Gas Networks Ireland

Gas to Bord na Móna, Edenderry Construction Methodology

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Introduction

This document outlines the construction techniques and methodologies which will be implemented during the construction of the proposed GNI143 Ballykilleen Pipeline, new Ballykilleen AGI and Kilwarden Offtake Installation. Gas Networks Ireland (GNI) will own the assets and will appoint a suitably qualified contractor to carry out the construction works.

The new pipeline will be installed using a combination of trenchless and open-cut methods and includes 17 no. road crossings and 32 no. watercourse crossings (river/stream/ditch/canal). This document is intended as an aid to understanding the methodologies to be employed during the construction of the GNI143 Ballykilleen Pipeline and above ground compounds.

1.1 Description of Development

Bord na Móna (BnM) are planning to convert the existing Hydrotreated Vegetable Oil (HVO) powered peaking plant, at its Edenderry Renewable Energy Complex, located just south of Edenderry, Co. Offaly, to natural gas turbines to reduce CO_2 emissions. The purpose of this project is to supply the proposed new gas-fired power station, located south of Edenderry, Co. Offaly, with natural gas.

The project development includes the following elements:

- Construction of a c. 23.65 km 300mm NB steel underground pipeline (named the GNI143 Ballykilleen Pipeline) with a maximum operating pressure of 85 barg.
- Construction of an above ground compound at the pipeline offtake location (Kilwarden Offtake Installation), comprising a hot tap, pipeline isolation valve and pigging facilities, enclosed within a 2.4m high palisade fence and a 1.2m high stook-proof fence.
- Construction of a new Above Ground Installation (AGI), Ballykilleen AGI, incorporating the following all enclosed within a 2.4m high palisade fence and 1.2m high weld mesh fence:
- A Pressure Regulating System (PRS) Kiosk which includes gas filtering, metering, and pre-heating (approx. 49m^2).
- A Packaged Boiler Unit (PBU) Kiosk, which includes gas fired boilers and a gas fired backup generator (approx. 23.4m^2).

- An E&I kiosk (approx. 15.75m^2).
- A Gas Analyser Kiosk (approx. 6.25m^2).
- Associated lighting / CCTV columns (c. 8m) and all ancillary services.
- In parallel with the pipeline installation, ancillary ducting system (2 no. 32/24mm fibre ducts) will be laid within the same trench alongside the gas pipeline to facilitate future telecommunications and fibre-optic services.

1.2 Abbreviations

Table 1: Abbreviations

Abbreviation	Definition
AGI	Above Ground Installation
FW	Fingleton White
GNI	Gas Networks Ireland
TBC	To Be Confirmed
BnM	Bord na Móna
PTTW	Pipeline To The West
NB	Nominal Bore
SAC	Special Area of Conservation
NHA	National Heritage Area
RVX	River Crossing
RDX	Road Crossing
WCX	Water Course Crossing
PRS	Pressure Regulating System
PBU	Packaged Boiler Unit
E&I	Electrical and Instrumentation

Proposed Development

The proposed Ballykilleen AGI, GNI143 Ballykilleen Pipeline, and Kilwarden Offtake Installation (tie-in point) are illustrated in Figure 1. The nearest existing gas transmission pipeline is the BGE77 pipeline, known as Pipeline to the West (PTTW), which has been selected for the new tie-in. A 300 mm NB pipeline will connect to the existing 750 mm NB BGE77 pipeline located in an agricultural field north of the R161 near Kinnegad, Co. Westmeath. This location provides roadside access for GNI personnel to the pigging facility.

From the Offtake Installation located in Kilwarden Co. Westmeath, the GNI143 Ballykilleen Pipeline routes south, cross country, through counties Meath and Offaly, and terminates at the new Ballykilleen AGI located within the Edenderry Power Station development site. The route includes several special crossings, notably the Kilwarden River, the Yellow River, M4 motorway, and the Grand Canal. A detailed breakdown of the route is provided in Sections 2.1 and 2.2.

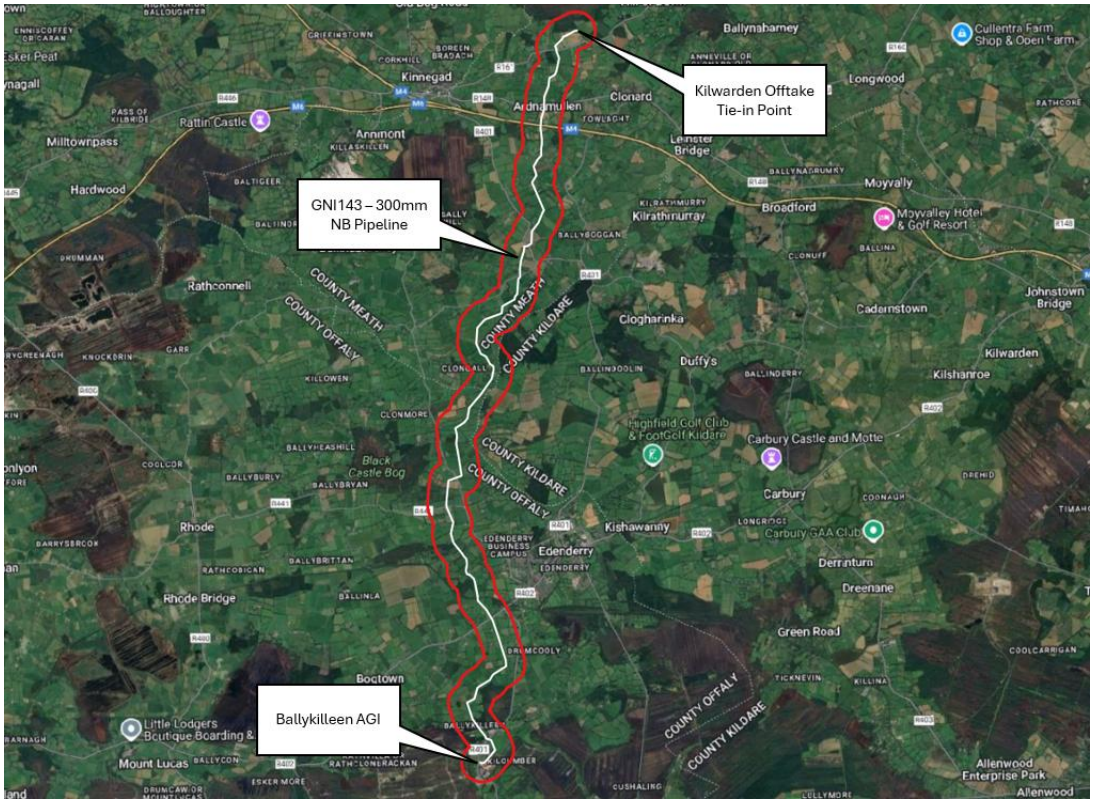


Figure 1: Gas to Bord na Móna, Edenderry Pipeline, AGI, and Tie-In Point

2.1 Tie-in Location (Kilwarden Offtake Installation)

The tie-in to the existing BGE77 pipeline shall be undertaken in an agricultural field just south of Mount Hevey Bog (SAC and NHA). The tie-in location is shown in Figure 2 and Figure 3. The depth of cover of the existing pipeline at this location is approximately 1.63 m according to as-built records. An excavation is required to facilitate the hot tap tie-in works (refer to Section 3.1).

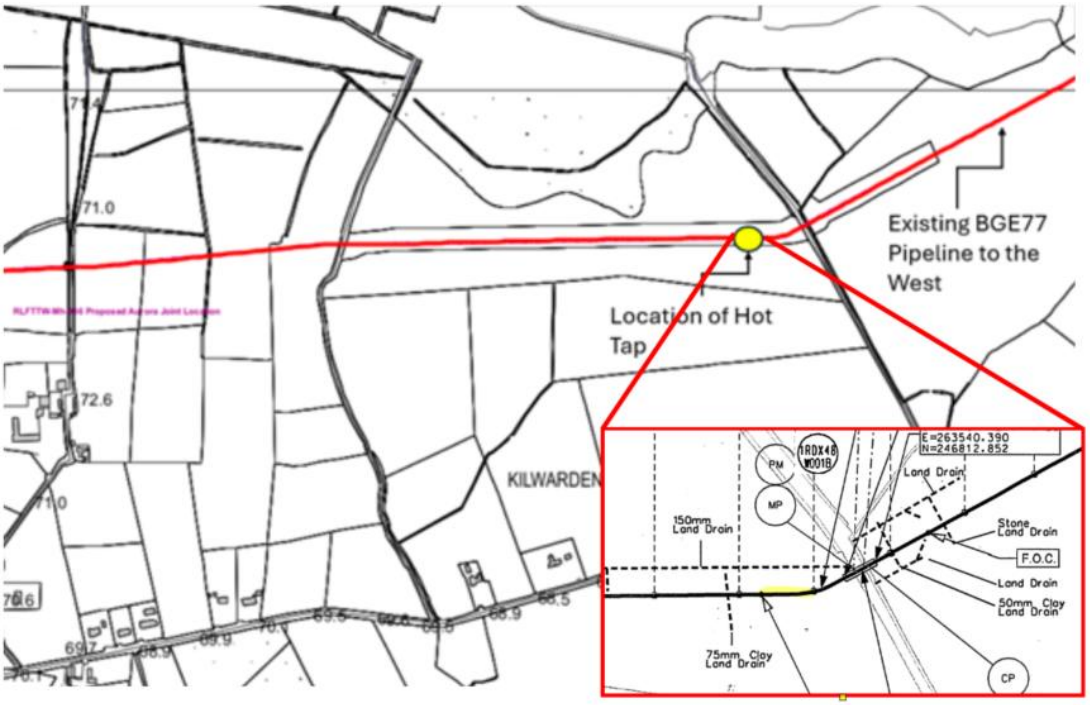


Figure 2: Tie in Location (Inset shows pipeline record here)

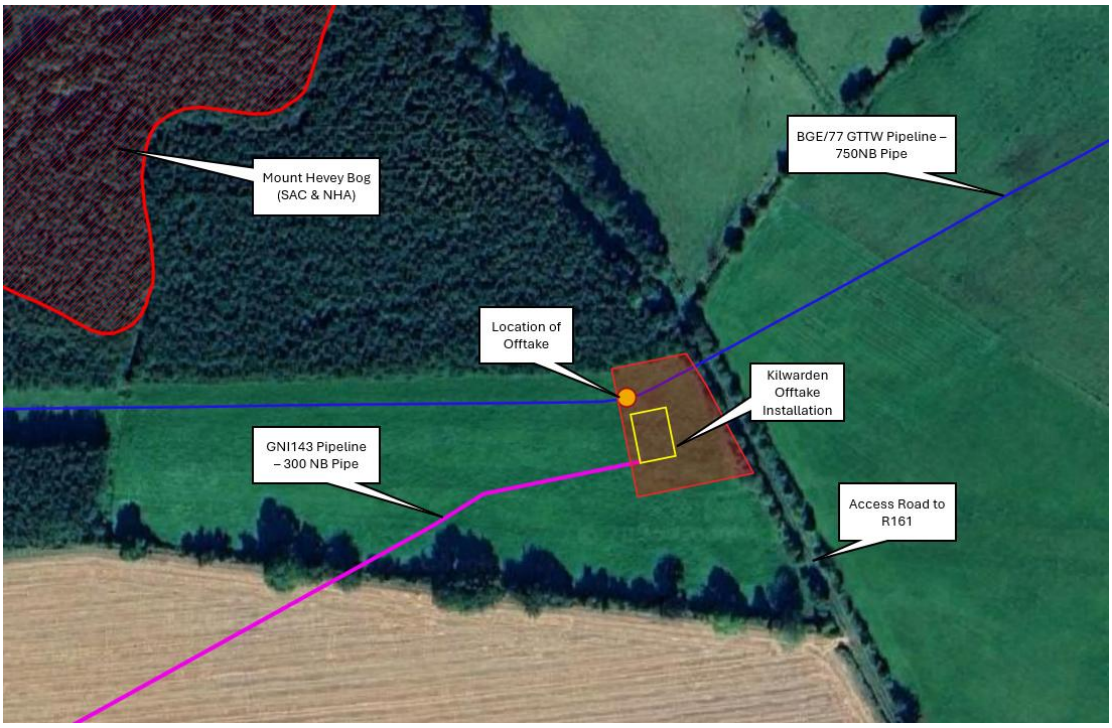


Figure 3: Kilwarden Offtake Tie in Location

Provision for a temporary pigging facility with on-site car parking shall be installed at the same location as the hot tap tie-in to accommodate future pigging and maintenance operations for the new GNI143 Ballykilleen Pipeline as shown in Figure 4. This site, Kilwarden Offtake Installation, will be a “dead” site (no electrical connection) and will consist of a below ground isolation valve in an access pit and an above ground connection for a temporary pig launcher.

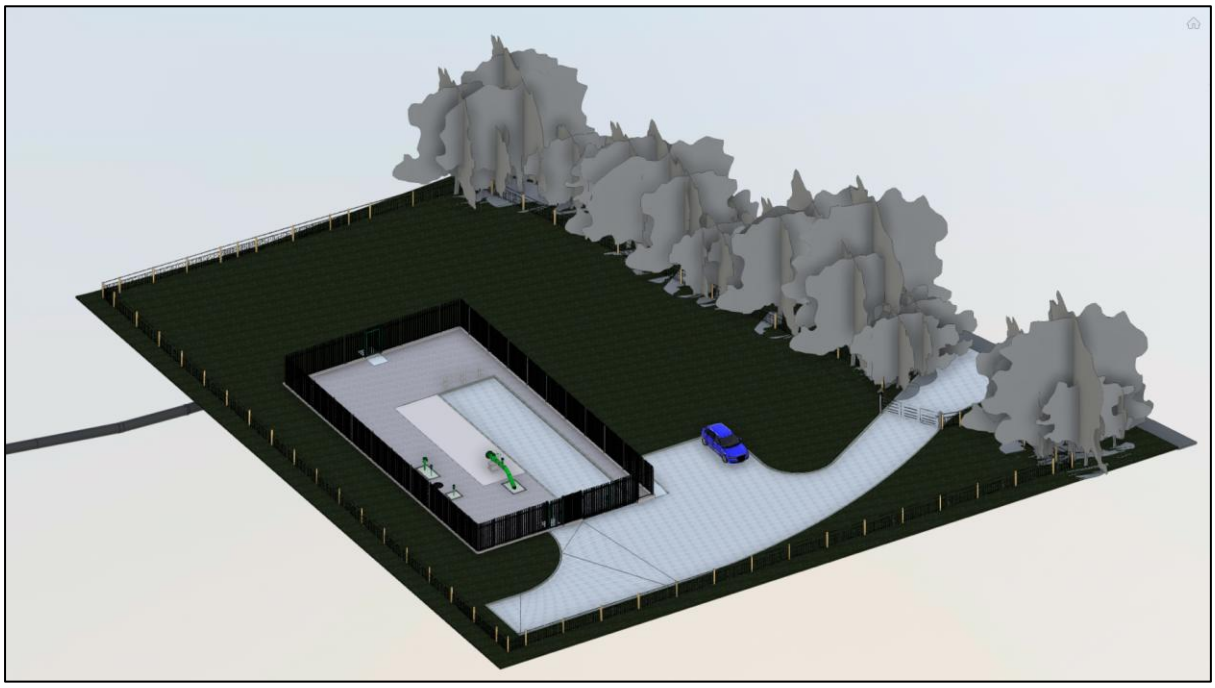


Figure 4: 3D Model of Kilwarden Offtake Installation.

