





# Foynes to Limerick Road (including Adare Bypass)

## Environmental Operating Plan



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## **APPENDIX A      Erosion and Sediment Control Measures**

# 1. INTRODUCTION

This document is a project-specific Environmental Operating Plan (EOP) for the construction phase of the proposed Foynes to Limerick Road (including Adare Bypass). It is intended to be used at the construction stage by the Contractor as a basis for the development of a comprehensive EOP for the proposed works. It has been developed in accordance with the TII *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*.

It will be a condition of the Construction Contract for the construction of the proposed development that the successful Contractor shall fully implement the EOP throughout the works. To oversee the implementation of the EOP, the Contractor will be required to appoint a responsible manager (refer to Section 2.3) to ensure that the measures set out in the Plan are fully executed for the duration of works and to monitor whether the mitigation measures employed are functioning properly (i.e. are effectively addressing the environmental impact(s) which they were prescribed for).

This EOP covers the activities of [*Successful Contractor Name*] and that of its sub-Contractors.

## 1.1 Description of Proposed Development

The proposed road development is located in west County Limerick in a predominantly rural area located close to a number of settlements including; Foynes, Askeaton, Rathkeale, Croagh, and Adare. The proposed road development has been divided into the sections outlined in Table 1.1 below.

**Table 1.1 Proposed Road Development Sections**

Section	Segment	Reference Chainages
A	Foynes to Ballyclogh Junction, Express Road	Ch. 1+000 – Ch. 7+320
B	Ballyclogh Junction to Askeaton, Express Road	Ch. 10+000 – Ch. 11+940
C	Ballyclogh Junction to Rathkeale Junction, Express Road	Ch. 20+000 - Ch. 29+240
D	Rathkeale to Adare – from Rathkeale Junction and tie in to existing N21 west of junction through to Attyflin Junction east of Adare, Motorway.	Ch. 50+000 – Ch. 65+550

The proposed road development includes the construction of the following main elements:

### Roads

- 15.6km of Type 2 Dual Carriageway Protected Road, extending from Foynes to Rathkeale, with an intermediate roundabout junction at Ballyclogh, 6.3km east of Foynes, and 9.3km north of Rathkeale;
- 1.9km of Single Carriageway Road from Ballyclogh towards Askeaton;
- 17.5km of Dual Carriageway M21 Motorway, of which 15.5km is new construction or widening of the existing road, from Rathkeale to Attyflin; and
- 0.6km of Single Carriageway Road connecting the existing N21 to the proposed M21 and Foynes to Rathkeale Protected Road at a roundabout junction at Rathkeale.

### **Junctions**

- 2 grade-separated junctions at Adare and Croagh, including structures, link roads and roundabouts (six in total);
- 5 at-grade roundabout type junctions, providing access points at Foynes, Ballyclogh, Askeaton, and two at Rathkeale.

### **Structures**

- 3 railway bridges;
- In excess of 200m long clear-span bridge over the River Mague at Adare
- 4 other large river bridges (over Robertstown, Deel and Greanagh);
- 18 river / stream bridges (including Ahacronane and Clonshire);
- 16 overbridges / underbridges;
- 22 underpasses; and
- 1 retaining wall.

### **Other Works**

- Drainage system in accordance with sustainable drainage design principles and guidance;
- The treatment of surface water run-off prior to outfall discharge, spill containment measures and attenuation treatment facilities;
- Diversion of existing services and utilities including High Tension electric lines and several transmission gas mains;
- Earthworks including excavation of approximately 3 million m<sup>3</sup> of soil and rock with processing into suitable construction material, and limited excavation and deposition of soft material within the site in landscaping works;
- Importation of a large volume of approximately 1 million m<sup>3</sup> of earthworks materials will be required as due to the flat and low-lying topography with a high groundwater level - the proposed road development cannot achieve an earthworks balance within the lands to be acquired;
- Construction of farm access tracks with accommodation works ancillary to the proposed road development;
- Provision of landscape planting, signage, lighting and other works ancillary to the construction and operation of the proposed road development;
- A terminal service area for HGVs near Shannon-Foynes Port;
- Accommodation of the Great Southern Trail Greenway (GST) walking and cycling route on the former railway line, where crossed north of Rathkeale; and
- The acquisition of 9 dwelling houses (of which 2 are currently uninhabitable) and 1 ruin for the construction of the proposed road development.

It is anticipated that the construction of the proposed road development will be progressed as a single construction contract with the construction phase lasting between 30 – 36 months (2.5 – 3 years). The proposed construction methodology for the road development is detailed in Chapter 4 Description of the Proposed Road Development, of the Environmental Impact Assessment Report.

## 1.2 Purpose and Scope

This EOP sets out the mechanism by which environmental protection is to be achieved on the proposed Foynes to Limerick Road (including Adare Bypass). It may be regarded as a comprehensive set of minimum environmental requirements for the Contractor to adhere to during the construction phase, which address all pathways for potential environmental and human health impacts as a result of the proposed works. It describes the Environmental Management System (EMS) of the construction phase of the proposed road development, which will be devised according to the criteria of ISO 14001:2004. It also sets out the mitigation measures prescribed in the EIAR and / or Natura Impact Statement (NIS), the mandatory measures (if any) stipulated in the conditions of the planning permission, and how these mitigation measures are to be implemented. It also assigns responsibilities for ensuring the effective implementation of this EOP Guidelines

The best practice measures set out in this EOP shall be informed by the relevant TII guidelines, including but not limited to the following:

- *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes;*
- *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 Schemes;*
- *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes;*
- *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes;*
- *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;*
- *Guidelines on the Management of Noxious Weeds on National Roads;*
- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes;*
- *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes;*
- *Guidelines for the Management of Waste from National Road Construction Projects; and*
- *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*

This is a non-exhaustive list and relevant guidance current at the time of construction will be followed.

## 1.3 EOP Structure

The contents of this EOP are presented as follows:

Chapter 2	<i>General Project Details</i>
Chapter 3	<i>Planning Consent</i>
Chapter 4	<i>Schedule of Commitments</i>
Chapter 5	<i>Register of Statutory Requirements</i>
Chapter 6	<i>Construction, Erosion and Sediment Control</i>

Chapter 7      *Construction and Demolition Waste Management*

Chapter 8      *Incident Response*

Chapter 9      *Invasive Species Management*

## **1.4 Contractor's Environmental Policy Statement**

Environmental Management is fundamental to the successful operation of construction activities. Therefore, the Environmental Policy must, as a priority, be understood by all parties involved in the contract and adhered to throughout the course of the works to allow for legal compliance and continuous improvement.

[*Successful Contractor Name*]'s Environmental Policy Statement is detailed below.

[*Insert policy statement*]



## **2. GENERAL PROJECT DETAILS**

This Chapter will be updated by the successful Contractor once appointed, to include the following:

- Brief overview;
- Location of the project;
- Location of site compounds;
- Contact sheets for site, employer and third-party contacts;
- Organisational chart; and,
- Register of duties and responsibilities.

Project details which have been identified prior to appointment of the Contractor are described in the subsequent subsections:

### **2.1 Construction Compounds**

#### **2.1.1 Compound Locations**

There will be a number of construction compound sites along and / or in the vicinity of the project as shown in Chapter 4 of the EIAR.

The compound sites are anticipated to range between 1 and 2.5 hectares in size and will include, stores, offices, materials storage areas, plant storage and parking for site and staff vehicles, and other ancillary facilities. These sites are likely to remain in place for the duration of the contract but may be scaled up or down during particular activities on site. Smaller temporary sites required for the construction of particular structures and bridges, excavation and processing of materials, specialised earthwork construction and at certain drainage areas may also be sited at various locations along the length of the proposed road development.

#### **2.1.2 Control Measures**

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

Surface run-off from the compounds will be minimised by ensuring that the paved / impervious area is minimised. All surface water run-off will be intercepted and directed to appropriate treatment systems (settlement facilities and oil trap) for the removal of pollutants prior to discharge. The site compounds will be fenced off, and a silt fence will be erected on the site boundary and maintained in good functional order (and replaced, if required).

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

The storage of all fuels, other hydrocarbons and other chemicals shall occur within the construction compounds only and shall be in accordance relevant legislation and BPGs. In particular:

- Fuel storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage.

- Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with *Best Practice Guide BPGCS005 – Oil Storage Guidelines* (Enterprise Ireland).

Chapter 8 of this EOP – Incident Response – shall include arrangements for dealing with accidental spillage and relevant staff shall be trained in these procedures.

## **2.2 Site Environmental Manager (SEM)**

In order to ensure the successful development, implementation and maintenance of the EOP, the Contractor will be required to appoint an independent Site Environmental Manager (SEM) to provide independently verifiable audit reports.

The Site Environmental Manager must possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken, a Level Eight qualification recognised by the Higher Education and Training Awards Council (HETAC), or a University equivalent, or other qualification acceptable to the Employer, in Environmental Science or Environmental Management, Environmental Hydrology, Engineering or other relevant qualification acceptable to the Employer.

Separate from the ongoing and detailed monitoring carried out by the Contractor as part of the EOP; the SEM shall execute the inspection / monitoring regime described below, and report to the employer. The results will be stored in the SEM's Monitoring file and will be available for inspection / audit by the Client, NPWS or IFI staff. All inspections / monitoring / results will be recorded on standard forms.

### **SEM Mandatory Inspection / Monitoring Regime:**

1. Control measures for works at or near water bodies shall be inspected on a daily basis.
2. In-situ concrete operations at or near watercourses shall be supervised and designated chute washing out facilities shall be inspected on a daily basis.
3. Site compounds shall be inspected on a weekly basis.

### 3. PLANNING CONSENT

If planning permission is granted for the proposed road development, the entire contents of the planning consent shall be inserted at this location.

*[Limerick City and County Council / successful Contractor shall insert planning consent]*

## 4. SCHEDULE OF COMMITMENTS

The Schedule of Commitments comprises:

1. The mitigation measures as outlined in Chapter 19 Mitigation and Monitoring Measures of the EIAR for the proposed development, plus any additional measures set out in the NIS for the proposed development, any commitments arising during the statutory planning process up to and including the Oral Hearing, and conditions imposed on the approval of the EIAR; and
2. Any relevant specifications and / or methodologies required to implement the prescribed measures / commitments properly; and
3. Any procedures for the monitoring of the implementation of the stated measures / commitments, which may identify whether (i) the measure / commitment will be implemented by the Contractors and (ii) once implemented, whether the measure/ commitment is effectively addressing the environmental impact it was prescribed to address.

An example of the layout of this table and potential entries is given below, see Table 4.1.

The current Schedule of Commitments is as follows:

*[Limerick City and County Council / successful Contractor shall insert Schedule of Commitments, as described above]*

**Table 4.1 Environmental Commitments (Example)**

Environmental Commitment	Source (Legislation / Specific Ref.)	Action Owner	Evidence	Target Date	Close Date
Noise and Vibration	EIAR Volume 2: Chapter 12 Noise and Vibration; Chapter 18 Mitigation Measures	Env. Manager / Noise Specialist / Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data / Environmental Control Measure Sheet	Ongoing	End of Contract
Biodiversity (Flora and Fauna)	EIAR Volume 2: Chapter 7 Biodiversity (Flora and Fauna); Chapter 18 Mitigation Measures	Env. Manager / Specialist Ecologist / Env. Designer / Site Agent / Foreman	Method Statement / Ecological Walkover / Pre-surveys / agreement from IFI / Site Inspections	Ongoing	End of Contract
Hydrology and Hydrogeology	EIAR Volume 2: Chapter 7 Biodiversity; Chapter 10 Hydrogeology; Chapter 9 Hydrology; Chapter 18 Mitigation Measures	Env. Manager / Specialist Ecologist / Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract
Air Quality and Climate	EIAR Volume 2: Chapter 12 Air Quality and Climate; Chapter 18 Mitigation Measures;	Env. Manager / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract

## 5. REGISTER OF STATUTORY REQUIREMENTS

This Chapter sets out the relevant statutory requirements, standards, Codes of Practice (CoPs) and Best Practice Guidelines (BPGs) which apply to the successful Contractor (and any appointed sub-Contractors) during the construction phase of the proposed development. It shall also include a methodology by which the Contractor will check compliance with same. The corresponding output may also be modelled on Table 1, above.

*[Register of legislation, standards, CoPs and BPGs to be added by Contractor]*

## 6. WATER QUALITY PROTECTION

### 6.1 Construction Erosion and Sediment Control Plan (CESP)

This section outlines the procedures and technical practices for implementing effective erosion and sediment control during the construction phase of the proposed development, through a variety of delivery methods. It provides an effective tool for reducing potential environmental effects by:

- Identifying erosion and sediment control objectives before construction;
- Encouraging planning to manage water, control erosion and control sediment by identifying potential impacts and mitigation measures;
- Providing a mechanism for clear communication to workers;
- Defining a performance expectation; and
- Assuring owners and regulators that due diligence has been exercised.

The purpose of this plan is to:

- Minimise erosion potential by effective planning, procedures and water management;
- Apply erosion control measures to prevent the movement of sediment; and
- Apply sediment control measures to prevent off-site sediment release in the event of sediment movement.

This Chapter is intended to be a live, working text and, therefore, the measures proposed herein may be added to or amended as the project progresses.

All of the protective measures and procedures included in this Chapter will be implemented in full in order to ensure that sediment laden run-off from the construction site does not enter watercourses / water bodies. It sets out the minimum requirements that must be adhered to by the Contractor – any alternative measures that may be incorporated at the construction stage will be required to provide at least the same or a better standard of protection.

#### 6.1.1 Consultations

Consultation has taken place with the National Parks and Wildlife Services (NPWS) and the Inland Fisheries Ireland (IFI) and their comments / observations with regard to measures and controls for water quality protection have been addressed in the Chapter.

#### 6.1.2 Scope and Methodology

The protection of lakes, watercourses, karst features and groundwater from pollution arising from construction works is achieved by avoidance in the first instance. Where potential impacts on lakes and watercourses cannot be avoided, the methodology seeks to implement appropriate mitigation during the construction phase to avoid adverse impacts and provide appropriate protection. This plan was completed and should be read with reference to the following documents:

- *The European Water Framework Water Framework Directive (WFD) 2000/60/EC – European Communities (Water Policy) Regulations 2003 (SI 722 of 2003) (as amended).*
- *The Fisheries (Consolidation) Act 1959 (as amended).*
- *The Fisheries (Amendment) Act 1999 (No. 35 of 1999).*

- *E.C. (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988).*
- *The Local Government (Planning and Development) Act 2000 (No. 30 of 2000).*
- *The Local Government (Water Pollution) Act 1977 (as amended),*
- *The Surface Water Regulations (S.I. No. 272 of 2009)*
- *The Wildlife Act (1976), as amended.*
- *Control of water pollution from construction sites. Guidance for consultants and Contractors (C532) (CIRIA, 2001).*
- *Control of Water Pollution from Linear Construction Projects. Technical Guidance (C648) (CIRIA, 2006).*
- *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. (Eastern Regional Fisheries Board, 2003).*
- *Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. (Southern Regional Fisheries Board, 2007).*
- *Guidelines for the crossing of watercourses during the construction of National Road Schemes. (National Roads Authority, 2008).*
- *Working at construction and demolition sites: PPG6 Pollution Prevention Guidelines (UK Environment Agency).*

#### **6.1.3 Principles of Erosion and Sediment Control**

The principles of erosion and sediment control during the construction stage of a road project as outlined in CIRIA C648 (2006) include:

- Erosion control (i.e. preventing run-off) is more effective than sediment control in preventing water pollution. Erosion control is less subject to failure from high rainfall, requires less maintenance and is also less costly.
- Plan erosion and sediment controls early in the project lifecycle and incorporate into the design and construction programme.
- Install drainage and run-off controls before starting site clearance and earthworks.
- Minimise the area of exposed ground.
- Prevent run-off and pollutants from entering the site from adjacent ground, as this creates additional polluted water.
- Provide appropriate control and containment measures on site.
- Monitor and maintain erosion and sediment controls throughout the project.
- Establish vegetation as soon as practical on all areas where soil has been exposed.

#### **6.1.4 Contents of the CSEP**

This CSEP contains the following information:

- i. An identification of existing land use, surface water features, low-lying areas and natural drainage pathways;
- ii. An outline of the main construction activities likely to be relevant in relation to erosion and sediment generation;
- iii. Identification of the areas most likely to have the potential for run-off;
- iv. Collection of information on soil types, rainfall data, etc;
- v. Selection of the best controls to avoid and minimise run-off and erosion;



- vi. Ensure that control measures are correctly installed and sized - initial run-off controls to be in place before site works begin;
- vii. A description of the inspection and maintenance programme throughout construction to ensure the necessary controls are in place and operational; and
- viii. Emergency Procedures.

## **6.2 Site Characteristics**

### **6.2.1 General**

The following gives a general overview of the landscape character and the main natural drainage pathways which are relevant in terms of erosion and sediment control.

### **6.2.2 Landscape Characters**

The landscape across the length of the proposed road development is generally low-lying and is crossed by several watercourses, the largest of which is the River Maigue in the east of the study area. The hydrology of the wider area also includes several lakes and seasonal lakes or turloughs, which are indicative of limestone landscapes.

Topography is generally undulating locally within a narrow elevational band from +2m OD to +53m within the route corridor. The lowest points are at the rivers (Maigue, Greanagh and Ahacronane), although the landscape around the river Deel is c. 20m OD in the route corridor. There is a series of small hills throughout the study area, rising to c.+50m OD maximum, but usually between +20m and +40m OD. The highest point appears to be +53m OD at Mulderricksfield townland in the north of the study area, east of Foynes.

### **6.2.3 Natural Drainage Ways**

The rivers and lakes along the proposed road development are located entirely within the Shannon International River Basin District (IRBD) and have been classified by the Water Framework Directive as Poor to Moderate water quality status along the entire development. The groundwater status for this region is classified primarily as Good with localised areas classified as Poor to the north of Adare and at Mulderricksfield.

The Foynes to Limerick Road crosses several watercourses which are part of the Lower Shannon Estuary Catchment. The rivers in the eastern section of the Study Area which are traversed by the proposed road development flow to the Shannon Estuary via the River Maigue catchment. Those in the middle section flow via the River Deel and the remaining western section flows directly to the Shannon Estuary. The proposed road development is in Hydrometric Area No.24, Shannon Estuary South Unit of Management (UoM).

There are 20 main watercourses crossed or intercepted by the proposed road development as summarised in Chapter 7 Biodiversity. A watercourse is defined as a channel that a flowing body of water follows and includes rivers, streams, tributaries and canals. All other culvert crossings proposed as part of this development traverse local or arterial drainage channels or drainage ditches. In general, all watercourses in the area flow from south to north towards the Lower Shannon Estuary.

The minor watercourses in Section A, the Robertstown and Ahacronane Rivers, discharge into the Churchfield Creek approx. 1.2km and 1.6km downstream of the development crossing respectively. The Churchfield Creek is tidal and confluent with the Shannon Estuary a further 2.5km along between Foynes Island and Aughinish Island.

Section B crosses over the Lismakeery /Ballycullen Stream only.

Section C of the proposed development crosses the River Deel in the townland of Milltown North, which continues northward passing through Askeaton and discharging to the Shannon Estuary.

Section D of the proposed road development crosses the Greanagh River twice (A and B) and also its tributary the Clonshire River, in the townland of Clonshire More and Rowermore. The proposed road crosses the River Maigue to the north of Adare which is the largest watercourse crossed by the proposed development. The Greanagh River confluences with the River Maigue 1km north of the proposed development before discharging to the Shannon Estuary a further 17km north. The Maigue and Greanagh Rivers are tidal at the crossing points with the proposed road development.

The ecological significance of these watercourses have been categorised in Chapter 7 Biodiversity, of the EIAR for the proposed development and range from Local Importance (Lower Value) through to National Importance.

### **6.3 Potential Sources of Run-off**

The following Sections outline what are considered to be the main potential sources of sediment and other water pollutants arising from the construction stage of the proposed road development.

#### **6.3.1 Earthworks**

The most significant area of concern regarding erosion and sediment control on any road construction project is the process where topsoil, subsoil and peat surfaces are exposed. Typically, these surfaces are exposed during:

- The initial site clearance works/topsoil strip;
- Excavation of cuttings;
- Construction of fill slopes;
- Excavation and backfilling of soft spots underneath proposed embankments;
- The construction of borrow pits and material deposition areas;
- Transportation of soils, particularly saturated peat, within the bounds of the development either to material deposition areas or stockpile locations.
- The construction of spoil repositories;
- Construction of haul roads for earthworks operations;
- Stockpiling of acceptable and unacceptable earthworks material for reuse or removal offsite; and
- Stockpiling of road construction material (rockfill, capping, and subbase, etc.)

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

#### **6.3.2 Structures and Concrete**

Concrete, grout and other cement-based products which would typically be used in the construction of structures are highly alkaline and corrosive and can have a devastating effect on water quality. Cement-based products generate very fine, highly alkaline silt (11.5 pH) that can physically damage fish by burning their skin and blocking their gills. This alkaline silt can also smother vegetation and the bed strata of watercourses and

can indirectly mobilise pollutants such as heavy metals by changing the water's pH. Concrete and grout pollution is often highly visible.

Particular risks are posed to water quality when construction is taking place over or near surface water bodies (e.g. bridges or headwalls), through the potential for spillage of cement-based compounds or hydrocarbons and physical disturbance giving rise to sediment release.

Cement and lime may also be used in soil improvement techniques and in soil stabilisation. These practices also have the potential for release to watercourses particularly through surface run-off of sediment laden waters.

### 6.3.3 Watercourse Crossings and In-stream Works

There are numerous minor watercourse crossings and stream diversions associated with this proposed road development. Diversion or maintenance of these channels has the potential to generate sediment through disturbance.

### 6.3.4 Construction Compounds and Machinery Re-fuelling / Lubrication

A number of construction compound sites will be required along and / or in the vicinity of the proposed road development. These compounds will include (but will not be limited to): material stockpiles, loading and unloading areas, fuel stores, machinery stores, canteens and site offices and toilets. The location, size and suitability of the sites selected will be at the discretion of the Contractor and will be subject to compliance with all relevant legislation.

Particular considerations in relation to the location of such facilities and their generation of pollution during the construction stage include: -

- Sanitary wastewater treatment;
- Hard-standing surface water run-off;
- Potential for hydrocarbon pollution to groundwater and surface water;
- Avoidance of flood risk areas; and
- Set back distances from sensitive watercourses and ecological receptors.

In addition to the construction compound sites discussed above, the construction of the proposed development will require rock processing areas with crushing facilities and material stockpiles at various locations along the proposed alignment. The location of these facilities will vary as the construction works progress. Rock processing areas will be located in areas of deep cuttings typically at the base of the cutting or in a specified area within the cutting itself. Cuttings through overburden may also require soil processing facilities.

The significant cuttings included with the proposed development are summarised in Table 6.1 below.

**Table 6.1 Significant Cuttings Proposed Along the Road Alignment**

From Ch.	To Ch.	Length (m)	Max. Cut Depth (m)	Soil type / Stratum
1+350	1+750	400	8.5	Glacial Till / Limestone
3+400	4+300	900	6	Glacial Till / Limestone

From Ch.	To Ch.	Length (m)	Max. Cut Depth (m)	Soil type / Stratum
5+100	6+400	1,300	19	Glacial Till / Limestone (Groundwater encountered)
51+300	51+700	400	6	Glacial Till
52+400	56+000	3,600	11	Glacial Till / Limestone (Groundwater encountered)
60+000	60+500	500	9	Glacial Till / Limestone

Cuttings / processing areas will generally include a material stockpile where material is stored before being hauled to areas of fill along the proposed development. These stockpiles and material / rock processing areas both have the potential to produce sediment which could be mobilised during periods of heavy rainfall.

In addition, it is envisaged that topsoil and / or acceptable material will be stockpiled during the course of the proposed road development. Stockpiles of granular material containing a high proportion of fines presents a risk for mobilisation of sediment laden water during periods of heavy rainfall.

## 6.4 Waterbodies and Groundwater Receptors

### 6.4.1 Waterbodies

The main waterbodies which could potentially be impacted by sediment are generally considered to be those relating to aquatic ecology (including adjacent wetlands) and fisheries. Other smaller local watercourses have the capacity to function as a conduit to more sensitive areas / watercourses further downstream. A summary of each of the main watercourse along the proposed road development is given in Table 6.2 below.

**Table 6.2 Summary of Watercourses Adjacent to the Proposed Development**

Ref. No.	Watercourse name	Section	Chainage	Evaluation
W1	Stream at Ardaneer	A	Ch. 1+100	Local Importance (Lower Value)
W2	Stream at Sroolane North	A	Ch. 2+150	Local Importance (Lower Value)
W3	Stream at Sroolane North	A	Ch. 2+500	Local Importance (Lower Value)
W4	Stream at Robertstown	A	Ch. 2+700	Local Importance (Higher Value)
W5	Ahacronane River	A	Ch. 4+450	County Importance
W6	Stream at Ballyclogh	A & B	Ch. 7+150 & Ch. 10+150	Local Importance (Lower Value)
W7	Ballycullen Stream	B	Ch. 10+300	Local Importance (Higher Value)
W8	Stream at Clonreask	B	Ch. 10+950	Local Importance (Lower Value)

Ref. No.	Watercourse name	Section	Chainage	Evaluation
W9	Ballycullen Stream	C	Ch. 20+950	Local Importance (Higher Value)
W10	Stream at Baunreagh	C	Ch. 21+950 & Ch. 22+450	Local Importance (Lower Value)
W11	River Deel at Milltown North	C	Ch. 24+000.	National Importance
W12	Doohyle Stream at Bullaun	C	Ch. 24+500 to Ch. 24+950	Local Importance (Higher Value)
W13	Doohyle Stream at Graigeen	C	Ch. 26+880 to Ch. 27+050	Local Importance (Higher Value)
W14	Doohyle Stream at Kyletaun	C	Ch. 28+200 to Ch. 28+300 and Ch. 28+550 to Ch. 28+750	Local Importance (Higher Value)
W15	Cloghatrida Stream at Blossomhill	D	Ch. 50+780 to Ch. 51+060	Local Importance (Higher Value)
W16	Clonshire River at Clonshire More	D	Ch. 56+550	County Importance
W17	Greanagh A River at Rower More	D	Ch. 58+180	County Importance
W18	Greanagh B River	D	Ch. 59+200	County Importance
W19	River Mague	D	Ch. 60+850 to Ch. 61+000	International Importance
W20	Stream at Monearla	D	Ch. 64+500 to Ch. 64+550	Local Importance (Higher Value)

The River Mague is crossed within its estuarine reaches and does not support spawning habitat for salmonids or lamprey species. The substrate in the vicinity of the crossing point is characterised by soft muds overlying coarse aggregates and large boulders. The river is subject to a c. 2.5 m tidal range in the vicinity of the bridge location and there is a corresponding zonation in the bankside vegetation communities. The Mague is a renowned salmon fishery and also supports good populations of Brown Trout (*Salmo trutta*), both resident and anadromous ("sea/slob trout") and Sea Trout. It also supports spawning by lampreys, possibly both Sea Lamprey and River Lamprey, though upstream migration may be impeded by weirs.

The River Deel in the vicinity of the crossing point is approximately 15m in width, with steep banks that have been modified during arterial drainage works in the past. The substrate is comprised of cobble and boulder with banks of softer sediments which support stands of bulrush. The substrate was heavily fouled with filamentous algae during all survey visits indicating nutrient enrichment. Nonetheless, the river supports moderate populations of trout and is an important recreational fishery.

The Greanagh River, Clonshire River, Blossomhill Stream and Ahacronane River are all moderate sized watercourses ranging from 2 to 6m in width. They support populations of Brown Trout along with a range of other fish species. As with the Rivers Mague and Deel, these watercourses have all been subject to some modification for drainage purposes in the past which has led to more uniform channel structure and

gradient with a consequential simplification of the flow regime and value for fish and other biota.

The remaining watercourses are all heavily modified channels with the characteristics of drainage ditches. These are frequently deeply excavated channels up to 4m below adjacent ground level, with long uniform profiles. Substrates as a result are normally dominated by silts with associated dense beds of macrophyte and emergent vegetation. These support good invertebrate populations and provide suitable habitat for small fish (Minnow, Stickleback and possibly juvenile Brown Trout) and Eels.

Water quality in watercourses is generally moderate with most showing evidence of nutrient enrichment or high sediment loads as a result of intensive land management within the catchment. Due to the underlying limestone geology, all the watercourses are trending towards high alkalinity which in some locations leads to a calcification of the substrate.

#### **6.4.2 Groundwater Receptors**

The route of the proposed development alignment passes through areas of karstified bedrock with surface features present such as swallow holes, springs, a turlough and numerous enclosed depressions. Exposed bedrock is also present in a number of locations. Given that these features provide a direct connection to groundwater and that the underlying aquifer is classified as a Regionally Important Groundwater Resource, protection from construction sediment and other water pollutants is required. The main features which require protection during the construction stage are summarised in Table 6.3 below. Details of these features and their locations are contained in Chapter 9 Hydrogeology of the EIAR.

**Table 6.3 Summary of Groundwater Receptors Adjacent to the Proposed Development**

Groundwater Feature	Description
Lough Selleher, Turlough	Located in a basin between two peaks of elevated ground between Craggs and Mulderricksfield to the south of the existing N69
Tomdeey Turlough	located in a field just south of the existing N69 at Tomdeely – some 5km east of Foynes this turlough forms a small depression in the land
Tomdeely North Turlough	This is a small feature located in scrubby lands to the north of the N69 at Tomdeely North some 5km east of Foynes
Foleys Turlough	This feature forms a small depression in agricultural lands north of the existing N69 at Morgans North some 4.6km east of Foynes and floods during winter months draining to bedrock through areas of exposed outcropping bedrock
Karst Springs	There are three karst springs recorded in the GSI karst database located in the vicinity of Barrigone east of Foynes close to the turloughs described above. A spring is located in the townland of Ballyellinan some 170m south of the supply borehole for the Craggs/Barrigone GWS (described below). The supply borehole itself for the Craggs/Barrigone GWS encountered a large fissure or conduit zone at depth which is reported to supply the main body of the water to the borehole. Further to the north, two springs are located in low-lying lands which drain to local ditches and are used for agriculture supply in adjacent lands. A number of other springs and wells were also noted as occurring in these areas on Ordinance Survey Historic Mapping in the townlands of Morgans North/South, Tomdeely/Tomdeely North and Coolrahee.
Pluvial/Groundwater flooding at Rincullia	This is a low lying area of land which forms a portion of KER4 at Rincullia (refer to Chapter 7 Biodiversity for further details regarding KER4). Bedrock is shallow or exposed in this location and pluvial/groundwater flooding occurs at a low point in a field, which slowly percolates to bedrock following periods of extended rainfall. The rocky nature of the surrounding lands has led to the development of dense scrub woodland.
Craggs-Barrigone GWS	The Group Water Scheme is supplied from a borehole that is located in the townland of Ballyellinan 3km west of Askeaton. The scheme supplies more than 63 connections The wellhead and treatment system are located within two pump houses located in agricultural lands approximately 740 m north of the proposed alignment before the water is pumped to the supply reservoir c.1.8km southwest of the supply borehole.
Croagh-Farrandonnelly GWS	The Group Water Scheme is supplied by a borehole located in the centre of Croagh Village adjacent to the existing N21 at a distance of c.600m to the south of the proposed road scheme. The terrain rises gently from Croagh village northward and the ground level at the proposed road scheme is 6m higher than at the borehole. The supply borehole is c.80m deep with bedrock encountered at 5.5m. The average daily abstraction rate from the borehole is 54 m <sup>3</sup> /day.  The Croagh-Farrandonnelly GWS supply borehole is located within Fedamore Groundwater Body and is within a Regionally important karstified aquifer.

