisheries significance. However, it will mitigate this constraint by constructing a temporary diversion of the stream prior to the culvert construction.

All instream and temporary construction works will be carried out in consultation and under supervision with IFI.

To minimise the extent of in-stream works, a temporary diversion of the Mattock (Mooretown) Stream to convey flow past the works area will be implemented prior to culvert works; refer to **Volume 3 – Technical Drawing MDT0806-RPS-01-N2-DR-C-DG2300** (Stream Diversion – Long Section). This will enable culverts 6B and 6C be constructed first in the dry, which will take approximately one month. However, some in-stream work will be necessary to construct the western end of culvert 6A and also the proposed removal of the existing culvert under the existing N2. The temporary diversion channel will be lined with pinned down

geotextile and topped with a layer of appropriately sized clean gravel that both secures the geotextile lining and provides rough substrate for fish and invertebrates. Once the temporary diversion of the channel and installation of Culverts 6B and 6C are completed, the channel will be reinstated and the installation of Culvert 6A will then be completed with dam and pump-over techniques.

Before diverting flow from the Mattock (Mooretown) Stream, it will need to be electrofished, returning any captured fish to the channel downstream of works.

Once the culverts are installed and realigned channel sections are appropriately reinstated using natural, locally sourced materials (rock, gravel), flow will be returned to the permanent channel and the temporary diversion channel will be removed, infilled, and reinstated with grass.

Construction under an advance contract will also remove this time risk from the main construction works programme. This will also remove any risk of failure of any of the control measures by allowing them to be fully established prior to the main works.

The existing N2 culvert will be removed towards the end of the overall construction period when traffic has diverted to the new bypass.

#### 5.14.5.3.2 River Boyne Enabling Works

As noted in **Section 5.14.5.3**, the initial critical path for the construction has been assessed to be through the construction of the River Boyne bridge. A key initial activity at this location is the facilitation of temporary access to the site, particularly to the flood plain area south of the river and for access to Attenuation Pond No. 2. This element is a significant element of construction in its own right, involving a temporary bridge over the Boyne canal navigation channel.

The programme duration for this element has been assessed to be six months and has been assessed to be a critical path activity.

#### 5.14.5.3.3 Access to the North side of the Boyne River

In order to construct Attenuation Pond No. 3 access to the north side of the river will be included in an advance works contract. This will entail early construction of the permanent access arrangements for Landowner 118/119 as described above.

#### 5.14.5.3.4 Other Works to be Considered

Other works that could be included in an Advance Works contract would be site fencing, noting that temporary access across the site will need to be maintained for local landowners in advance to the construction of the permanent access proposals. Consideration could also be given to the inclusion of following in an advance works contract:

- **Landowner 107/108:** Overbridge 1 and associated access tracks could be constructed and ready for landowner's use prior to severing lands for mainline construction.
- **Landowner 118/119:** Overbridge 3 and associated access tracks could be constructed and ready for landowner's use prior to severing lands for mainline construction.
- Diversion of Overhead ESB line.
- The advance contract could also consider site clearance in order to remove seasonal constraints risk from the main construction contract.

#### 5.14.5.3.5 Conclusion

The Phase 1 works are critical works with considerable constraints associated with their implementation. It is concluded that an Advance Works contract would remove considerable programme and cost risk from the Main Works contract. It is estimated that an advance works contract would reduce the overall construction period from 36 months to circa 30 months.

As noted, a final decision has not yet been made to implement an Advance Works contract or not and in the absence of this decision, both options have been assessed here.

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## 5.14.6 Public Realm and Traffic Management in Slane

The construction of the proposed public realm and traffic management proposals in Slane Village can only be carried out after the proposed bypass has been constructed and is open to traffic, relieving the existing traffic volumes within the village.

As such, the construction of the works in Slane village, which are an integral part of the scheme are most likely to be procured under a separate construction contract undertaken after the bypass works are completed.

The scope of construction works in Slane is described in **Section 5.4.10** above.

The likely construction period for the proposed works in Slane village is estimated to be between 6 and 9 months.

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