The facility will be secured with a 2.4m high palisade fence and accessed via a private road connecting to the R161, as illustrated in Figure 5. This access road shall undergo minor upgrade works during the construction phase to support future operational needs of GNI. A 50mm surface layer of CL.804 will be installed during construction and repaired afterwards.

The Offtake Installation footprint (smaller compound) and beneath the new site road will be excavated down to firm bearing strata to remove a layer silt that has been recorded in the site investigations. This is anticipated to be a maximum excavation of 600mm. The required levels will then be achieved by building up from this level using imported T1 material.

Careful consideration has been given to the drainage design to prevent off-site flooding. A suitably designed soakaway pit will be installed to ensure proper water management without negatively impacting surrounding land. The soakaway is to be constructed with Wavin Aquacell Core R modular units, with one layer of geotextile to the perimeter to allow infiltration to the surrounding soil.

Figure 5: Private Road Entrance Accessing the Kilwarden Offtake Installation.

2.2 Pipeline Route

The GNI143 Ballykilleen pipeline extends in a south-westerly direction from the Kilwarden Offtake Installation towards the Ballykilleen AGI. Detailed alignment information is provided in the pipeline route maps included in the planning application pack. The proposed works primarily involve the installation of long sections of conventional pipeline, which will be laid in open-cut trenches at a nominal minimum depth of 1.2 metres, traversing multiple agricultural fields.

In addition to these open-trench sections, the pipeline will also traverse rivers, roads, watercourses, and a canal on route to the BnM facility.

Trenchless crossing techniques for pipeline construction will be required at the Kilwarden River (RVX01), the Yellow River (RVX02), the M4 Motorway (RDX04), and the Grand Canal (WCX23).

It is also anticipated that 4 no. other regional roads as detailed in Table 2 will use trenchless construction techniques, however this is to be confirmed during the construction phase by the appointed contractor who may decide to use open-cut methods.

For the remaining roads and watercourses, listed in Table 2 and Table 4, the proposed approach shall be to use open-cut crossing methods. However, it is important to note that this is only the current proposed construction methodology, and the contractor may opt for trenchless construction techniques if deemed more suitable. Trenchless installation may prove to be less intrusive and, in some cases, more efficient from a constructability perspective. The final selection for the crossing construction methodology of these specific crossings will be at the discretion of the contractor, based on site-specific conditions and assessments.

2.2.1 Road Crossings

The proposed GNI143 Pipeline intersects several private laneways, regional and local roadways, and the M4 motorway. The names of each road and the proposed construction method for traversing them are listed in Table 2.

The crossing of the M4 motorway (RDX04) shall be carried out using trenchless techniques to satisfy the TIIs requirements. All other road crossing methods are to be determined by the appointed contractor. Design anticipates some of the other road crossings will be crossed using trenchless techniques however this is to be confirmed, as noted in Table 2.

Images of each of the road crossings can be found in APPENDIX A:. A typical open-cut road crossing detail is included in the planning application drawings.

Table 2: GNI143 Pipeline Road Crossings

RDX No.	Road No.	Pipeline Chainage (m)	Approximate Crossing Span/Length (m)	Anticipated Crossing Construction Technique [1]
RDX01	R161	850	16	Open Cut
RDX02	R148	2472	65	Trenchless
RDX03	L80217	2505		Trenchless
RDX04	M4	3000	350	Trenchless
RDX05	L40181	3925	12	Open Cut
RDX06	L8022	5150	15	Open Cut
RDX07	R401	6485	24	Trenchless
RDX08	L80241	7140	16	Open Cut
RDX09	L4091	7431	20	Open Cut
RDX10	L1004	14441	13	Open Cut
RDX11	Private Lane	14679	8	Open Cut
RDX12	R441	15338	19	Trenchless
RDX13	L5007	16800	20	Open Cut
RDX14	R402	18743	26	Trenchless
RDX15	L5003	19489	9	Open Cut
RDX16	Private Lane	22090	10	Open Cut
RDX17	R401	22757	120	Trenchless

[1] RDX04 M4 Motorway shall utilise trenchless construction techniques. Other road crossing techniques shall be confirmed by the appointed contractor at construction phase.

2.2.2 River Crossings

The GNI143 Ballykilleen Pipeline route from the Kilwarden Offtake to the Bord na Móna facility requires two river crossings: the Kilwarden River (RVX01) and the Yellow River (RVX02). Due to the environmental sensitivity and the need to preserve river integrity during construction, trenchless methods will be employed at both locations. Please refer to Section 3.2.6 for details on the methods considered for crossing the rivers detailed in Table 3.

Table 3: GNI143 Ballykilleen Pipeline River Crossings

RVX No.	River	Pipeline Chainage (m)	Approximate Crossing Span/Length (m)	Anticipated Crossing Construction Technique
RVX01	Kilwarden River	1230	272	Trenchless
RVX02	Yellow River	11414	509	Trenchless

2.2.3 Watercourse Crossings

The current proposed GNI143 Ballykilleen Pipeline route crosses 30 watercourses, the majority of which will be crossed using an open cut methodology, the details of which can be found in the planning application drawings. Please refer to APPENDIX A: for images of each WCX.

A trenchless crossing shall be used for the Grand Canal crossing (WCX23). Design anticipates some of the other watercourse crossings will be crossed using trenchless techniques however this is to be confirmed by the appointed contractor, as noted in Table 4.

Table 4: GNI143 Ballykilleen Pipeline Water Course Crossings.

Water Crossing	Chainage/ ITM Coordinates	Crossing Span (m)	Anticipated Crossing Technique Technique [1]	Reference Drawing No.
WCX01	1900	3	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX02	3187	6	Trenchless	GNI143-GNI-PL-CRD-0003-01
WCX03	4893	3	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX04	6666	7	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX05	7303	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX06	7496	20	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX07	8030	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX08	8815	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX09	9278	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX10	9603	7	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX11	10036	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX12	10125	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX13	12916	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX14	13124	8	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX15	13376	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX16	14871	10	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX17	15543	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX18	16054	3	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX19	16366	7	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX20	16706	9	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX21	16882	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX22	17204	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX23	18090	192	Trenchless	GNI143-GNI-PL-CWC-0001-01
WCX24	20522	4	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX25	20679	6	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX26	21034	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX27	22459	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX28	22617	5	Open Cut	GNI143-GNI-PL-MIS-0004-01
WCX29	22753	4	Trenchless	GNI143-GNI-PL-CRD-0016-01
WCX30	23151	5	Open Cut	GNI143-GNI-PL-MIS-0004-01

1] WCX23 Grand Canal crossing shall utilise trenchless construction techniques. Other watercourse crossing techniques shall be confirmed by the appointed contractor at construction phase.

The Grand Canal crossing (WCX23) is located 5km north of the BnM facility and is the only canal crossing on the route. The location of the crossing is shown in Figure 6. A trenchless crossing shall be used at this location. Please consult drg. No. GNI143-GNI-PL-CWC-0001-01 included in the planning application.

Figure 6: Grand Canal Crossing (WCX23)

2.3 AGI Location

The GNI143 Ballykilleen Pipeline will terminate in Ballykilleen AGI which will be located within BnM's Renewable Energy Complex at Edenderry Power Station. The Ballykilleen AGI will be accessible by GNI personnel only and on-site car parking will be provided for GNI Ops. The design includes provision for a temporary pig trap, an 85 to 36.5 barg Pressure Reduction Skid (PRS) including gas filtering, metering and pre-heating, a Packaged Boiler Unit (PBU), a Gas Chromatograph kiosk and an E&I kiosk. The 3D model of the Ballykilleen AGI is shown below in Figure 7. All proposed above ground structures and buildings are shown in drawings 14303-GNI-01-PL-SLA-0001-01 as included in the planning application.

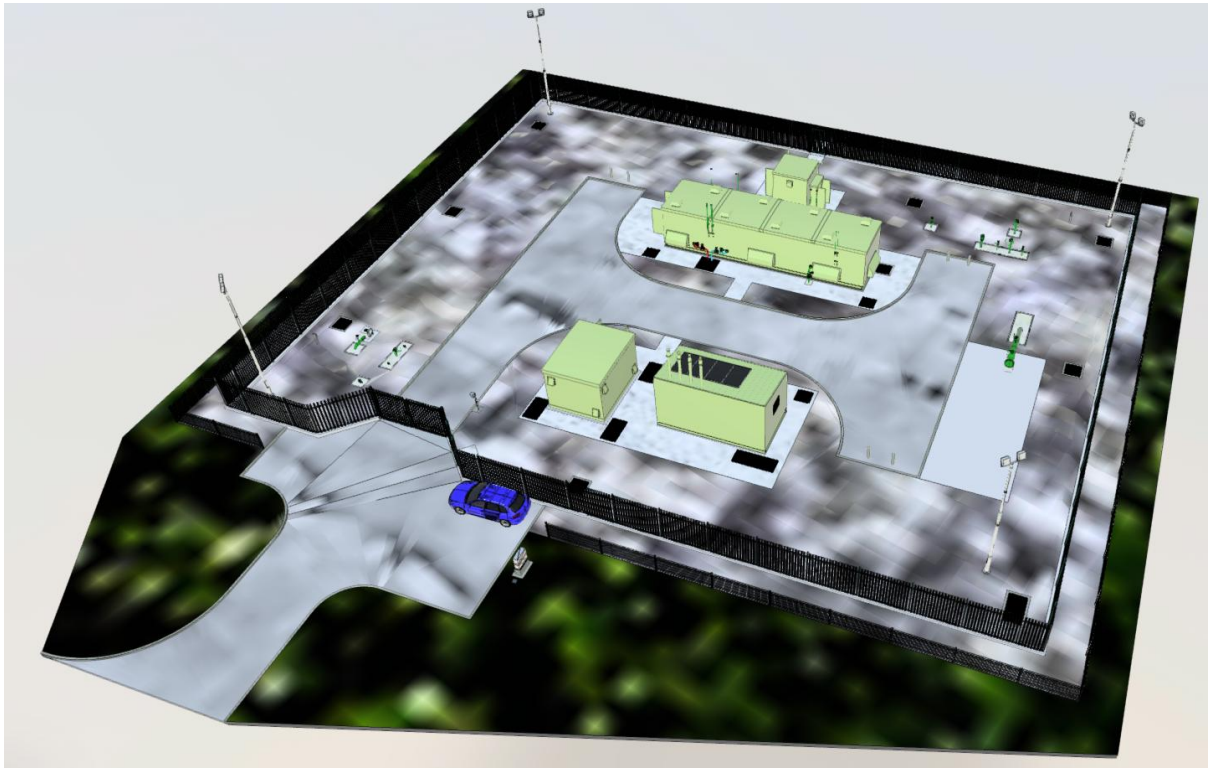


Figure 7: 3D Model of Ballykilleen AGI

2.4 Temporary Construction Compound

5 no. temporary construction compounds have been identified for the project, with their locations detailed in Table 5. All of these compounds may not be required but have been identified and assessed as options. Each compound will function as primary construction access point and will support key construction activities, including:

- HGV and Plant Entry: Controlled access for delivery of materials, equipment, heavy plant, and linepipe.
- Bulk Linepipe Storage: Designated areas for the storage of steel pipeline sections.
- Technical Facilities and Cabins: Temporary dark rooms (where required for welding inspection) and storage containers for materials and equipment.
- Security and Access Control: Temporary security fencing, controlled entry points and site signage.
- Site Offices: Accommodation for site management, engineering, supervision and administrative functions.
- Welfare Facilities: Temporary units providing toilets, showers, drying rooms, changing areas, and break facilities.

- Plant and Machinery Storage: Areas designated for the temporary storage of construction plant and equipment.
- Chemical and Fuel Storage: Secure, fully bunded storage areas with a capacity of 110% (or 25% of total volume stored whichever is greater).
- Parking: Provision for approximately 60 workers' vehicles, construction vehicles, and idle plant.
- Waste Storage: Segregated areas for construction and hazardous waste, with appropriate containment issues.

Temporary Construction Compound 02, 03 & 04 also have the capacity to store the full quantity of linepipe required for the project. All storage operations will comply with IGEM/TD/1 Supplement 1. The drawings referenced can be found in the planning application pack.

Table 5: Temporary Construction Compound Locations

Construction Compound Name	Easting	Northing	Reference Drawing
Temporary Construction Compound 1	53.464915	-7.045484	GNI143-GNI-PL-TCC-0001-01
Temporary Construction Compound 2	53.446186	-7.054215	GNI143-GNI-PL-TCC-0002-01
Temporary Construction Compound 3	53.345428	-7.069357	GNI143-GNI-PL-TCC-0003-01
Temporary Construction Compound 4	53.292128	-7.146862	GNI143-GNI-PL-TCC-0004-01
Temporary Construction Compound 5	53.292840	-7.086618	GNI143-GNI-PL-TCC-0005-01

Construction Methodology

3.1 Hot Tap Construction

3.1.1 Site Establishment

A perimeter fence will be erected around the temporary construction compound as indicated in Figure 8 and included in the planning application drawings. Temporary car parking, site offices and other facilities will be established to support the early works which will primarily consist of earth moving. Adequate space will be allocated to facilitate crane or HIAB access for the offloading of the hot tap tee, valves, pipework/fittings, site offices and welfare facilities.