Groundwater Feature	Description
Domestic and Agricultural Groundwater Supplies	More than 70 No. groundwater supply boreholes or springs for domestic and agricultural within 300m of the proposed development have been identified.
The Askeaton Fen Complex	<p>The Askeaton Fen Complex SAC (site code no 002279) includes a number of individual sites scattered to the north and south of the N69 between Askeaton and Kildimo. The fens are groundwater fed through a series of springs and seepages and occur in basins between undulating hills of Limestone in an otherwise intensive agricultural landscape.</p> <p>In addition to the above, there are also a number of sites which are afforded protection under National Legislation (Natural Heritage Areas) located in the vicinity of the proposed road development. Four of these sites are sensitive in terms of groundwater (and/or surface water) all of which form part of the Askeaton Fen Complex SAC:</p> <ul style="list-style-type: none"> <li>• Ballinvirrick Marsh pNHA (Site Code: 001427)</li> <li>• Cappagh Fen pNHA (Site Code: 001429)</li> <li>• Ballymorrisheen Marsh pNHA (Site Code: 001425)</li> <li>• Gorteennamrock Fen pNHA (Site Code: 001433)</li> </ul>
Fen Wetland at Ballyellinan (KER7)	An area of Rich Fen Wetland (conforming to Annex I habitat Alkaline Fen) bordering the L6062-L1220 (refer to Chapter 7 Biodiversity and KER7). Areas of exposed bedrock near the centre and along the perimeter of this site are likely providing groundwater to this wetland habitat. There is a karst spring source noted in the GSI karst database some 420m to the west of the western boundary of the fen wetland. The supply borehole for the Craggs/Barrigone GWS is located approximately 170m further north of this spring (c.500 north-west).
Fen Wetland at Lismakeery (KER11)	A wetland area which contains Rich Fen (conforming to Annex I habitat Alkaline Fen) and wet grassland located to the north of Ballycullen House at Lismakeery (refer to Chapter 7 Biodiversity and KER11). This wetland area is receiving groundwater inflow from seepages and springs located around the perimeter likely concentrated towards the south and south-western boundary. The area is noted as "Liable to Floods" on historic Ordinance Survey Mapping and has clearly been subject to extensive drainage in the past which has been only somewhat successful. A series of ditches and drains bisect the lands and drain north-west towards the adjacent Lismakeery Stream. Lands to the north-east of the central drain have been far less affected compared to lands to the south-west which has therefore been noted to contain a more diverse plant community – refer to Chapter 7 Biodiversity and KER 7 description for further details. One spring was identified by historic mapping to the north-west of these lands with other springs and seepages likely present in the area.



Groundwater Feature	Description
Fen Wetland at Blossomhill (KER21)	<p>An area of rich fen (conforming to Annex I habitat Alkaline Fen) and wet grassland located between the existing N21 to the south and Doohyle Lough to the north – refer to KER 21 in Chapter 7 Biodiversity for further details. This area is listed as benefited lands by the OPW following an arterial drainage scheme and a drainage channel flows a short distance east before turning and flowing north to a smaller Lough at Blossomhill. This lough then drains north to Doohyle Lough and then north-west to the River Deel. There are numerous springs and wells located in the vicinity of Blossomhill Lough which were identified on historic Ordnance Survey Mapping. This wetland area is therefore modified but still retains high ecological value with groundwater forming an important part of the hydrology of surrounding area.</p>

## 6.5 Earthworks

### 6.5.1 Existing Environment – Solid Geology

The proposed road development is underlain by sedimentary rocks with igneous intrusions. The sedimentary rocks generally consist of limestones of the Lower Carboniferous (Dinantian) age. These formations include Ballysteen Formation, Waulsortian Limestone Formation, Rathkeale Formation, Durnish Formation and Viséan Limestone (Undifferentiated).

Ballysteen Formation generally consists of two units: an upper unit and a lower unit. The lower unit consists of dark well bedded bioclastic limestones. The limestones are mainly argillaceous wackestones with a rich invertebrae fauna of crinoids, brachiopods, bryozoa, calcareous algae and conodonts. The upper unit of the formation is more argillaceous and has a typical carbonate / shale ratio of 30 -40%.

Waulsortian Limestone Formation generally consists of three units: basal and top units with isolated clustered banks set in offbank bedded limestones, and a main unit of massive coalesced bank limestone. The dominant lithology in this formation is commonly a very fine pale-grey massive, unbedded, biomicrite wackestone, with crinoid fragments and fenestrate bryozoa, frequently with large sparry cavities floored by multi-layered carbonate muds.

Rathkeale Formation consists of dark argillaceous limestones and shaly mudstones. The formation is unfossiliferous apart from trace fossils. The limestones are well bedded, brittle and have a (clisiophyllid) fracture cleavage.

Durnish Formation consists of uniform, blue, black, bioclastic limestones which commonly contain bands of chert nodules parallel to bedding. These well-bedded cherty packstones and wackestones contain abundant in-situ coral beds and brachiopod bands, the corals being chiefly large solitary Caniniid-Clysiophyllid types.

Viséan Limestone (Undifferentiated) consist of dark grey to black thinly bedded cherty argillaceous wackestones and packstones, locally rich in foraminifera and crinoids. The limestones are bioturbated, and skeletal remains show less evidence of abrasion than the grainstones interbedded with the volcanic.

Limestone is readily dissolved by rainwater. It is often highly permeable which results in bare limestone (karst) areas.

Old Red Sandstone formation from the Devonian / Carboniferous age also underlies the study area to the south of the River Shannon west of the River Maigue.

The majority of the proposed road development is underlain by limestone noted to be karstified. This karstification has impacts on surface and groundwater quality due to the presence of preferential flowpaths to sensitive water bodies which allow rapid conveyance within the aquifer system.

Cut sections will reduce the depth of subsoil from particular areas along the proposed road alignment. This will have a localised effect on the groundwater vulnerability rating, as the pathway for potential contaminants to migrate into the underlying aquifer is shortened. Areas where bedrock is at or close to surface will be particularly sensitive.

Significant cuttings where aquifers may be affected are outlined in Table 6.4. Potential impacts may arise for the groundwater regime at these cuttings which are also located

within the Zones of Contribution of group water scheme wells and several private agricultural abstraction wells.

**Table 6.4 Significant Cut Sections at Aquifers**

Site Name	Maximum Cut depth (m)	Depth to bedrock (m bgl)	Description
Regionally Important Karstified Aquifer: Cut section 5+150 – 6+400	19	2	Potential interception of local groundwater table with maximum cut depths of up to 19m with Limestone bedrock encountered at depths of approximately 0 - 4m. Cutting will also intercept interflow, deeper percolation flow and overland run-off from the steep hillslope that would otherwise have flowed north-east. Potential contaminated road drainage entering the underlying aquifer.
Regionally Important Karstified Aquifer: Cut section 52+450 – 56+450	11	2	Potential interception of local groundwater table with maximum cut depths of up to 7m with Limestone bedrock encountered at depths of approximately 1 - 3m. Cutting will intercept interflow and overland run-off from the hillslope that would otherwise have flowed south-east. Potential contaminated road drainage entering the underlying aquifer.

#### 6.5.2 Existing Environment – Subsoils

Bedrock outcrops in a large number of locations along the proposed road development, with rock and karstified rock present at or near ground surface level, where subsoils are predominantly absent. Soils and subsoil are represented by peats, alluvium, marine deposits, glacial tills and fluvioglacial sand and gravels. Alluvium is present along most of the rivers and streams. Areas of soft ground are typically shallow (less than 4m deep) but extend up to 6m deep in two localised areas.

#### 6.5.3 Soft Soils

Small areas of soft soil, which are not extensive along the proposed development, will require to be excavated and replaced. This material will be spread thinly as a surface layer on the general earthworks top surface as part of the landscaping works. The excavation and removal to material deposition areas presents risks to adjacent waterbodies from potential sedimentation and nutrient enrichment from potential organic material within the peat sediment.

#### 6.5.4 Imported Material

There will be a requirement to import construction materials and concrete. There are a number of quarries in the vicinity of the proposed road development which may be utilised in the sourcing of this material. Only those quarries that are authorised will be used in the construction phase. The assessment of the earthworks quantities including the reusability of the materials indicate that there will be a deficit of acceptable material over the entire project of approximately 1.1 million m<sup>3</sup>.

#### 6.5.5 Quarrying and Rock Processing

The processing of rock from cuttings for reuse within the proposed road development will require rock crushing and processing facilities. The exact locations of rock processing facilities will be determined by the appointed Contractor; however, it is likely

that this activity will occur within the road cutting footprint itself. These activities have the potential to create high quantities of sediment laden run-off given the hardstanding nature of the rock cut face. The main watercourses at risk are therefore those adjacent to the likely location of these rock processing facilities which are:

- Stream at Ardaneer Ch1+100 with a rock cutting proposed between Ch. 1+350 and Ch. 1+750;
- The Ahacronane River at Ch. 4+450 with a rock cutting proposed between Ch. 3+400 and Ch. 4+300;
- The Ahacronane River at Ch. 4+450 and stream at Ballyclogh Ch. 7+150 with a rock cutting proposed between Ch 5+100 and Ch. 6+400;
- Stream at Blossomhill with a rock cutting proposed between Ch. 51+300 and Ch. 51+700;
- The Clonshire River at Clonshire More Ch. 56+550 with a rock cutting proposed between Ch. 52+400 and Ch. 56+000; and
- The River Mague with a rock cutting proposed between Ch. 60+000 and Ch. 60+500.

## **6.6 Erosion and Sediment Controls**

### **6.6.1 General**

The principal objectives in relation to erosion and sediment control during the earthworks operation will be:

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

### **6.6.2 Principal Avoidance Measures**

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

- i. Site clearance involving topsoil stripping will progress along with the earthworks and will not be carried out over large areas in advance of the earthworks;
- ii. Soft soils to be excavated as part of the proposed road development will be deposited within the works area as part of the landscaping treatment for the completed earthworks along the route. The use of silt fencing and limiting the proximity of soil improvements to streams and watercourses will limit sediment entering adjacent watercourses and minimise water quality impacts on waterbodies; and
- iii. Bridge and watercourse crossing construction will involve clear span bridge structures or culverts over all the significant rivers and streams in order to avoid significant and lengthy works adjacent to major watercourses.

### 6.6.3 Principal Control Measures – General

This Section outlines the principal mitigation and protection measures that will be prescribed for the construction phase in order to protect all the catchments, watercourses and ecologically designated areas. Specific measures are described in Section 6.7. General control measures will include:

- Maintenance of good site management at all times and all site personnel will be made aware of the importance of the freshwater environment and the requirement to avoid pollution of all types, throughout all stages of the construction phase.
- Surface water flowing onto the construction area will be minimised through the advance construction of cut-off ditches (Plate 6.1, below).
- All soiled construction run-off water will pass through sedimentation ponds prior to outfall to the receiving watercourse. These sedimentation ponds may be a combination of temporary settlement ponds and permanent attenuation ponds for the road drainage during the construction phase—.
- The storage of oils, fuel, chemicals and hydraulic fluids will be in secure areas within the site compounds and will not occur within a minimum of 10m from watercourses.
- Storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage. Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with *Best Practice Guide BPGCS005 – Oil Storage Guidelines* (Enterprise Ireland).
- 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 to the NRA *Guidelines for the crossing of watercourses during the construction of National Road Schemes*. All chemical and fuel filling locations will be protected from potential spillages through the provision of appropriate protection measures including bunded areas and double skinned bowser units with spill kits.
- Compounds / storage facilities will be located at least 50m away from sensitive watercourses. In addition, measures will be implemented to ensure that silt laden or contaminated surface water run-off from the compound does not discharge directly to the watercourse.
- Foul drainage from all site offices and construction facilities will be taken off-site and disposed of by a licensed Contractor in accordance with legislation to prevent pollution of rivers and local water supply.



**Plate 6.1**      **Example of cut-off ditch**



**Plate 6.2**      **Typical silt fence usage**

- Management of construction material stockpiles to prevent siltation of watercourse systems through run-off during rainstorms will be undertaken. This will involve the construction of collector ditches surrounding material stockpiles to contain run-off and direct it to the settlement ponds (either operational or temporary depending on the construction sequence) before discharge to an adjacent watercourse. In addition, the establishment of vegetation on the exposed soil adjacent to material stockpiles may also be used to slow down and treat (through settlement) run-off waters. A typical example of where silt fences would be employed adjacent to stockpiled material is indicated in Plate 6.2, above.



- Where construction works are carried out alongside stream and river channels, protection of such rivers from silt load will be carried out. This will be through the use of retaining a grassed buffer zone, the provision of silt fences or compacted earthen berms so as to prevent direct run-off of waters from the construction site to watercourses.
- Where road drainage outfalls are to be located, the vegetation at these sites will be stripped immediately prior to the construction of the outfall and a Hessian or equivalent material pinned over all exposed soil following completion. This will be re-seeded using native species of grass only.
- Where required, the pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, *etc.*, for outfalls, bridges and culverts will be completed in the dry and allowed cure for 48 hours before re-flooding in order to avoid pollution of watercourses.
- Use of settlement ponds, silt traps and bunds and minimising construction within watercourses. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap. Examples of typical temporary settlement ponds / lagoons are presented in Plates 6.3 – 6.5, below.
- Riparian vegetation will be fenced off to provide a 5m buffer zone for its protection. Construction works at crossings will result in the loss of riparian vegetation which will be minimised so as to result in the least amount of disturbance and loss being incurred.
- Any surface water abstracted from a river for use during construction (e.g. over-pumping of a drain) shall be through a pump fitted with a filter to prevent intake of fish.



**Plate 6.3**      **Typical temporary settlement pond / lagoon**



**Plate 6.4**      **Typical temporary settlement pond / lagoon**



**Plate 6.5**      **Typical temporary settlement pond / lagoon**

- The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage which as stated earlier has a deleterious effect on water chemistry and aquatic habitats and species. Alternate construction methods are encouraged for example, use of pre-cast concrete or permanent formwork will reduce the amount of in-situ concreting required. Where on-site batching is proposed by the Contractor, this activity will be carried away from watercourses (minimum 10m). Washout from such mixing plant and also from concrete delivery trucks will be carried out only in a designated contained impermeable area. A typical washout facility is indicated in Plate 6.6, below.





**Plate 6.6**      **Typical washout facility**

- Wheel wash facilities will be installed at the exit from each material deposition area. All construction vehicles leaving the material deposition areas will be required to pass through these facilities.
- Temporary sedimentation ponds will be provided within these areas at appropriate locations which will be influenced by the compartmentalisation sequencing. These ponds will provide treatment for sediment run-off prior to discharge to adjacent watercourses.

## **6.7 Mitigation Measures**

### **6.7.1 Watercourse Crossings**

A summary of each watercourse that is either crossed by or in close proximity to the proposed road development is given in Table 6.5, below. Specific mitigation measures proposed for each of these locations to mitigate risks to water quality have been summarised under a number of headings below. In addition, Figures 1 – 23 in Appendix A outline specific mitigation measures at each location. A list of construction requirements at each of the major / significant river crossings is also provided below.

The works area in the vicinity of each watercourse will be cordoned off prior to any construction activities commencing on site. The provision of double silt fences along the cordoned work areas will be employed to contain any potential silt or sediment run-off. Where multiple crossings are proposed due to parallel access tracks adjacent to the mainline, a double silt fence will be provided between the two crossing points to protect from potential sediment run-off at each location.

Stockpiling, temporary or otherwise, of construction material or topsoil will be prohibited within 10m of watercourses in order to minimise sources of sediment run-off. In addition, site compounds shall not be located within 50m of any watercourse. Fuel storage, temporary or otherwise, shall be permitted only within site compound areas and not within 10m of a watercourse at these locations.

To avoid any risk of impacting on sensitive fishery watercourses during construction, all instream works with Fisheries Requirements will only be permitted between the period of the 1<sup>st</sup> May and the 31<sup>st</sup> September.

**Table 6.5 Summary of watercourses potentially impacted during the construction of the proposed development**

Ch.	Location	Watercourse	Treatment	Structure Ref. No.	Clear Span
1+100	Ardaneer	Stream	Culvert	FR-C1	No
2+150	Sroolane North	Stream	Culvert	FR-C2	Yes
2+525	Sroolane North	Stream	Diversion of stream under Robertstown River Bridge	FR-C4	Yes
2+575	Sroolane North	Stream	Extension of Existing Culvert north of N69	FR-C3A	No
2+625	Robertstown	Robertstown	Extension of Existing Culvert north of N69	FR-C4	Yes
2+650	N69 / Robertstown	Robertstown	N69 and Robertstown River under combined bridge	UB01	Yes
4+440	Rincullia	Ahacronane	Culvert	FR-C5	Yes
7+160	Ballyclogh	Stream	Culvert	FR-C6	No
10+070	Ballyellinan	Stream	Stream diversion and culvert under L1220	FR-C7A	No
10+150	Ballyellinan	Stream	Stream diversion and culvert	FR-C7	No
10+300	Ballycullen	Ballycullen	Culvert	FR-C8	Yes
10+400	Ballycullen	Stream	Stream diversion	-	-
10+950	Ballycullen	Stream	Culvert	FR-C9	No
11+650	Cloonreask	Stream	Culvert	FR-C10	Yes
20+975	Ballyclogh	Ballycullen	Culvert	FR-C11	Yes
21+950	Baunreagh	Stream	Stream diversion and culvert	FR-C12	No
22+250 to 22+450	Lismakeery / Baunreagh	Stream	Stream Diversion	-	-
24+000	Milltown / Boolaglass	River Deel	Bridge	RVB01	Yes
24+350	Boolaglass	Stream	Culvert	FR-C14	No
24+500	Boolaglass	Doohyle Stream	Combined culvert and underpass	FR-C15	Noyes
24+500 to 24+700	Boolaglass	Doohyle Stream	Stream Diversion	-	-
24+950	Bullaun / Nantinan	Stream	Stream diversion and culvert	FR-C16	No

Ch.	Location	Watercourse	Treatment	Structure Ref. No.	Clear Span
25+150 to 25+550	Nantinan / Feeagh	Drainage Ditches	Six drainage connectivity culverts	FR-C17 to - FR-C22	No
25+650	Feeagh	Stream	Culvert	FR-C23	No
26+300	Ardgoul South / Graigeen	Stream	Culvert	FR-C24	No
26+950	Graigeen	Doohyle Stream	Stream diversion under Roadbridge	FR-C25 / UB04	No
28+220	Kyletaun	Doohyle Stream	Combined culvert and underpass	FR-C26 / UP08	Yes
28+660	Kyletaun	Stream	Stream diversion and culvert	FR-C27	No
29+000	Kyletaun / Rathkeale	Stream	Culvert	FR-C28	Yes
50+750	Wolfeburgess East	Stream to Doohyle Lough	Combined culvert and underpass	M21-C1	Yes
50+750 to 51+050	Wolfeburgess East	Stream to Doohyle Lough	Stream diversion and culvert	-	-
56+550 to 56+710	Clonshire More	Stream	Stream Diversion	-	-
56+575	Clonshire More	Clonshire River	Bridge	M21-C3	Yes
58+175	Rowermore	Greanagh River A	Bridge	RVB02	Yes
59+250	Kilnockan	Greanagh River B	Bridge	RVB03	Yes
59+300 -59+600	Kilnockan	Stream	Stream Diversion	-	-
60+700	Islandea	Stream	Stream diversion and culvert	-	-
60+925	Islandea / Adare	River Maigue	Bridge	RVB04	Yes
62+300 to 62+600	Mondellihy	Stream	Stream diversion and culvert	-	-
63+550	Kilgobbin	Stream	Culvert	M21-C12	No
63+750	Kilgobbin	Stream	Culvert	M21-C13	No

### 6.7.2 Temporary Sedimentation Basins

In order to limit the potential for pollution due to run-off from construction, run-off waters will be directed through a sedimentation pond prior to discharge. In this regard, save as set out below, the operational (permanent) road drainage attenuation ponds together with the associated outfalls to the receiving watercourse, will be constructed in advance of the main construction works.

The purpose of a temporary sedimentation basin is to provide an area where sediment laden run-off is allowed to pond, so that the suspended sediment will settle out.

At specific locations (e.g. during the advancement of deep rock cuttings at Mulderricksfield and Amogan Beg through to Croagh), it may be necessary to first establish temporary sedimentation basins in areas where it is not possible to construct the operational attenuation ponds in advance of the construction works, or where it will not be possible to outfall to an attenuation pond due to the nature of the works or topography.

In order to ensure that temporary sedimentation ponds are sized correctly, the design parameters to be followed for these ponds is detailed below. Run-off from the exposed surfaces has been calculated using the Modified Rational Method and applying extreme rainfall information obtained from Met Éireann and specific to the area. The ponds shall be designed to accommodate a depth of rainfall constituting to a 1 in 10-year (14 hour) flood event at 1m depth. Contingency measures should be in place to release water via a spillway or similar in the event of a more serious rainfall event.

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

where:  $Q$  = peak discharge ( $m^3 / \text{hour}$ );  
 $C$  = coefficient of permeability\*;  
 $i$  = rainfall intensity\*\* ( $m / \text{hour}$ ); and  
 $A$  = contributing area ( $m^2$ )

\* Conservatively assume 0.6 for a stripped construction site  
 \*\* The depth of rainfall constituting to a 1 in 10-year (14 hour) flood event at 1m depth

The design of temporary sedimentation ponds shall be carried out as in accordance with *Control of Water Pollution from Construction Sites* (CIRIA, 2001) and *Control of water pollution from linear construction projects* (CIRIA, 2006).

Each temporary pond shall be subject to detailed design by the Contractor. Permanent attenuation ponds which are constructed in advance of the main earthworks, to be utilised during the construction stage shall be sized in accordance with the detailed drainage design to cater for the 1 in 100-year flood event. During the construction stage, accumulated sediment will be removed on a periodic basis. On completion of the road construction works, permanent ponds utilised during the construction stage shall be cleaned of any remaining silt and debris and all necessary works undertaken to establish the required vegetation for the long-term operation of the pond.

### 6.7.3 Water Quality Protection at Outset of Construction

The initial construction sequence will mitigate potential impacts upon the receiving waters. A double layer of silt fences along identified work areas adjacent to watercourses (as shown in Figures 1 – 23 in Appendix A) will be provided in advance of works commencing on site to contain silt and sediment run-off. Pre-earthwork ditches will then be provided in order to collect surface run-off during the start of construction. On completion of the earthworks, the drainage along this section will be established as soon as is practicable.

Once the permanent road drainage has been installed, it will outfall to one of the proposed attenuation pond locations. During the construction stage, temporary drainage measures will be employed to connect this drainage to the attenuation ponds

where required, or in certain instances to a temporary settlement pond. This will prevent untreated surface water run-off discharging to existing watercourses.

#### **6.7.4 Requirements at Sensitive Watercourses**

- i. A suitably qualified project ecologist will be employed by the Contractor to ensure successful implementation of the mitigation measures.
- ii. Throughout all stages of the construction phase of the project the Contractor will ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the freshwater environments and the requirement to avoid pollution of all types.
- iii. All design, construction and operation will be carried out in accordance with *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes* (TII, 2006) and *Control of water pollution from construction sites; Guidance for Consultants and Contractors* (SP156) (CIRIA, 2001) and *Guidelines on the Protection of Fisheries During Construction Works* (IFI, 2016).
- iv. An Incident Response Plan (Section 8.2) will be established to deal with incidents or accidents during construction that may give rise to pollution within any watercourse. This will include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (including oil booms, soakage pads, etc.).
- v. Where further pre-construction site investigation (including archaeological works) is required in the vicinity of or adjacent to any watercourses, these works will be carried out with due sensitivity and appropriate measures employed to minimise siltation.
- vi. Site compounds and soil storage areas will be located at a minimum distance of 50m from any watercourse. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- vii. Sediment traps or settlement ponds will be provided for all watercourses during construction. Total suspended solid levels in all waters discharging to any watercourse shall not exceed 25mg/l. All construction site run-off will be channelled through a stilling process to allow suspended solids to settle out and through some form of spill-containment facility prior to discharge to the drainage network.
- viii. The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- ix. The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment.
- x. All machinery operating in-stream will be steam-cleaned in advance of works and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken on dry land.
- xi. In-stream works on all watercourses supporting salmonids shall be undertaken during the period 1<sup>st</sup> June to 30<sup>th</sup> October, as required by IFI, to avoid accidental damage or siltation of spawning beds. This will include preparatory work such as piling or rock blasting in the vicinity of watercourses. Bank works will not interfere with migrating fish from March to June and spawning fish migration from October to February.
- xii. Clear span structures and box culverts will be used on watercourses as specified in Table 6.5 above. Where culverts are proposed, these shall as a minimum match the existing width of the watercourse.

- xiii. Culvert designs have avoided impacting on flow regimes and riverbed profiles upstream and downstream of the structure and allow for unimpeded movement of fish by ensuring a minimum depth of water within the structure. Flow regimes for all crossings identified as supporting salmonids shall allow for the unimpeded passage of fish upstream and downstream, by having the invert buried 500mm below bed level, be open bottomed or be clear spanning.
- xiv. Where watercourses require re-alignment to provide a right-angle crossing to the road or to minimise culvert length, the designs incorporate sinuosity and varied flow regimes with substrate composition to reconstruct a natural river system in both plan and profile. Realignment will tie in with the upstream and downstream sections of the existing channel. Landscaping along realigned sections of watercourse will aim to recreate riparian habitats using exclusively appropriate native species.
- xv. New stretches of watercourse on realignments will be completed and have vegetation established prior to connecting to the original watercourse. Abandoned stretches will be electro-fished by suitably qualified personnel (under licence from IFI or NPWS as appropriate) to salvage fish and white-clawed crayfish where identified as occurring or having the potential to occur.
- xvi. Where bank strengthening or scour protection is required, this will utilise sensitively placed rock armour with appropriate landscaping to tie the feature into the existing riverbank profile. Neither Gabion baskets nor Reno mattresses shall be used.
- xvii. The risk of accidental transfer of non-native invasive species will require adherence to current BPGs for avoiding the spread or transfer of all invasive plants and animals in accordance with the TII *Guidelines on the Management of Noxious Weeds and Non-native plant species on National Road Schemes* (2010) along with any modified or updated approaches to invasive alien species control ([www.invasivespeciesireland.com](http://www.invasivespeciesireland.com)).
- xviii. These measures will be enforced during construction to ensure accidental spread does not occur on machinery or materials from / to the site. The developers will also adopt any modified or updated approaches to invasive alien species control.
- xix. Where concrete or other wet materials are to be used, bunded steel decks will be used to capture any spilled concrete, alkaline water displaced from inside tubular steel piles or spilled sealants or other materials.
- xx. Any such materials collected on these platforms will be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan.

#### **6.7.5 Material Deposition Areas**

No designated Material Deposition Areas (MDAs) are required as part of proposed road development.

#### **6.7.6 Concrete Works**

The use and management of concrete in or close to watercourses must be carefully controlled to avoid spillage, which has a deleterious effect on water chemistry and aquatic habitats and species. Alternative construction methods have been proposed where possible (e.g. use of pre-cast units, use of cofferdams / diversions / over pumping) to place concrete in the dry, and permanent formwork. This will reduce the risks associated with concreting works. Where the use of in-situ concrete near and in watercourses cannot be avoided, the following control measures will be employed:

- When working in or near the surface water and the application in-situ materials cannot be avoided, alternative materials (e.g. biodegradable shutter oils) shall be used;
- Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters;
- Placing of concrete in or near watercourses will be carried out only under the supervision of a suitably qualified Environmental Manager;
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately, and run-off of same prevented from entering watercourses / water bodies;
- Concrete waste and wash-down water will be contained and managed on-site to prevent pollution of all surface watercourses;
- On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas;
- Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at a construction compound (or other appropriate facility designated by the supplier);
- Chute washout will be carried out at designated locations only. These locations will be signposted. Drivers of concrete plant and all delivery drivers will be informed of their location with the order information and on arrival on-site; and,
- Chute washout locations will be provided with an appropriate designated, contained impermeable area and treatment facilities, including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the procedure(s) set out in Chapter 7 of this EOP – Construction and Demolition Waste Management.

#### **6.7.7 Specific Mitigation Measures**

Specific mitigation at the most significant watercourses are detailed in this section. Photographs showing the specific mitigation measures at these watercourses and for the remainder of the proposed road development are included in Appendix A of this EOP.

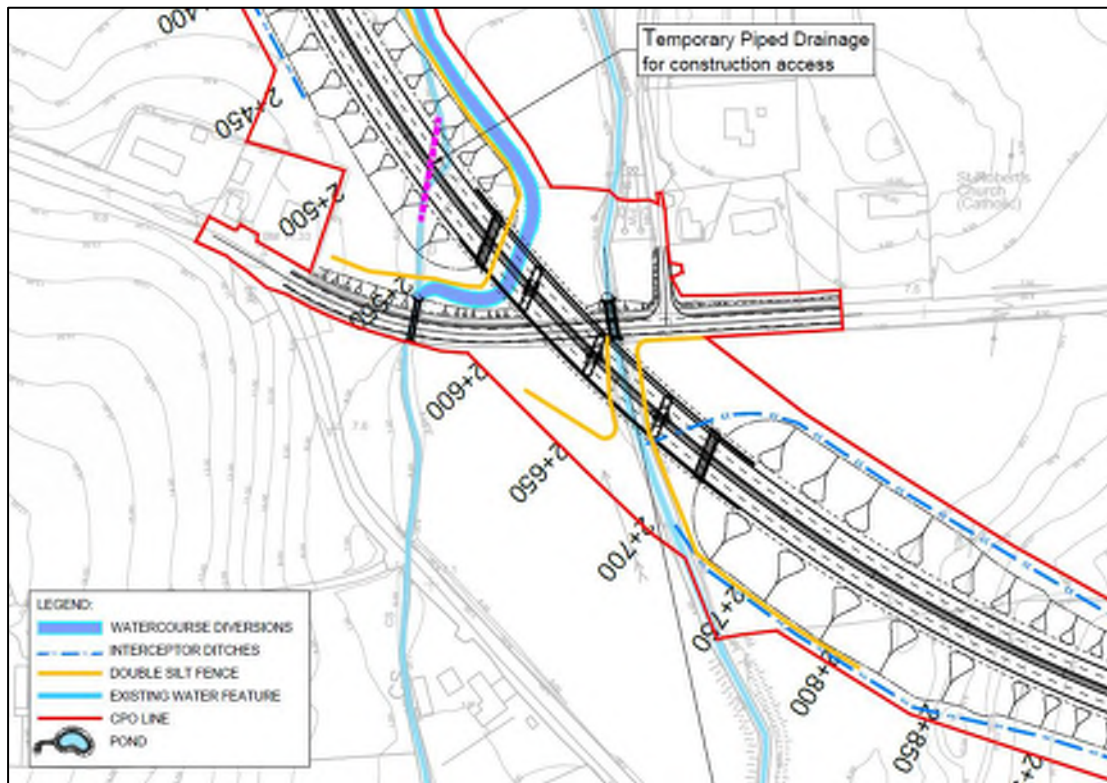
##### **Robertstown River – Ch. 2+700**

The Robertstown River is crossed by the proposed road development at Ch. 2+700. It is proposed that the river remains on existing line and crosses under the mainline in bridge UB01 which will span both the Robertstown river and the existing N69. A replacement and extension of the existing small bridge that carries the Robertstown River under the N69 is proposed to maintain the existing river north of the N69 which is proposed to be widened. The provision of double silt fences along the cordoned work area is proposed to prevent soil from the construction of the earth embankments on both sides of the river and soil for excavation for the bridge foundations and utility diversions from entering the river and diverted tributary to the north of the N69, as shown below (Plate 6.9).