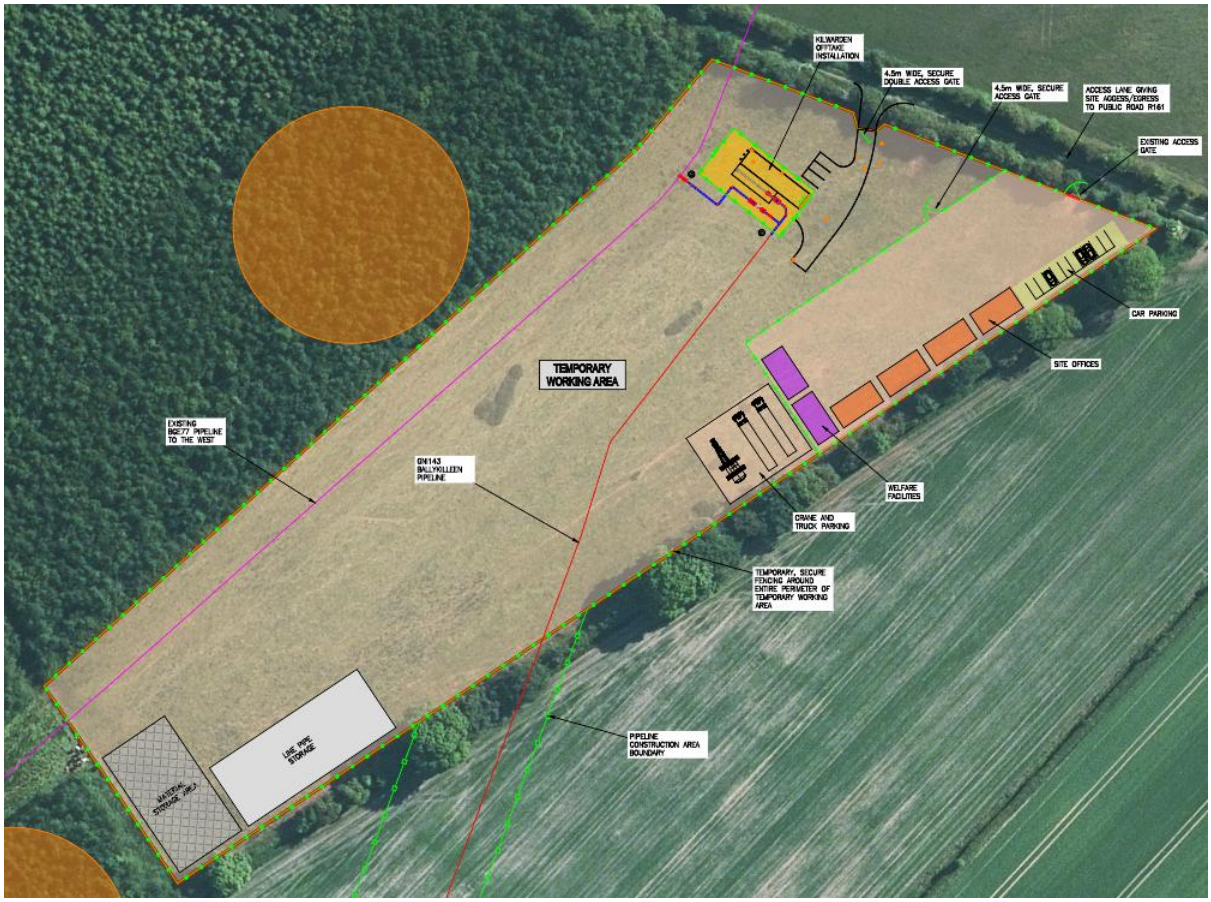


Figure 8: Kilwarden Offtake Installation Construction Compound (refer to drg. no. GNI143-GNI-PL-TCC-0001-01).

The topsoil of the site will be cleared to a typical depth of 300 mm. The topsoil will be stored separately to the subsoil for future reinstatement. Topsoil will be kept free from disturbance for the duration of construction to reduce risk of physical damage and compaction. All excavated material will be reused onsite, and no import of soil is expected. Excess excavated material will be stockpiled for use as engineering fill, landscaping and other uses throughout the site.

A single laydown area will be established during the earthworks and site preparation phase which will be used by the main follow-on contractors to accommodate temporary construction facilities such as site offices, parking, storage of construction materials and temporary sheds/workshops. Laydown will be constructed of excess cut material, and a layer of stone will be placed over a layer of geotextile membrane as required. The laydown area will be suitably drained and any areas which will involve the storage of fuel and refuelling will have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems. During the removal of the topsoil and placement of the stone for the laydown area precautions will be taken to minimise run-off into ditches and drains.

3.1.2 Battered Excavations

To ensure excavation stability for the hot tap installation, a battered excavation method is anticipated to be used. This technique involves grading the excavation walls at an angle rather than maintaining vertical faces, thereby reducing the risk of wall collapse, particularly in loose or unstable soil conditions. Battered excavations are typically suitable where sufficient working space is available around the hot tap, where excavation depths are relatively shallow, and where ground conditions are dry with a low water table. The method of excavation is also installed for ease of access/egress to the pit. The sloped walls reduce the need for temporary access structures to gain access, allowing for gradual entry and exit from the excavation pit.

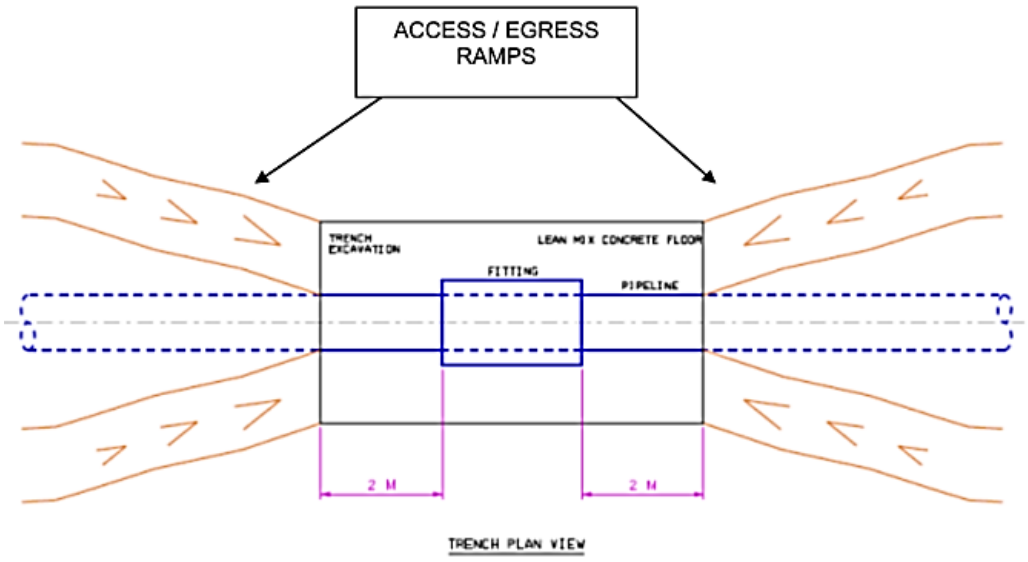


Figure 9: Excavation Details taken from AD/SP/004

All excavation activities shall comply with the current GNI standards and statutory regulations regarding minimum dimensional requirements, as outlined in Appendix E of document AD/SP/004. The specific batter angle will be determined by the contractor based on site-specific geotechnical conditions and the required depth of excavation. An illustrative example of a Hot Tap installation employing this method is provided in Figure 10.

Figure 10: Hot Tap Tee Battered Excavation

3.1.3 Sheet Piling

In the event that a battered excavation is deemed unsuitable due to site constraints sheet piling may be considered as an alternative option to support the excavation for the hot tap installation, however this must be agreed with GNI prior to conducting works. Sheet piling is generally preferred in deeper pits with limited space and poor soil stability. It is expected that the trench will be c. 10m x 5m. With an approximate depth of 3.4m. Sheet piling an area of this size is estimated to take between two to five days. This timeframe includes the installation of sheet piles as per the following high-level sequence:

- Use of a vibration pile driver to ensure reduced noise pollution. See Figure 11 below of a commonly used brand known as MOVAX.
- Excavation to the trench formation level upon the completion of the sheet piling.
- Provision for safe access for operators and mitigation of groundwater issues if required.

A tracked 16 - 32 tonne excavator would be best suited to this work. While a smaller excavator may be preferred for its manoeuvrability in the relatively small area, the length of the pile will ultimately define this. A smaller excavator would also reduce the noise pollution when tracking.

Figure 11: MOVAX Side Grip Pile Driver

The duration of the sheet piling works is subject to variables such as ground type, accessibility, and construction staff experience. While the projected timeline ranges from two to five days, favourable conditions could lead to completion within two days. A Hot Tap installation utilising this excavation technique is illustrated in Figure 12.

Figure 12: Hot Tap Tee Excavation Supported by Sheet Piles

3.1.4 Civil Works

A temporary concrete working platform will be constructed to facilitate welding operations within the hot tap excavation. A 100 mm thick layer of lean mix concrete shall be used to seal the floor of the excavation as per AD/SP/004. This platform will provide a stable, level surface for site personnel and ensure sufficient clearance beneath the pipeline, typically between 500–600mm, to allow welders to work safely and effectively in a supine position. Upon completion of drilling and welding works, the concrete slab will be broken out from site. The new installed carrier pipe shall be adequately supported with mechanical jack type supports, or other adjustable supports, suitable for the pipe to compensate for superimposed loads during drilling operations as per */PM/P24 and AD/SP/004.

Concrete pipe supports will also be installed beneath the existing pipeline either side of the proposed hot tap tie in point to prevent overstressing the existing pipe. The supports will be

as per GNI standard detail BGE/ST/2006 and will be installed in advance of the hot tap works. These supports will provide bracing and support to minimise vibration or impact on the line during drilling and welding.

A concrete plinth will also be constructed for the baseplate of the hot tap valve. This will eliminate turning moment stresses from the hot tap connection due to ground settlement afterwards.

Enhanced security measures will be implemented when the existing PTTW pipeline is exposed and will be confirmed in consultation with the on-site IPEC inspector. These measures may include temporary backfilling of exposed pipe sections or the deployment of 24-hour on-site security personnel, depending on the assessed risk and site-specific requirements.

Following the installation and backfilling of the hot tap tee and associated pipework, the site will be brought up to the agreed formation level. A 2.4 m high palisade security fence will be erected around the compound boundary, including all associated access and emergency gates. A 1.2 m high stock proof fence will be installed outside the compound to the filed entrance location. Please refer to drg. no. 14301-GNI-01-PL-SLA-0001-01 as included in the planning application drawings.

Concrete will be poured and levelled for the civil support base of the temporary pig trap, the concrete roadway and car parking spaces within the site as shown in Figure 13. Site drainage will also be installed. It is expected that the site drainage shall discharge into a soakaway located outside of the Offtake Installation Compound boundary as shown on drg. no. 14301-GNI-01-PL-SLA-0001-01.

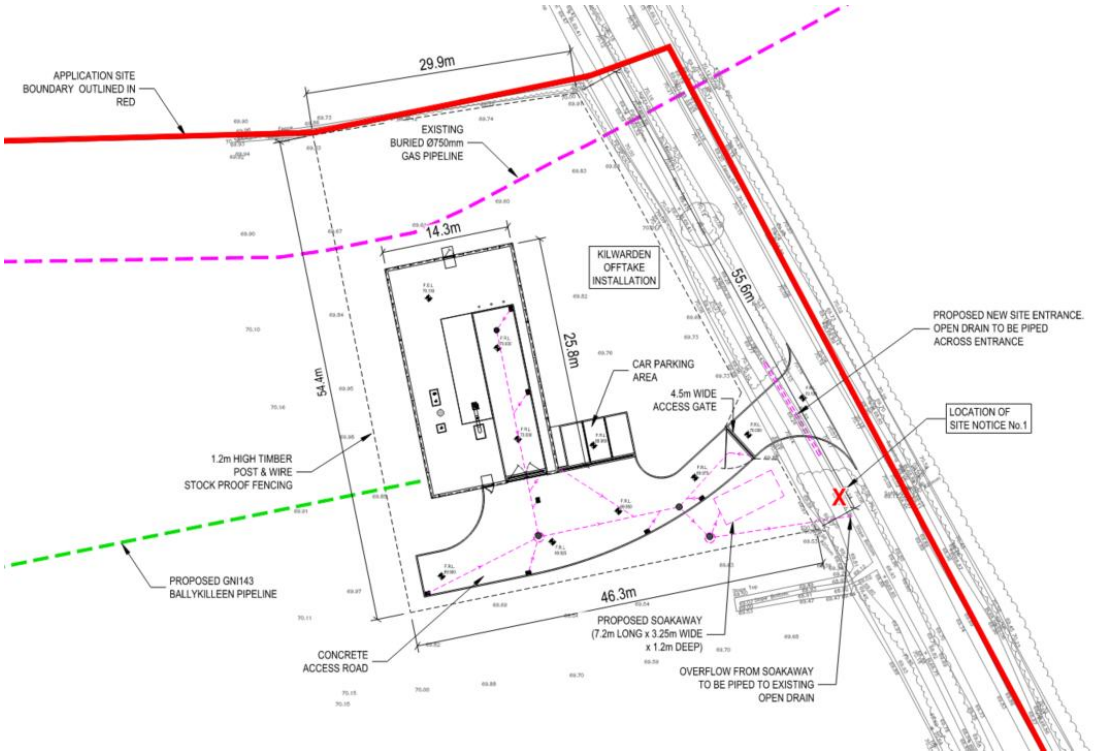


Figure 13: 14301-GNI-01-PL-SLA-0001-01 Site Layout of the Kilwarden Offtake Installation.

Site Investigations (SI) have been conducted at the Offtake location. The findings from the investigations have directly informed the civil design of the compound. Subsurface conditions were found to be predominantly wet and peaty. To mitigate these conditions and ensure effective site drainage, the civil design incorporates the following measures:

- A 7.2 m × 3.25 m × 1.6 m soakaway pit will be constructed in the southeastern corner of the compound to facilitate infiltration and manage surface water runoff.
- Excavations beneath the pigging compound, concrete access road, and car parking spaces will be carried out to a maximum depth of 600 mm or to firm bearing strata, whichever is shallower. At excavation depth, a geomembrane layer will be installed to prevent water ingress, followed by placement of T1 material fill to achieve the proposed finish levels and provide a stable, free-draining base.
- The compound will be constructed at an increased elevation relative to the surrounding field to promote positive drainage and prevent surface water accumulation.

The compound area within the 2.4 m high palisade security fence will be finished with a layer of stone chip. For further details on the landscaping and surface finish strategy, refer to Drawing No. 14301-GNI-01-PL-LA-0001-01.

3.1.5 Mechanical Works

Hot tapping is a technique used to create a connection to an existing pressurised pipeline without the need to shut down or decommission the system. The process involves welding a fitting onto the live (hot) pipeline, followed by cutting through the pipe wall (tap) using a hot-tapping machine. Please refer to drg. no. 14301-GNI-01-PL-SLA-0001-01 for further details of the Kilwarden Offtake Installation compound.

All welded fittings shall be installed onto the pipeline in accordance with AD/SP/004 and supervised by a welding inspector. The integrity of the completed fitting shall be proved by a 4-hour pneumatic pressure test. The pressure shall be 1.2 times the actual pipeline pressure prevailing. Soap tests shall be carried out on all welds on a regular basis throughout test period (minimum 30-minute intervals) to confirm welds are leak free. Where the fitting is installed in the horizontal orientation, consideration should be given to the use of a centralising boss.

The welding team will consist of two to four qualified welders, supported by two certified welding inspectors present in the pit to complete the welding works at any given time.

Weather protection canopies shall be of flame-retardant material and shall be of adequate size to provide unhindered access for the heating, welding and inspection operations. A minimum height of 2 m above the pipe, 2 m either side of the weld location and 2 m out from the side of the pipe is recommended.

All high-pressure welds shall be subject to 100% non-destructive testing as per AD/SP/002 Clause 8.3.

All above ground pipework shall be painted in accordance with AD/SP/009 while all below ground pipework shall be coated in accordance with AD/SP/008.

Where a pipe is in contact with a mechanical jack or ring type support, the pipe will be coated in MCL (Refer to AD/SP/008), at 100 mm either side of the contact area. The supports will have min 1.6 mm thick neoprene, grade C70 to BS 2752 at the contact point as per BGE/ST/1003

Any damage to existing coating during the works shall be repaired to the same specifications.

Following installation, coating and surveying, the new pipework will be backfilled. CL503 will be transported to the excavation and placed around all pipework and valves during the backfilling process.

3.2 Pipeline Construction

3.2.1 Access Points

Construction personnel will access the pipeline working spread at designated access locations along the route. These access locations will comprise Temporary Construction Compounds (as discussed in Section 2.4), Working Width Entry Points (WWEPs) and standard road crossings, each serving a specific function within the construction methodology. Please refer to drg no. GNI143-GNI-PL-MIS-0001-01 which outlines the locations of the access points along the pipeline route.

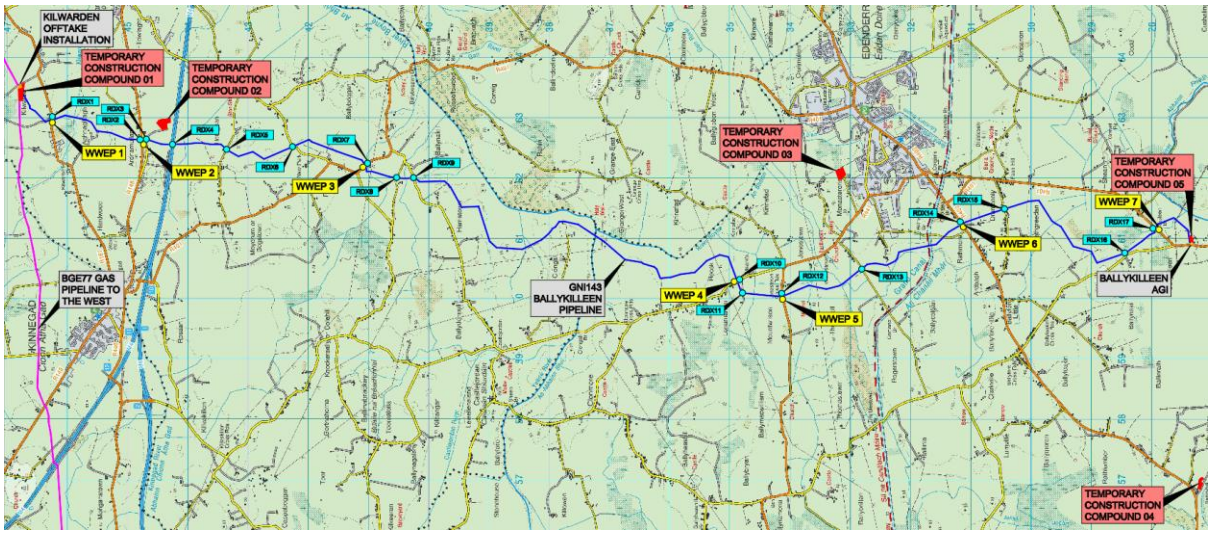


Figure 14: WWEP locations outlined on drg. GNI143-GNI-PL-MIS-0001

Laydown areas will be established at each road crossing to support construction activities and facilitate the crossing. Two types of laydown areas are being proposed, **Type A** and **Type B**. The laydown area type proposed in each location is depending on whether it has been identified as a WWEP or a standard road crossing.

3.2.1.1 Laydown Area Type A

A Laydown area Type A will be established at the Working Width Entry Points (WWEPs). These will act as the principal points of access to the pipeline working width for plant, equipment, and construction vehicles. These will facilitate the movement of heavy plant, delivery vehicles including line pipe deliveries), and construction traffic associated with the main pipeline spread. Temporary access gates will be installed at these locations, typically on both sides of the crossing where required, with the selected entry point determined by the location and progression of active works.

As shown in Figure 14, seven WWEP have been identified along the pipe road at the following road crossings: RDX1, RDX2 & 3 (Combined), RDX7, RDX10, RDX12, RDX14 and RDX17. An example of a WWEP with its associated temporary laydown areas can be seen in Figure 15.

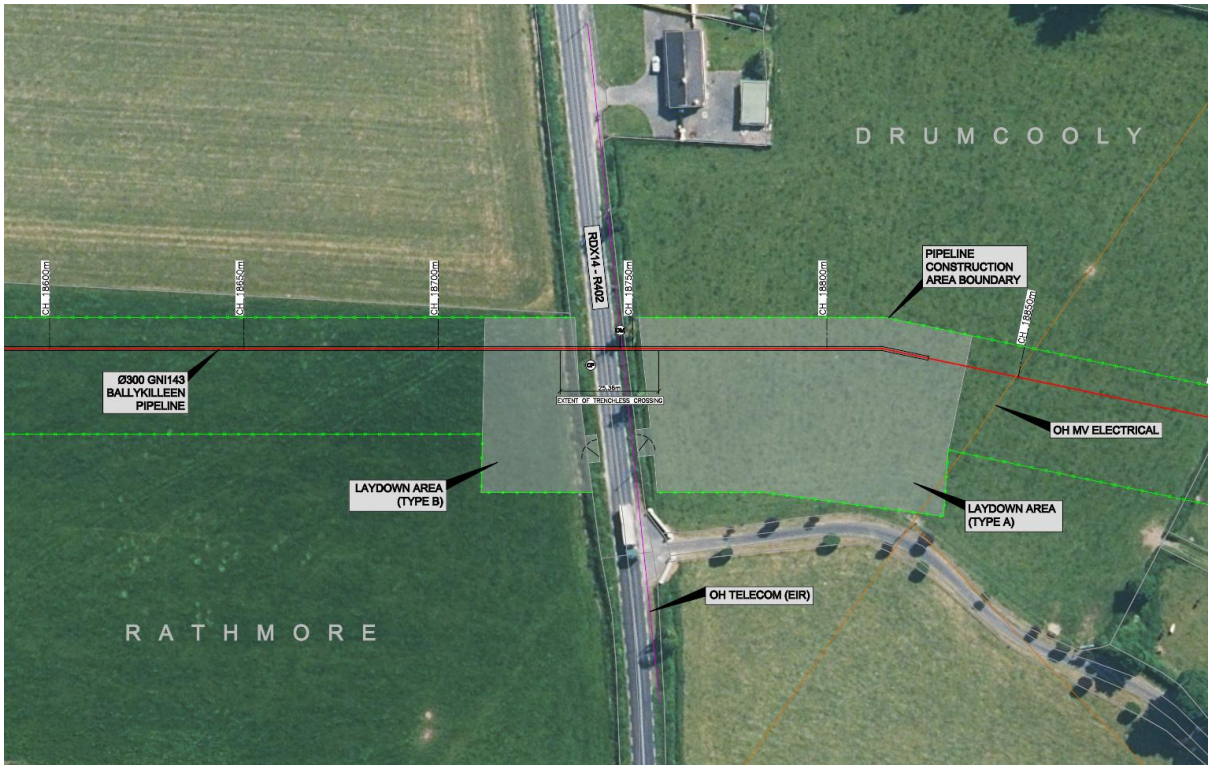


Figure 15: RDX14 with Temporary Laydown Area outlined (refer to drg. no. GNI143-GNI-PL-CRD-0013-01).

Laydown Area Type A Activities:

- HGV and plant entry point: Access for construction traffic, including linepipe deliveries.

- Security and access control: Temporary fencing, controlled entry points, and signage.
- Site offices: Temporary offices for site supervision and coordination where required.
- Technical facilities and Cabins: Temporary dark rooms (where required for welding and inspection), material and equipment storage containers.
- Welfare facilities: Temporary welfare units including toilets, showers, drying rooms, changing facilities, and break areas.
- Plant and machinery storage: Designated areas for temporary storage of construction plant and equipment.
- Materials storage and staging: Temporary storage of construction materials including pipeline sections, aggregates, sheet piling, steel, cement, and ancillary materials.
- Chemical and fuel storage: Any fuels, oils, or chemicals stored will be contained within designated, secure, fully bunded areas with a minimum capacity of 110% (or 25% of total volume stored, whichever is greater).
- Parking: Parking provision for up to approximately 60 workers' vehicles, construction vehicles, and plant not in use.
- Waste storage: Segregated waste storage areas for construction and hazardous wastes, where applicable, with appropriate containment measures.

Laydown Area Type A Establishment works:

- The topsoil in these areas will be stripped to a typical depth of 300 mm and stored separately from the subsoil for future reinstatement.
- A stone chipping may be used within the laydown area;
- Temporary access gates will be installed at these locations, typically on both sides of the crossing where required, with the selected entry point determined by the location and progression of active works;
- Temporary culverting where roadside drainage is present;
- Temporary security fencing and gates
- Where practicable, compounds will utilise existing entrances or access points to avoid the creation of new access roads and minimise disturbance to existing infrastructure.
- Traffic management, sightlines, and visibility measures.
- Typical size of these areas: 75m x 45m.

3.2.1.2 Laydown Area Type B

These are secondary construction access points. These will primarily facilitate the crossing of construction vehicles and plant from one side of the road to the other in order to maintain continuity of the pipeline working spread. They will be established within the working width on both sides of each road crossing. These laydown areas will generally be smaller in scale than those provided at Type A and will typically support limited car parking and short-term material staging. An example of such a road crossing temporary laydown area is shown in Figure 16.

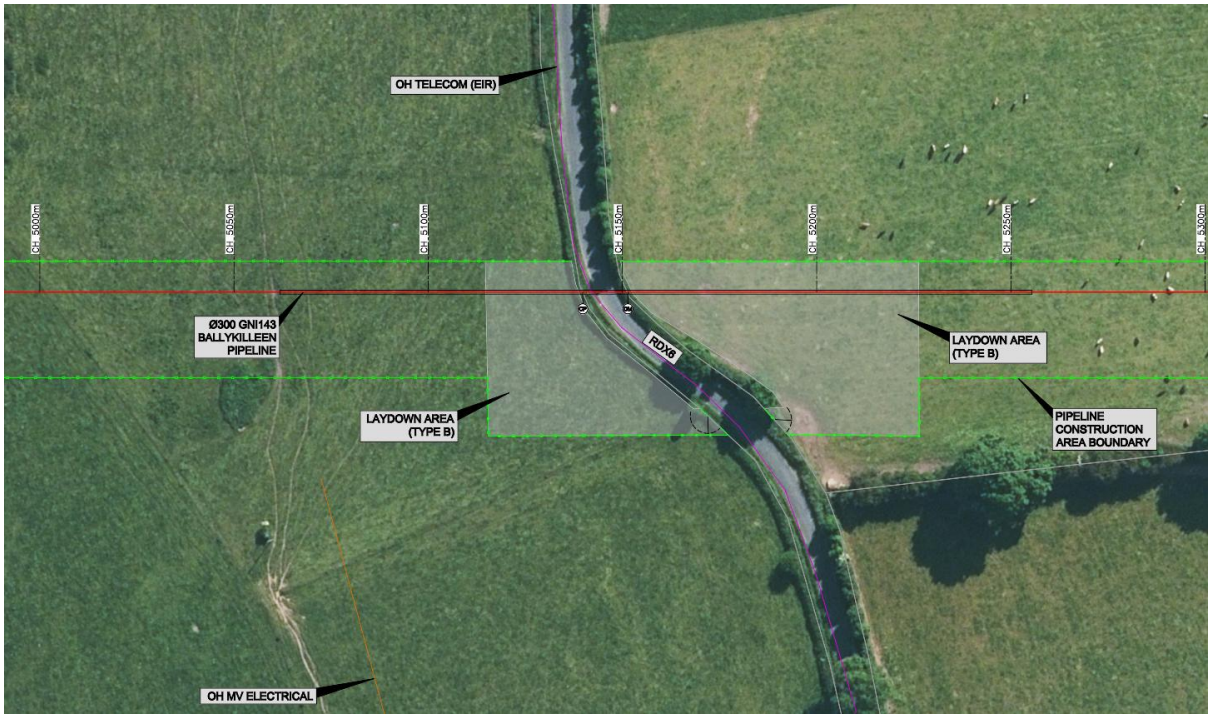


Figure 16: RDX06 Temporary Laydown Area (Refer to drg. no. GNI143-GNI-PL-CRD-0005-01).

Laydown Area Type B Activities:

- Light vehicle entry point: Access primarily for light vehicles and construction plant.
- Security and access control: Temporary fencing and controlled access points.
- Limited site facilities: Single storey temporary offices, temporary welfare facilities where required.
- Plant and machinery holding: Short-term holding of plant and equipment.