**Plate 6.8 Robertstown River**



**Plate 6.9 Robertstown River silt fencing provision**

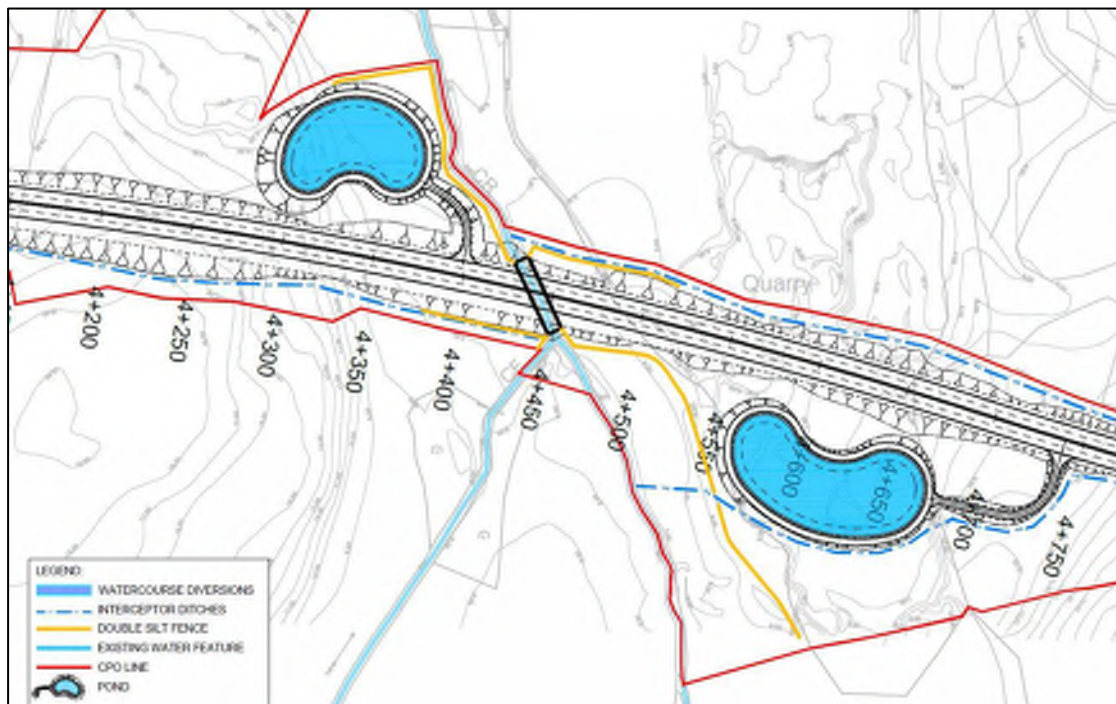
### **Ahacronane River – Ch. 4+400**

The Ahacronane River is crossed by the proposed road development at Ch. 4+450. It is proposed that the river remains on existing line and crosses under the mainline at Structure FR-C5 which will clear span the river. The provision of double silt fences along the cordoned work area is proposed to prevent soil from the construction of the earth embankments on both sides of the river and soil for excavation for the structure foundations, as shown below (Plate 6.10).





**Plate 6.10 Ahacronane River**



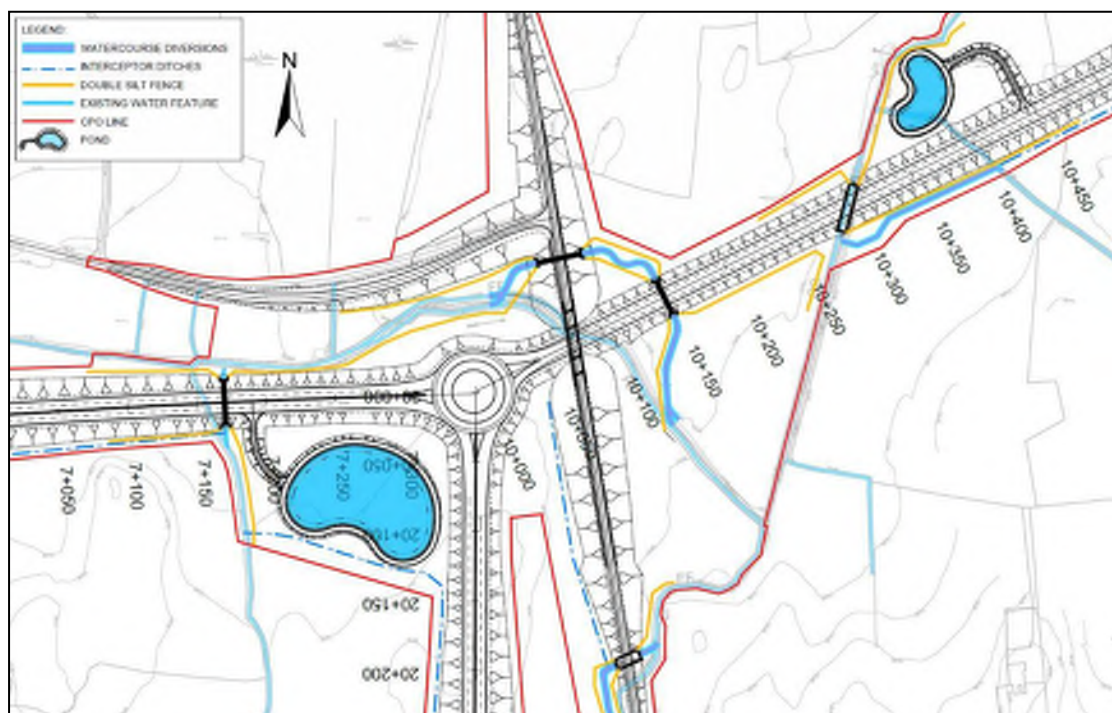
**Plate 6.11 Ahacronane River silt fencing provision**

### **Ballycullen / Lismakeery Stream – Ch. 10+300 and Ch. 20+950**

The Ballycullen Stream is crossed at three locations by the proposed road development at Ch. 10+300, Ch. 20+950 and the L1220. Three new structures are proposed to carry the stream at these crossings. The existing stream crossing on the existing L1220 is shown below (Plate 6.12). The provision of double silt fences along the cordoned work area is proposed to prevent soil from the construction of the earth embankments entering the stream once the stream has been diverted. For the stream diversion temporary silt fencing and settlement pond will be required to deal with localised silt issues at the diversions.

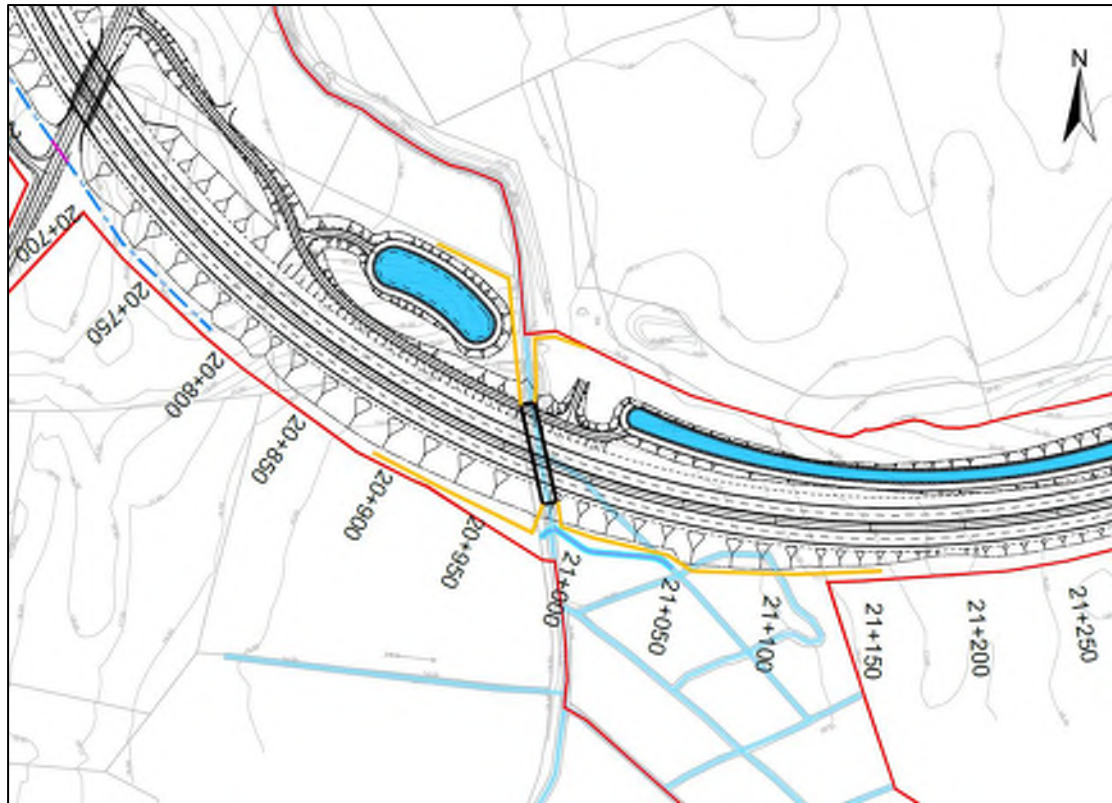


**Plate 6.12** Ballycullen Stream on the existing L1220



**Plate 6.13** Ballycullen Stream silt fencing provision at Ch. 10+300 and L1220





**Plate 6.14 Ballycullen Stream silt fencing provision at Ch. 20+950**

#### **River Deel – Ch. 24+000**

The River Deel is crossed by the proposed road development at Ch. 24+000. It is proposed that the river remains on existing line and crosses under the mainline in bridge RVB01. The provision of double silt fences along the cordoned work area is proposed to prevent soil from the construction of the earth embankments entering the river.



**Plate 6.15 River Deel at crossing**



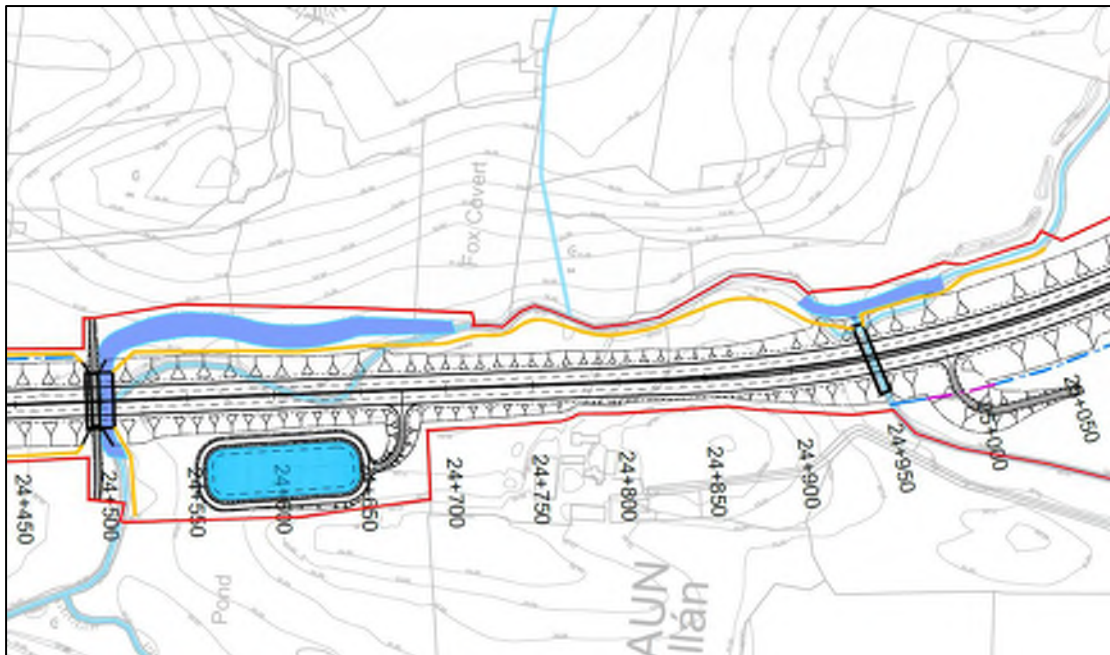
**Plate 6.16 River Deel silt fencing provision at Ch. 24+000**

**Doohyle Stream – Ch. 24+500, Ch. 26+935 and Ch. 28+220**

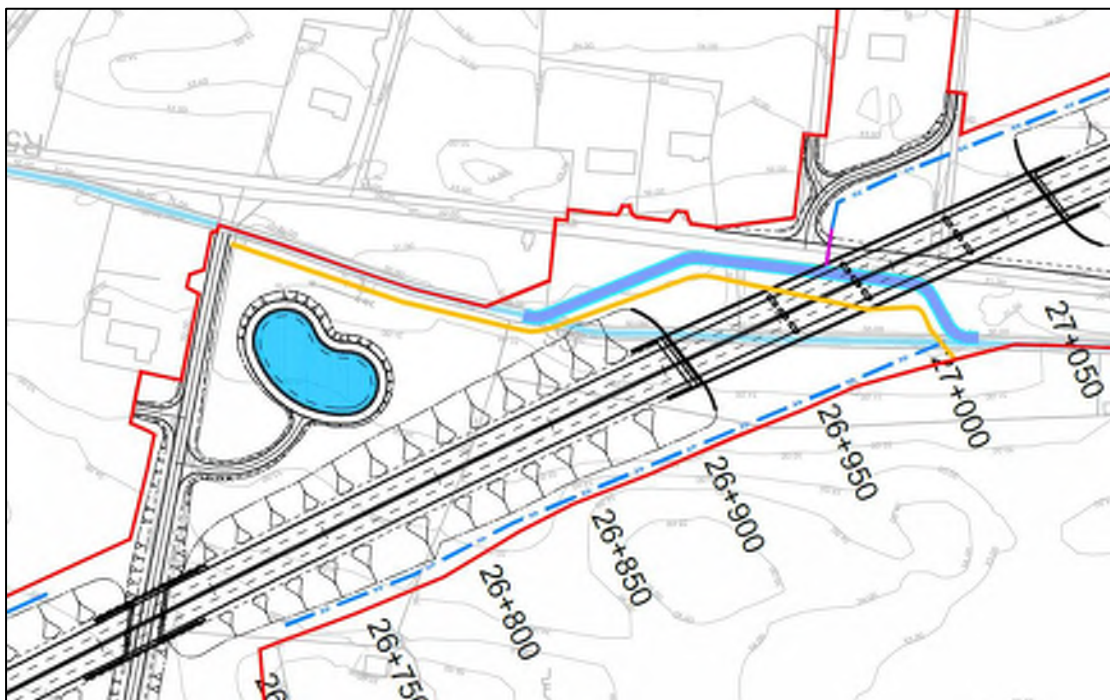
The Doohyle Stream is crossed by the proposed road development at Ch. 24+500, 26+935 and 28+220. The crossing at Ch. 24+500 is within watercourse diversion FR-WD14 and utilises a small bridge. The crossing at Ch. 26+935 is via a diversion



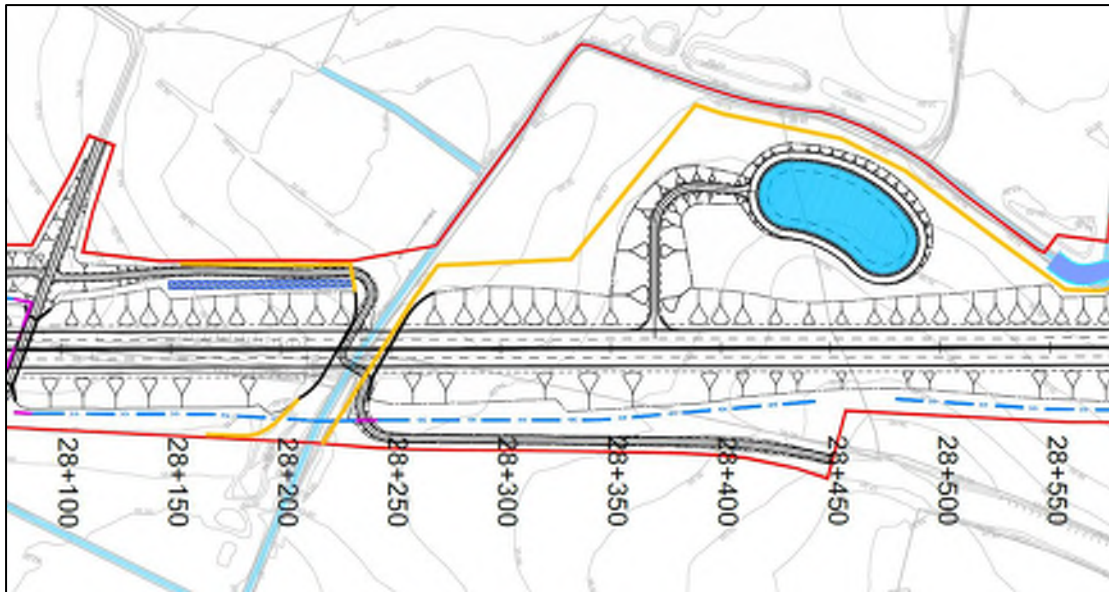
incorporated within structure UB04 which includes the bridge over the R518. The crossing at Ch. 28+220 is incorporated within structure UP08. Details of the proposed silt fencing provision are shown in the Plates 6.17 – 6.18, below.



**Plate 6.17** Doohyle Stream silt fencing provision at Ch. 24+500



**Plate 6.18** Doohyle Stream silt fencing provision at Ch. 26+935

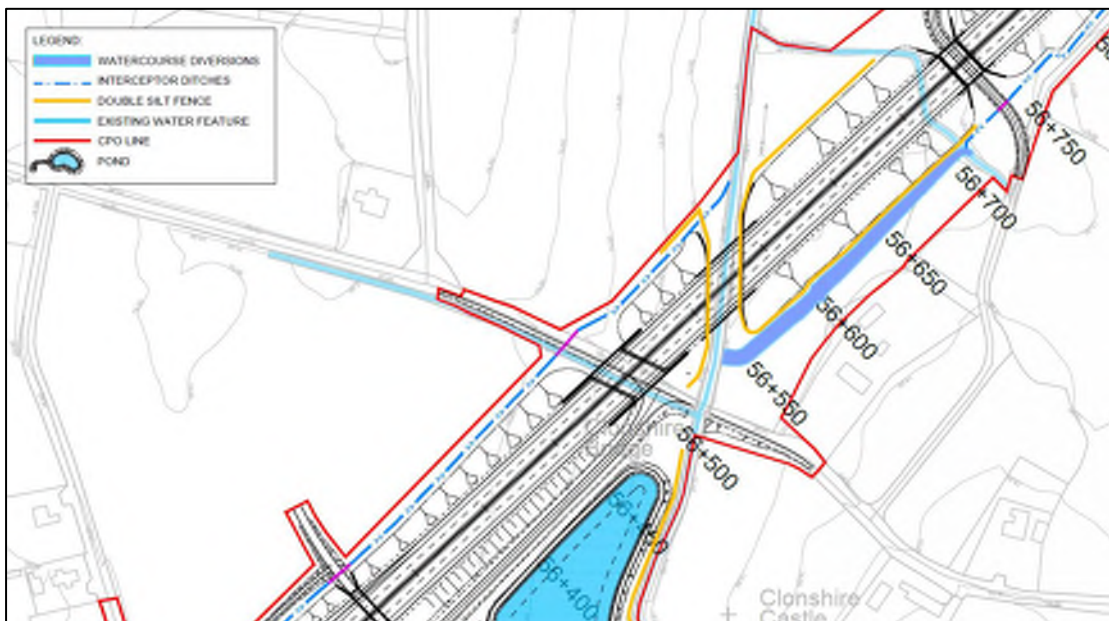


**Plate 6.19 Doohyle Stream silt fencing provision at Ch. 28+220**

### **Clonshire & Greanagh River – Ch. 56+550, Ch. 58+180 and Ch. 59+260**

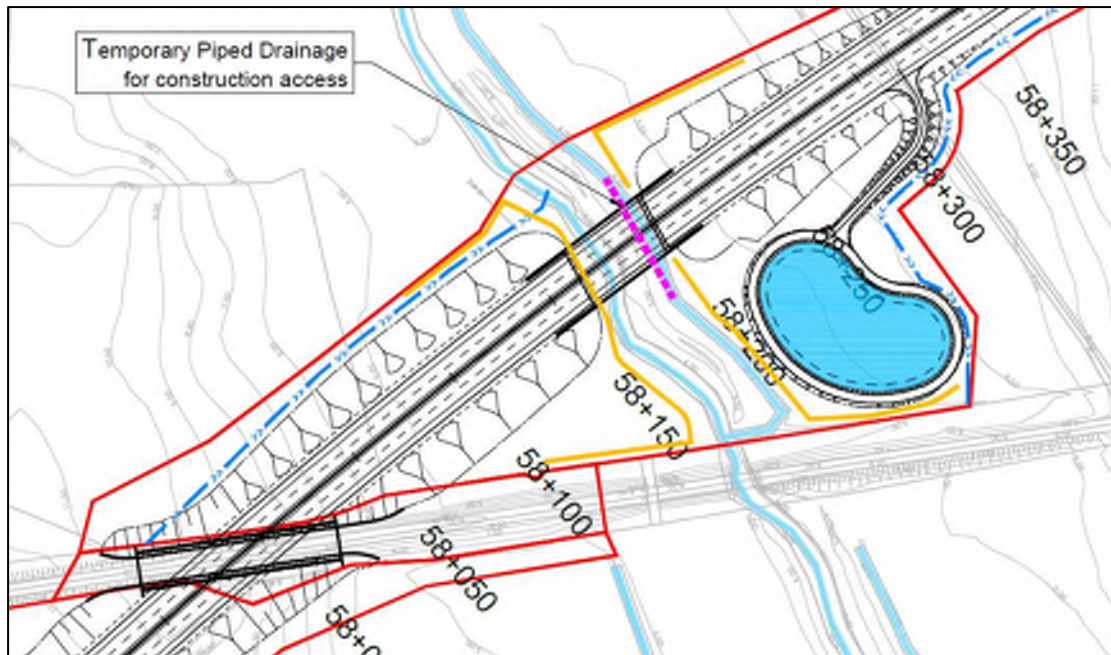
The Greanagh River and its tributary, the Clonshire River, cross the proposed road development three times along Section D at Ch. 56+500 (Clonshire), 58+180 (Greanagh A) and 59+260 (Greanagh B). It is proposed that the river remains on its existing line and crosses under the mainline.

The bridge at Ch. 58+180 at the Greanagh (A) spans an Office of Public Works (OPW) flood embankment and back-drain on the eastern side. The bridge at Ch. 59+260 also spans OPW flood embankments and back-drains on both sides of the Greanagh River (B). At the Greanagh River at both Ch. 58+180 and 59+260 it is proposed that the drainage ditches / backdrains to the rear of the bunds be piped, culverted or spanned over temporarily during the construction phase to allow for construction of the bridges at these locations.

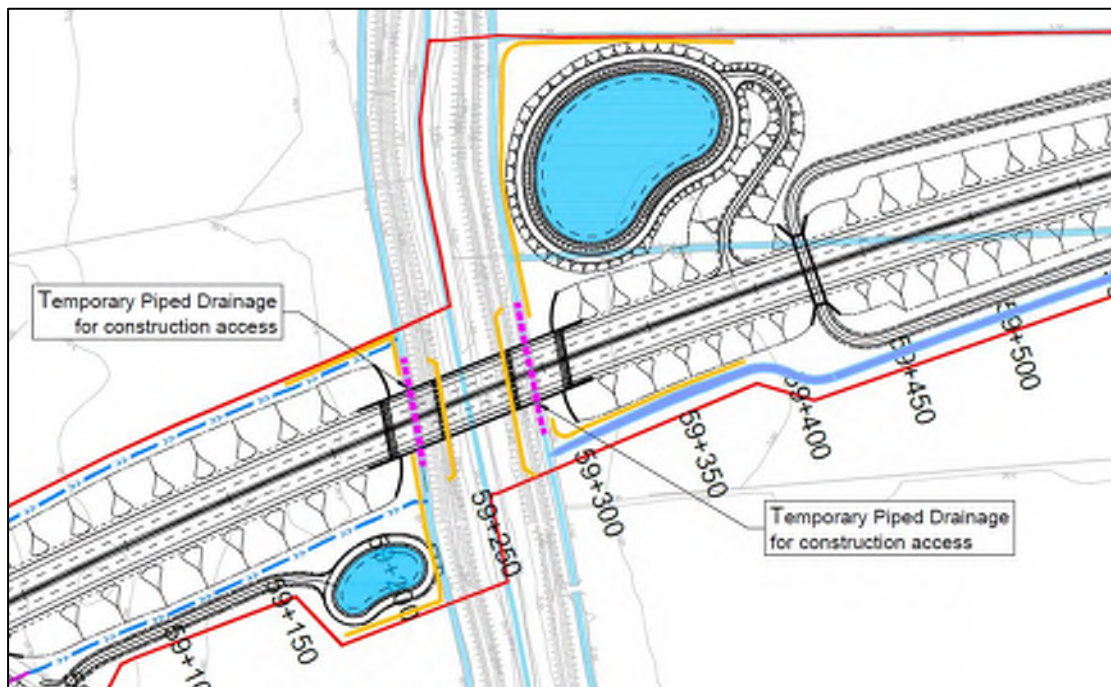


**Plate 6.20 Clonshire River silt fencing provision at Ch. 28+220**





**Plate 6.21 Greanagh River (A) silt protection measures at Ch. 58+180**



**Plate 6.22 Greanagh River (B) silt protection measures at Ch. 58+180**

### **River Maigue – Ch. 60+950**

The River Maigue is crossed in the townlands of Islandea / Adare to the north of Adare and the existing N21 river bridge to the east of Adare. The river is surrounded on both sides by flood bunds, which rise to a level of approximately 4.0m MSL (Plate 6.23).

The proposed bridge design for the River Maigue crossing was developed through careful assessment of the biodiversity issues within the Lower River Shannon SAC which extends southward along the tidal stretch of the River Maigue as far the existing road bridge in Adare. Consultations with the National Parks and Wildlife Service (NPWS) informed the design process to develop a bridge proposal that would avoid

biodiversity impacts for the qualifying interest habitats and flora within the SAC. There will be some limited temporary disturbance to vegetation and topsoil within the SAC on the riverbanks outside of the tidal mudflats, but this will have no impact for the integrity of the protected habitats.



**Plate 6.23 River Maigue cross-section adjacent to proposed bridge crossing**

Consideration was given to flooding along the river channel in consultation with the OPW. Arising from this, the proposed piers have been positioned appropriately within the flood control embankments, and sufficient vertical clearance is provided above the embankments for maintenance access and hydraulic capacity. The construction method for the proposed River Maigue Bridge will involve no disturbance to the river channel, for biodiversity reasons within the SAC, with the exception of some temporary piling for crane platforms outside the edges of the tidal zone, where works exclusion zones are defined for biodiversity protection measures, as outlined below. Sheet pile walls will be inserted into the riverbanks outside of the tidal mudflats that will be protected from disturbance during the construction works. These sheet piles will provide suitable supports for all temporary works, support props and cranes for the erection of the bridge. The proposed steel bridge deck can be erected in sections and connected over the river channel with the central span section temporarily supported by props on the banks.

To protect the water quality in the river a temporary drainage system will be provided at the works areas on the riverbanks, with all water directed away from the river and into a collection system that will be provided with suitable pollution control measures before discharge to the existing drainage system that links to the river through flap-valve outlets. These measures will protect against accidental spillages from the construction machinery and processes from entering the river channel. Further measures will be adopted during the pouring of concrete for the bridge deck above the steel beams so as to prevent accidental spillages of pollutant materials directly into the river.

The low-water river channel is 30m wide, which is 40m along the skew angle of the bridge centreline alignment. On the western side of the river there is a 10m wide (13m skew) inter-tidal zone consisting mainly of a mud bank which is where the Triangular Club-rush may grow, and this zone will be protected fully from any works disturbance. On the eastern bank the similar zone is a little narrower, as the slope is a bit steeper. The overall width of the river corridor not to be disturbed is, therefore, about 50m wide (or 66m on the skew angle). To provide a small buffer zone for driving of sheet piles,



a 70m clear zone is proposed for the works exclusion zone. Full details of the works and exclusion zone are provided within the EIAR.

Works zones for the bridge piers and main span erection extend for about 10m north and south of the bridge along the riverbanks, apart from the south-eastern corner, where additional space is provided for the main crane base. In these zones that are within the SAC, the topsoil is to be stripped and stored in the nearby areas the CPO for later reinstatement. Access to the work zones to the rear of the flood bunds will require temporary piping or temporary bridges to span over the drainage ditches.

Plate 6.24 shows the proposed silt protection measures at the River Maigue Crossing.

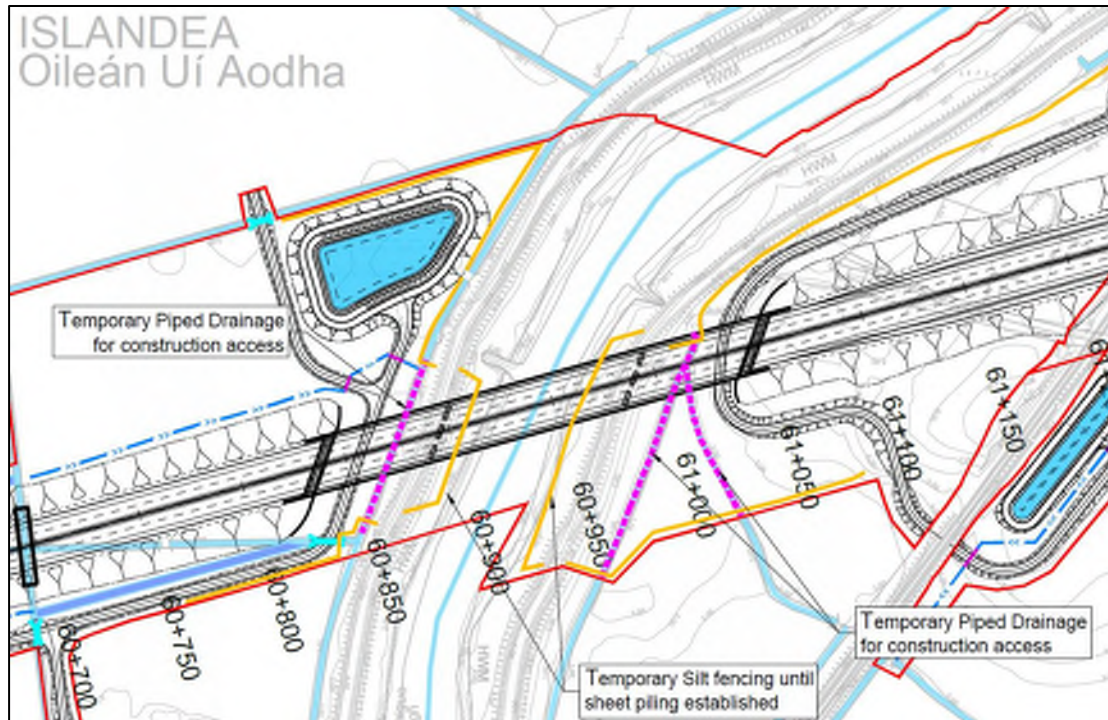


Plate 6.27 River Maigue silt protection measures at Ch. 60+900

## 6.8 Monitoring and Audit

### 6.8.1 Introduction

The minimum requirements for the control of sediment shall include all of the controls, measures, mitigations and monitoring described in this Plan. The monitoring of all aspects of the EOP, including sediment control, will be carried out by the contractor. The responsibilities of the Employer will be discharged by the Employer's Site Representative Staff. The contractor will be required to undertake continuous monitoring of the works to ensure compliance with the EOP, including the measures set out in this section. In addition, the Employer's Site Representative Staff will oversee the works to ensure that the Contractor is complying with their responsibilities. The avoidance, control and mitigation measures outlined in this Chapter will ensure that erosion and sedimentation arising from the works is controlled. They have been developed in accordance with best practice, in consultation with environmental organisations including NPWS and IFI, and have been shown to work on other projects. As with all systems, there is a requirement to have monitoring, audit and feedback loops to demonstrate the effective operation of the system. The following Sections describe the frameworks of the pre-construction monitoring and construction monitoring regimes.

### **6.8.2 Pre-construction Monitoring Regime**

Pre-construction water quality monitoring in the receiving watercourses shall be undertaken at the following watercourses:

- i. Robertstown River;
- ii. Ahacronane River;
- iii. Lismakeery Stream;
- iv. River Deel;
- v. Clonshire River;
- vi. Greanagh River; and
- vii. River Mague.

This monitoring shall entail a minimum of six no. monthly samples being taken to establish baseline conditions. This testing shall include (but will not be limited to):

- Suspended Solids (SS);
- Turbidity;
- Dissolved Oxygen (DO);
- Nitrate;
- Nitrite;
- Total Nitrogen;
- Phosphate;
- Total Phosphorus;
- Temperature;
- Ammonia;
- Biological Oxygen Demand (BOD); and
- Total Hydrocarbons.

### **6.8.3 Construction Monitoring Regime**

Similarly, monthly surface water quality sampling shall be undertaken at the above locations and for at least the same sample quality parameters throughout the construction phase. This monitoring will be reviewed on an ongoing basis during construction. Where the surface water regulations are exceeded in these watercourses, an investigation shall be undertaken to identify the source of non-compliance and corrective action implemented where the non-compliance is deemed to be associated with the proposed road development. To support the reactive element of this monitoring, all watercourses to which there is a discharge from the works shall be monitored on a daily basis for turbidity. Readings will be taken from the watercourses immediately upstream and downstream of the works, and where the difference between these readings exceeds 30ntu, investigatory procedures shall be triggered by default.

Such investigation will establish whether or not the elevated turbidity readings are as a result of the construction works. Where this is the case, immediate corrective actions, which may include cessation of the sediment generating works, will be enforced until such time that such polluting activities can be controlled.

#### 6.8.4 Responsible Parties

##### **Contractor**

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

##### **Site Environmental Manager (SEM)**

As stipulated previously, in Section 2.3 of this Plan, a SEM shall be appointed by the Contractor for the duration of the proposed works. In addition to the on-going and detailed monitoring carried out by the Contractor as part of the EOP; the SEM shall carry out the inspection / monitoring regime described below on behalf of the employer:

- i. Inspect the Principal Control Measures outlined in this Chapter on a weekly basis. Report findings to the Contractor;
- ii. Inspect surface water treatment measures (ponds, tanks, mini-dams, sandbags, etc.) on a daily basis and obtain turbidity readings;
- iii. Inspect all outfalls to watercourses on a daily basis and obtain turbidity readings. Where excavation, deposition, pumping out or concreting works are on-going in the vicinity obtain turbidity readings three times per day;
- iv. Daily visual inspection of watercourses to which there is a discharge from the works and those in the vicinity of construction works;
- v. Wheel wash facilities shall be inspected on a weekly basis;
- vi. Borrow Pits shall be inspected on a daily basis while in operation and on a weekly basis thereafter;
- vii. Material Deposition Areas shall be inspected on a daily basis while in operation and on a weekly basis thereafter;
- viii. Stockpiles shall be monitored on a daily basis while being filled or emptied and otherwise on a weekly basis;
- ix. Control measures for works at or near water bodies shall be inspected on a daily basis;
- x. Concrete operations at or near watercourses shall be supervised and designated chute washing out facilities shall be inspected on a daily basis;
- xi. Site Compounds shall be inspected on a weekly basis;
- xii. The contractor's EOP monitoring results shall be audited by the SEM on a frequent basis (6 times per quarter at a minimum);
- xiii. Any and all exceedance of the investigatory level for turbidity shall be reported to the Employer and shall be investigated thoroughly by the SEM and the contractor. Where the works are identified as the source causing the exceedance, the procedure outlined in Item "(xiv) (a)- (d)" below shall be followed;
- xiv. Any direct release of sediment to a watercourse causing plumes or exceedance of the turbidity investigatory levels shall result in: -
  - xv. the Employer shall be notified immediately;
  - xvi. the Contractor will be required to take immediate action and to implement measures to ensure that such discharges do not re-occur;
  - xvii. Works if stopped, shall not recommence until appropriate corrective measures to avoid any repetition are put in place. Such measures shall be agreed with the SEM following consultation with the Employer;

- xviii. Works and/ or discharges from the works shall not recommence until written consent is received from the SEM.
- xix. Where the SEM considers that the risk of a sediment release is high, he/she shall inform the Contractor and request protective action to be taken. The SEM shall report all such notifications and requests to the Contract Manager and the Client.

The results will be stored in the SEM's Monitoring file and will be available for inspection / audit by the Client, NPWS or IFI staff. All inspections / monitoring / results will be recorded on standard data forms.

## **6.9 Emergency Procedures**

### **6.9.1 Introduction**

Prior to commencing works, the Contractor shall prepare an Incident Response Plan (see Section 8.2) based on a thorough risk assessment. The plan shall detail the procedures to be undertaken in the event of the release of any sediment into a watercourse, serious spillage of chemical, fuel or other hazardous wastes (e.g. concrete), non-compliance incident with any permit or license, or other such risks that could lead to a pollution incident, including flood risks.

### **6.9.2 Resources**

Relevant staff, including cover staff, shall be trained in the implementation of the Incident Response Plan and the use of any spill kit / control equipment as necessary. The contractor shall provide a list of all such staff to the Employer's Site Representative detailing the name, contact number, and training received, and the date of that training. The Contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment to the Employer's Site Representative. All such plant and equipment shall be maintained in place and in good working order for the duration of the works.

### **6.9.3 Spill Response**

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

- i. Instruction to stop work;
- ii. Instruction to contain the spill;
- iii. Details of spill clean-up material location;
- iv. Name and contact details of responsible staff;
- v. Measures particular to the location and the activity;
- vi. Instruction to contact the SEM (including Name and Contact Details).

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

## **6.10 References**

CIRIA (2001). *Control of Water Pollution from Construction Sites (C532)*

CIRIA (2006). *Control of water pollution from linear road projects (C648)*

NRA / TII (2006). *Guidelines for the Crossing of Watercourses during the Construction of Road Projects*

*NRA / TII (2007). Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan*

## 7. CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

### 7.1 Introduction

This Chapter has been developed to ensure that waste arising on-site during the construction and demolition phase of the proposed development will be managed and disposed of in a way that ensures the provisions of the *Waste Management Acts, 1996-2011* and associated *Regulations 1996 and 2001* are complied with and to ensure that the principles of waste hierarchy are implemented. The development of this Chapter has been informed by the following guidance documents:

- Department of the Environment, Heritage and Local Government (DEHLG) (2006). *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*;
- Environmental Protection Agency (EPA) (2015). *Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-hazardous*;
- CIRIA (1997). *SPU SP 133 Waste Minimisation in Construction: Site Guide*;
- *Waste Management Acts 1996 and 2001 and associated Regulations*;
- National Construction & Demolition Waste Council (NCDWC) (2006). *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*; and
- TII / NRA (2008). *Guidelines for the Management of Waste from National Road Construction Projects*.

Prior to the commencement of any construction works, a Waste Management Co-ordinator (WMC) will be appointed by the Contractor to assume responsibility for the further development of this Plan and the management and treatment of all waste materials generated during the duration of the proposed construction phase.

The Construction and Demolition Waste Management Plan must contain (but not be limited to) the following information:

- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times;
- Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of, where necessary; and,
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

### 7.2 Waste Management Strategy

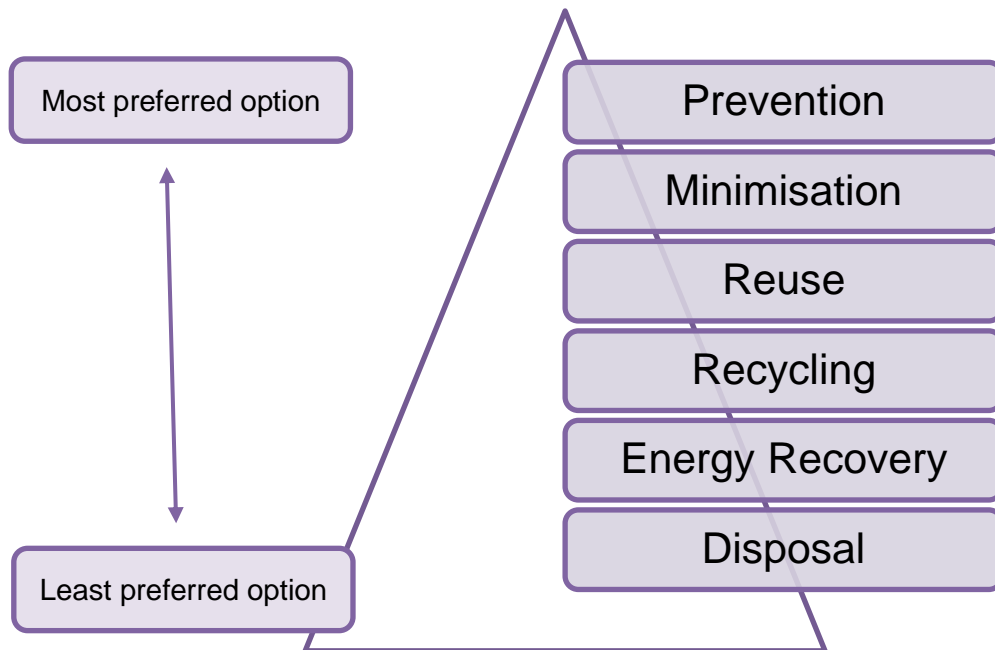
#### 7.2.1 Scope

The Contractor will develop a Construction and Demolition Waste Management Chapter that will detail (at a minimum):

- Licensing of Waste Disposal;
- Site clearance;
- Excavations, stockpiling and disposal of materials;

- Measures to protect water quality;
- Importation, stockpiling and placing of fill;
- Management of drainage works to ensure no pollution of watercourses;
- Construction vehicle management; and,
- Dust and noise abatement measures.

### 7.2.2 Waste Hierarchy



**Plate 7.1 The Waste Hierarchy (adapted from DEHLG, 1998)**

The management of construction and demolition waste will be conducted in accordance with 'the waste hierarchy'; with waste prevention and minimisation being the first priority, followed by reuse and recycling, and disposal (i.e. to landfill) and energy recovery (i.e. incineration) regarded as least preferred options (Plate 7.1). During site clearance and construction works, there are numerous opportunities for the beneficial reuse or recycling of materials, which ultimately reduces the volume of material which needs to be consigned to landfill sites. The Construction and Demolition Waste Management Chapter finalised by the Contractor shall be developed in accordance with the waste hierarchy, as it is ordered in Plate 7.1.

### 7.2.3 Source Segregation

Wastes generated on the construction site will be identified and segregated according to their respective categories, as described by the European Waste Catalogue (EWC) list of 'construction and demolition wastes (including excavated soil from contaminated sites)' (Table 7.1).

**Table 7.1 Construction and demolition waste categories (as per EWC (EPA, 2015))**  
\* For the purposes of this list of wastes, PCBs will be defined as in Directive 96/59/EC

Code	Description
<i>1701</i>	<i>Concrete, bricks, tiles and ceramics</i>
170101	Concrete
170102	Bricks
170103	Tiles and ceramics
170106	Mixtures or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances
170107	Mixtures of concrete, bricks, tiles and ceramic other than those mentioned in 170106
<i>1702</i>	<i>Wood, glass and plastic</i>
170201	Wood
170202	Glass
170203	Plastic
170204	Glass, plastic and wood containing or contaminated with dangerous substances
<i>1703</i>	<i>Bituminous mixtures, coal tar and tarred products</i>
170301	Bituminous mixtures containing coal tar
170302	Bituminous mixtures other than those mentioned in 170301
170303	Coal tar and tarred products
<i>1704</i>	<i>Metals (incl. alloys)</i>
170401	Copper, bronze and brass
170402	Aluminium
170403	Lead
170404	Zinc
170405	Iron and steel
170406	Tin
170407	Mixed metals
170409	Metal waste contaminated with dangerous substances
170410	Cables containing oil, coal tar and other dangerous substances
170411	Cables other than those mentioned in 170410
<i>1705</i>	<i>Soil (incl. excavated soil from contaminated sites), stones and dredging spoil</i>
170503	Soil and stones containing dangerous substances
170504	Soil and stones other than those mentioned in 170503
170505	Dredging spoil containing dangerous substances
170506	Dredging spoil other than those mentioned in 170505
170507	Track ballast containing dangerous substances
170508	Track ballast other than those mentioned in 170507
<i>1706</i>	<i>Insulation materials and asbestos-containing construction materials</i>



Code	Description
170601	Insulation materials containing asbestos
170603	Other insulation materials consisting of or containing dangerous substances
170604	Insulation materials other than those mentioned in 170601 and 170603
170605	Construction materials containing asbestos
1708	<i>Gypsum-based construction material</i>
170801	Gypsum-based construction materials contaminated with dangerous substances
170802	Gypsum-based construction materials other than those mentioned in 170801
1709	<i>Other construction and demolition wastes</i>
170901	Construction and demolition wastes containing mercury
170902	Construction and demolition wastes containing PCB* (e.g. PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)
170903	Other construction and demolition wastes (including mixed wastes) containing dangerous substances
170904	Mixed construction and demolition wastes other than those mentioned in 170901, 170902 and 170903

Wherever possible, metal, timber, glass and other recyclable material will be segregated and removed off-site to a permitted / licensed facility for recycling. In order to achieve this, designated waste storage areas will be created at the construction compound or other suitable locations for the storage of segregated wastes prior to transport for recovery / disposal at suitably licensed / permitted facilities. Suitably sized containers for each waste stream will be provided within the waste storage area and will be supervised by the WMC. The number and sizing of containers will be agreed with waste management contractors in advance of the commencement of construction works. Source segregation of waste will result in cost savings to the project as well as providing an environmentally sound route for the management of all construction and demolition wastes.

#### 7.2.4 Re-use

Possibilities for re-use of clean, non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Waste Acceptance Criteria testing has been carried out on areas of made ground as part of the ground investigation works, and this has not indicated the presence of contamination. Where excavated material is not be reused within the works, the Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable. The Contractor will ensure that any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.

#### 7.2.5 Material Management

In order to prevent and minimise the generation of waste, the Contractor will be required to ensure that raw materials are ordered so that the timing of delivery, the quantity delivered, and the storage is not conducive to the creation of unnecessary waste. The Contractor, in conjunction with the material suppliers, will be required to develop a programme showing the estimated delivery dates and quantities for each specific material associated with each element of construction and demolition works. Following a 'just-in-time' approach improves cash flow, better utilises storage space

and reduces potential loss to theft and accidental damage, as well as making the site safer.

It is essential that the planning, construction and demolition works are undertaken in close collaboration with waste management contractors, in order to determine the best techniques for managing waste and to ensure a high level of recovery of materials for recycling. The Contractor will be required to continuously seek to improve the waste management process on-site during all stages of construction and maximise opportunities for re-use and recycling where they exist. For example, in relation to waste packaging, the Contractor will seek to negotiate take-back of as much packaging waste as possible at source to ensure maximum recycling. The finalised Construction and Demolition Waste Management Chapter will be included as an agenda item at the weekly construction meetings. In addition, any updates to the text will be communicated to the whole team (including the Client) at the monthly meetings.

#### **7.2.6 Auditing**

The Contractor will record the quantity (in tonnes) and types of waste and materials leaving the site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials from the construction phase are delivered will be recorded along with the quantity of waste (in tonnes) delivered to each facility. Records will show all material recovered and disposed of.

The waste management strategy for the project will follow the accepted waste hierarchy and the Contract will implement the following measures (at a minimum):

- Wherever possible, materials for construction activities will be ordered as to require the minimum possible storage time;
- Materials will be ordered, where possible, in sizes to prevent wastage;
- A WMC shall be appointed by the Contractor, who will be responsible for handling, storage and delivery of materials to the proposed road development;
- It shall be ensured that stored material is protected from damage from plant and environmental factors such as rain and wind;
- Storage areas shall be secured so as to prevent unauthorised access;
- A waste management compound shall be established to handle incoming waste from construction activities – this should facilitate the segregation of key waste streams to maximise the opportunity to re-use, recycle and return wastes generated on-site;
- A separate secured area shall be provided for dealing with hazardous waste; and,
- Separate facilities shall be provided for the storage of fuels and chemicals.

#### **7.2.7 Waste and Recycling Targets**

Through their finalised waste management strategy, The Contractor shall aim to achieve the following targets, insofar as possible:

- Reuse of all earthworks materials on site;
- 100% recycling of surplus reinforcement and other metals; and,
- No contamination of skips / waste containers, i.e. no additional costs due to incorrect materials being placed in skips / containers designated for other categories of waste.

## 7.2.8 Waste and Recycling Opportunities

The Contractor will seek opportunities, wherever possible, to reduce the amount of waste generated on site and maximize the potential for recycling materials in accordance with the waste hierarchy through the following:

- Maximising the re-use of soils on site during the construction of the proposed road development;
- Storing materials in designated areas and separate from wastes to minimise damage;
- Returning packaging to the producer where possible;
- Segregating construction and demolition wastes into reusable, recyclable and non-recyclable materials;
- Reusing and recycling materials on site during construction where practicable;
- Recycling other recyclable materials through appropriately permitted/licensed Contractors and facilities; and,
- Disposing of non-recyclable wastes to licensed landfills.

## 7.3 Waste Disposal Licensing

### 7.3.1 Licensing Requirements

Under the *Waste Management (Collection Permit) (amended) Regulations, 2016*, a waste collection permit for waste corresponding with the above-stated EWC categories (Table 6.1) is required by a waste haulier to transport waste from one site to another. Compliance with the *Waste Management (Shipments of Hazardous Waste in Ireland exclusively) Regulation, 2011* is also required for the transportation of hazardous waste by road. The export of waste from Ireland is subject to the requirements of the *Waste Management (Shipment of Waste) Regulations, 2007*. The Contractor will ensure that the transport and movement of all waste is carried out in compliance with these (and any other relevant) requirements.

Waste may only be treated or disposed of at facilities that are licensed to carry out the specific activity in question. Records of all waste movements and associated documentation will be held on-site. Generally, operators of waste management sites will facilitate a site visit and inspection of documentation if deemed necessary. Prior to any on-site recovery process, including the operation of mobile plant, an operator must apply to the local authority (i.e. Limerick City and County Council) for a waste facility permit under the *Waste Management (Facility Permit and Registration) Regulations, 2007*. It is planned that waste activities at the site will comprise of source segregation, storage and collection and, therefore, it is highly unlikely that any waste licensable or waste permissible activity will be undertaken.

### 7.3.2 Exclusion from Legislation

The Waste Framework Directive (2008/98/EC) identifies certain materials that are not subject to its requirements. A key exclusion affecting construction projects is set out in Article 2(1)(c), which states that the Directive does not apply to:

*"[...] uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated [...]"*

This provision is repeated in the *Waste Management Acts*, as amended by the *European Communities (Waste Directive) Regulations, 2011 (SI No. 126/2011)*.

Should materials generated by construction activities fall within this provision, they are not then subject to the other requirements of the EU or national waste legislation. This means that, for example, such materials are not defined as 'waste', do not need to be handled by duly authorised waste collectors and do not need to pass to disposal or recovery facilities that are subject to waste licences or other equivalent forms of statutory authorisation.

## **7.4 Proposed Construction Methodology and Material Usage**

### **7.4.1 Site Preparation**

Archaeological investigation works including testing and any follow-on resolution works will be undertaken prior to the main works contract commencing on site. Pre-construction works are likely also to include targeted diversion works of services and utilities including electricity, particularly the high voltage overhead lines, telecommunications and water services. Due to the nature of some of the diversions a number of these service diversions will only be possible during the main construction works. Advanced tree clearance, hedgerow clearance and fencing contracts may also be undertaken dependant on the anticipated seasonal timing of the award of the contracts. The finalised Construction and Demolition Waste Management Chapter will take the following into account:

- The extent of the areas to be cleared and the potential types and volumes of arisings;
- The location of any structures to be demolished;
- Statutory requirements; and,
- Specific environmental requirements and seasonal requirements, e.g. in respect of bats, birds and salmonids.

### **7.4.2 Site Offices and Construction Compounds**

There will be a number of construction compound sites along and / or in the vicinity of the proposed development.

The arrangements within the construction compounds, as well as the storage of fuels, other hydrocarbons and other chemicals within them, will comply with all of the mitigation measures / conditions set out in this EOP. Compounds will also have appropriate levels of security to limit potential vandalism, theft and unauthorised access.

Following completion of construction, these areas will be cleared and re-instated. Temporary buildings and containers, parking areas and waste material (such as rubble, aggregates and unused construction materials) will not be permitted to remain exposed on these sites and will need to be removed and disposed of appropriately.

### **7.4.3 General Construction and Demolition Works**

General construction and demolition wastes are made up of waste such as wood, packaging, metals, plastics, bricks, blocks, canteen waste and some hazardous waste (e.g. oils, paints and adhesives). Site clearance and residual waste will be generated during the construction phase. While it is difficult at this stage to predict precise tonnage of these wastes, the EPA has produced typical figures for the construction and demolition waste, based on the National Waste Database. This includes a percentage breakdown of each waste type in the construction and demolition stream (Table 7.2). A more detailed estimate of the anticipated quantities of these materials will be added to this Chapter by the successful Contractor.

**Table 7.2: Waste Materials Generated on a Typical Irish Construction Site**

<b>Waste Type</b>	<b>Proportion of Total</b>
Soil and stones	51%
Concrete, bricks, tiles, ceramic, plasterboard	39%
Asphalt, tar and tar products	2%
Metals	2%
Other	6%
<b>Total Waste</b>	<b>100</b>

### **Excavated Clay, Soil and Stones**

Excavated soils, clay peat and rock will be loaded directly to vehicles, for use within the proposed development, as appropriate (e.g. as fill material). Where short-term temporary storage is unavoidable, the method of storage of such material will be key to its potential future use, since certain types of soils and clays are likely to degrade if left uncovered in wet weather. Topsoil will be stored separately from other soil types and, where possible, clay mounds will not be more than 2m in height, as storage in larger mounds may damage soil structures and limit future use.

### **Concrete**

Waste concrete is likely to arise during the construction phase of the proposed development. It is proposed that waste concrete generated will be returned to the supplier for reuse. For every tonne of concrete waste that is recycled for aggregate in new concrete, significant savings are made in terms of energy and carbon dioxide emissions. By avoiding disposal costs, money will also be saved. Residual concrete waste will be source-segregated and stored in designated containers at the waste storage area for subsequent separation and recovery at a remote facility.

### **Metals**

Metal waste has a significant scrap value. Although it is now common practice for sites to segregate metals for reuse and recycling, there are still sites where metal is thrown away with general rubbish. One of the primary sources of metal waste is steel reinforcement. Wastage of steel reinforcement will be reduced by (i) ordering made-to-measure steel from the manufacturer and (ii) detailed scheduling of all reinforced concrete structural elements. Skip hire companies may provide free skips for the storage of scrap metal on-site, and this will be investigated prior to construction commencing. When metal storage containers are full, they will be removed by the waste storage Contractor and sent to a metals recycling facility.

### **Timber**

Timber waste will be stored separately as it is readily contaminated by other wastes and, if it is allowed to rot, will reduce the recyclability of other stored wastes. Any pallets will be returned to the supplier for re-use. Off-cuts and trimmings will be used in formwork, where possible. A container for waste wood will be covered, where possible, and placed in the waste storage area. Waste wood will be collected by a waste Contractor, who will send it to a wood recycling facility for chipping. Treatment of timber with chemicals and the over-use of nails will be minimised and avoided, since both will make it difficult to reuse / recycle timber afterwards. The utilisation of reclaimed timber products will also be investigated.

### **Packaging and Plastic**

Packaging waste can become a major problem on construction sites. Double handling will be avoided by segregating packaging wastes immediately after unwrapping. Many suppliers are now prepared to collect their own packaging for recycling, and this will also be investigated prior to works commencing. It is intended that, where possible, materials with recycled packaging will be purchased. Waste packaging will be segregated and stored in separate containers, preferably covered, in the waste storage area, for collection by the waste management Contractor and distribution to packaging recycling facilities.

### **Blocks, Bricks and Tiles**

The careful storage of these raw materials will significantly reduce the volume of associated waste arising on site. The most likely wastes produced will be off-cuts, trimmings and waste arising from breakages. Every effort will be made to use broken bricks and off-cuts.

### **Hazardous Wastes**

Prior to removal from the site, any hazardous waste identified will undergo a comprehensive waste assessment and classification by a suitably qualified person, in accordance with the EWC and European Hazardous Waste List (EPA, 2015). It should be noted that if non-hazardous waste becomes contaminated with hazardous waste the entire load will be considered hazardous. It is, therefore, critical to ensure that waste segregation areas are provided and are used properly to separate out hazardous, non-hazardous and inert waste arising. Hazardous wastes will be identified, removed and kept separate from other construction and demolition waste materials in order to avoid cross-contamination. Specific method statements detailing the necessary mitigation measures required during excavation, handling, transportation and disposal of hazardous wastes encountered on the site will be prepared, as required.

The likely disposal / treatment options for any hazardous wastes available to the Contractor will depend on the nature of the hazardous material and the concentration of parameters of concern. The costs associated with treatment and disposal will similarly vary depending on the concentration of parameters of concern and on the tonnage in question. There are several operators / facilities in Ireland which could potentially accept the contaminated material or assist in the export of the material abroad for special treatment, depending upon the results of the Waste Acceptance Criteria testing. A comprehensive protocol of the disposal of hazardous wastes will be provided detailed (by the successful Contractor) in the final version of this Chapter.

### **Hazardous Liquids (Oils, Paints, Chemicals)**

Hazardous liquid waste arising from the construction process will require careful handling. Oils, paints, bitumen, adhesives and chemicals will be kept in a separate contained storage area which will be locked when not in use. Lids will be kept on containers in order to avoid spillage or evaporation. Waste oils, paints and chemicals, and their containers, will require careful handling and disposal. These will be stored in a containment tray with a capacity to contain 110% of the volume of the largest container. Fuels and hazardous chemicals will be stored in double-skinned containers or within a bund (i.e. an impervious structure with the capacity to contain 110% of the volume of the largest tank stored within it). All containers will be carefully labelled.

### **Canteen Wastes**

Staff canteens have the potential to generate food waste and packaging waste. Designated receptacles will be provided at the canteen to allow for the segregation and storage of individual waste streams. These will include receptacles for (i) food waste, (i.e. brown bin for waste food, tea leaves, coffee, paper towels, compostable packaging, etc.), (ii) clean, dry recyclables (i.e. green bin for recyclable plastics, metals, paper, cardboard), (iii) glass (i.e. red bin) and (iv) residual waste bin (i.e. black bin for waste items which cannot be recycled or composted by the service provider in question). Further segregation may be provided for recyclable fractions (i.e. plastic, paper, metal, etc.) in consultation with the selected waste management Contractor.

### **Residual Waste**

Waste material other than those outlined above can constitute a significant proportion of the total waste generated by construction sites. This waste is normally made up of residual, non-recyclable waste such as soiled paper, cloth, cardboard or plastics, as well as residual canteen waste. Given the heterogeneous nature of this material, it is most important that residual waste is kept separate from the other waste streams to avoid contamination. This material will be stored in a dedicated container in the waste storage area. Container size and collection frequency will be assessed with waste management Contractors as works proceed. All residual wastes will be dispatched to a suitably licensed facility for disposal. Other construction and demolition waste material will be collected in receptacles with mixed construction and demolition waste materials for subsequent separation and disposal at a segregation facility. Efforts shall be made to ensure that residual waste bins / containers are not being used by default, when the waste in question could be placed in a specific corresponding bin / container for more environmentally sustainable treatment (i.e. reuse, recycling, composting, etc.).

## **7.5 Assignment of Responsibilities**

A WMC will be appointed who will have overall responsibility for waste management on the site. The Employer (Limerick City and County Council) will receive summaries of any audit reports, which will be completed within three months of the end of each calendar year. The effectiveness and accuracy of the documentation may also be monitored on a regular basis via routine site visits. Following appointment of the preferred Contractor, this Chapter will be updated in accordance with the final design, and copies of the finalised EOP will be distributed to the Employer, the Site Manager and the site sub-Contractors. The WMC appointed by the Contractor will be appropriately trained and experienced in all aspects of waste management. In addition, the WMC and the site crew must be in a position to:

- Distinguish reusable materials from material suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on best locations for stockpiling reusable material;
- Separate material for recovery; and,
- Identify and liaise with operators of recovery outlets.

The WMC will be responsible for educating all site staff, sub-Contractors and suppliers about the available alternatives to energy recovery (incineration) and disposal to landfill. Training will also be given to all site staff in on-site materials management. The WMC will continually identify waste minimisation actions and update this Chapter accordingly.

## 7.6 Training

Copies of this EOP will be made available to all personnel on-site. All site personnel and sub-Contractors will be instructed about the objectives of the plan and informed of the responsibilities that fall upon them as a consequence of its provisions. This is traditionally carried out during the induction process for new staff members. Where source segregation and material re-use techniques apply, each member of staff will be given instructions on how to comply with the requirements set out in this Chapter. Site notices will be designed and displayed prominently to reinforce the key messages contained in this Chapter.

## 7.7 Waste Records

When establishing the system for on-site waste management, the use of electronic tools should be considered to provide for convenient recording of information in a useful format such as "Smart – waste". The Contractor will be required to arrange for full details of all arisings, movements and volumes of construction and demolition waste to be recorded during all stages of the proposed road development. Each consignment of construction and demolition waste removed from the site will be documented in the form of a Waste Movement Record form, which will ensure full traceability of the material to its final destination. Separate record forms will be completed in respect to each waste transfer that takes place. The Contractor will also receive printed documents / records from waste disposal companies used, quantifying the exact amount of waste material removed from site. Documents from disposal companies shall also identify how much material went to landfill / recycling / etc. All such records will be retained in a designated location and made available for auditing.

## 7.8 Summary

Waste will inevitably be generated during the construction and demolition phase of the proposed development. This Chapter presents a preliminary strategy for the management of said waste. Prior to commencement of the construction phase, the successful Contractor will further develop and finalise the strategy, as instructed herein.

It is intended that all waste soils, rock and concrete will be used on-site, where possible, for infilling or landscaping.