- Materials storage and staging: Temporary storage and staging of pipe, fittings, and small quantities of construction materials.
- Parking: Parking for up to approximately 10 workers' vehicles and limited construction plant.

Laydown Area Type B Establishment:

- The topsoil in these areas will be stripped to a typical depth of 300 mm and stored separately from the subsoil for future reinstatement.
- A stone chipping may be used within the laydown area;
- Temporary access gates will be installed at these locations, typically on both sides of the crossing where required, with the selected entry point determined by the location and progression of active works;
- Temporary culverting where roadside drainage is present;
- Temporary security fencing and gates; and
- Where practicable, compounds will utilise existing entrances or access points to avoid the creation of new access roads and minimise disturbance to existing infrastructure.
- Traffic management, sightlines, and visibility measures.
- On completion of construction works, these areas will be reinstated to their original condition, with topsoil replaced and land restored accordingly.
- Typical size of these areas 45m x 30m.

3.2.2 Site Specific Access Requirements

Exceptions are noted at the M4 crossing (RDX04), the Grand Canal Crossing (WCX23) and the Yellow River crossing (RVX02). To access the work area located on the opposite side of the motorway, construction personnel must utilize the private agricultural access roads running parallel to the M4 and cross via bridge EL-M04-006.00 as shown in Figure 17 and Figure 18. No access will be required from the motorway.

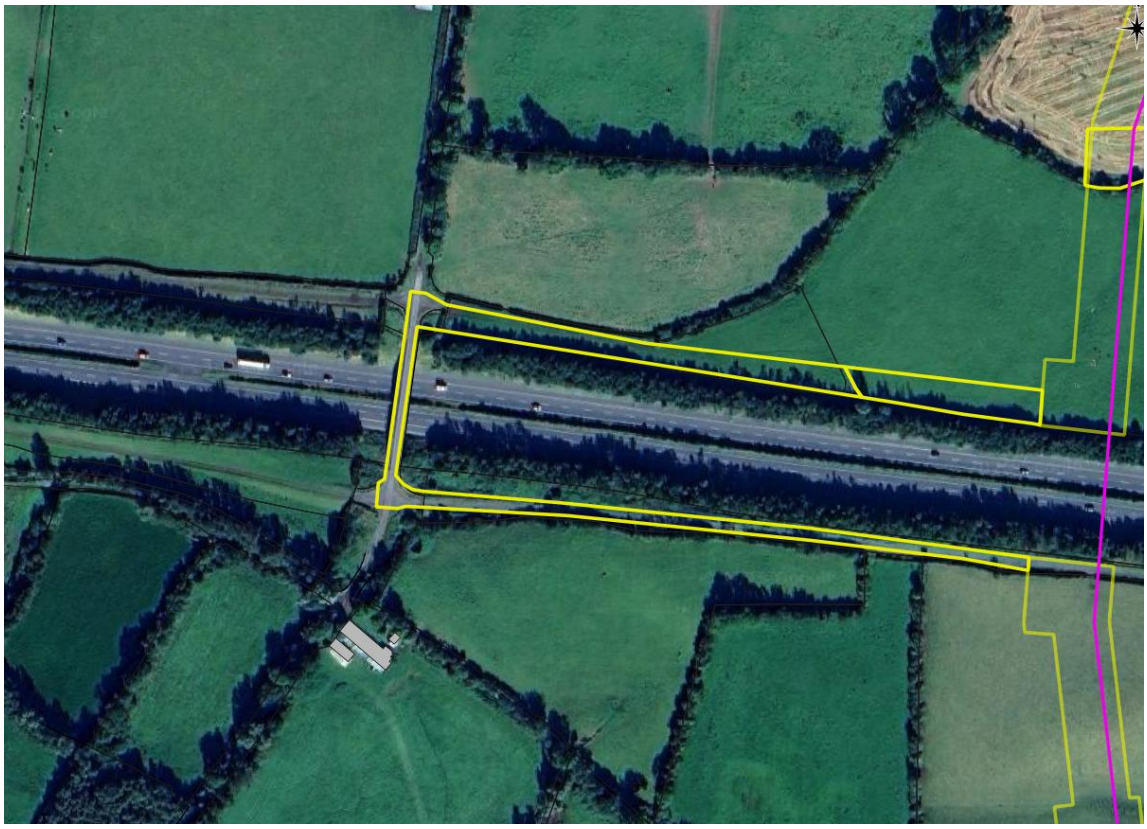


Figure 17: Access Road Across the M4

Figure 18: Motorway Bridge EL-M04-006.00.

The working spread will be interrupted at the Grand Canal (WCX23) and at the Yellow River (RVX02). Access to the northern section of WCX23 will be provided via RDX13, while the southern section will be accessed via RDX14. Access to the northern section of RVX02 will be provided via RDX09, while the southern section will be accessed via RDX10.

Where roadside drainage is present at road access points or crossing points, appropriate measures will be taken to ensure there is no interruption to the drainage system such as temporary culverting.

During construction, sightlines at access points and crossings will be maintained in accordance with the local authorities' requirements, with temporary controls implemented where required. The conditions of the road opening licence will be adhered to.

Where possible, existing agricultural gates will be repurposed as temporary access points, provided they align with the pipeline route. In some cases, these gates may require widening to accommodate heavy machinery or to facilitate movement across the road between work zones. The topsoil in these areas will be stripped to a typical depth of 300 mm and stored separately from the subsoil for future reinstatement. To minimise the risk of physical damage and compaction, topsoil will be kept undisturbed for the duration of construction. All excavated material will be reused on site, and no soil import is anticipated. However, stone chippings may be used within the laydown area, as illustrated in Figure 19.

Figure 19: Typical Establishment of Laydown Area at a Road Crossing

3.2.3 Material Deliveries

Linepipe will be transported to the working spread from the designated Temporary Construction Compounds mentioned in Section 3.2.1, which are strategically located adjacent to the GNI143 Ballykilleen Pipeline route to facilitate efficient delivery. Linepipe will be delivered via the local road network, using the designated Working Width Entry Points for access indicated in drg. no. GNI143-GNI-PL-MIS-0001-01 included in the planning application pack. Smaller quantities of materials can be temporarily stored in the Laydown Area Type B areas prior to use.

3.2.4 Access to Kilwarden Offtake Installation

The Kilwarden Offtake Installation will be accessed via the private access road from the R161, detailed in Section 2.1. Access will be gained to the compound utilising the existing field entrance as shown in drg. no. 14301-GNI-01-PL-SLA-0001-01.

3.2.5 Access to Ballykilleen AGI

The Ballykilleen AGI compound will be accessed by construction personnel via the BnM Renewable Energy Complex entrance off the R401. As indicated in dg. No. 14303-GNI-01-PL-SLA-0001-01.

3.2.6 Open Cut Methodology

The majority of GNI143 Ballykilleen Pipeline will be installed using an open cut construction method as described below.

3.2.6.1 Route Preparation and Working Width

Before construction commences, the route will be surveyed and pegged out. Where required, pre-construction field drainage will be installed to ensure current drainage systems continue to work throughout construction.

A working width of 30 m will be fenced off, and hedges and trees will be removed within the working width as required. The GNI143 Ballykilleen Pipeline route has been refined to minimise the number of mature trees requiring felling. Streams/rivers are flumed by installing temporary pipes and bridged as described in Section 3.2.8. This will allow for a continuous running track for construction vehicles along the pipeline route.

A larger working width of approx. 30 x 45 m is typically required at the road and watercourse crossings. The working width will be accessed via the road crossing entrances to prevent damage to agricultural land not within the working width. Temporary security gates will be set back and installed at road crossings to prevent unauthorised access to the working width.

Ecological protections and mitigations will be implemented in accordance with the project EIAR requirements and coordinated by the appointed Ecological Clerk of Works (ECoW).

3.2.6.2 Topsoil Stripping

After the working width is fenced off the topsoil will then be cleared to a typical depth of 300 mm as illustrated in Figure 20 and shown by Figure 21. Archaeological monitoring will be in place while topsoil is being stripped from the spread. The topsoil will be stored separately to

the subsoil for future reinstatement. Topsoil will be kept free from disturbance for the duration of construction to reduce risk of physical damage and compaction.

During the construction phase, excavated topsoil will be temporarily stored in a linear mound along the works corridor.

At watercourses the topsoil stack will be kept back an appropriate distance from the bank to ensure floodwater can escape. Watercourse banks will be graded back to allow for safe working, see Section 3.2.6.7 for further details.

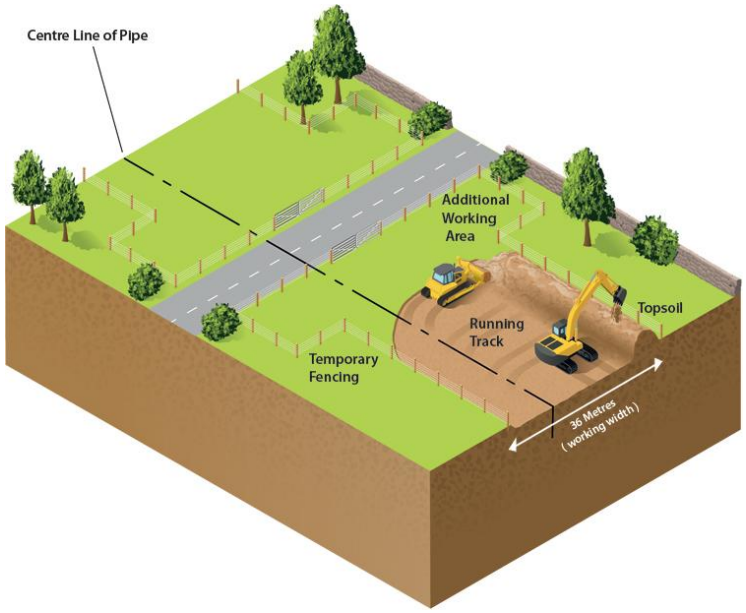


Figure 20: Illustration of Topsoil Removal in an Agricultural Field

Figure 21: Image of Topsoil Removal Within Working Width

Between approximate chainages (CH 13,000 – CH14,000) the pipeline will cross through the 1% AEP (Zone A) and 0.1% AEP (Zone B) flood zones. Within this area it is proposed that the working width topsoil mound will have a secondary purpose to serve as a berm, providing secondary protection by helping to limit the ingress of floodwaters into the excavated trench and construction area.

Topsoil stripping shall not be undertaken in the area identified in Figure 22 at RVX02. This area is located within a designated flood zone. In this section, the pipeline will be installed using trenchless construction methods to avoid disturbing sediment and to mitigate the risk of sediment migration. To further support environmental protection measures, the contractor shall deploy bog mats along the construction running track in designated flood zone areas. These mats will be placed directly on top of the existing topsoil to minimise ground disturbance and prevent sediment from entering adjacent watercourses.

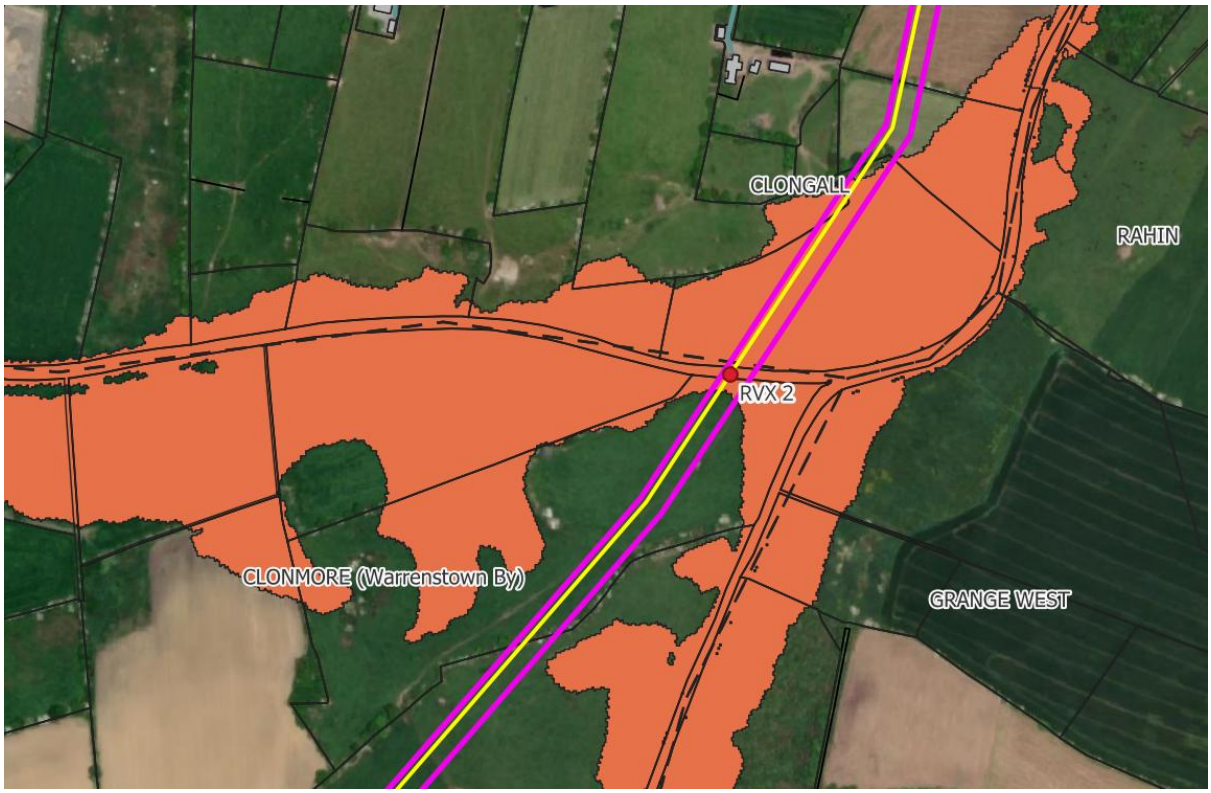


Figure 22: Flood zone Extent located at RVX02

3.2.6.3 Pipe Stringing

Lengths of pipe will be delivered to site and stored in predefined pipe storage areas (outlined in section 2.4) along the GNI134 Ballykilleen Pipeline route. When ready, the individual pipe lengths are transported from the linepipe storage compounds and strung out along the track in preparation for welding as shown in Figure 23. Standard pipe used along the route shall be in 12 m or 18 m lengths.