Waste arising during the construction phase will be minimised by the purchasing manager, who will time the ordering of materials so as to reduce the likelihood of over-purchase and / or damage during storage. Construction and demolition waste fractions will be segregated and stored on-site in designated containers in the waste storage area, prior to transport by licensed hauliers to facilities for recycling and disposal in accordance with waste hierarchy, insofar as possible.

A competent, suitably qualified WMC will be appointed by the Contractor to ensure that the requirements set out in this Chapter are fully implemented throughout the duration of the proposed works. Training will be given to all staff so that they are aware of the waste management strategy and their responsibilities.

Records will be kept in order to trace the import / export of materials to-and-from the site. This record keeping should allow the Employer to make informed decisions regarding waste management in the future and will be made available to the relevant statutory authorities (including the EPA), should it be required.



The design and implementation of the waste management strategy for the construction phase of the proposed development will provide for the optimum management and of waste generated by the project and will ensure that there will be no worse than a neutral or imperceptible impact from waste management practices during construction.

## **8. INCIDENT RESPONSE**

### **8.1 Introduction**

This Chapter describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts during the construction phase of the proposed development are prompt, efficient, and appropriate to particular circumstances. It has been developed to provide the information that each employee may need to respond to an emergency and to handle it effectively.

#### **8.1.1 Objectives for Incident Response**

The primary objectives are to:

- Ensure the health and safety of workers and visitors along the site;
- Minimise any impacts to the environment and to ensure protection of the water quality and the aquatic species dependant on it;
- Protect property and operations at the proposed site and to minimise the impact on the continuity of business; and,
- Establish procedures that enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property and the environment.

#### **8.1.2 Responsibility**

It is the responsibility of the SEM (Section 2.3) to maintain and update this Plan as required. It shall be reviewed on an ongoing basis and amended, as necessary, when one or more of the following occur:

- Applicable regulations are revised;
- The Incident Response Plan (Section 8.2) fails (in respect of any one or more of the above-stated objectives) in an emergency;
- The project changes in its design, construction, operation, maintenance, or other circumstance in a way that materially increases the magnitude / changes the nature of the potential impacts on the environment, workers or visitors to the site; and/or,
- Amendments are required by a regulatory authority.

#### **8.1.3 Other Plans**

Limerick City and County Council has a Major Emergency Plan prepared in accordance with the Government's Major Emergency Management Framework<sup>1</sup>. It details the initial contact that should be made in the case of an emergency incident, as well as those responsible for following up once an emergency event is declared. This plan may be referred to during both the construction and operation phases.

### **8.2 Incident Response Plan**

The Incident Response Plan will include the following, as appropriate:

- Reference to the Method Statements and Management Plans for other construction activities, insofar as they are relevant for the purposes of mitigating against health and safety and pollution incidents;

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<sup>1</sup> Available at: [https://www.limerick.ie/sites/default/files/limerick\\_city\\_and\\_county\\_council\\_mep\\_2014.pdf](https://www.limerick.ie/sites/default/files/limerick_city_and_county_council_mep_2014.pdf)

- Procedures to be adopted to contain, limit and mitigate any adverse effects, as far as reasonably practicable, in the event of a health and safety or pollution incident;
- Details of spill clean-up companies appropriate to deal with pollution incidents associated with the materials being used or stored on site;
- Procedures to be followed and appropriate information to be provided in the event of any incident, such as a spillage or release of a potentially hazardous material;
- Procedures for notifying appropriate emergency services, authorities, the Employer's Representative and personnel on the construction site;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required;
- Maps showing the locations, together with address and contact details, of local emergency services facilities such as police stations, fire authorities, medical facilities and other relevant authorities; and,
- Contact details for the persons responsible on the construction site and within the Contractor's organisation for pollution incident response.

**Name and address of the Client:**

Limerick City and County Council  
Dooradoyle Road, Dooradoyle,  
Limerick, Co. Limerick, V94 WV78

The contact within the Client organisation is [name] (tel. no).

**Site Location:**

The proposed road development is located in west County Limerick in a predominantly rural area, close to a number of settlements including Foynes, Askeaton, Rathkeale, Croagh, Adare and Patrickswell (Appendix A).

**Potential Incidents:**

Potential incidents requiring emergency response procedures:

- Fuel and oil spills;
- Road traffic accidents involving chemical or biological spills;
- Landslides and earth slippages;
- Extreme rainfall events, causing flooding of watercourse;
- Fires;
- Activities resulting in noise and vibration, air pollution, hazardous substances or impacts on water;
- Waste management; and,
- Discharge of effluent.

The Contractor will update the list of potential incidents based on the detailed design of the proposed development, and include, as a minimum, the following:

- The measures to be taken to reduce the risk potential;
- Procedures to be put in place to deal with the risk;
- Person responsible for dealing with incidents;
- Procedures for alerting key staff;
- Standby/rota systems;
- Clearly defined roles and responsibilities;
- Names of staff and Contractors trained in incident response;
- The types and location of emergency response equipment available and appropriate personal protective equipment to be worn;
- A system of response coordination;
- Off-site support; and,

<ul style="list-style-type: none"> <li>Particular emergency service or persons to be notified in case of incident.</li> </ul>		
<b>Date and version of the plan:</b> October 2019 V1		<b>Name or position of person(s) responsible for compiling / approving the plan:</b> Gemma Rothwell and Barry Corrigan Roughan & O'Donovan - AECOM Alliance
<b>Review Date:</b>		<b>Date of next exercise:</b>
<b>Objectives of the IRP:</b> To carry out the construction works in such a way as to avoid injury, health hazards or pollution incidents. However, should any such incident occur, procedures and measures will be implemented to contain, limit and mitigate the effects as far as reasonably practicable.		
<b>List of external organisations consulted in the preparation of the IRP:</b> [TBC by Contractor when preparing IRP]		
<b>Distribution of the IRP</b>		
<b>Recipient</b>	<b>No. of copies</b>	<b>Version</b>

### 8.3 External Contacts

External Contacts		
Contact	Office Hours	Out of Hours
Limerick County Fire Service	+353 (61) 556859	+353 (61) 417833
Gardaí: Emergency	999 / 112	999 / 112
Gardaí: Adare Garda Station	+353 (061) 396 216	+353 (061) 396 216
Gardaí: Foynes Garda Station	+353 (061) 65122	+353 (061) 65122
University Hospital Limerick	+353 (061) 301 111	+353 (061) 301 111
EPA Regional Office Limerick	+353 (061) 224764	-
Limerick City and County Council Emergency Planning Department	+353 (061) 417833	+353 (061) 417833
ESB	1850 372 757	1850 372 999
Bord Gáis	1850 200 694 / 1850 20 50 50	1850 205 050
Waste Management Contractor	TBC	
Specialist Advice	TBC	
Specialist Clean up Contractor	TBC	
Limerick City and County Council	+353 (61) 556000	+353 (061) 417833
Inland Fisheries Ireland		To be agreed with IFI
National Parks & Wildlife Service		To be agreed with NPWS

### 8.4 Internal (Contractor's) Contacts

Internal Contacts		
Contact	Office Hours	Out of Office Hours
<b>Names and positions of staff authorised/trained to activate and coordinate the IRP</b>	TBC	
	TBC	
	TBC	
	TBC	
	TBC	
	TBC	
Other Staff	TBC	
Managing Director	TBC	
Site Manager	TBC	
Health & Safety Manager	TBC	

## 8.5 Chemical Product and Waste Inventory

Inventory of Chemical Products and Wastes						
Trade Name / Substance	Solid / Liquid / Gas or Powder	UN Number	Maximum Amount	Location Marked on Site Plan	Type of Containment	Relevant Health and Environmental Problems

## 8.6 Pollution Prevention Equipment Inventory

Inventory of Pollution Prevention Equipment (on- and off-site resources)			

## 8.7 Monitoring

The Contractor will investigate and provide reports on any health and safety or pollution incidents to the Employer's Representative, including, as appropriate:

- A description of the incident;
- Contributory causes;
- Adverse effects;
- Measures implemented to mitigate adverse effects; and,
- Effectiveness of measures implemented to prevent pollution.

The Contractor will undertake appropriate monitoring of the procedures and measures set out in the EOP for construction activities required to prevent health and safety or pollution incidents to ensure they are being adequately implemented.

The Contractor will monitor the effectiveness of the procedures and measures implemented in the event of an incident and the effectiveness of the response procedures set out in the Incident Response Plan to identify any areas where improvement is required.

## 9. CONSTRUCTION PHASE INVASIVE SPECIES AND BIOSECURITY MANAGEMENT

### 9.1 Introduction

This Invasive Alien Species (IAS) Management Plan outlines the management measures to be followed to manage and control the spread of identified IAS during construction phase of the proposed development. Pro-active, preventative, best practice management of IAS during construction works can help prevent negative environmental impacts, excessive development costs, and future structural damage.

This plan will be adopted and refined by the Contactor, in agreement with Limerick City and County Council, and in accordance with the relevant legislation (Section 9.2), the principles of IAS management (Section 9.3) and the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII (formerly NRA), 2010).

### 9.2 Legislative Context

Management of IAS during the construction and operation of the proposed development must comply with all relevant legislation, including:

- *European Communities (Plant Protection Products) Regulations, 2012 (SI No. 159/2012);*
- *European Communities (Sustainable Use of Pesticides) Regulations, 2012 (SI No. 155/2012);*
- *European Communities (Birds and Natural Habitats) Regulations, 2011 to 2015 (SI No. 477/2011);*
- *Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (hereinafter referred to as the 'Plant Protection Products Regulation')*
- *Regulation (EU) No 1141/2010 laying down the procedure for the renewal of the inclusion of a second group of active substances in Annex I to Council Directive 91/414/EEC and establishing the list of those substances*
- *Regulation (EU) No 354/2013 on changes of biocidal products authorised in accordance with Regulation (EU) No 528/2012;*
- *Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species;*
- *Waste Management Acts, 1996 to 2013, and related legislation;*
- *Safety, Health and Welfare at Work Act, 2005;*
- *Safety, Health and Welfare at Work (Construction) Regulations, 2013;*
- *Safety, Health and Welfare at Work (General Application) Regulations, 2007;*
- *Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001;*
- *Noxious Weeds Act 1936 and,*
- *Wildlife Acts 1976-2012.*

The following sections discuss the implications of key statutory requirements of the above-stated legislation.



### 9.2.1 The Birds and Natural Habitats Regulations (SI. No. 477/2011)

The Third Schedule of the Birds and Natural Habitats Regulations sets out a 'black list' of IAS of Community concern. According to Regulation 49, it is an offence to allow / cause to disperse any of the IAS listed on the Third Schedule, without taking "*all reasonable steps and [exercising] all due diligence to avoid committing the offence*". Furthermore, it is an offence to allow / cause to disperse vector material of a subset of IAS of Community concern, Blue Mussel (*Mytilus edulis*), Slipper Limpet (*Crepidula fornicata*), Japanese Knotweed (*Fallopia japonica*), and Bohemian Knotweed (*Fallopia x bohemica*).

### 9.2.2 The Plant Protection Products Regulations (SI No. 159/2012)

The *Plant Protection Products Regulation* lays down rules for the use of plant protection products (PPPs) within the EU, including the use of herbicides to control invasive alien plant species (IAPS).

To comply with the Regulation, herbicides used to control IAPS should be used:

1. In accordance with their authorisation;
2. Having regard to the principles of integrated pest management (IPM; Section 9.3.1); and
3. Giving priority to non-chemical and natural alternatives, wherever possible.

Additionally, PPPs shall always be used in accordance with the product label in question.

PPPs can be approved by Member States, subject to use restrictions and conditions, including:

- The manner and conditions of application;
- Designation of categories of users (such as professional and non-professional);
- Designation of areas where the use of PPPs may not be authorised or where the use may be authorised under specific conditions; and
- The need to impose risk mitigation measures and monitoring after use.

Those using PPPs to treat IAPS will need to be familiar, and comply, with such conditions and restrictions.

Those proposing to use PPPs to manage IAPS should be well informed of the contents of the authorisation in question. Article 31(1) of the *Plant Protection Products Regulation* states:

*"The authorisation shall define plants or plant products and non-agricultural areas (for example railways, public areas, storage rooms) on which and the purposes for which the plant protection product may be used."*

Article 31(2) states that the authorisation shall set out the requirements relating to the use of PPPs. Furthermore, Article 31(3) provides that the authorisation must also include, where applicable:

- The maximum dose per hectare in each application;
- The period between the last application and harvest; and,
- The maximum number of applications per year.

Article 31(4) provides that the requirements relating to the use of the PPPs may include:

- A restriction with respect to the use of the PPPs in order to protect the health of the users, bystanders, residents or the environment (such restriction shall be included on the label);
- The obligation before the product is used to inform any neighbours who could be exposed to the spray drift and who have requested to be informed;
- Indications for proper use according to the principles of IPM;
- Designation of categories of users, such as professional and non-professional; and
- The approved label.

It should be noted that the *Plant Protection Products Regulation* provides that the Minister for Agriculture, Food and the Marine may establish a register of authorised PPPs. PPPs cannot, subject to certain exceptions, be used unless they have been entered on the register or granted a trial permit. Those proposing the use of PPPs should check to ensure that the product is entered on the register (<http://www.pcs.agriculture.gov.ie/products/>) or has been granted a trial permit.

In relation to 'record keeping', Article 67(1) of the *Plant Protection Products Regulation* provides that:

*"Professional users of [PPPs] shall, for at least three years, keep records of the [PPPs] they use, containing the name of the [PPP], the time and the dose of application, the area and the crop where the [PPP] was used."*

Regard should be had to Regulation 16 of the *Plant Protection Products Regulation*, in relation to record keeping.

### 9.2.3 The Sustainable Use of Pesticides Regulations (SI No. 155/2012)

Those persons seeking to manage IAPS using pesticides must procure the services of registered and appropriately trained advisors and professional users, as required. Article 3(3) of the *Sustainable Use of Pesticides Directive* defines the term 'advisor' in the following manner:

*"'advisor' means any person who has acquired adequate knowledge and advises on pest management and the safe use of pesticides, in the context of a professional capacity or commercial service, including private self-employed and public advisory services, commercial agents, food producers and retailers where applicable"*

In relation to 'Register', Regulation 4(1)(d) of the *Sustainable Use of Pesticides Regulations* provides that, "[The Minister may establish a register of–] advisors on the use of pesticides." Regulation 4(2) provides that "The Minister may set conditions for registration under paragraph (1)."

Where it is proposed to use professionals to treat IAPS, the Contractor will need to ensure that "professional users of pesticides" have appropriate training and are registered. The *Sustainable Use of Pesticides Directive* requires Member States to:

*"[...] set up systems of both initial and additional training for [...] professional users of pesticides and certification systems to record such training so that those who use or will use pesticides are fully aware of the potential risks to human health and"*

*the environment and of the appropriate measures to reduce those risks as much as possible.”*

Regulation 5(1) of the Sustainable Use of Pesticides Regulations, states that a professional user of pesticides shall:

- *“hold a certificate confirming that the professional user has been trained to a standard determined by the Minister in the subjects listed in Annex I of the Directive”; and,*
- *“comply with any additional training requirements as determined by the Minister”.*

Regulation 4 of the *Sustainable Use of Pesticides Regulations* grants the Minister for Agriculture, Food and the Marine the power to establish a register of professional users and any class or classes of professional users. The Minister is also granted the power to set conditions for registration. Regulation 5(1)(a) of the *Sustainable Use of Pesticides Regulations*, states that a professional user of pesticides shall *“be entered in the Register”*. Furthermore, Regulation 5(3) provides that *“A person shall not act as a professional user unless he or she is entered in the Register.”*

Regulation 5(2) provides that the Minister for Agriculture, Food and the Marine may remove a professional user from the Register, where the professional user:

1. ceases to be a professional user,
2. fails to comply with any additional training requirements, or
3. has been found guilty of an offence resulting in:
  - a. misuse of pesticides, or
  - b. water pollution.

It is, therefore, important that those employing professional users of pesticides in the management of IAPS ensure that the users are, and continue to be, entered on the register for the duration of the works. Information relating to professional users and the register is available on the website of the Pesticide Registration and Controls Divisions (PRCD) of the DAFM (<http://www.pcs.agriculture.gov.ie/sud/professionaluserssprayeroperators/>).

In relation to *“Health and Safety Requirements in the Workplace”*, Recital 12 of the Preamble to the *Sustainable Use of Pesticides Directive* provides:

*“To the extent that the handling and application of pesticides require the setting of minimum health and safety requirements at the workplace, covering the risks arising from exposure of workers to such products, as well as general and specific preventive measures to reduce those risks, those measures are covered by Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work and Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to their exposure to carcinogens or mutagens at work.”*

The *Sustainable Use of Pesticides Directive* states that *“in order to minimise the adverse impacts of pesticides on human health and the environment”*, Member States have *“to provide for systems for regular technical inspection of pesticide application equipment already in use.”* Ireland responded to this requirement through Regulation 9 of the *Sustainable Use of Pesticides Regulations*. Pursuant to Regulation 9(2), the Minister for Agriculture, Food and the Marine must establish and maintain a list (to be published on a website) specifying:

- The type or class of pesticide application equipment to be inspected and certified;
- The standard each type or class of equipment is required to meet; and,
- The frequency at which each type or class of equipment is to be inspected and certified.

Whilst these inspection and certification requirements relate to certain types or classes of equipment, Regulation 9(5) provides, generally, that “*A professional user shall only apply pesticides with equipment that is correctly calibrated and is appropriate for the use intended.*”

It is extremely important to note that the *Sustainable Use of Pesticides Directive* and related Irish transposing Regulations place additional restrictions and, in some cases, prohibitions, on the use of pesticides in certain specified areas. Such areas include areas for the abstraction of drinking water, transport routes (such as railway lines), areas with sealed or very permeable surfaces, groundwater vulnerable areas, areas used by the general public or defined vulnerable groups, and European (i.e. Natura 2000) sites.

The *Sustainable Use of Pesticides Directive* highlights that the aquatic environment is especially sensitive to pesticides, which means that particular attention is required to avoid contaminating surface water and groundwater when using pesticides. Measures to avoid such pollution may include the establishment of buffer and safeguard zones, and the planting of hedges along surface waters to reduce exposure of water bodies to spray drift, drain flow and run-off. The Directive states that the dimensions of buffer zones will depend on the circumstances of each case. The *Sustainable Use of Pesticides Directive* also indicates that the use of pesticides (i) in areas for the abstraction of drinking water; (ii) on or along transport routes (such as railway lines); and, (iii) on sealed or very permeable surface, can lead to higher risks of pollution of the aquatic environment. The Directive highlights further that in such areas the pesticide use should, therefore, be reduced as far as possible, or eliminated, if appropriate.

The *Sustainable Use of Pesticides Regulations* detail “*Prohibitions on pesticides near aquatic environment and drinking water*”. Regulation 11(1) provides that “*A person shall not use a pesticide within the relevant specified distance of a type or class of water source specified in a list [...]*”. The Minister for Agriculture, Food and the Marine is required to establish and maintain a list specifying:

- “*the type or class of water source subject of a safeguard zone referred to in Article 11 of the Directive*”;
- “*the distance from each type or class of water source that a safeguard zone applies to*”; and,
- “*where a water source differs significantly in its vulnerability from the standard water source [...], such water source and its safeguard zone relevant distance [...]*”.

This list is required to be published on a website maintained by the Minister. Those involved in the use of pesticides to manage IAPS must make themselves fully aware of this list and relevant safeguard zones, etc.

Regulation 11(4) provides that:

*“Subject to paragraph (5), a person shall not use a pesticide within 50 metres of a landscape feature that is known to be a ground water vulnerable area including exposed cavernous or karstified limestone features (such as swallow-holes and collapse features).”*

The Minister may, however, “approve an alternative distance [...] if that alternative is based on a reasoned argument and supported by scientific evidence”. Such applications for approval of an alternative distance shall be in such form and contain such particulars as the Minister may require.

Regulation 11(7) provides:

*“Subject to paragraphs (1) and (4), a person shall not use a pesticide close to water other than in accordance with the conditions set out in the approved label for that pesticide”.*

**Table 9.1 Mandatory min. distances between abstraction points and pesticide application (Schedule 2 of the Sustainable Use of Pesticides Regulations)**

Water Source	Distance
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 100m <sup>3</sup> or more of water per day or serving 500 or more persons,	200m
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 10m <sup>3</sup> or more of water per day or serving 50 —500 persons,	100m
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 1-10m <sup>3</sup> of water per day or serving 10-50 persons,	25m
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 1m <sup>3</sup> or less of water per day or serving 10 or less persons,	5m

In relation to “Specific Areas”, Regulation 12(1) of the *Sustainable Use of Pesticides Regulations* provides that, subject to paragraph (2), a person shall not apply a pesticide in:

- Areas used by the general public or by defined vulnerable groups; or
- A European (i.e. Nature 2000) site.

“Vulnerable groups” are defined in the *Plant Protection Products Regulation* to mean “persons needing specific consideration when assessing the acute and chronic health effects of plant protection products” and include “pregnant and nursing women, the unborn, infants and children, the elderly and workers and residents subject to high pesticide exposure over the long term”. The term “European Site” is defined in the *European Communities (Birds and Natural Habitats) Regulations, 2011*, and includes special areas of conservation and special protection areas.

Regulation 12(2) of the *Sustainable Use of Pesticides Regulations* states,

*“Where a person, having completed a risk assessment, is obliged to use a pesticide in [a specified] area [...] he or she shall ensure that preference is given*

*to the use of low risk plant protection products or biological and cultural control measures and where such measures are not capable of performing the necessary function, a person shall prioritise the use of plant protection products that are not classified as  $R_{50}$  [...]*".

Regulation 12(3) provides:

*"Where a person uses a pesticide in an area referred to in paragraph (1) the onus of proof will lie with that person to show that there was no viable alternative and appropriate risk management measures were put in place".*

In relation to "Integrated pest management", Regulation 14 of the Sustainable Use of Pesticides Regulations states:

*"A professional user shall apply the general principles of integrated pest management as set out in Annex III to the Directive and maintain records to demonstrate the application of such principles".*

In relation to "Good plant protection practice", Regulation 15 of the Sustainable Use of Pesticides Regulations states:

*"A professional user shall apply the principles of good plant protection practice as published by the Minister and maintain records to demonstrate the application of such principles".*

## **9.3 Principles of Invasive Alien Species Management**

### **9.3.1 Integrated Pest Management**

The principles of Integrated Pest Management (IPM), as set out by the Department of Agriculture, Food and the Marine (DAFM, n.d.), are as follows<sup>2</sup>:

1. The prevention and / or suppression of harmful organisms should be achieved or supported among other (i.e. non-chemical) options, especially by:
  - i. crop rotation;
  - ii. use of adequate cultivation techniques (e.g. stale seedbed technique, sowing dates and densities, under-sowing, conservation tillage, pruning and direct sowing);
  - iii. use, where appropriate, of resistant / tolerant cultivars and standard / certified seed and planting material;
  - iv. use of balanced fertilisation, liming and irrigation / drainage practices;
  - v. preventing the spreading of harmful organisms by hygiene measures (e.g. by regular cleansing of machinery and equipment); and
  - vi. protection and enhancement of important beneficial organisms (e.g. by adequate plant protection measures or the utilisation of ecological infrastructures inside and outside production sites).
2. Harmful organisms must be monitored by adequate methods and tools, where available. Such adequate tools should include observations in the field as well as scientifically sound warning, forecasting and early diagnosis systems, where feasible, as well as the use of advice from professionally qualified advisors.
3. Based on the results of the monitoring, the professional user has to decide whether and when to apply plant protection measures. Robust and scientifically sound threshold values are essential components for decision making. For

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<sup>2</sup> Note: Principle No. 1 relates to agricultural systems and is not of relevance to the construction phase of the proposed development. All principles have been listed for completeness.

harmful organisms, threshold levels defined for the region, specific areas, crops and climatic conditions must be taken into account before treatments, where feasible.

4. Sustainable biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control.
5. The pesticides applied shall be as specific as possible for the target and shall have the least side effects on human health, non-target organisms and the environment.
6. The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary, e.g. by reduced doses, reduced application frequency or partial applications, considering that the level of risk in vegetation is acceptable and they do not increase the risk for development of resistance in populations of harmful organisms.
7. Where the risk of resistance against a plant protection measure is known and where the level of harmful organisms requires repeated application of pesticides to the crops, available anti-resistance strategies should be applied to maintain the effectiveness of the products. This may include the use of multiple pesticides with different modes of action.
8. Based on the records on the use of pesticides and on the monitoring of harmful organisms the professional user should check the success of the applied plant protection measures.

### 9.3.2 Good Plant Protection Practice

Good Plant Protection Practice (GPPP) provides the basis for the proper and appropriate use of PPPs. GPPP places a legal obligation on professional users to ensure that (i) product is used in accordance with the conditions of use (specified on the product label), and (ii) empty packaging and unused or obsolete product is disposed of lawfully. Additionally, GPPP confers responsibilities on professional users to act in a responsible and sympathetic way in relation to PPP use adjacent to residents and other property owners.

The terms of authorization and the conditions of use of a PPP are detailed on the product label and are referred to as the "GAP" (Good Agricultural Practice). The final step in the authorisation of a PPP involves the approval of a product label. This approved label contains the necessary information to enable end users to use the product safely and in conformity with both EU and national law. However, where certain use scenarios exist whereby it is not economically justified to produce comprehensive efficacy data, competent authorities may grant approvals which do not necessarily appear on the PPP label. In Ireland such uses are referred to as "Off Label Approvals", details of which may be obtained from the DAFM.

Where it is found that a professional user of PPPs does not conform to the principles of GPPP or maintain records to demonstrate the application of such principles, they will be considered to be in breach of *Regulation 15 of Statutory Instrument 155 of 2012 "The European Communities (Sustainable Use of Pesticides) Regulations 2012"*, and consequently shall be subject to either a Fixed Payment Notice or a disallowance under the Basic Payment Scheme or both.

The principles of GPPP, as set out by the DAFM (n.d.), are detailed in the following Sections. Certain of the GPPP principles set out by DAFM (n.d.) are not of relevance to the use of pesticides to control IAPS and have been omitted from this text. It should be noted that the language used in the GPPP principles (e.g. 'crop', 'harvest') generally applies to agricultural systems. However, the principles detailed below apply to the

use of PPPs in general, including the use of pesticides in the control of IAPS. For the purposes of IAS management during the construction of the proposed development, the term 'crop' may be considered synonymous with 'area / occurrence / stand of IAPS', and the term 'pest' may be considered synonymous with 'IAPS'.

### **Conditions of Authorisation of PPPs**

The PPP authorisation procedure establishes the acceptable conditions of use for each individual PPP. However, it is frequently the case that acceptable levels of crop protection can be achieved by using lower rates of application or fewer applications of PPPs. When the use of a PPP is the required crop protection solution, professional users are required to use as little PPP as possible but as much as is absolutely necessary. It can be considered GPPP to:

1. Vary the choice of active substances and formulations to control certain pests;
2. Reduce:
  - a. the individual dose applied to the crop, and/or
  - b. the number of applications to be used; and
3. Increase:
  - a. the interval between applications, and
  - b. the interval between last application and harvest.

It is illegal and therefore never considered GPPP to:

1. Exceed:
  - a. the maximum individual dose (MID) permissible (for a particular crop),
  - b. the maximum number of applications permissible (for a particular crop);
2. Reduce:
  - a. the interval between PPP applications,
  - b. the interval between the last PPP application and harvest – pre-harvest interval (PHI); or
3. Apply a PPP via application equipment not specified in the authorisation document or on the PPP label.

The concept of GPPP relates to all PPPs, including those formulated with micro-organisms and macro-organisms. Where PPPs containing either macro- or micro-organisms are used, professional users should be aware of the interaction between these products and chemical products. Professional users are obliged to apply the principles of IPM (Section 9.3.1), and it is GPPP to apply such principles and seek to derive maximum benefit from natural as well as cultural control elements.

### **Choice of PPP Dosage**

The maximum individual dose (MID) of a PPP is specified on each product label. However, use of reduced dose is permitted if the prevailing agronomic conditions allow. It is not GPPP to use higher doses (as they are not authorized, and such use is therefore illegal).

### **Choice of Water Volume**

For all crops, it is important to apply sprays with the correct water volume. Frequently product labels prescribe a range of water volumes. For some crops (tall crops of some protected crops) PPP dose will be specified as a concentration (amount of PPP in



specific quantity of water). It is not considered GPPP to apply PPPs in a concentration which is considered on the label to be too high or indeed too low.

### **Number, Timing and Frequency of Applications**

It is GPPP to apply only as many treatments as are absolutely necessary to achieve effective and sufficient control of the target pest. The number of treatments necessary may vary considerably between seasons and / or locations. The timing of the first and, if necessary, subsequent applications should be based on the current pest pressure, anticipated future pest pressure and prevailing environmental conditions. Forecasting and early warning systems exist for some crop-pest combinations and can facilitate optimum timing of PPP application. In addition, account should be taken of local experience from farmers and agronomists as well as timely visual observations. Prophylactic use of PPPs can be considered GPPP in instances where certain crop pests have the ability to inflict significant damage to both crop yield and crop quality. Such treatment may be applied in a fixed programme of calendar dates, phenological growth stages of the crop or on first identification of target pest. The timing of the last application is determined by pest pressure and the pre-harvest interval prescribed on the PPP label.

### **Tank Mixing**

It is GPPP to use products in tank mixes, provided the timing and rate of the application is consistent with the conditions of use, for each product when applied separately. By reducing the number of spray applications, operator exposure, fuel use, passages through the crop, *etc.*, can be reduced. However, it is not GPPP to use products which are chemically or physically incompatible in a tank mixture or where their individual efficacy or safety is compromised. Some product labels may contain specific tank mix recommendations, e.g. "for control of PEST X use in tank mix with PRODUCT Y". Other product labels may contain more general recommendations for tank mixing, e.g. "for resistance management purposes". In situations not specifically addressed on product labels, it is considered GPPP to use products in a tank mix, where on the basis of historic field use and / or field trial, evidence generated by the approval holder or on the advice of an advisor, their compatibility and continued efficacy has been established.

### **Use of Adjuvants**

It is considered GPPP to use an adjuvant with particular PPPs or in particular use scenarios. Such use should not be counter to the conditions of the authorisations concerned. It is the case that in certain circumstances satisfactory efficacy of particular PPPs can only be achieved by the inclusion of a particular adjuvant. It is not considered GPPP to use an adjuvant with a PPP in such a manner that results in unacceptable residues of the PPP being present at harvest, following storage, or where such use is explicitly precluded on the PPP label.

### **Equipment and Method of Application**

It is GPPP to select equipment and application conditions which ensure that a high proportion of the PPP applied reaches its target. Many factors must be taken into consideration, e.g. nozzle type, pressure, spray volume, droplet size, speed, *etc.*, when selecting the equipment and method of application to be used. However, in making such selections, for each PPP, care must be taken to ensure that efficacy is maintained. It is especially important that the equipment used be properly calibrated and that the calibration be regularly checked, to ensure that the correct dosage is applied.

## **Use of PPPs and Water**

As water moves, both on the surface, and under the ground, suspended or dissolved substances such as PPPs can move with it. PPPs which are water soluble, volatile or have poor soil adsorption qualities often have a higher risk of appearing in water. In addition, when PPPs are being applied, the application can sometimes be less accurate than desired, resulting in drift from the treatment area, which if adjacent to surface water can lead to contamination. To help mitigate any contamination of surface or indeed ground water, the conditions of use of an increasing number of PPPs may include a 'buffer zone', where no application of the PPP may take place. Where a PPP label does not prescribe a specific buffer zone, a minimum distance of 1m of untreated area must be maintained between the treated area and the water course.