Pipe will be cold bent where required using specialist bending machines to accommodate small changes in pipeline direction e.g. to accommodate natural changes in site contour. For larger changes in direction, prefabricated forged bends will be used. Bends shall be stored with the linepipe and transferred to the working width in the same manner.

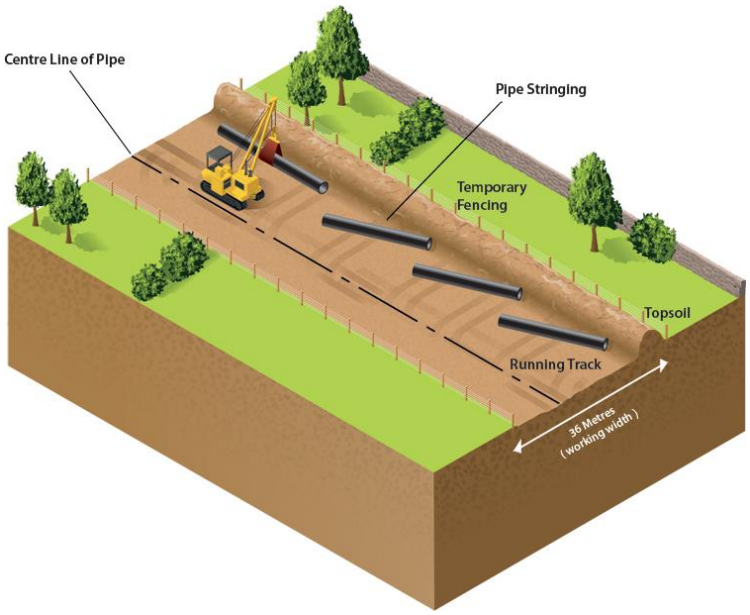


Figure 23: Illustration of Pipe Stringing

3.2.6.4 Pipe Welding and Trenching

The strung-out sections of pipe are welded together above ground, as shown in Figure 24 and Figure 25, and all welds are subject to non-destructive testing. The pipe welds are then coated for corrosion protection. The coating is then subject to holiday testing, to detect any discontinuities.

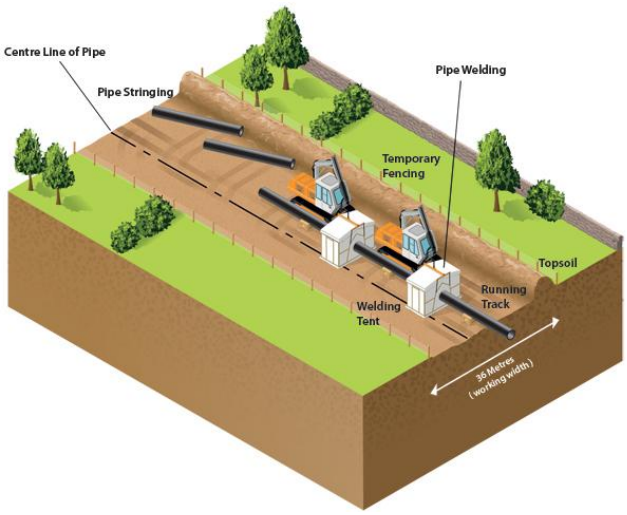


Figure 24: Illustration of Pipe Sections being Welded Together

Figure 25: Welding Canopy Used for Welding Pipe Sections Together.

Trenches are excavated to the required minimum 1.65 m depth (to base of trench), ensuring depth of cover to the top of the pipe is not less than 1.2 m. Subsoil will be stored on the opposite side of the trench to the topsoil to prevent mixing. The trench will be typically excavated as per dg. no. GNI143-GNI-PL-RD-0001-01 as included in the planning application drawings. Trench excavation is shown below in Figure 26.

Trench supports and close sheet piling may be used where necessary to aid construction. Dewatering of the pipe trench may be required along the pipeline route and will be carefully controlled to prevent sediment entering watercourses in accordance with the contractor's Construction Environmental Management Plan (CEMP).

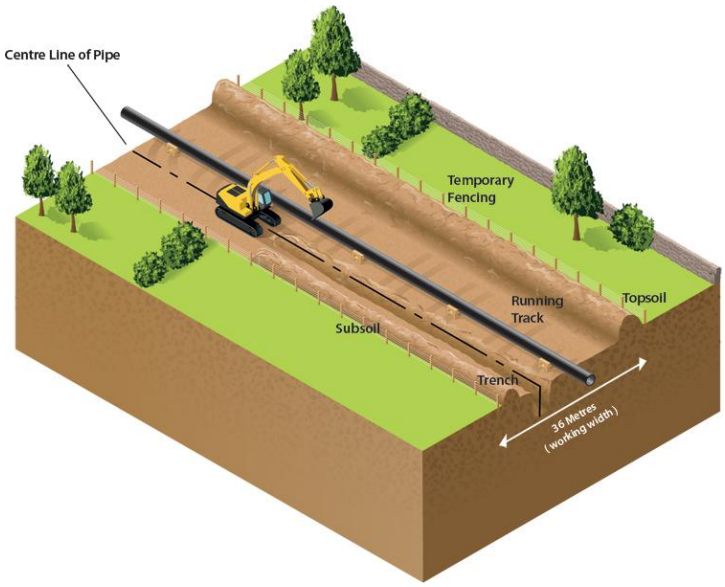


Figure 26: Illustration of a Trench Being Excavated for a Gas Pipeline

The approximate quantity of material expected to be excavated is detailed in Table 6.

Table 6: Approximate Quantity of Material to be Excavated.

Works Area	**Quantity (m^3)**	**Description**
Topsoil	232,650	Works areas (including pipeline working width based on 0.3m deep, 30m wide and 23.65 km long)
Pipeline Subsoil	31,725– 19,035	Based on total trench depth of 1.65m, width of 1m to 0.6m and length of 23.65 km. Excluding topsoil.
Hot Tap & Pigging Compound	250.6	Based on all concrete surface areas being excavated to 0.45m below ground plus additional for hot tap area & topsoil stripping as per AD/SP/005

Ballykilleen AGI	708	Based on all concrete surface areas being excavated to 0.45m below ground & topsoil stripping as per AD/SP/005

3.2.6.5 Pipeline Lowering-in and Backfilling

Prior to lowering in the pipeline, the excavated trench should be evenly bedded throughout its length, with preapproved CL. 503 material, to a minimum depth of 150mm (300mm in rock). After the 300mm NB pipeline is lowered into the trench as shown in Figure 27 and Figure 28, the pipeline will be surrounded with preapproved CL. 503 material to a minimum depth of 150mm over the pipeline as shown in Figure 29 and detailed in the planning application drawings. Ancillary ducting shall be installed just above the pipeline within the trench as shown in Figure 29.

Backfill shall be placed in layers of 300mm to accommodate warning tape and to facilitate compaction. Backfill materials will be consolidated by tamping or rolling in layers. Where appropriate, water stops will be installed in the trench to prevent the pipe trench acting as a conduit for groundwater.

The trench is backfilled, and the topsoil is spread across the working width as shown in Figure 30. It is anticipated that the majority (95%) of the excavated soil will be reinstated as backfill. Any remaining excavated soil will be removed from site and disposed of in accordance with regulations by the contractor.

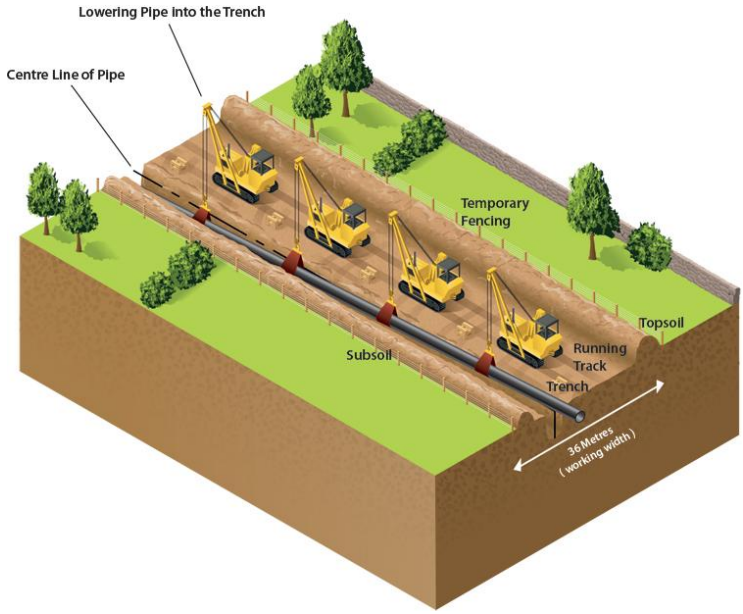


Figure 27: Illustration of Pipeline Being Lowered into a Trench

Figure 28: Image of Pipeline Being Lowered into a Trench

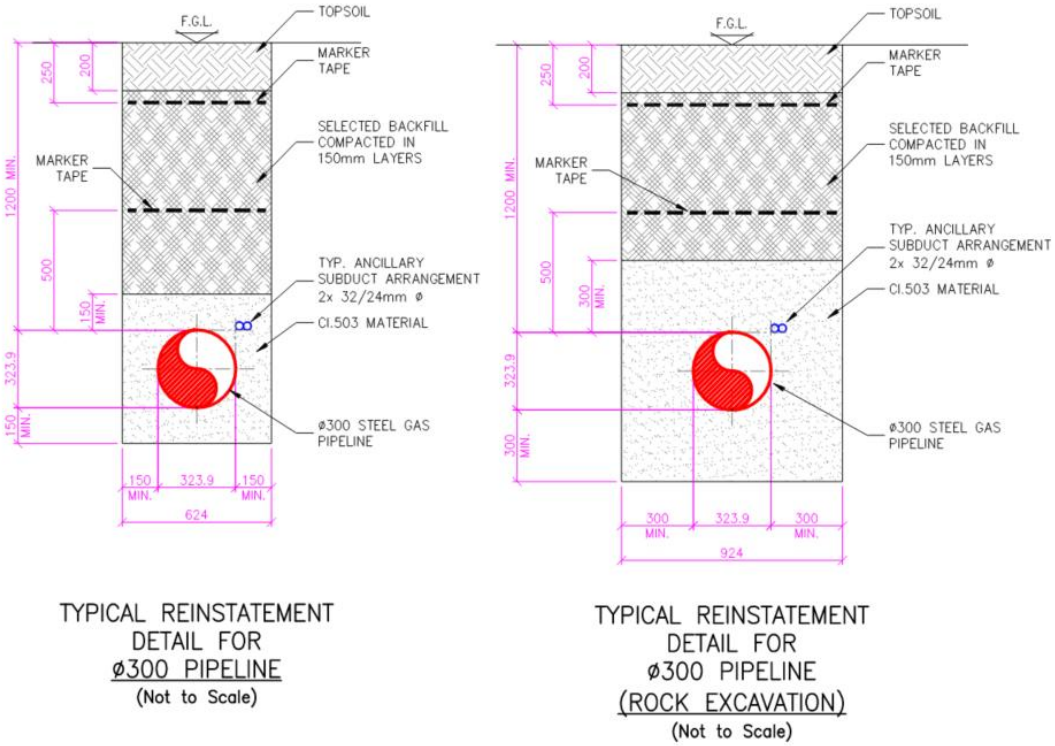


Figure 29: Example Cross Section of Reinstated Trench Showing Pipe, CL.503 Material, Subsoil, Marker Tape and Topsoil

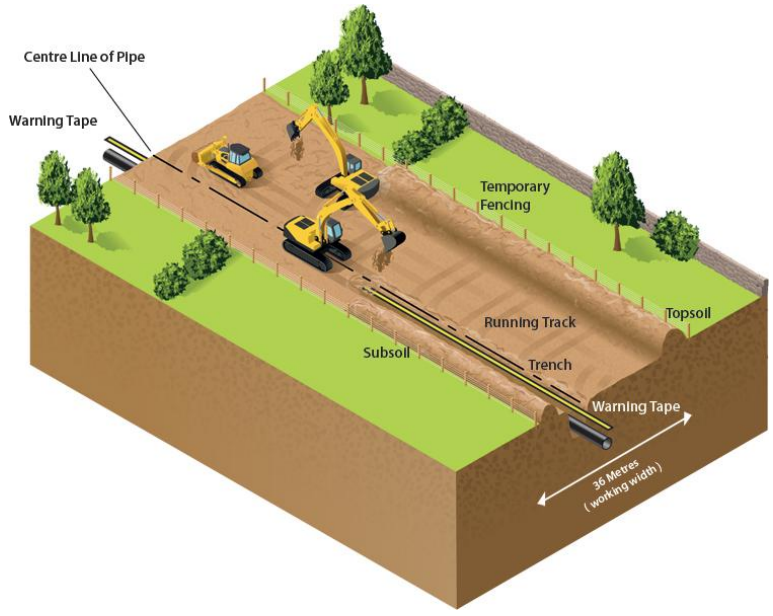


Figure 30: Illustration of Backfilling the Trench

3.2.6.6 Service Crossings

Crossing of existing third-party services (electric, storm sewer, foul sewer, potable water, etc) will follow a typical service crossing drawing, whereby the pipeline will be installed to avoid interaction with the existing underground service. A minimum separation distance of 500mm will be maintained between the pipeline and the third-party service where required. A typical service crossing drawing provided is included in drawing GNI143-GNI-PL-MIS-0003-01. There are no disruptions or disconnections of third-party services expected.

3.2.6.7 Watercourse Crossings

Open cut water crossings are carried out as quickly as possible (typically 3-4 days) to minimise their potential environmental impact. Please see the planning application drawings for a typical open cut stream / watercourse crossing. The contractor may opt for a trenchless crossing method if they deem it more suitable for ease of construction. As outlined in Section 2.2, the crossing of the Kilwarden River (RVX01), the Yellow River (RVX02) and the Grand Canal (WCX23) are considered primary crossings and will utilise a trenchless crossing technique. The procedure for open cut crossing is as follows:

- At the beginning of construction, any trees or hedges along the watercourse crossing banks are removed along with the adjacent topsoil.
- The construction traffic will traverse the watercourse with the use of an
    a) appropriately sized flume and running track crossover or
    b) a temporary bridge crossing.

  This is to be confirmed for each crossing by the contractor. Section 50 consent from OPW will be sought where required.
- The water course is then left uninterrupted until a few days (estimated 2-3 days) before the pipeline install time. The banks are then graded back to bed level. Topsoil shall be stored separately to the subsoil.
- Flume pipes sized to ensure they are capable of accommodation flood flow water volumes are inserted into the watercourse, ensuring they extend past the area of the proposed trench and running track. The flume pipes are surrounded with sandbags to create a seal. Straw bales are placed downstream to capture sediments as required.