### **Spray Drift**

If during the application of PPPs, spray reaches areas other than the intended treatment area, it is referred to as 'spray drift'. Users of PPPs must ensure that all reasonable precautions are taken to prevent spray drift. To that end, professional users should be aware of the following, where applicable:

- Wind speed and direction (preference is to spray if wind does not exceed Force 3);
- Volatility of the local weather conditions;
- Vehicle speed;
- Nozzle type;
- Application pressure;
- Boom height;
- Level of equipment maintenance; and
- Equipment setting.

Spray drift can cause deleterious effects to wildlife and can cause nuisance to neighbouring residents and adjacent landowners, and therefore, is considered a misuse of PPPs and is not GPPP.

### **Drift Reduction**

When using PPPs, take all necessary measures to prevent or minimise drift from the treatment area. Such measures include the use of appropriate equipment to apply the product, taking account of the weather conditions, being considerate of residents and adjacent landowners' neighbours' interests and in turn protecting members of the public, wildlife and the environment from any possible negative effects.

The following actions should be considered, where applicable:

- Check the weather forecast and the conditions at the site prior to application of a PPP;
- Reduce the application rate of the product will reduce the potential amount of product which could drift off target;
- Use the coarsest appropriate spray quality at all times;
- Maintain the boom height as low as possible whilst still providing an even spray pattern at the correct target height. (the correct boom height will depend on the spray pattern and the angle of the individual nozzles, the space between nozzles, the flatness of the area being treated and the design of the boom);

- Reduce the spray pressure and speed of the vehicle (but make sure the intended application rate, water volume and spray quality are maintained);
- Consider not treating an area closest to the downwind border of the area you are treating (for field crops, an untreated buffer zone will be most effective if the crop – or plants of at least the same height as the crop – continues into the buffer zone);
- In orchards, consider having appropriate natural windbreaks, such as other trees around the treated area;
- Use suitable drift-reducing systems, e.g. twin-fluid nozzles, air-induction nozzles, rotary atomisers, pre-orifice nozzles, air-assistance for field crop sprayers, shrouded boom sprayers for sports turf and other amenity areas, and re-circulating tunnel sprayers for spraying fruit bushes and trees; and
- Use an authorised drift-reducing additive in appropriate situations (depending on the type of equipment being used and the nature of the spray solution).

It is illegal and therefore never considered GPPP to:

- Apply PPPs where they are likely to drift from the treatment area toward adjacent sensitive areas such as residents, schools, hospitals, parks, *etc.*;
- Apply PPPs where they are likely to drift from the treatment area toward non-target plants;
- Apply PPPs inside buffer zones prescribed on PPP labels unless complying with Surface water Tool for Reducing the Impact of Pesticides on the Environment (STRIPE) guidelines (DAFM, 2015); or
- Apply PPPs within safeguard zones around water abstraction points, wells, boreholes and ground water vulnerable areas as set out in S.I. No. 155/2012.

### **Filling PPP Application Equipment**

All mixing, filling and / or loading of PPP application equipment should be carried out away from waterways, ditches, drains, boreholes, wells or springs. On farms and holdings, it is best practice to have a specific area for filling a sprayer or other application equipment. Such an area should not drain directly or indirectly into a water course. It is acknowledged that it is not always possible to fill, mix or load the sprayer in the same designated area, especially where work is carried out at several separate locations.

It is illegal and therefore never considered GPPP to:

- Fill PPP application equipment (sprayer) directly from a water course; or
- Carry out mixing loading or other handling operations immediately adjacent to a water course.

### **Disposal of PPP Packaging and Unused PPP**

#### **Rinsing of Containers**

It is GPPP to clean PPP containers (packaging) using the 'triple rinse technique', unless otherwise specified on the product label. PPP containers should be triple rinsed immediately after emptying. Triple rinsing involves three sequential separate rinses and should be carried out as follows:

1. Drain the empty PPP container fully into the sprayer.
2. Fill the empty container 10 – 20% full of water, replace cap securely.
3. Shake the container vigorously. and

4. Remove the cap, add the washings to the sprayer and let the containers drain for 30 seconds or more.
5. Repeat steps 1 to 4 two times to ensure that the containers are clean.
6. Carefully rinse any residue on the outside of the container including the cap and cap threads and add to the sprayer for use.
7. Inspect the containers after triple rinsing to ensure that all visible residues (inside and outside) are removed and ensure containers are fully drained.
8. Store in a bag to avoid contamination with water, dirt, etc. until ready to deposit in bring centre or collection depot.

Unrinsed empty PPP containers are considered hazardous waste and therefore must be disposed of as hazardous waste.

#### Disposal of Cardboard 'Outers'

It is GPPP to dispose of cardboard boxes / outers used to transport PPPs by recycling. However, where such cardboard is contaminated with a PPP, this cardboard must be disposed of as hazardous waste.

#### Disposal of Other Containers

It is GPPP to follow the disposal instructions detailed on the product label. Where it is not possible or practical to triple rinse, the label instructions will require the user to dispose of as hazardous waste or to return empty packaging to the authorisation holder.

#### Disposal of Obsolete PPP

When a PPP is revoked, there typically follows a maximum grace period which allows the PPP to be marketed at retail level for a period of 6 months and allows a further 12-month period to use the product. After this period elapses, the obsolete PPP is considered 'hazardous waste' and, therefore, must be disposed of in accordance with the corresponding regulations, via a licensed hazardous waste contractor. Where the product revocation results from unacceptable environmental or human health risks, no grace period will be allowed.

#### Disposal of Sprayer Rinsate and Washings

PPP application equipment should be kept as clean as practicably possible. This may involve washing the equipment inside and out, within the area last treated. The sprayer operator must ensure that washings, or unused spray solution applied within the treated area, does not breach the maximum application rate for the PPPs on that crop / area. Generally, repeated flushing of spraying equipment with low volumes of water is as effective as a single rinse using a large volume of water.

### **Storage of PPPs**

Professional end users of PPPs shall store PPPs in a safe and responsible way, at the very least complying with the following requirements:

1. The structure of the storage facility shall be such that:
  - i. It is not connected to a pack-house or area where food products are present
  - ii. It is a dedicated chemical store and is not used for any purpose other than storage of plant protection and biocidal products and other chemicals,
  - iii. It is enclosed and of sound construction,

- iv. It has a secure lock,
  - v. In the case of walk-in stores, it is well ventilated,
  - vi. It is well lit,
  - vii. Its construction is such that leakages or spillages are retained within the store,
  - viii. Shelving provided is made from non-absorbent materials, and
  - ix. A warning sign is displayed on the entrance to the store.
2. Facilities that shall be available and used, as appropriate, shall include at least:
  - i. A list of key emergency contact numbers displayed near the entrance of the store (e.g. doctor, fire service),
  - ii. Recommended protective clothing and equipment, clean and properly maintained,
  - iii. Appropriate PPP measuring devices (e.g. scales, measuring jugs, etc.),
  - iv. Facilities for soaking up small spillages or leakages (e.g. bucket of sand or peat).
3. The operating procedures followed, shall include the following:
  - i. Powders shall be stored separately from or above liquids,
  - ii. PPPs shall only be stored in their original containers.

### **Resistance Management**

Pest resistance to PPPs, or decreased susceptibility of a pest population to a PPP can develop from continued use of the same PPP or family of PPPs. Pest populations can evolve and develop pesticide resistance via natural selection, whereby the most resistant specimens survive and pass on their genetic traits to their offspring. Alternatively, successive applications of the same PPP can itself exert a selection pressure leading to the development of an increasingly resistant population. Reducing rates of application (and frequency) may also encourage the survival of resistant strains of pests, weeds or diseases. Some PPP modes of action are more prone to the development of resistant populations; therefore, where a PPP is designated as a high-risk product in terms of resistance, PPPs with alternative modes of action should be used for subsequent or at least alternate applications. It is considered GPPP to use PPPs or PPP combinations containing a number of active substances with different modes of action that are effective against the target pest.

### **9.3.3 Biosecurity**

For the purposes of this IAS Management Plan, 'biosecurity' refers collectively to best practice measures / protocols aimed at the prevention of dispersal / introduction of IAPS. IAPS may be accidentally dispersed very easily via seeds / spores, plant fragments (many IAPS can re-grow from small pieces of tissue) and / or soil contaminated with either. The following biosecurity measures are recommended to prevent the dispersal of IAPS.

### **Buffered Exclusion Zones**

Following the pre-construction IAS survey, and prior to the commencement of construction works, exclusions zones shall be established around all occurrences of IAPS in the site of the proposed development. These exclusion zones shall include appropriate buffer zones around the perimeter of the plants / stands in question (e.g. in the case of Japanese Knotweed (*Fallopia japonica*), a 7m buffer zone must be in place). Exclusion zones shall be fenced and clearly marked with warning signage in order to prevent accidental entry / incursion. If it necessary to pass through an

exclusion zone, routes within the zone(s) in question shall be overlaid with a geotextile layer which has a layer of sand on top to prevent damage by heavy machinery and entry / exit to the area shall only be via designated points, with designated wash-down areas put in place (as described in the following paragraph). Any traffic into and out of exclusion zones should be minimised / prevented outright, insofar as possible. Tracked vehicles should not be allowed to enter infested areas under any circumstances. Personnel entering exclusion zones must take precautionary measures to prevent the dispersal of plant material and / or contaminated soil to other areas.

### **Inspect, Remove, Clean, Dispose, Notify**

All PPE, machinery, vehicles and other equipment that has entered an area infested with IAPS, aquatic invasive species or non-native pathogens must be thoroughly cleaned at a designated wash-down area **before entering other areas / leaving the site**. As emphasised by Inland Fisheries Ireland; inspect, remove, clean, dispose, notify.

#### Inspect

Personnel must thoroughly inspect their clothing, PPE (particularly footwear), equipment, machinery, vehicles, *etc.*, for IAS material upon leaving areas infested with IAPS or non-native pathogens and whenever leaving aquatic environments (especially rivers). This inspection shall take place at the designated wash-down area before entering other areas or leaving the site. Any and all material from IAPS (regardless how small) should be regarded as a potential propagule (i.e. material from which a full plant can re-grow).

#### Remove

Any adherent material (vegetation, soil, fish, scales, *etc.*) shall be removed at the designated area.

#### Clean

All footwear, clothing, PPE, equipment, machinery or vehicles used must be thoroughly cleaned before leaving the designated area. Appropriate cleaning equipment (e.g. soap, water, hoof-pick, stiff-bristled brush, power washer, disinfectant (e.g. Virkon Aquatic), *etc.*) should be made available at designated areas. Drive-through baths / wheel-washes and boot-baths should also be provided, as required. In the case of leaving aquatic environments, all PPE and equipment should be allowed to dry thoroughly after cleaning. If boats and / or outboard motors have been used in the aquatic environment, the interior and exterior surfaces should be power-hosed with heated water, disinfected (if possible) and allowed to dry thoroughly prior to entry into another aquatic environment.

#### Dispose

In the case of leaving aquatic environments, ensure all water from the environment is drained from boats, tanks, buckets, equipment before leaving the wash-down area. Potentially contaminated water / soil remaining at wash-down areas shall be stored and disposed of appropriately.

#### Notify

Report any sightings of aquatic IAS to [info@caisie.ie](mailto:info@caisie.ie).

All cleaning / disinfection products shall be stored and used in accordance with the relevant legislation.



### Site Specific Machinery

Where there is a risk of cross-contamination across one or more sites / sections of sites, designating site-specific machinery / vehicles should be considered. Such machinery / vehicles should be used on one site only, and not moved around between one site / site section and another without completion of a 'deep clean' and disinfection at a designated wash-down area.

### Restricted Access to Aquatic Environment

Because of the risk of dispersal / introduction of aquatic IAS, personnel shall be prevented from entering surface waters unless strictly required for the purposes of the proposed works. Signage should be erected advising personnel not to enter watercourses. Where entry to surface waters is required for the purposes of the proposed works:

1. A risk assessment shall be completed which considers the risk of dispersal / introduction of IAS; and
2. The 'Inspect, Remove, Clean, Dispose, Notify' protocol shall be implemented in full by all personnel involved.

### 9.3.4 Health and Safety

An appropriate risk assessment, which includes Health & Safety considerations, should be carried out before any control or survey work is undertaken. Protective clothing must be worn when attempting control. All works to be compliant with the *Safety, Health and Welfare at Work Act, 2005* as well as the *Safety, Health and Welfare at Work (General Application) Regulations, 2007*.

#### Health and Safety during Physical Control

Chainsaws should only be used by those with appropriate training and skill. The use of chainsaws should adhere to *the Guide to Safe Working with Timber and Chainsaws*. Chainsaws and other equipment used for physical control should be properly maintained and inspected, and correct protective equipment should be used at all times (HSA, 2010). Persons engaged in physical control efforts should be aware of the risk posed the human health by phytotoxins. Physical contact with Giant Hogweed (*Heracleum mantegazzianum*), for instance, can cause irreversible damage to human skin.

#### Health and Safety during Chemical Control

While using herbicide, it is paramount that clearly visible signs stating the use of herbicide and its risk to children and animals are in place until treated plants are dry. Symptoms of ingestion by human and animals consist of burns to the mouth and throat, salivating, nausea, vomiting and diarrhoea. If herbicide ingestion is suspected medical treatment should be sought immediately. Glyphosate has a low known toxic effect on aquatic life. Water for mixing of a 10% solution should be sourced from a private source (pre-collected and stored).

It is very important that the *Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001* as well as the *European Communities (Authorisation, Placing on the Market, Use and Control of Plant Protection Products) Regulations, 2003* are consulted.

The success of the management plan for chemically treated stands will be based on the initial reduction in area IAS ascertained from annual pre-treatment monitoring followed by the complete eradication from the site within 5 years.

To comply with the *Quality Control procedures for Sustainable Use of Pesticides Legislation*, the application of herbicide can only ever be undertaken by registered professional users. Registered Pesticide Advisors (RPA) can provide Quality Control by approving procedures prior to works. Professional users will also demonstrate proper use, ensuring only authorised products are used and all works are catalogued and documented pursuant to the requirement of *Plant Protection Products Regulations*. These documents and practices will also need to be reviewed by the RPA. They also include measures to aid the identification of relevant species, with information on the timing, products and methodology for chemical control and measures to implement in order to avoid environmental damage during application.

#### 9.4 Responsible Persons

The SEM (as described in Section 2.3) shall be responsible for the full implementation of the measures set out in the final draft of this Chapter. This person shall be appropriately trained in respect of IAS ecology and management. The finalised version of this EOP (including the finalised Construction IAS Management Plan, shall be maintained at site office(s) at all times. The measures set out in the Plan shall be communicated to all Contractors and Sub-contractors working during the construction phase of the proposed development.

#### 9.5 Invasive Alien Plant Species in the Study Area

A desk study and surveys were carried out to identify the presence, if any, of invasive alien plant species (IAPS) listed on the Third Schedule of the Birds and Natural Habitats Regulations 2011 (S.I. No. 477/2011) (refer to Chapter 7 of the EIAR for the proposed development – Biodiversity). Three IAPS were identified in the site of the proposed development – Floating Fairy-fern (*Azolla filiculoides*), Himalayan Balsam (*Impatiens glandulifera*), and Giant Hogweed (*Heracleum mantegazzianum*) (Table 9.2).

**Table 9.2 IAPS identified in the site of the proposed development**

Common Name	Scientific Name	Location
Floating Fairy-fern	<i>Azolla filiculoides</i>	Occurs in very small quantities, primarily within tidal debris that marks the upper tidal limit on the banks of the River Mague.
Himalayan Balsam	<i>Impatiens glandulifera</i>	Occurs in small quantities along the River Deel, in the vicinity of the proposed crossing point, and on the Cloghatrida Stream at Ballingarrane, adjacent to Key Ecological Receptor 17 (refer to Chapter 7 of the EIAR for the proposed development – Biodiversity), where it grows amongst riparian woodland of willow, ash, sycamore and briar.
Giant Hogweed	<i>Heracleum mantegazzianum</i>	Occurs in small quantities at the proposed crossing point on the River Mague. Very large stand upstream at the N21 bridge at Adare.



Japanese Knotweed (*Fallopia japonica*) was not identified within the site of the proposed road development or the immediate vicinity, although there are two records of the species in the greater area (NBDC, 2019):

1. At the N69 Ferry Bridge over the River Mague (OSi Grid Ref. R482522); and
2. At Ballyshonick to the north of Curraghchase (OSi Grid Ref. R406536).

Additionally, a single Giant Rhubarb (*Gunnera tinctoria*) plant was identified just outside the proposed development boundary, south of the alignment at Ch. 60+675. At its current location, the occurrence does not pose a risk to the proposed development, but pre-construction IAPS surveys should establish whether this species has become established within the development boundary prior to works.

**As described in Section 9.2.1, it is an offence to cause or allow to disperse any of these above-stated IAPS.** The following sections describes the identified IAPS in terms of ecology and negative ecological and socioeconomic impacts.

#### 9.5.1 Floating Fairy-fern, *Azolla filiculoides*

*Information from Millane & Caffrey (2014a), unless otherwise stated.*



**Plate 9.1**      *A. filiculoides* at Mague crossing point.

Floating Fairy-fern is a very small ( $\leq 25\text{mm}$  width), perennial, freshwater aquatic plant, which is native to the Americas (Hill & McConnachie, 2009), and now well established in Ireland as an invasive species. Its leaves, which are green to red in colour, form dense mats which float on the surface of the water. The species becomes established and reproduces very rapidly, with a doubling of population in 4 – 5 days under ideal environmental conditions (Lumpkin & Plucknett, 1982). Reproduction is both vegetative and sexual. The Irish Non-native species Application based Risk Analysis (NAPRA) assessment for *A. filiculoides* concluded that the species poses an overall 'moderate / major' ecological and socioeconomic risk in Ireland. The species outcompetes native aquatic plants, reduces macroinvertebrate species diversity and alters aquatic physicochemical qualities where it occurs. It also impedes water abstraction and recreational and commercial aquatic activities once it establishes mats, which can be up to 10ha in area (Hill & McConnachie, 2009). The species also creates a drowning risk for children and pets / livestock, by creating the illusion of a vegetated terrestrial area on the surface of waterbodies. It performs best in slow-moving to static, low-lying waters, of which there is an abundance of in Ireland. A non-native biological control agent, the Frond-feeding Weevil (*Stenopelmus rufinasus*) has been introduced to Ireland in tandem with the IAPS, and may have resulted in its eradication at one or more locations (Baars & Caffrey, 2008).



**Plate 9.2 Close-up of *A. filiculoides* (Source: Colette O' Flynn)**

The species has been deliberately introduced to Ireland as a result of the aquarium and / or ornamental plant trade, and accidentally, as a hitch-hiker on aquarium / ornamental plant trade products and aquatic equipment. Within Ireland, it is dispersed as a 'hitch-hiker' on boats, fishing gear and other aquatic equipment, as well as by natural means (e.g. aquatic animal movements, flowing water and flooding events). Additionally, without stringent biosecurity protocols in place, the species could easily be dispersed by in-stream works. Non-reproductive plant material will survive long periods in transit once it remains moist, while spores of the plant can remain viable throughout long periods of dessication.



**Plate 9.3 Frond-feeding Weevil (*S. rufinasus*) (Source: Corin Pratt)**

Because of its aquatic nature, and its ability to regenerate from very small fragments of vegetation / recalcitrant spores, anthropogenic physical / chemical eradication efforts are unlikely to be effective. As such, preventing the spread of this IAPS using stringent biosecurity measures is paramount.

### 9.5.2 Himalayan Balsam, *Impatiens glandulifera*

*Information from Millane & Caffrey (2014b), unless otherwise stated.*

Himalayan Balsam is a tall (50 – 250 cm high) annual, terrestrial flowering plant, which is native to the western Himalayan mountains, and now well established in Ireland as an IAPS. Leaves are opposite, petiolate, lanceolate to obovate, noticeably serrated at margins and in whorls. Stems are green to red with prominent nodes, and sometimes branch at the top. Roots are shallow, and adventitious roots can form at the lower nodes, particularly if the plant is knocked over. Flowers are typically pink (but vary from white to purple) and trumpet-shaped, and produce seeds which remain viable in soil for ~ 18 months (Beerling & Perrins, 1993) and are dispersed by exploding seed pods.



**Plate 9.4 Flowers of *I. glandulifera* (Source: Colette O' Flynn)**

The plant performs best in wet / damp ground which is not subject to winter frost, particularly along riverbanks and in damp woodland in lowland areas, where it very rapidly forms dense monocultural stands to the detriment of native plant species. Other impacts include accelerated riverbank erosion, increased sedimentation of adjacent surface waters and reduced macroinvertebrate and arbuscular mycorrhizal fungal species diversity / abundance. Furthermore, the flowers of the species, which are especially rich in nectar, may draw pollinators away from native flora. Dense riparian stands of the species are also likely to deter anglers by restricting access, impeding casting and being aesthetically unappealing.

The species has been introduced to Ireland deliberately via the ornamental plant trade, and is dispersed from locations where it is established by natural seed dispersal (explosive seed pods and aquatic seed dispersal), and accidentally as a hitch-hiker on footwear and clothing, on boats and other aquatic gear, in contaminated soil and by construction works. There is an abundance of suitable habitat in Ireland; establishment (since c. 1900) has been very rapid and dispersal will continue.

Physical treatment ('balsam bashing') is feasible and can successfully eradicate a local occurrence where treatment is implemented properly and repeatedly across several years – but substantial manpower is required. Chemical treatment or a combined physical-chemical treatment may also be employed. Because of the likelihood of dispersal via movement of contaminated soil, stringent biosecurity protocols are required for construction works in the vicinity of occurrences of this IAPS.





**Plate 9.5** *I. glandulifera* in seed at Deel crossing point.

### 9.5.3 Giant Hogweed, *Heracleum mantegazzianum*

Giant hogweed is a very tall (up to 5m high), monocarpic flowering plant, native to the Caucasus, and now well established in Ireland as an IAPS. The stem is green with small purple splotches, thick (5 – 10cm diameter), ridged, hollow and hairy towards the top (Nielsen *et al.*, 2005). Leaves are large, opposite, deeply divided and pinnate. Flowers are large, white and umbelliferous, and produce many seeds. Individual plants come to maturity typically at 3 – 5 years (but may take up to 12 years to reach maturation given poor environmental conditions), when they produce seed and die (Nielsen *et al.*, 2005). Before reaching maturity, plants persist in a rosette stage, without the very tall stem and flower (Nielsen *et al.*, 2005). The species may be confused with native wild carrot species such as Hogweed (*Heracleum sphondylium*) and Wild Parsnip (*Pastinaca sativa*) but the giant stature, purple splotched stem, and larger, more deeply divided leaves distinguish the invasive relative. The species is a garden escape which was introduced deliberately as an ornamental plant in the 19<sup>th</sup> century. It is dispersed sexually by seeds (which may be transported in water and by vehicles on roadsides) and performs best in damp / wet soil, especially on riverbanks and roadsides, and in bogs and fens.

Negative impacts include displacement of native plant species, accelerated riverbank erosion and increased sedimentation of adjacent surface waters. Additionally, the sap of the plant contains a photosensitizing furanocoumarin, which causes potentially very severe phytodermatitis when it comes into contact with human skin (Nielsen *et al.*, 2005). Resultant burns can re-appear for years to come, whenever the affected skin is exposed to direct UV light. Similarly, the plant can also cause injury of pets and livestock (UK Department of Agriculture and Rural Development, n.d.). Riparian stands can also impede or wholly prevent access to riverbanks. Consumption of the plant by dairy cows results in an unpleasant odour in milk produced. The plant may also act as a host for fungal pathogens of arable and horticultural crop species (UK Department of Agriculture and Rural Development, n.d.).

Because the plant takes several years to reach sexual maturity, early physical and / or chemical treatment can successfully eradicate local occurrences. Considering the hazardous nature of this IAPS, all efforts should be made to prevent its spread and protect personnel from exposure to its sap.



Plate 9.6 *H. mantegazzianum*

## 9.6 Construction Invasive Alien Species Management Plan

### 9.6.1 General IAS Management Measures

This Construction IAS Management Plan has been prepared in accordance with the relevant legislation and the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII (formerly NRA), 2010). The measures prescribed herein should be regarded as mandatory minimum measures.

The following general measures will be implemented to prevent / minimise the dispersal / introduction of IAS during the construction phase of the proposed development:

- A preconstruction IAPS survey shall be carried out, taking in the entirety of the site of the proposed development. At a minimum, this survey shall aim to identify and map the occurrences of all IAPS listed on the Third Schedule of the Birds and Natural Habitats Regulations 2011 (S.I. No. 477/2011) but should also aim to identify and map other IAPS which could potentially be further dispersed as a result of the construction and operation of the proposed road development.
- As prescribed in the mitigation measures in Chapter 7 of the EIAR for the proposed development – Biodiversity – a number of works exclusion zones shall

be established at the site of the proposed development to protect certain Key Ecological Receptors (KERs) during the proposed works. Creation of these zones shall serve to protect these areas from any new introductions of IAPS as a result of the works. Establishment of these zones will require defining the works zone at the outset and the installation of appropriate protective fencing and in some cases silt fencing, **prior to any other works being undertaken.**

- Prior to the commencement of any works, areas in the site of the proposed development where IAPS occur shall be fenced and clearly marked with appropriate signage which identify the species and warn not to enter or interfere with vegetation in the fenced areas.
- Prior to the commencement of any works, all personnel shall be informed of the IAPS that have been identified on-site, their locations, the impacts associated with them, and instructed not to enter the areas in question or interfere with vegetation in the fenced areas. In particular, all personnel shall be advised of the presence and location of Giant Hogweed on the site, and the associated human health risks.
- The biosecurity measures outlined in Section 9.3.3 shall be implemented in full.
- All landscaping involved in the construction of the proposed development shall be conducted in accordance with '*A Guide to Landscape Treatments for National Road Schemes in Ireland*' (Burns *et al.*, n.d.) and the *Horticulture Code of Good Practice* (Kelly, 2012).
- All species utilised in landscaping for the proposed development will be (i) native species (for trees / shrubs see Appendix 1 of Burns *et al.*, n.d.) which are (ii) of national (and preferably regional / local) provenance and (iii) free from non-native pathogens.
- Where treatment of IAPS is undertaken:
  - The treatment shall be carried out in accordance with the statutory requirements set out in Section 9.2 (and any other relevant legislation), the principles of IAS management set out in Section 9.3, and the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII (formerly NRA), 2010);
  - Post-control monitoring shall be undertaken;
  - Any IAPS-contaminated soil and / or IAPS plant material for disposal shall be disposed of according to the relevant legislation and BPGs; and
  - A risk assessment shall be prepared in advance of any attempted treatments.
- The use of machinery (particularly tracked machinery) shall be limited in the vicinity of occurrences of IAPS.
- All equipment (including footwear and tools) and machinery (including tracked machinery, excavators (incl. buckets), trailers, dumper trucks, *etc.*) used (a) in IAPS treatment or (b) in the immediate vicinity of known occurrences of IAPS, shall be thoroughly cleaned at designated areas to prevent the spread of IAPS propagules.
- Insofar as possible, works should not be undertaken which necessitate the disturbance / movement of soil or water containing IAPS.
- Cutting (or other interference with) known occurrences of IAPS plant material shall not be undertaken by personnel other than those that are qualified to treat IAPS (as per the regulations described in Section 9.2).



### 9.6.2 Soil Management Plan

Soil that is bare or degraded is vulnerable to colonisation by IAPS. Soil may be degraded in a number of ways. The natural seedbank may be depleted as a result of IAPS establishment. Soil may also become desiccated, compacted or otherwise degraded as a result of improper storage. Therefore, proper, well planned soil management will contribute to the prevention of IAPS dispersal.

This Plan has the dual objectives of protecting the ecological integrity of the soils on-site and of preventing the dispersal / introduction of IAPS as a result of all soil related activities during the proposed works. It shall be developed in agreement with Limerick City and County Council, and in accordance with the following documents:

- *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII, 2010);
- *A Guide to Landscape Treatments for National Road Schemes in Ireland* (Burns *et al.*, n.d.); and
- *Specifications for Road Works Series 600 – Earthworks* (TII, 2013).

The contractor is required (at a minimum) to address the following:

- The protocols for stripping, storage, reuse and / or disposal of soil, topsoil and subsoil;
- The protocol for monitoring (monthly or bi-monthly) of soil stores;
- Special measures to be implemented, as required, for the storage of soil from marsh or wetland communities;
- Measures that will be implemented to prevent contamination of soil stores with IAS;
- Measures that will be implemented to prevent the importation of any materials (particularly soils, gravel, stones and landscaping plants / seeds) contaminated with IAS;
- Measures that will be implemented to prevent the dispersal of IAPS which have been identified on the site of the proposed development (i.e. those identified in this Chapter and any other sites / IAPS subsequently identified) via movement of contaminated soil;
- Procedure for disposal of IAS-contaminated soil;
- Designation of responsible person(s); and
- Procedure for monitoring the implementation and efficacy of the Plan.

The Soil Management Plan shall contain (but not be limited to, as described above) the following measures:

- All materials imported to the site of the proposed development for the purposes of the proposed works (especially soils, gravel and stones) shall be free of IAS. Locations from which such materials are sourced should be assessed for the presence of IAS in advance of importation. Materials shall be accepted from IAS-free sources only.
- Where soil stores are due to be in situ for extended periods ( $\geq 1$  year), they shall be seeded with a native grass mix to reduce the potential for colonisation by IAPS and / or invasive native species.



### 9.6.3 Floating Fairy-fern, *Azolla filiculoides*

#### Control

Under the Birds and Natural Habitats Regulations, it is an offence to allow or cause the dispersal of Floating Fairy-fern. There are three options for control of the species – physical, biological and chemical – none of which is ideal. An in-depth cost-benefit analysis, which considers the potential control options set out below (as well as the option of not attempting eradication), should be carried out in accordance with the methodology set out by Invasive Species Ireland (n.d.). Stringent biosecurity protocols shall be required to prevent the spread of this IAPS as a result of the proposed development (refer to Section 9.3.3).

#### Physical Control

Because of its aquatic habitat, very small size and ability to regenerate from very small fragments of tissue, physical control may be ineffective. However, according to the IFI, “*Where Azolla is present it will be required to remove it from the channel to prevent the further spreading*”. For this species, physical control would involve gathering with buckets and / or using a baffle board barrier to raise water levels and allowing wind and water currents to gather all vector material against the boards, prior to careful mechanical removal. This approach would likely necessitate follow-up treatments, since spores may be present in the water.

#### Biological Control

According to Invasive Species Ireland, “*The primary recommended approach to tackle A. filiculoides infestations is by biological control using [Stenopelmus rufinasus]*” (n.d., p. 5) but it should be noted that the biological control agent in question is also a non-native species, and the potential legal and ecological implications of such an approach are unclear. This approach is discussed – and indeed, advocated – by Baars and Caffrey (2008), who cite a case in Co. Cork, where *S. rufinasus* appear to have eradicated the infestation in a number of months. According to the report, developed for Invasive Species Ireland, the weevils “*are unable to utilise the native species as a food source*” and their population collapses once the water fern has been eradicated (Baar & Caffrey, 2008). This non-native weevil is already established in the wild in Ireland, and may already be present at the occurrence of the IAPS at the site of the proposed development.