- The pipe trench is then excavated below the flume pipe. This excavated material is stored separately to the topsoil and subsoil and only this material will be used to backfill the watercourse trench. If dewatering is required, particular care will be taken to ensure appropriate sediment control is taken.

- The pipeline is installed in the trench. For watercourse crossings, a minimum distance of 1.6 m will be maintained from the top of the pipeline to the bottom of the true cleaned bed or proposed dredging level of the watercourse as per I.S. 328: 2021. A precast marker slab will be laid 300 mm above the pipeline.

- The trench is backfilled such that it is level with the rest of the watercourse bed. The watercourse banks are then reformed to their original profile.

- Where a temporary bridge is being used, the dams and flume can be removed at this point, and the watercourse is allowed to flow normally for the remainder of construction.

- Where the watercourse is flumed with a running track traversing it, this will remain in place until the pipeline section is completed. Then the dams and flume can be removed.

- When the running track is no longer required the bridge crossing or the flume and running track crossover is removed.

- Where appropriate the banks of the watercourse shall be reinstated with native plants and fencing is erected as agreed with the landowner.

Figure 31: Bridge Crossing of Water Course.

Figure 32: Temporary Bridge in Situ.

3.2.6.8 Road Crossings

As per Section 2.2.1 it is anticipated that there will be 11 no. open cut road crossings, however the number of road crossings to be open cut shall be confirmed prior to construction. It is envisaged that the L4181, L8022, L80241, L4091, L1004 and L5007 roads can be closed, and diversions put in place to allow for the works to be undertaken. Open cut road crossings shall be complete and reinstated within 1 no. working day.

If full road closure if not permissible the road crossing will be done in two parts as outlined below:

- One half of the road is closed for construction, and the other side of the road will be open to traffic using a stop-go traffic light system.
- The trench will be excavated, pipe will be welded, tested and inserted. Immediate reinstatement for the closed side of the road will be carried out.
- The open side of the road will then be closed, and the previously closed side of the road will be open to traffic again using a stop-go traffic light system.
- Again, a trench will be excavated, pipe will be welded, tested and inserted. Immediate reinstatement for the closed side of the road will be carried out.
- Both sides of the road will be opened as normal following the works.

Concrete and asphalt/bitmac road crossings will have immediate permanent reinstatement in accordance with design drawings, *IS 328:2021, GNI/AD/SP 007, Guidelines for Managing Openings in Public Roads 2017 (The Purple Book)* and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities. A cross section of a reinstated road crossing trench is included in the planning application drawings.

3.2.6.9 Reinstatement

The working area will be reinstated such that normal farming activities can be recommenced by the landowner. Land drains will be installed as required taking care to ensure the drains do not act as pathways for contamination or do not cause flooding of site. The working area will be regraded, and grass seed will be set as shown in Figure 33 and Figure 34. Fences and walls will be reinstated to meet landowner's requirements using materials that match the

existing fences/walls as appropriate. Hedgerow sections that were removed will be replaced to match the removed hedgerow where possible.

Grass seed, hedgerow plants and CL.503 are the only envisaged imported materials for the purposes of reinstatement. A permanent wayleave of 14m will be sought to allow access for GNI to excavate and inspect the pipeline in the future.

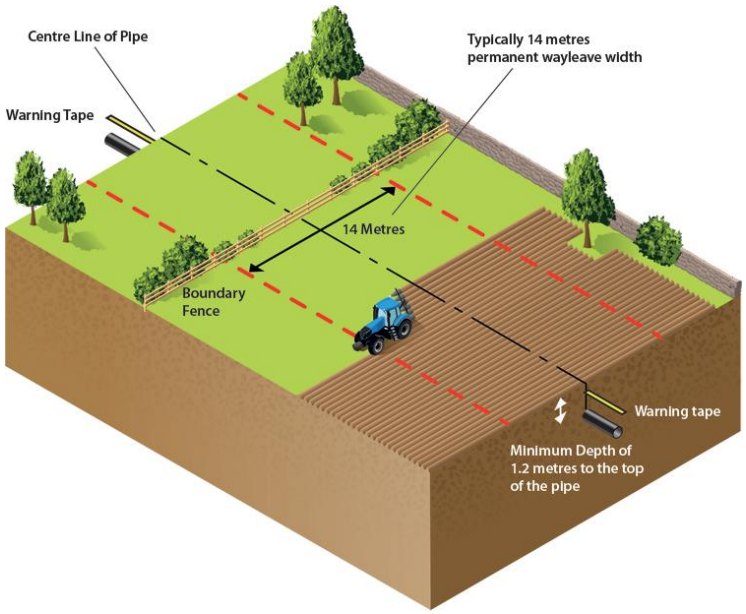


Figure 33: Illustration of Reinstatement of Agricultural Field Following Gas Pipeline Installation

Figure 34: Image of Reinstatement of Agricultural Field Following Gas Pipeline Installation

Where the pipeline enters the BnM facility, reinstatement works will include the installation of concrete slabs directly above the pipeline, in accordance with BGE/ST/2001. These slabs are being installed to provide additional impact protection and safeguarding, particularly in the vicinity of a section of the BnM site that has been zoned for future development. For further technical details and layout specifications, please refer to drawing GNI143-GNI-PL-RD-0001-01 included in the planning application drawings.

3.2.7 Trenchless Methodology

As outlined in Section 2.2, several crossing locations require trenchless construction techniques along the pipeline route. The crossing of the Kilwarden River (RVX01), the M4 motorway (RDX04), the Yellow River (RVX02) and the Grand Canal (WCX23) are considered primary crossings and will utilise a trenchless crossing technique.

Based on the current pipeline alignment and ground investigation (GI) data, Horizontal Directional Drilling (HDD) has been proposed as the optimum method at each of the primary crossing locations. This is the current proposed construction methodology however may be subject to change. The appointed contractor may choose an alternative trenchless technique if deemed more appropriate based on site-specific conditions. The exact crossing methodology is subject to detailed design by the contractor. Therefore, the methodology outlined should be considered preliminary and may be refined post contract award.

In accordance with Sections 2.2.1 and 2.2.3, six additional road crossings (RDX2, RDX3, RDX7, RDX12, RDX14, RDX17) and one additional watercourse crossing (WCX29) are suggested to be constructed using trenchless methods. However, the final construction approach will be determined by the appointed contractor during the construction phase, who may opt for open-cut techniques instead. Should trenchless construction be employed for these crossings, it is anticipated that either guided auger boring or horizontal directional drilling will be utilised.

3.2.7.1 Horizontal Directional Drilling

HDD is a steerable trenchless method which involves guiding a pilot hole along a pre-determined profile beneath the obstacle using a surface-launched drilling rig, with minimal impact on the surrounding area. The depth of the drilled profile can be set to minimise

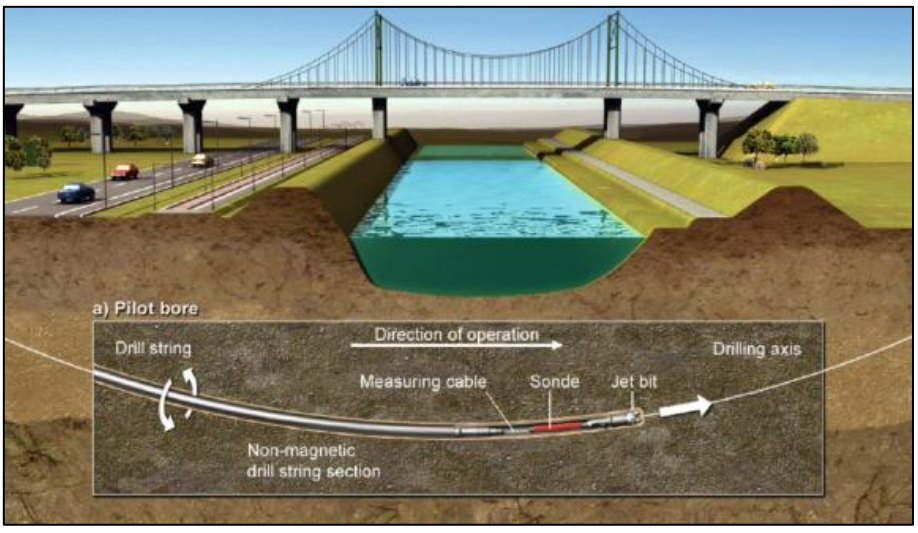
damage to the obstacle being crossed, deeper crossings can be undertaken when ‘fragile’ or sensitive obstacles need to be crossed.

Once the pilot hole is complete the bore is enlarged in stages using reamers in soft ground or hole openers in hard ground to a diameter approximately 40% greater than the diameter of the pipeline to be installed.

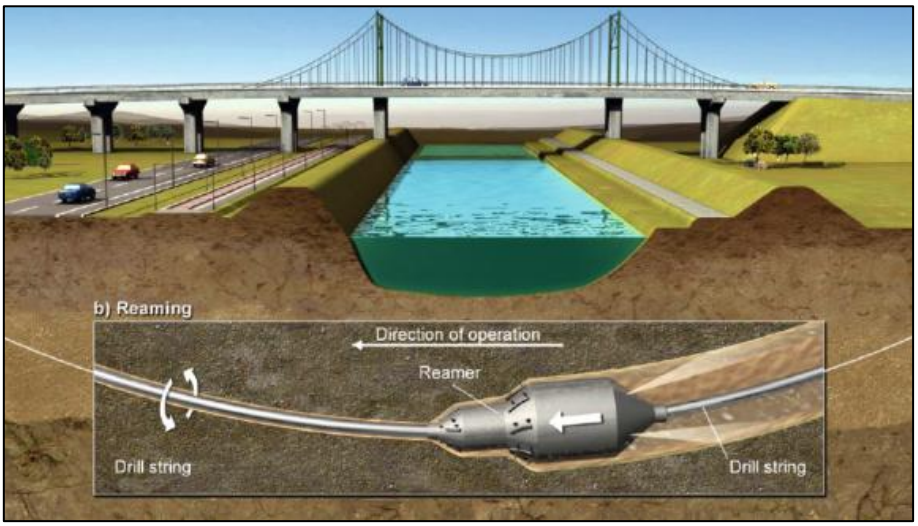
When the bore has been enlarged to the required diameter the product pipeline is pulled through using the drilling rig. A stringing site equivalent to the length of the HDD crossing is required to fabricate the product pipeline in a single length allowing the installation operation to be completed without interruption.

During the detailed design phase, a hydrofracture calculation is usually undertaken to facilitate the HDD profile design. The hydrofracture calculation takes consideration of the ground properties and drill fluid pressures to determine whether the bore will plastically deform under pressure leading to a breakout of drilling fluid. The output from the hydrofracture calculation typically includes a graph which guides the drill operator on the maximum allowable drilling fluid pressure along each section of the HDD to ensure potential of a frac out can be mitigated.

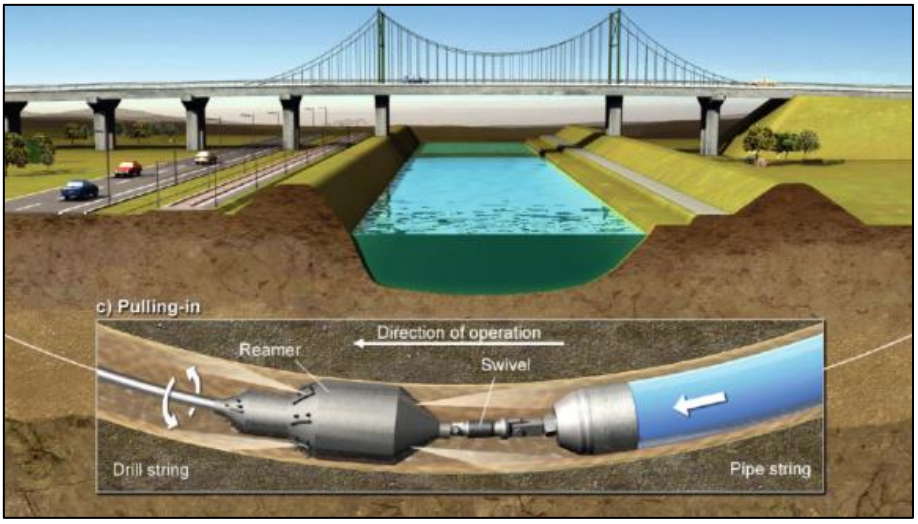
A typical HDD sequence is indicated in the following schematics:



Schematic of Pilot Hole Drilling (Indicative Only)



Schematic of HDD Bore Reaming / Hole-Opening (Indicative Only)



Schematic of Pipeline Installation into HDD Bore

During drilling operations, the bore is supported by drilling fluid which also performs functions such as drill bit cooling, lubrication and removal of drill cuttings.

HDD is feasible in a wide range of ground conditions; however, the presence of gravel in high quantities normally precludes the use of the technique due to the increased risk of failure. Detailed information on the ground conditions along the proposed route is required to fully assess the suitability of the technique.

The HDD entry compound will require an area in the region of 1500m^2 – 2000m^2. The area will accommodate temporary storage of topsoil, HDD drill rig, welfare units, HDD fluid mixing tanks, fluid collection tanks, HDD drill rod storage, cabins and hydraulic power packs. A water supply is required for mixing the bentonite drilling fluid, which is typically delivered by tanker if no mains water supply is available at the site.

During pilot bore operations, drilling fluid will be pumped to the cutting head to fluidise the ground, cool the drill bit and act as a lubricating agent. Drill cuttings suspended in the drill fluid will be transferred through the HDD bore annulus back to the HDD entry pit where they will be collected before being transferred into the recycling unit. The recycling unit will remove suspended solids and return clean drilling fluid back to the entry pit. During reaming operations drill fluid returns will also be pumped to the exit pit where it will be transferred into holding tanks. The holding tanks containing drill fluid will be transported back to the HDD rig site for re-cycling or if required, taken off site for disposal.

Contingency plans will be put in place such should a frac out occur. Drill fluid pressures will be continuously monitored at the HDD rig to prevent such an event but in the unlikely case it does occur a team will be deployed to the frac out site to construct containment bunds and deploy absorbent mats/socks. Contained fluids will be cleaned up and removed from site. The HDD drill string will be retracted in preparation for re-entry on the new profile/alignment. The HDD profile/alignment will be re-designed to prevent re-occurrence and drilling operations will recommence once approved.