#### Chemical Control

While, in theory, chemical control is a potential option for the control of this IAPS, it may be regarded as a last resort approach, after other options (of which biological control would appear to be the only at present) have been ruled out. As stated by Invasive Species Ireland (n.d., p. 6):

*“The Invasive Species Ireland Steering Group do not support unjustified general, non-specific chemical control of aquatic invasive species due to potential impacts on non-target species; residual impact and persistence in the environment; the lack of associated rigorous monitoring to appraise effectiveness of control methods; and the potential noncompliance with the Water Framework Directive.”*

#### Disposal

Options for disposal of plant material (if a physical control treatment is implemented) include disposal to licenced landfill, burying at depth, and composting (not in the vicinity of surface water bodies).

#### 9.6.4 Himalayan Balsam, *Impatiens glandulifera*

##### Control

Under the Birds and Natural Habitats Regulations, it is an offence to allow or cause the dispersal of Himalayan Balsam. In order to prevent the dispersal of the species, treatment shall be undertaken with the objective of eradicating the occurrence of Himalayan Balsam within the site of the proposed development, **prior to the commencement of works**. Treatment shall be conducted in accordance with the relevant legislation and the principles of IAPS management and informed by the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII, 2010). There are physical and chemical options for treatment of the IAPS (Table 9.3).

##### Physical Control

This approach is likely to be effective where good access is available to the stand in question. Plants can be hand-pulled, cut, mown or strimmed back to ground level before flowering in June. Cutting any earlier will promote greater seed production in re-growth. Plants have to be cut below the lowest node to prevent re-growth. Annual repeated physical treatments will be required until the stand is eradicated. Shallow root systems permit effective hand-pulling but, in this case, a follow-up will be required in August of the same year due to sprouting of new seedlings. Plant material and contaminated soil shall be stored on top of an impermeable membrane prior to disposal and the storage area shall be monitored for several years afterwards to ensure contamination has not occurred. Vector material and contaminated soil in transit shall be covered to prevent spillage. Provided seeds are not present, pulled / cut plant material can be composted, but care should be taken, since adventitious roots can be formed at lower nodes. Otherwise, material should be disposed of at a licenced landfill, and those involved in the transportation / disposal of vector material and / or contaminated soil shall be made aware of the nature of the material, and the risks and statutory requirements associated with its handling, storage and disposal.

##### Chemical Control

Please note: The vicinity of the occurrence in question to the aquatic environment has implications for chemical control options and the Contractor should ensure that any IAPS control efforts undertaken do not contravene the relevant legislation. Glyphosate or 2,4-D amine can be employed in the chemical control of Himalayan Balsam. Either should be applied during the active growth period, when seedlings have grown enough to be sufficiently covered by the spray (i.e. late spring). Glyphosate is a systemic herbicide and may be applied as a foliar spray where extensive infestations occur. However, care should be taken where sensitive non-target species are present, since this is a broad-spectrum herbicide. In such cases, application should be made using a 'weed wiper'. 2,4-D amine is effective against many broadleaved IAPS and does not affect grasses, which may be important in soil stabilisation in the area in question. It may, therefore, be preferable to glyphosate in certain circumstances. In the case of chemical control, repeat treatments to seedlings will be required for 5+ years. Follow-up monitoring will also be required in mid-spring and mid-summer to assess re-growth.

The stand / occurrence in question may extend beyond the proposed development boundary, in which case, (a) measures should also be put in place to prevent recolonization (e.g. placement of an above and below-ground impermeable membrane), or (b) attempts should be made to eradicate upstream occurrences to prevent re-colonisation. Post-treatment monitoring and follow-up treatments shall also be implemented, as required.

**Table 9.3 Summary of control options for Himalayan Balsam (TII, 2010)**

Mode	Method	Season	Follow-up
Physical	Hand pulling	Pro-flowering following recent rain	Regular follow-up to deal with seedlings
	Mowing or cutting	Before flowering in June. Mowing required regularly for control	Regular follow-up to deal with seedlings
Chemical	Glyphosate	During active growth in late spring (late April to May)	Foliar spray, wiper applicator or spot treatment
	2,4-D Amine ( <b>not near water</b> )	During active growth in late spring (late April to May)	Foliar spray, wiper applicator or spot treatment

### Disposal

Options for disposal of vector material and contaminated soil include disposal to licenced landfill, composting and deep burial.

## 9.6.5 Giant Hogweed, *Heracleum mantegazzianum*

### Control

Under the Birds and Natural Habitats Regulation, it is an offence to allow or cause the dispersal of Himalayan Balsam. In order to prevent the dispersal of the species, treatment shall be undertaken with the objective of eradicating the occurrence within the site of the proposed development prior to the commencement of works. Treatment shall be conducted in accordance with the relevant legislation, the principles of IAPS management, and informed by the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII, 2010). There are physical and chemical options for treatment of the IAPS (Table 9.4).

Due to the hazardous nature of the vector material, a risk assessment shall always be completed prior to any control efforts being implemented. All operatives involved in control measures (including those involved in transportation, storage and disposal) shall be made fully aware of the associated health risks and shall wear full protective clothing, as required, including gloves, face mask and mask to prevent inhalation of airborne droplets of sap.

As seeds may remain viable for 15 years, control will require continued efforts over several years to fully eradicate an established occurrence. Disturbance of soil in the area in question can result in seeds coming out of dormancy, and a resultant 'flush' of re-growth. Soil within 4m of mature plants is likely to contain very high numbers of seed and should not be transferred to other parts of the site or disposed of inappropriately. The majority of seeds, however, will be contained within the top 5cm of soil and will persist for 1 – 2 years.

Regardless of the control method applied, eradication of the occurrence will require repeated annual efforts (because of the very high regenerative capacity of the species), and the treatment of plants should commence early in the growing season but not prior to inflorescence.

### Physical Control

Young plants can be teased out of the soil using hand tools. This is most effective when soil is moist (i.e. recently after rain). Care should be taken to pull the entire

plants intact. Where plants are taller than 1.5m, the upper part of the stem can be cut back (e.g. with a scythe), and the lower part of the plant can be used to lever the roots out of the soil. The central crown of the root system must be fully removed to prevent re-growth (smaller, fibrous lateral roots cannot send up new shoots). Seeds heads on old stems (where they occur) should be removed by bagging to prevent accidental spread of seeds. Where a stand is well established (i.e. with numerous sexually mature plants), the soil seed bank will contain many viable seeds, and continuous germination of seedlings will occur for several years following the removal of existing plants. Thus, ongoing follow-up treatments will be required for 5+ years to ensure eradication. Seedlings should be left to grow for a few weeks prior to pulling, in order to make removal easier. Grazing animals (including goats and sheep) have been effectively employed in the physical control of Giant Hogweed (Nielsen *et al.*, 2005) but such an approach may have adverse animal welfare implications and should be very well researched and planned to prevent any such negative outcomes prior to implementation. Mowers, trimmers and weed whackers should not be used in the physical control of Giant Hogweed. This approach can stimulate budding on the root crown, and result in the uncontrolled spraying of phytotoxic sap. Plant material and contaminated soil shall be stored on top of an impermeable membrane prior to disposal and the storage area shall be monitored for several years afterwards to ensure contamination has not occurred. Vector material and contaminated soil in transit shall be covered to prevent spillage. Vector material and contaminated soil should be disposed of at a licenced landfill.

### Chemical Control

Please note: The vicinity of the occurrence in question to the aquatic environment has implications for chemical control options and the Contractor should ensure that any IAPS control efforts undertaken do not contravene the relevant legislation. Chemical control may be applied in the eradication of Giant Hogweed but, as with the physical approach, follow-up treatments will be required to address seedling re-growth. Glyphosate is the most effective agent for the task. Foliar sprays are suitable for large infestations, but non-target species will also be killed, since this is a broad-spectrum herbicide. It is strongly advised that foliar sprays should be undertaken before the flowering stem has fully elongated and when all parts of the stand are accessible to operators, in early to mid-spring, and during period(s) of mild, calm, dry weather. In the same season, a follow-up spray of re-growth may need to be carried out. Direct stem injection may also be employed where there are a small number of mature plants and / or where there is sensitive vegetation in the vicinity. In this case, 5ml of the solution (5% v/v) is injected into the stem at approx. 30cm above the ground. Care should be taken, since phytotoxic sap has been known to squirt out of the injected stem. A 'weed swipe' or brush may also be used for more targeted application.

In areas where eradication efforts (physical or chemical) have been implemented, the seed bank and soil will be in suboptimal condition, and re-vegetation efforts will be required, to prevent soil erosion, minimise Giant Hogweed seedling re-growth and prevent other IAPS / native invasives from colonising the area. However, it should be noted that "*Sowing grass mixtures in sandy soils of a floodplain and along riverbanks should be avoided, because the seeds of invasive hogweed species along with other seeds are deposited by flooding. The seeds are retained in the grass sward and will germinate well in spring. In such places only root cutting and cutting of the plants before flowering can be recommended for the control of invasive hogweeds*" (Nielsen *et al.*, 2005, p. 40). Thus, where the species is established upstream, re-vegetation with grasses may be ill-advised. Planting of flood-resistant native tree saplings (which might ultimately shade out any Giant Hogweed which re-grows when they become tall enough) may be more suitable in such circumstances (Nielsen *et al.*, 2005).

An integrated physical-chemical approach (e.g. cutting, chemical control, soil cultivation, re-vegetation) may be most effective in the control of Giant Hogweed. In any case, follow-up treatments *will be required* in order to ensure effective control.

The stand / occurrence in question may extend beyond the proposed development boundary, in which case, (a) measures should also be put in place to prevent recolonization (e.g. placement of an above and below-ground impermeable membrane), or (b) attempts should be made to eradicate upstream occurrences to prevent re-colonisation.

**Table 9.4 Summary of control options for Giant Hogweed (Til, 2010; Nielsen et al., 2005)**

Mode	Method	Season	Follow-up
Physical	Removal using hand tools and full PPE	Spring, following recent rain	Follow up to deal with seedlings for 5+ years
Chemical	Glyphosate	Foliar spray in mid-spring before stem elongation. Otherwise, cut back and spray re-growth. Stem injection during growing season.	Foliar spray, wiper applicator, spot treatment, stem injection or hand pulling for 5+ years.
	2,4-D Amine ( <b>not near water</b> )	Foliar spray in mid-spring before stem elongation. Otherwise, cut back and spray re-growth. Stem injection during growing season.	Foliar spray, wiper applicator, spot treatment, stem injection or hand pulling for 5+ years.

### Disposal

Options for disposal of vector material and contaminated soil include disposal at licenced landfill and deep burial.

### Prevention of Exposure to Sap

- Areas in the site of the proposed development where Giant Hogweed occurs shall be fenced and clearly marked with signage identifying the species and warning of the associated human health impacts.
- All personnel working in areas infested with Giant Hogweed should wear appropriate synthetic, water-resistant protective clothing (including gloves, goggles and masks to protect the skin of the face and to prevent inhalation) (Nielsen *et al.*, 2005).

### Treatment of Exposure to Sap (as per Nielsen et al., 2005)

- In cases in which skin is exposed to sap, the area affected should be washed with soap and water as soon as possible, and hidden from exposure to direct sunlight for at least 48 hours. Application of an appropriate topical steroid (as prescribed by a qualified medical professional) early on can reduce the severity of the resultant phytodermatitis and ease discomfort.
- In cases of exposure which involved large volumes of sap and / or a large area of skin and / or particularly sensitive area(s) (e.g. face and eyes), medical advice should be sought immediately

## 9.7 References

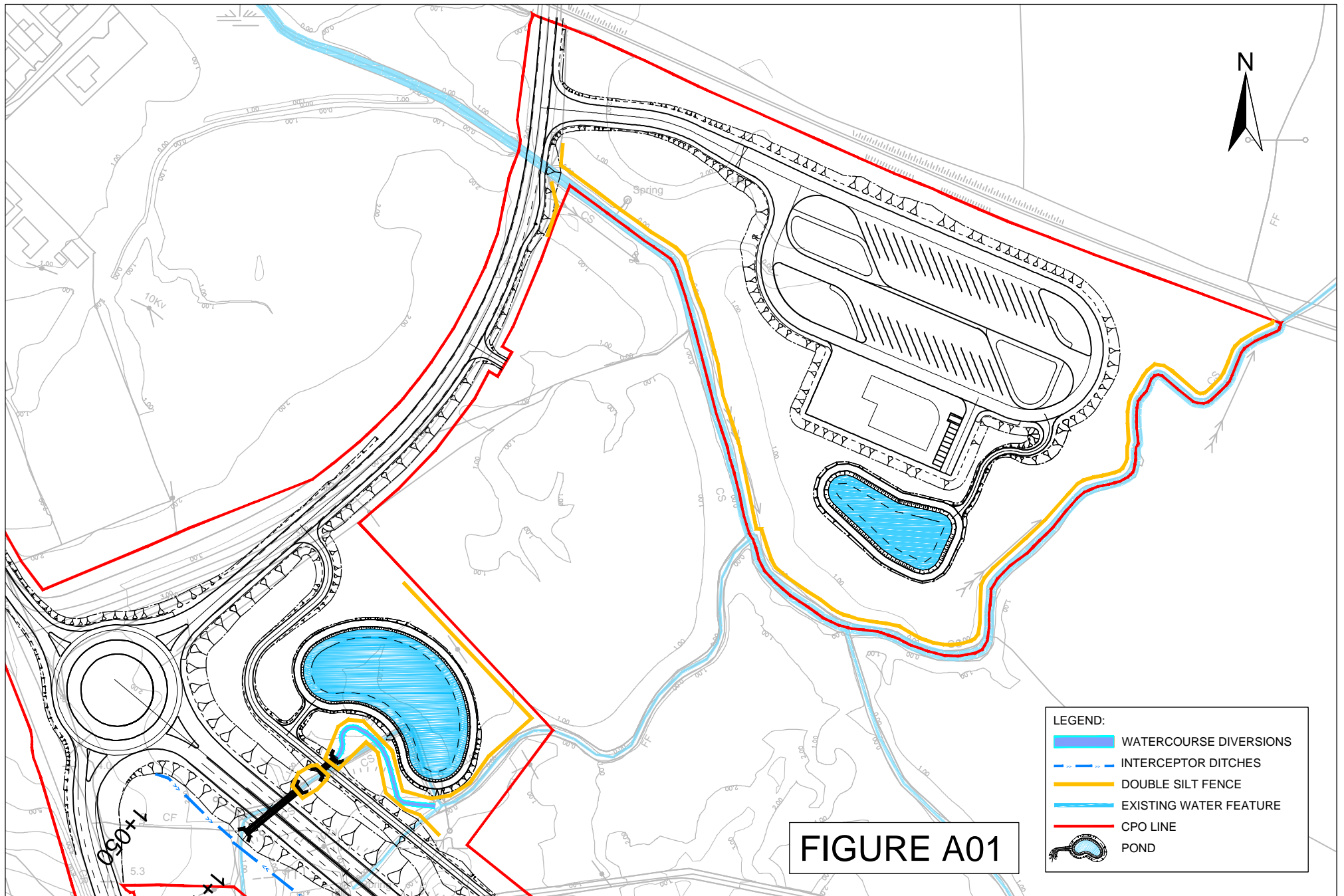
- Baars, J.-B. & Caffrey, J. (2008). *Case Study 4: Water fern, Azolla filiculoides – Under biological control in Ireland*. Report prepared for Invasive Species Ireland.
- Beerling, D.J. and Perrins, J.M. (1993). *Impatiens glandulifera* Royle (*Impatiens roylei* Walp.), *Journal of Ecology*, 81(2), 367-382.
- Burns, T., Dolan, L.M.J. & Whelan, P. (n.d.). *A Guide to Landscape Treatment for National Road Schemes in Ireland*. Document prepared for TII (formerly NRA).
- DAFM (n.d.). “*Good Plant Protection Practice*”.
- DAFM (2015). *Guidelines on how to use STRIPE (Surface water Tool for Reducing the Impact of Pesticides on the Environment)*.
- Hill, M. & McConnachie, A.J. (2009). *Azolla filiculoides* Lamarck (Azollaceae), in *Biological Control of Tropical Weeds using Arthropods (1<sup>st</sup> Edition)*, Eds.: R. Muniappan, G.V.P. Reddy & A. Raman, pp. 74 – 87. Cambridge, UK: Cambridge University Press.
- HSA (2010). *Guide to Safe Working with Timber and Chainsaws*.
- Invasive Species Ireland (n.d.). *Water Fern (Azolla filiculoides) Invasive Species Action Plan*.
- Millane, M. & Caffrey, J. (2014a). *Risk Assessment of Azolla filiculoides*. Document prepared for IFI and NBDC.
- Millane, M. & Caffrey, J. (2014b). *Risk Assessment of Impatiens glandulifera*. Document prepared for IFI and NBDC.
- Kelly, J. (2012). *Horticulture Code of Good Practice: To prevent the introduction and spread of Invasive Non-native Species*. Report prepared for the Northern Ireland Environment Agency and the NPWS (of Ireland).
- Lumpkin, T.A. & Plucknett, D.L. (1982). *Azolla* as a green manure: Use and Management in crop production, in *Westview Tropical Agriculture Series No. 5*, 230pp. Colorado, USA: Westview Press.
- NBDC (2019). *Biodiversity Maps*. [Website].
- Nielsen, C., Ravn, H.P, Nentwig, W. & Wade, M. (eds.) (2005). *The Giant Hogweed Best Practice Manual. Guidelines for the management and control of an invasive weed in Europe*. Hoersholm, Denmark: Forest & Landscape Denmark, 44 pp. Guide prepared for the European Commission’s ‘Giant Alien Project (2002 – 2005).
- TII (formerly NRA (2013). *Specifications for Road Works Series 600 – Earthworks (including Erratum No. 1, dated June 2013)*.
- TII (formerly NRA) (2010). *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads*.

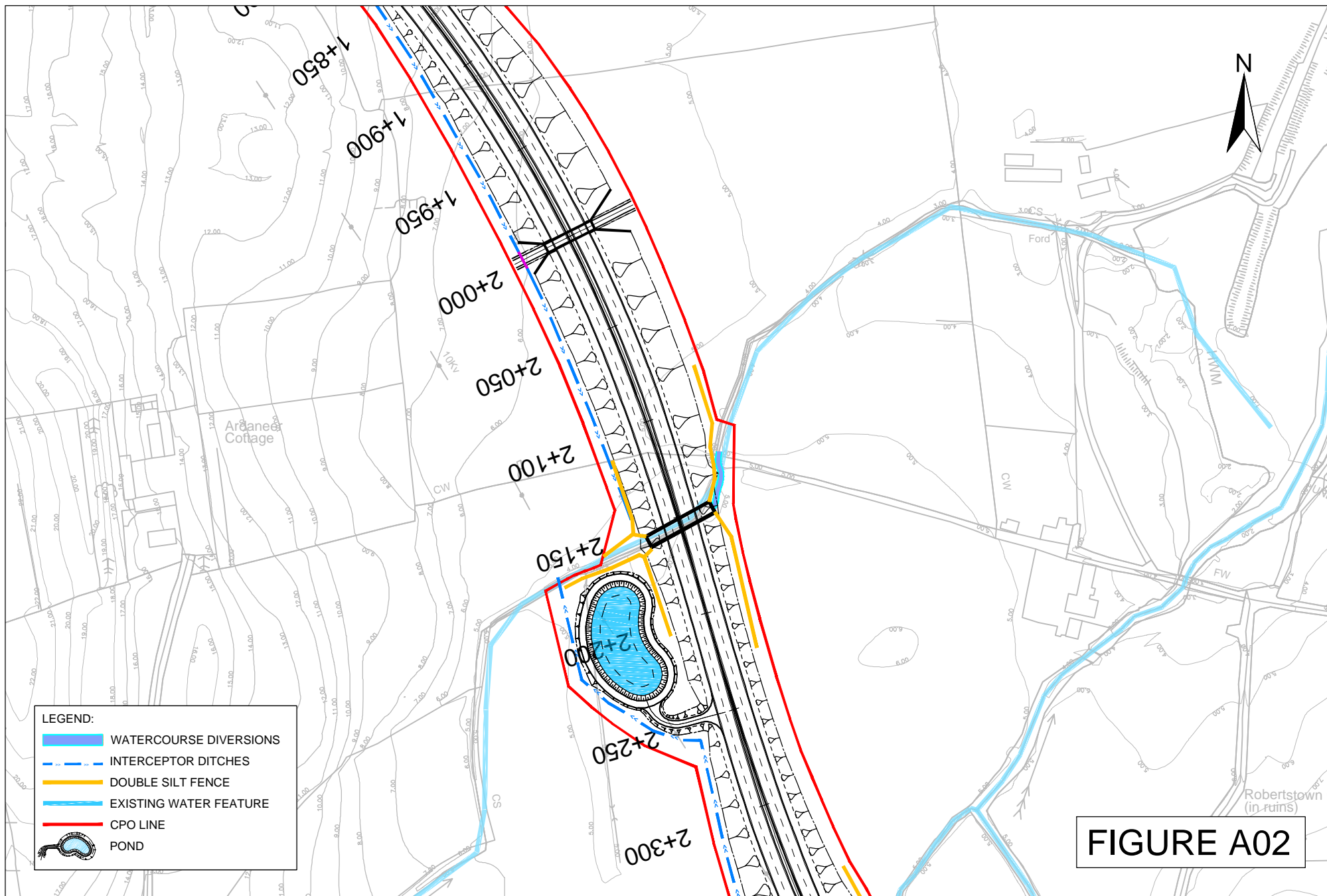
UK Department of Agriculture and Rural Development (n.d.) *Giant Hogweed (Heracleum mantegazzianum)*. Report prepared as part of *Countryside Management* series of publications.

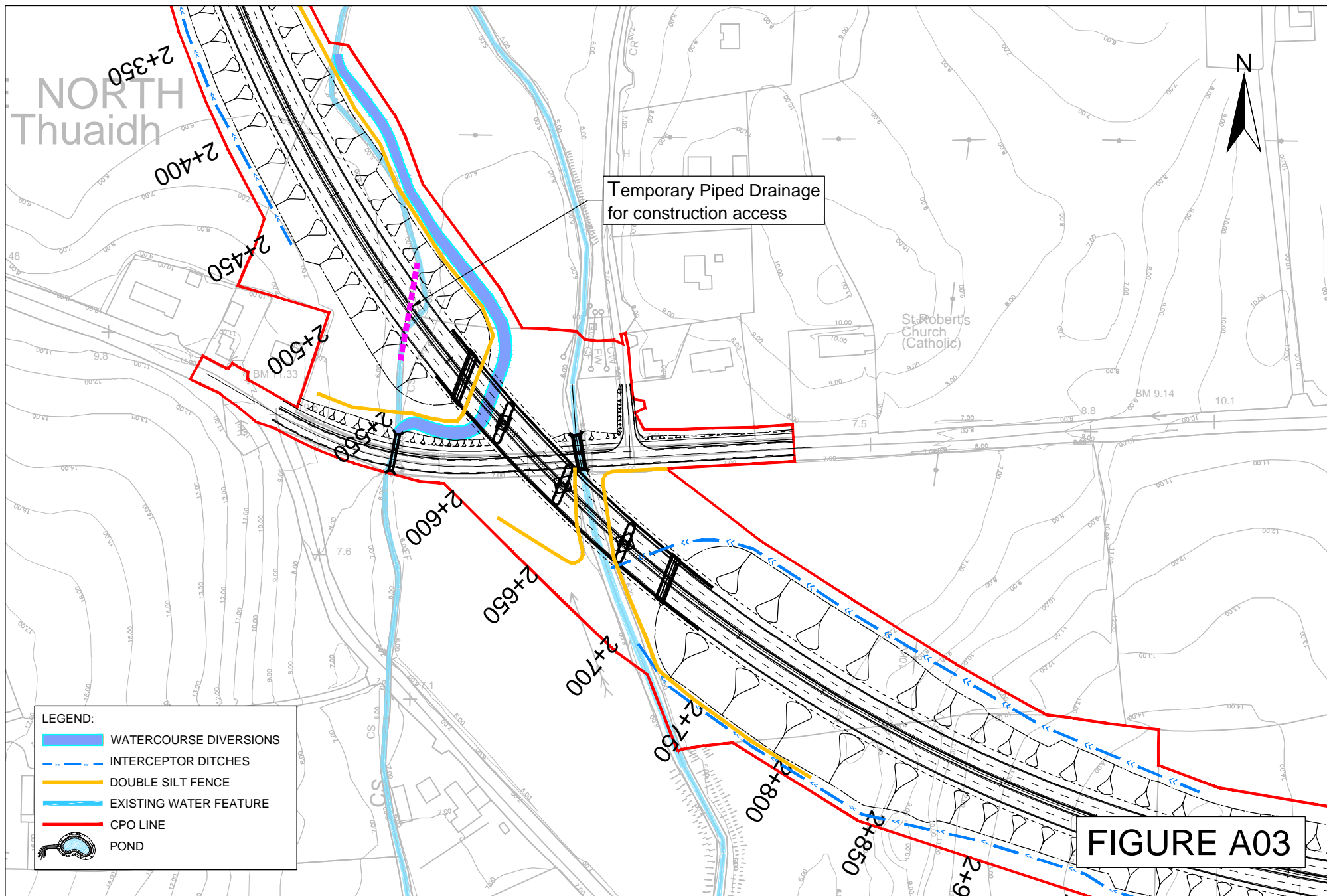


# **APPENDIX A**

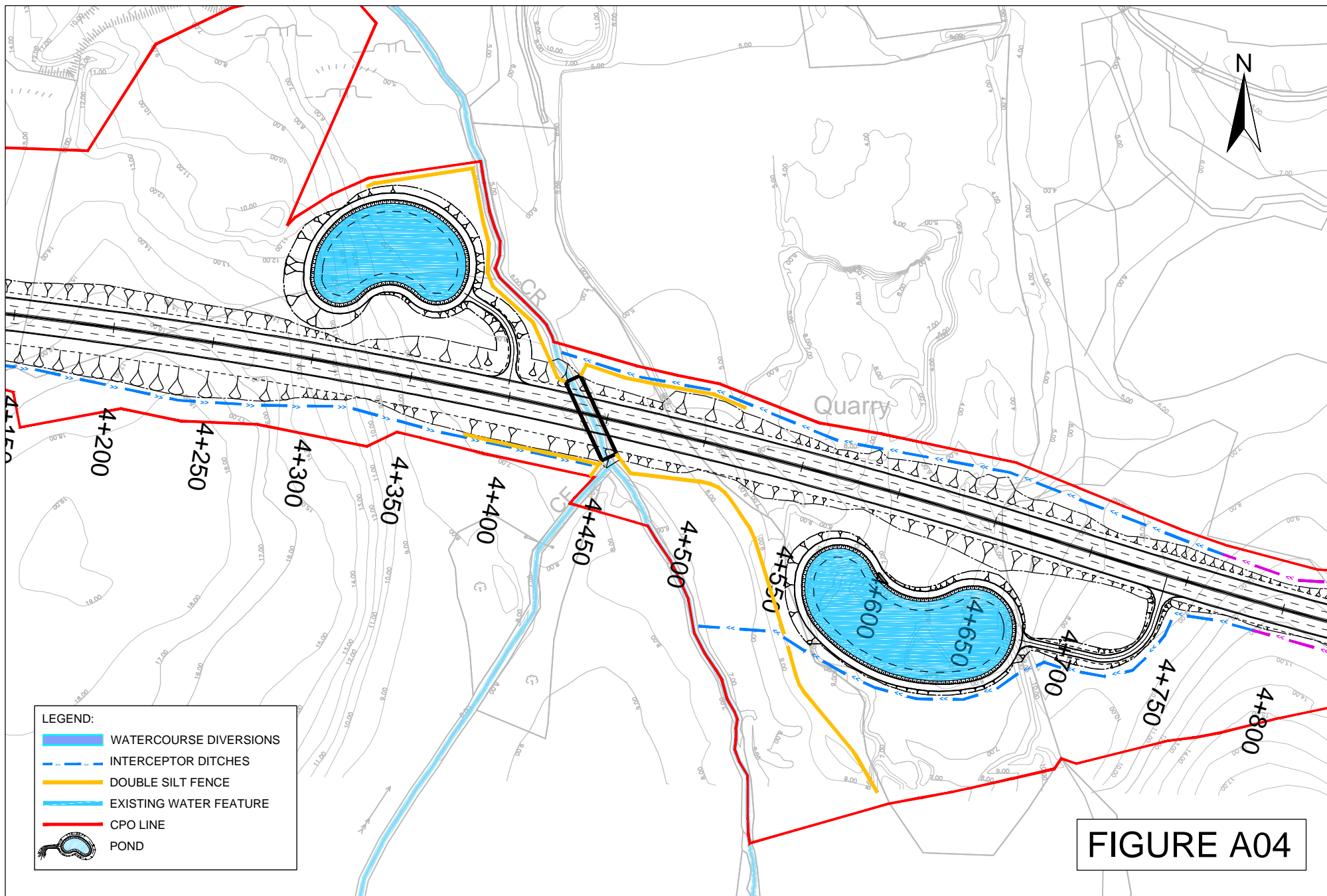
## **Erosion and Sediment Control Measures**

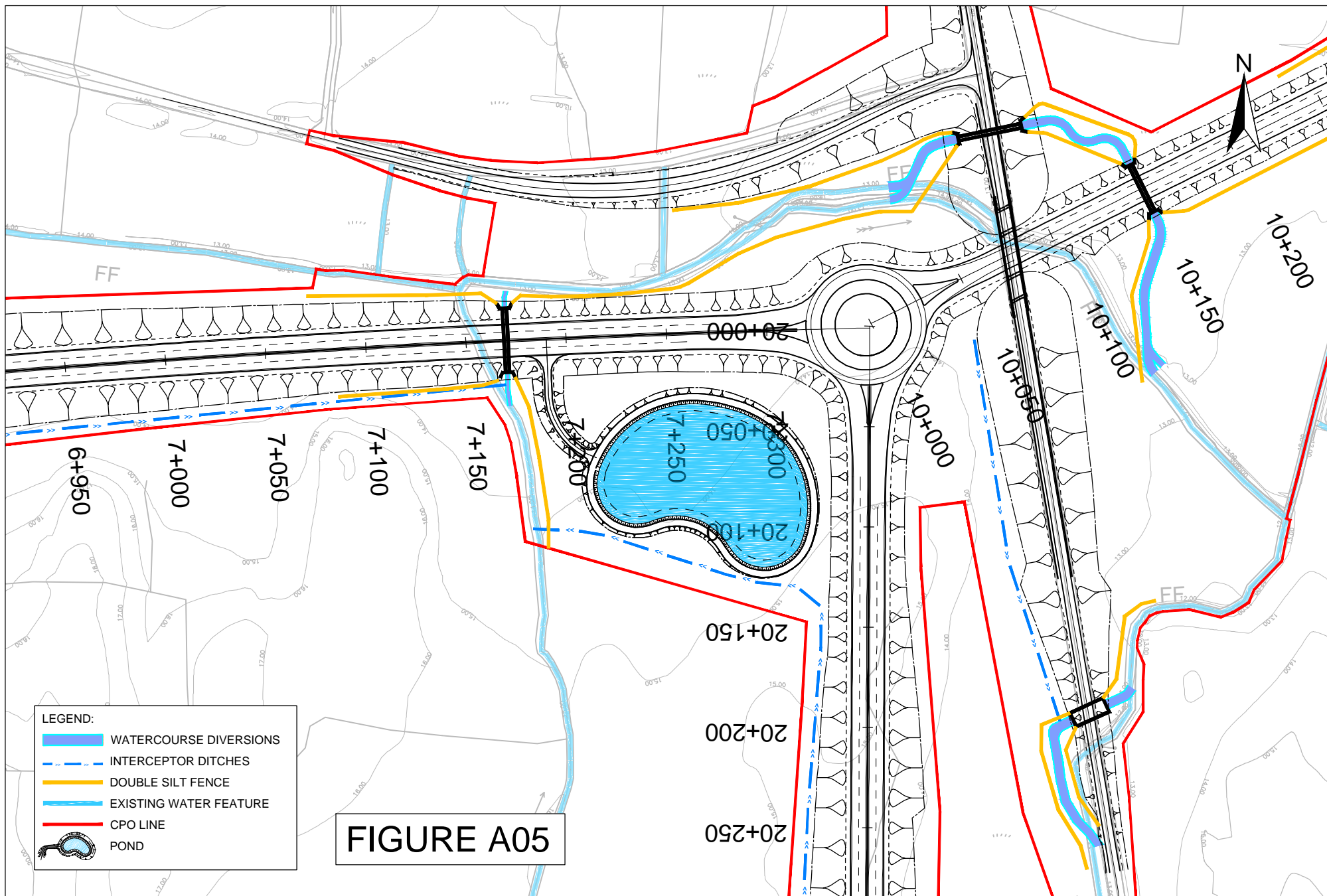












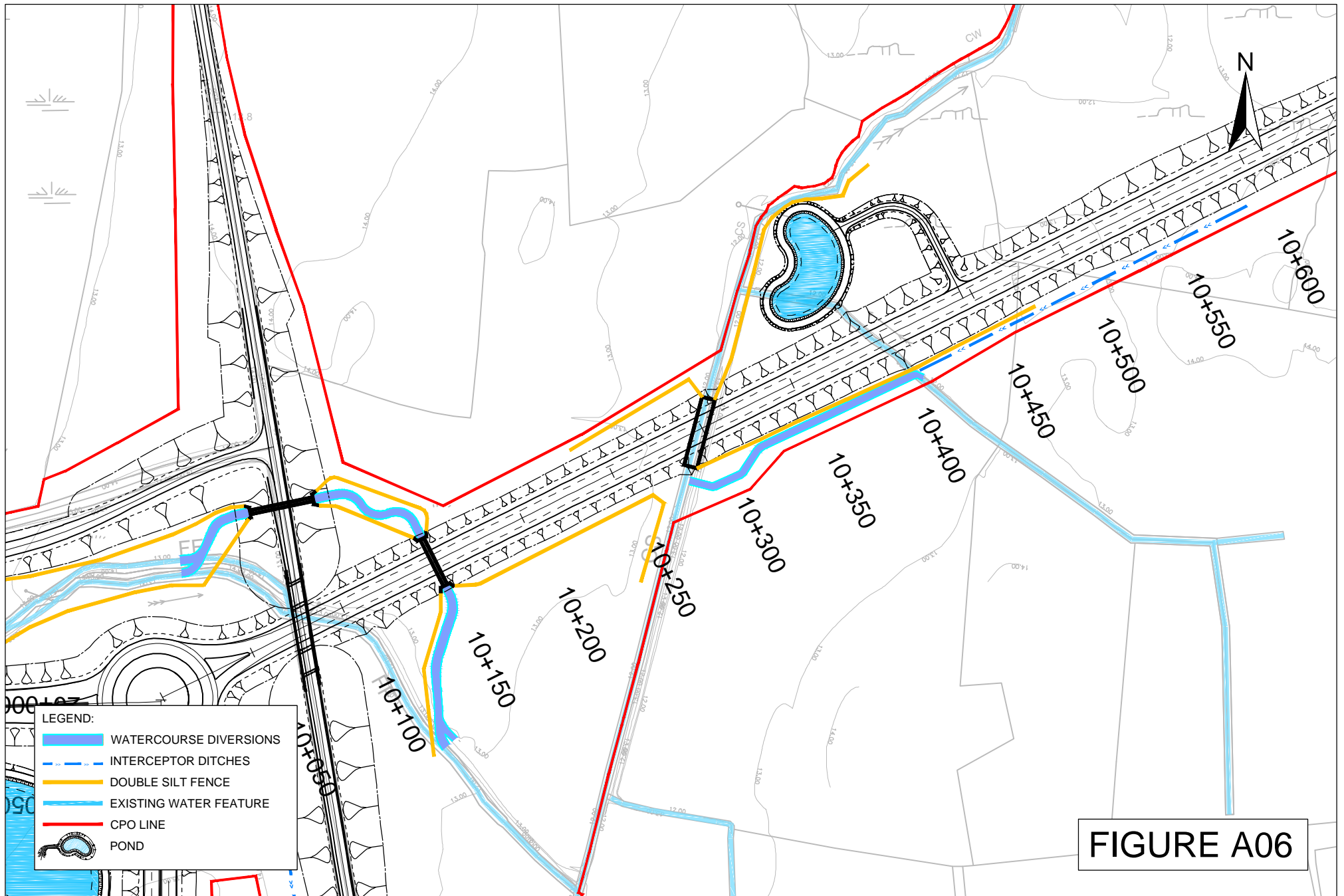


FIGURE A06



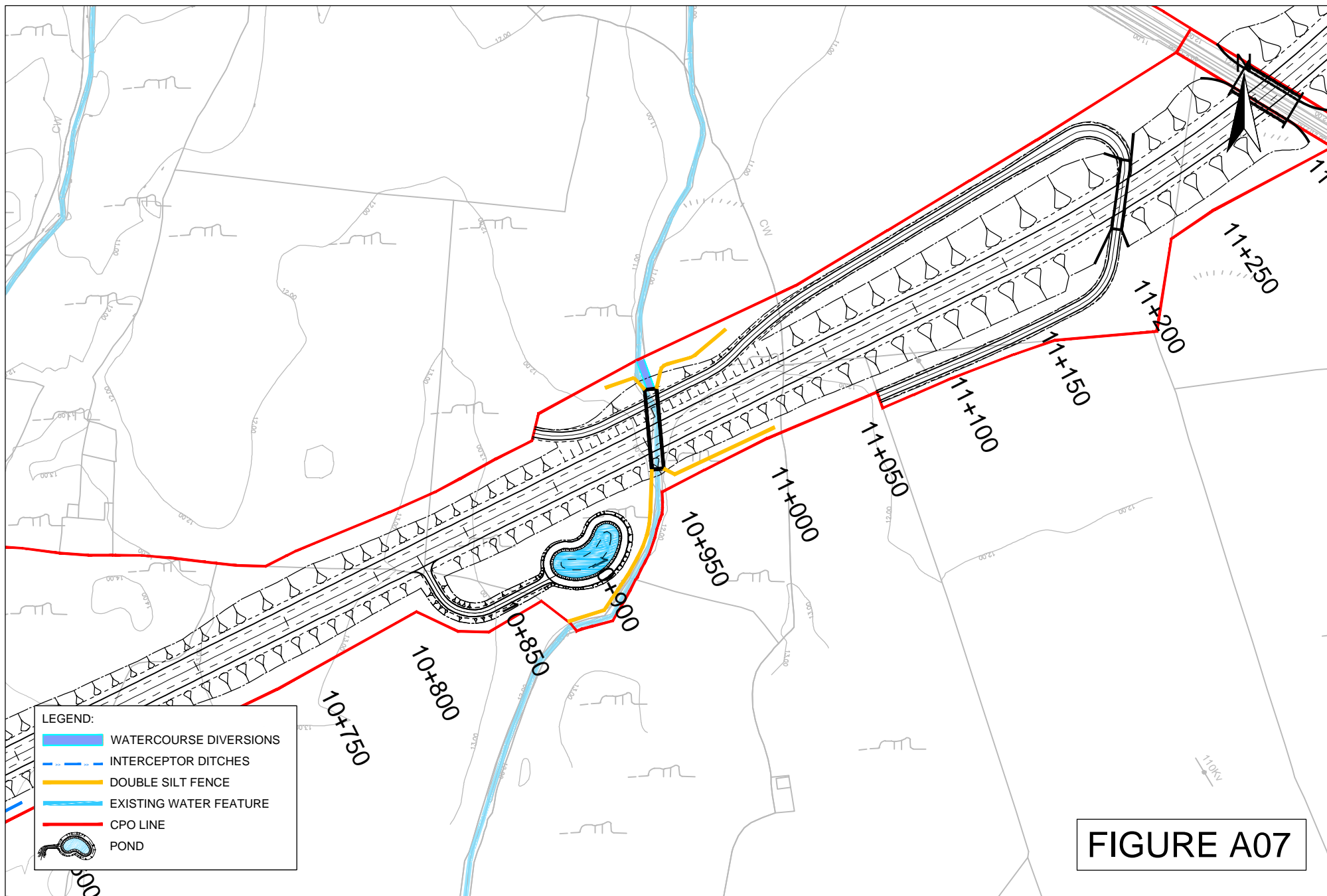
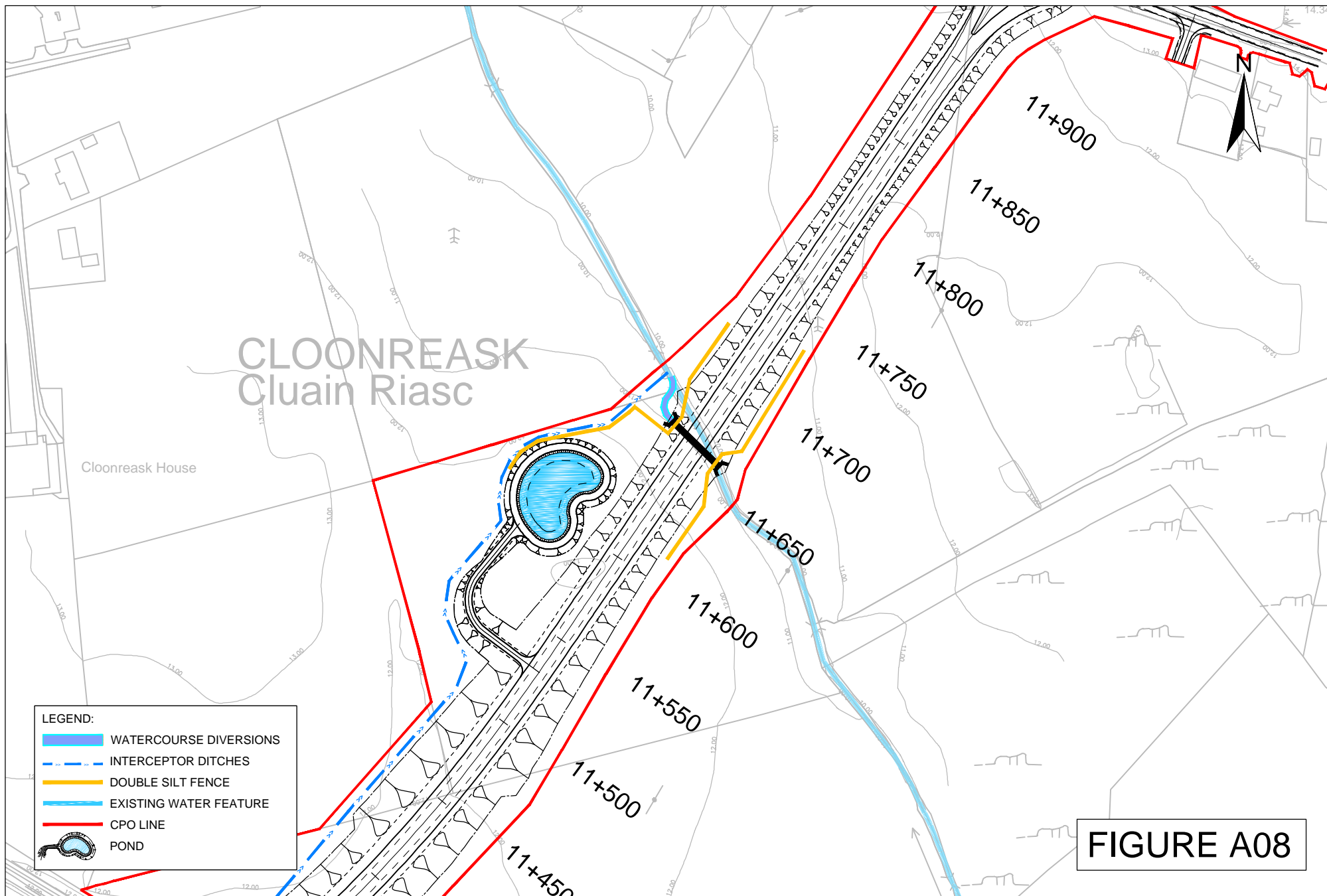
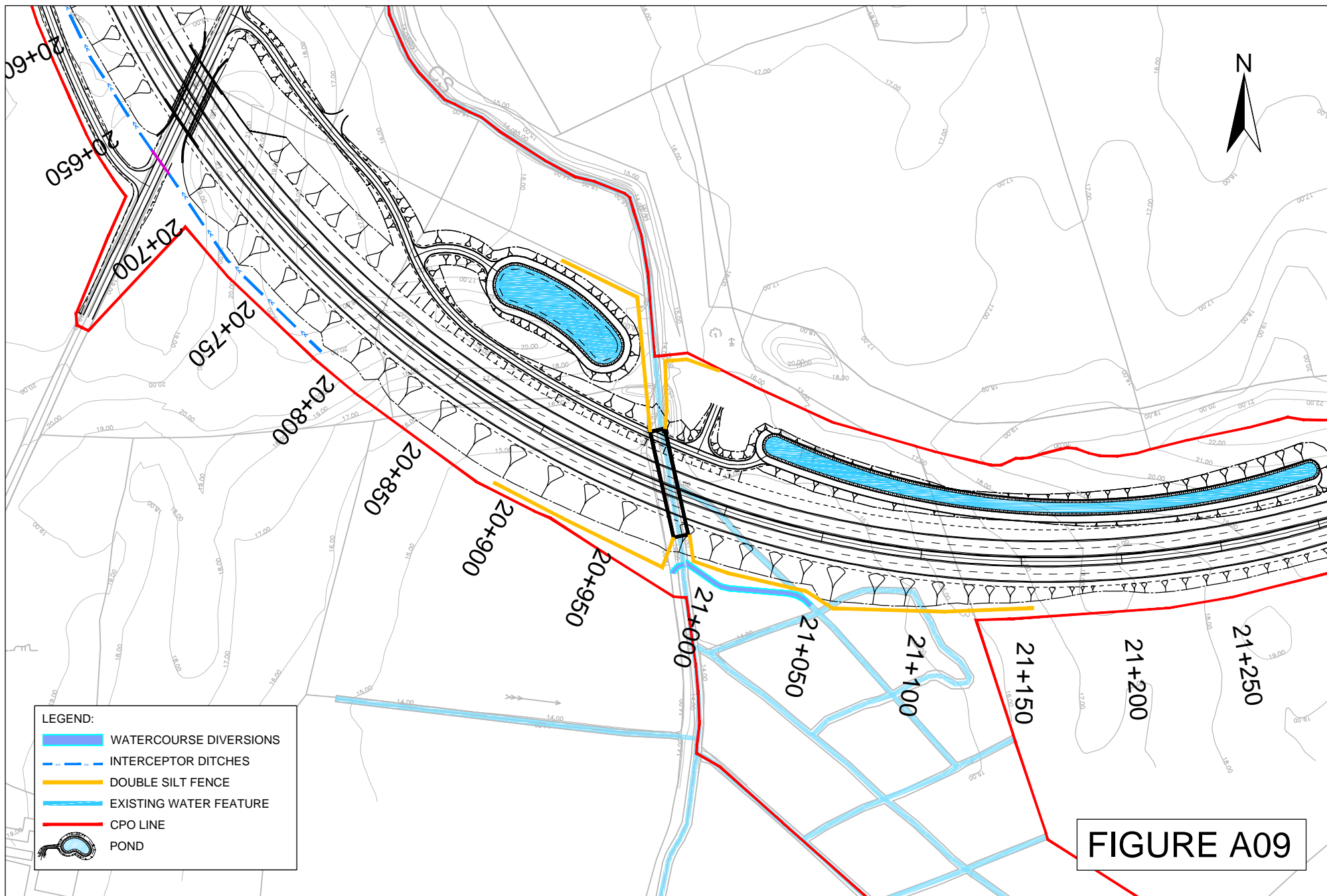
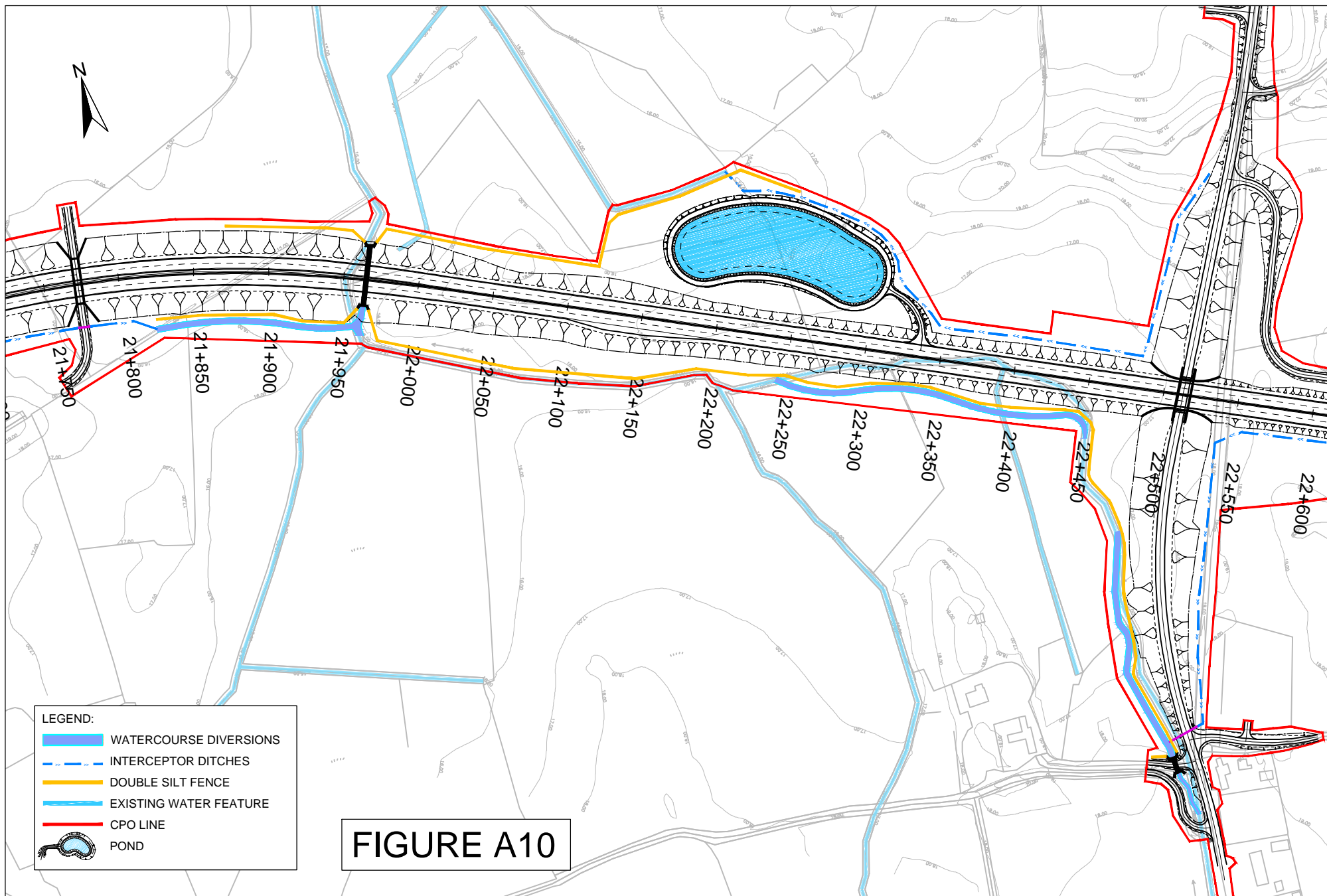


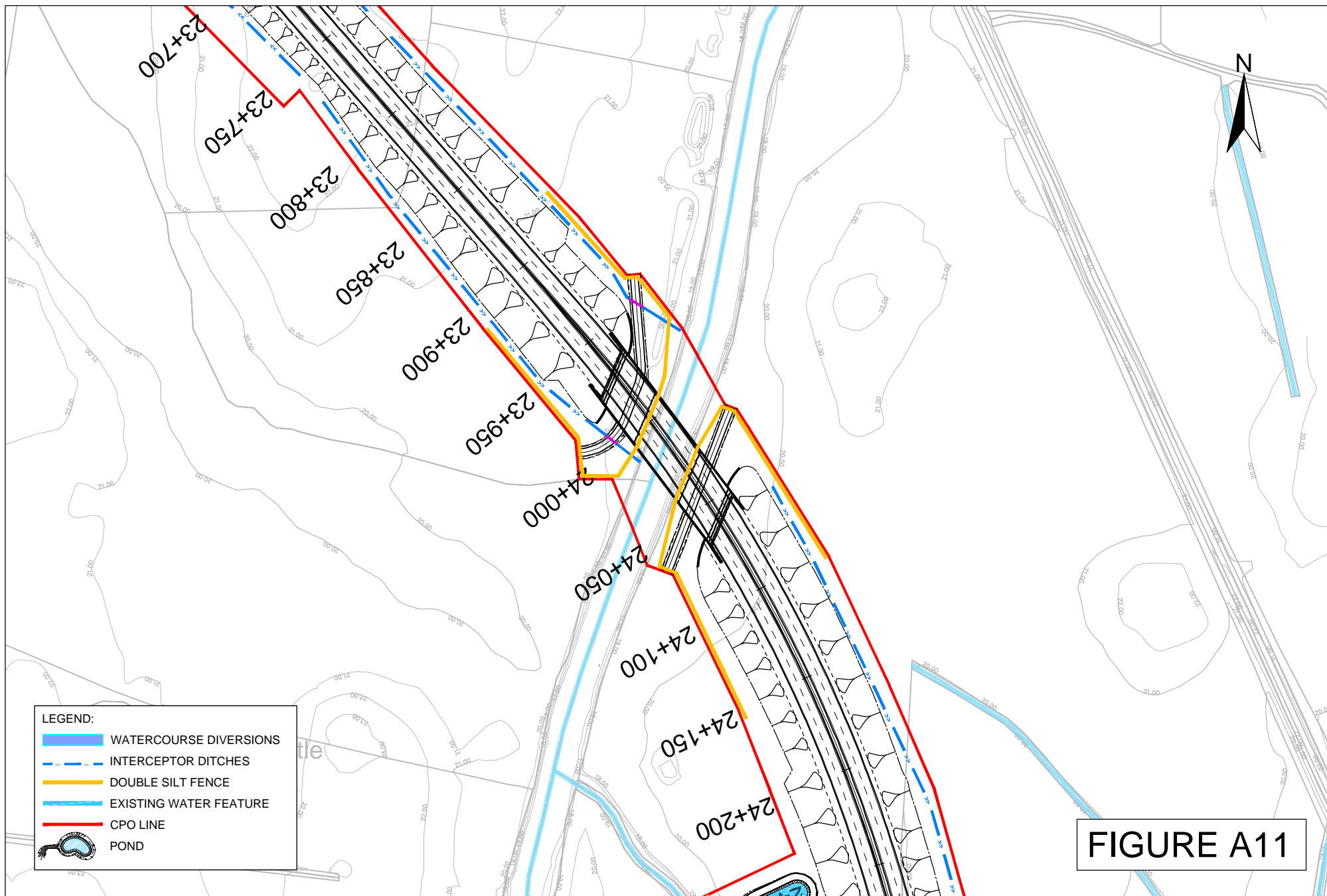
FIGURE A07











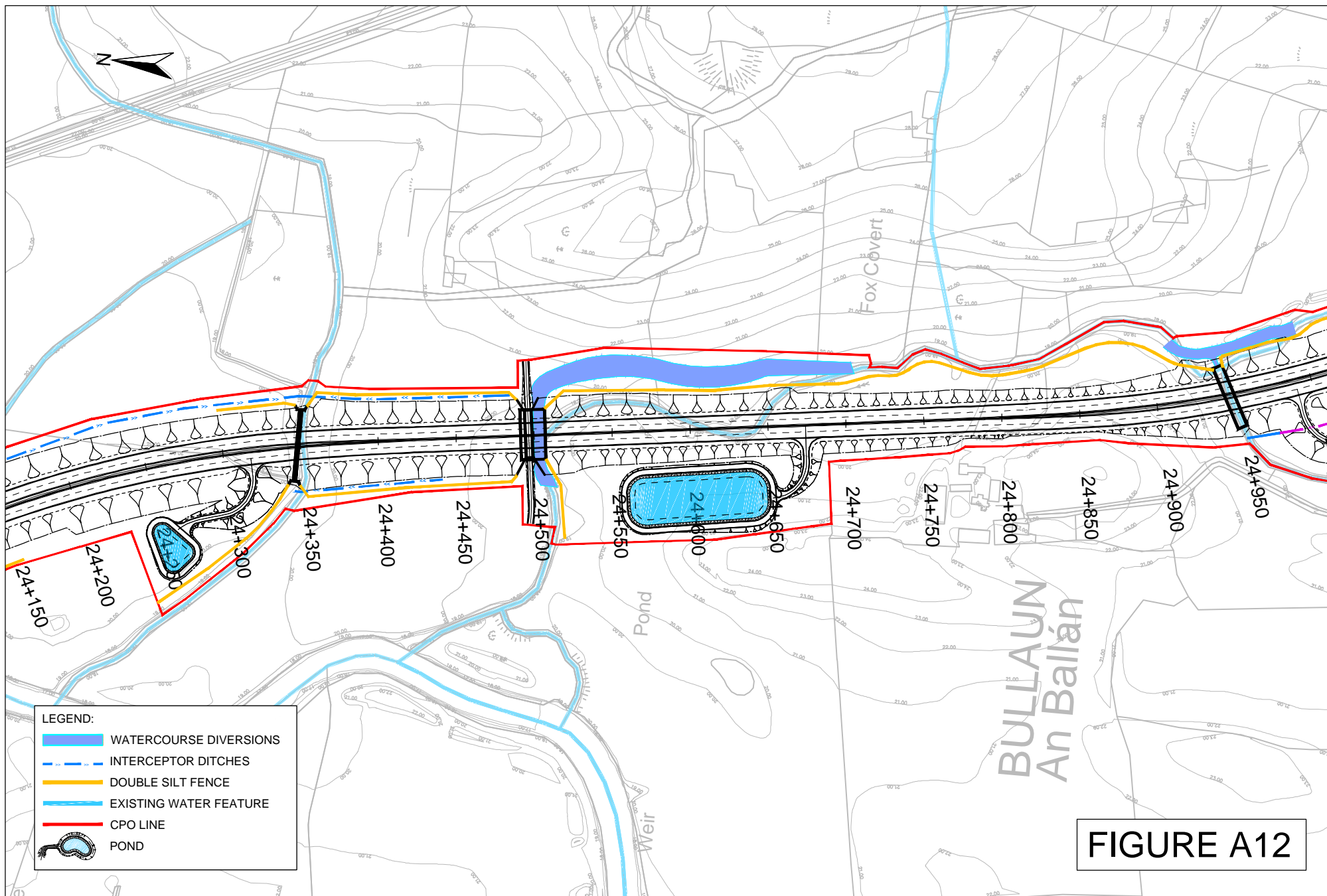


FIGURE A12

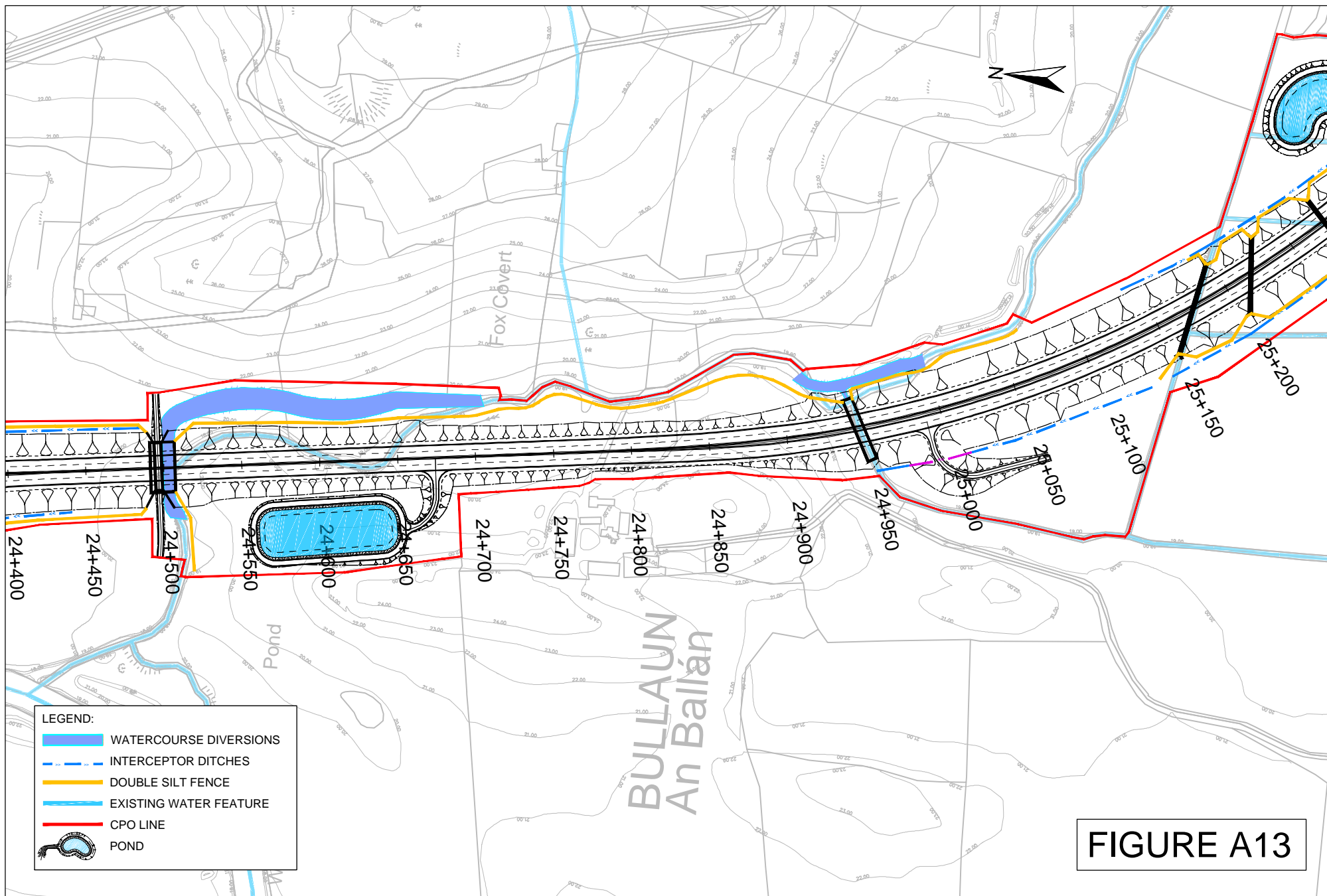


FIGURE A13