Prior to commencing HDD works, a comprehensive Frac-Out Management Plan will be developed and implemented. This plan will include:

- Geotechnical and hydrogeological surveys to identify zones of high frac-out potential and define safe operating parameters (maximum mud pressure, flow rates, etc.).
- Continuous monitoring of drilling fluid pressure, flow rates, and pit volume at both entry and exit points, with automated alarms to flag deviations from established thresholds.
- Use of low-invasion drilling techniques (e.g., reduced pressure reaming), staged pressure relief, and adjustable flow-rate controls to minimise overpressure.
- Should a frac-out occur, a dedicated response team will immediately mobilise to the release location, erect containment bunds, deploy absorbent mats and socks, and implement spill-recovery procedures in line with the plan. Collected fluids and solids will be removed to licensed disposal or recycling facilities.
- Following containment and cleanup, the HDD profile and drilling parameters will be reviewed and amended to eliminate recurrence. Operations will only recommence once the revised plan and design have received all necessary approvals.

3.2.7.2 Preliminary HDD Designs

The construction methodologies and design details provided should be considered as preliminary and potentially subject to change, or refinement, by the construction contractor after contract award.

Kilwarden River Crossing (RVX01)

The HDD at RVX01 involves drilling an 18" (Approx.) diameter bore below the watercourse and land drain on the north side of the watercourse and installing the 12" pipeline inside the completed bore. The drill maintains a depth of at least 8.18m below the bed of the river. This allows for additional coverage to ensure a minimum of 1.6 m cover beneath the true riverbed level, in accordance with I.S. 328.

The pipe string for the HDD crossing can be fabricated within the current pipeline working width on the south side of the crossing. Some curvature of the pipe string will be required in order to follow the working width alignment as depicted in Figure 35.

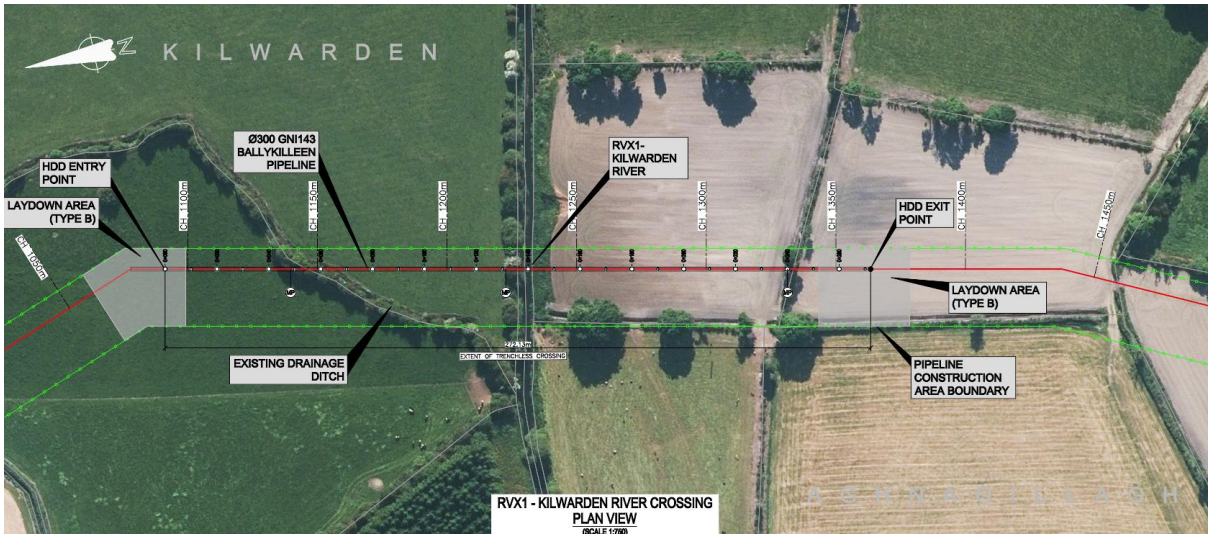


Figure 35: Plan View of the proposed HDD Crossing and Pipe String Corridor at the Kilwarden River (refer to drg. no. GNI143-GNI-PL-CRI-0001-01).

Preliminary HDD design parameters are as outlined below:

- HDD Bore Diameter: 18" (approx. 450mm)
- Drill Length: 272 m
- Drill Depth Below Riverbed: 14.46 m
- Launch Area: 1000 m^2

- Entry Angle: 14°
- Entry Bend Radius: 360 m
- Reception Area: 1000 m^2
- Exit Angle: 12°
- Exit Bend Radius: 360 m

M4 Motorway Crossing (RDX04)

The HDD at RDX04 involves drilling an 18” (Approx.) diameter bore below the carriageway and installing the 12” pipeline inside the completed bore. The drill maintains a depth of at least 9.44m below the carriageway. This allows for additional coverage to ensure a minimum of 1.2 m cover beneath the road is maintained.

The pipe string for the HDD crossing can be fabricated within the current pipeline working width on the south side of the crossing. The pipe string area, highlighted in purple in Figure 36, maintains a relatively straight alignment which is the optimal configuration when installing the pipe.

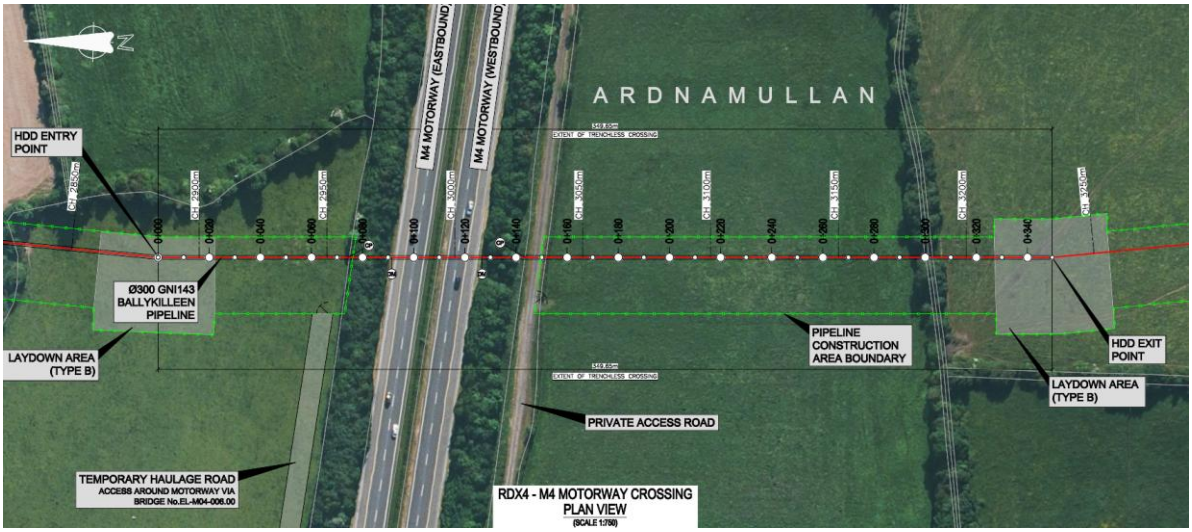


Figure 36: Plan View of the proposed HDD Crossing and Pipe String Corridor at the M4 Motorway Crossing (refer to drg. no. GNI143-GNI-PL-CRD-0003-01).

Preliminary HDD design parameters are as outlined below:

- HDD Bore Diameter: 18” (approx. 450mm)
- Drill Length: 350 m
- Drill Depth Below Motorway: 18.49 m
- Launch Area: 1000 m^2

- Entry Angle: 14°
- Entry Bend Radius: 360 m
- Reception Area: 1000 m^2
- Exit Angle: 12°
- Exit Bend Radius: 360 m

Yellow River Crossing (RVX02)

The HDD at RVX02 involves drilling an 18" (Approx.) diameter bore below the watercourse and installing the 12" pipeline inside the completed bore. This is the longest of the proposed HDD designs with a span of 458m. The drill maintains a depth of at least 8.53m below the bed of the river. This allows for additional coverage to ensure a minimum of 1.6 m cover beneath the true riverbed level, in accordance with I.S. 328.

The pipe string for the HDD crossing can be fabricated within the current pipeline working width on the south side of the crossing. Some curvature of the pipe string will be required in order to follow the working width alignment as depicted in Figure 37.

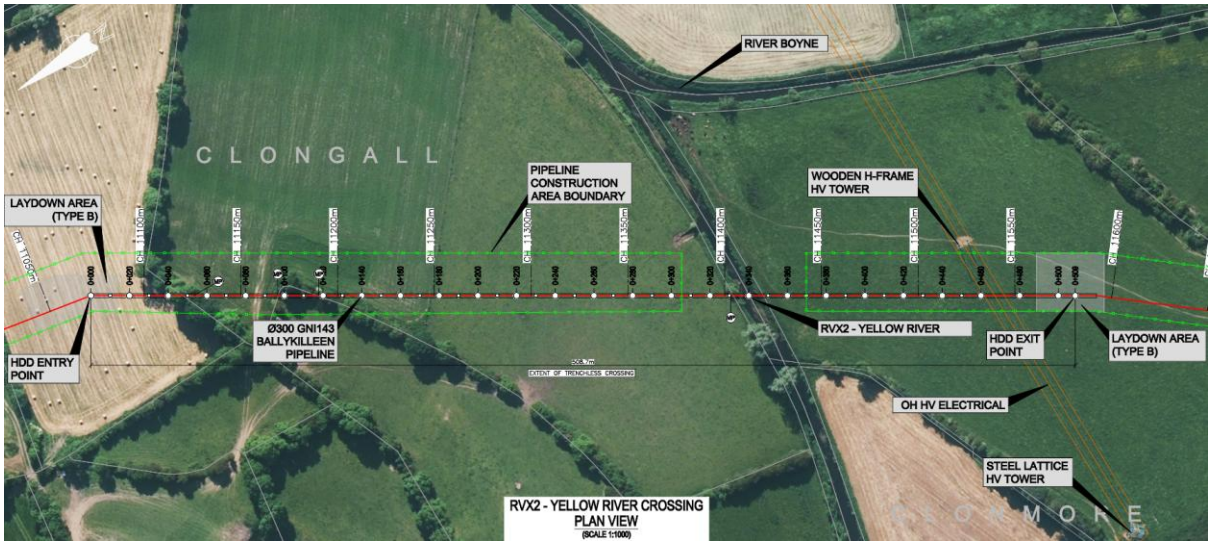


Figure 37: Plan View of the proposed HDD Crossing and Pipe String Corridor at the Yellow River Crossing (refer to drg. no. GNI143-GNI-PL-CRI-0002-01).

Preliminary HDD design parameters are as outlined below:

- HDD Bore Diameter: 18" (approx. 450mm)
- Drill Length: 509 m
- Drill Depth Below Riverbed: 21.73 m
- Launch Area: 1000 m^2

- Entry Angle: 14°
- Entry Bend Radius: 360 m
- Reception Area: 1000 m^2
- Exit Angle: 12°
- Exit Bend Radius: 360 m

Grand Canal Crossing (WCX23)

The HDD at WCX23 involves drilling an 18" (Approx.) diameter bore below the watercourse and installing the 12" pipeline inside the completed bore. This is the shortest of the HDD designs with a span of 192m. The drill maintains a depth of at least 9.22m below the bed of the canal. This allows for additional coverage to ensure a minimum of 1.6 m cover beneath the true riverbed level, in accordance with I.S. 328.

The pipe string for the HDD crossing can be fabricated within the current pipeline working width on the north side of the crossing. The pipe string area, highlighted in purple in Figure 38, maintains a relatively straight alignment which is the optimal configuration when installing the pipe.

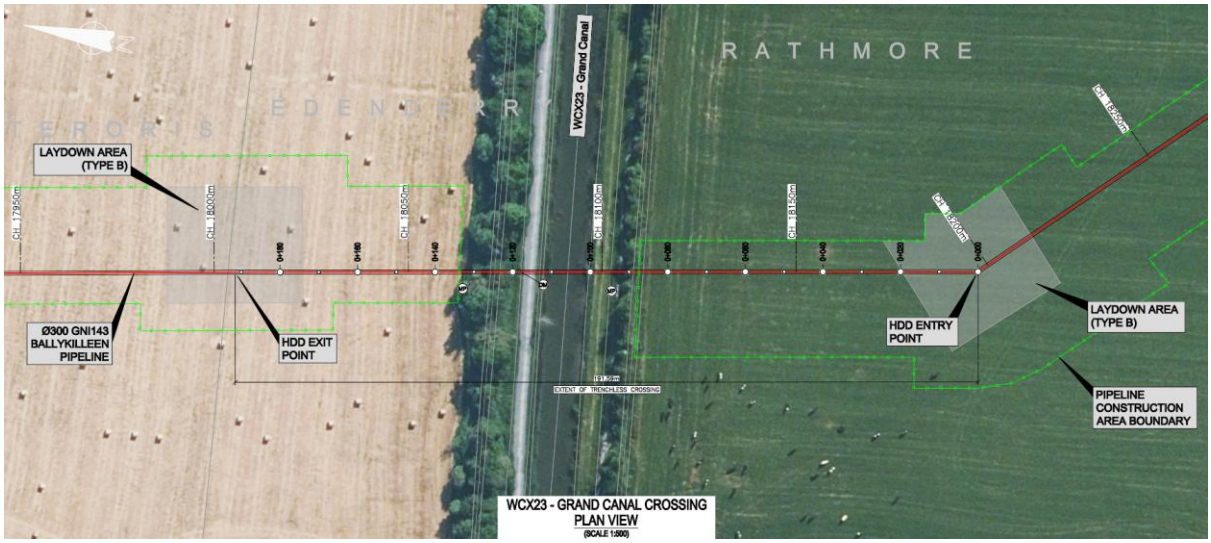


Figure 38: Plan View of the proposed HDD Crossing and Pipe String Corridor at the Grand Canal Crossing (refer to drg. no. GNI143-GNI-PL-CWC-0001-01).

Preliminary HDD design parameters are as outlined below:

- HDD Bore Diameter: 18" (approx. 450mm)
- Drill Length: 192 m
- Drill Depth Below Riverbed: 9.2 m

- Launch Area: 1000 m^2
- Entry Angle: 12°
- Bend Radius: 360 m
- Reception Area: 1000 m^2
- Exit Angle: 12°

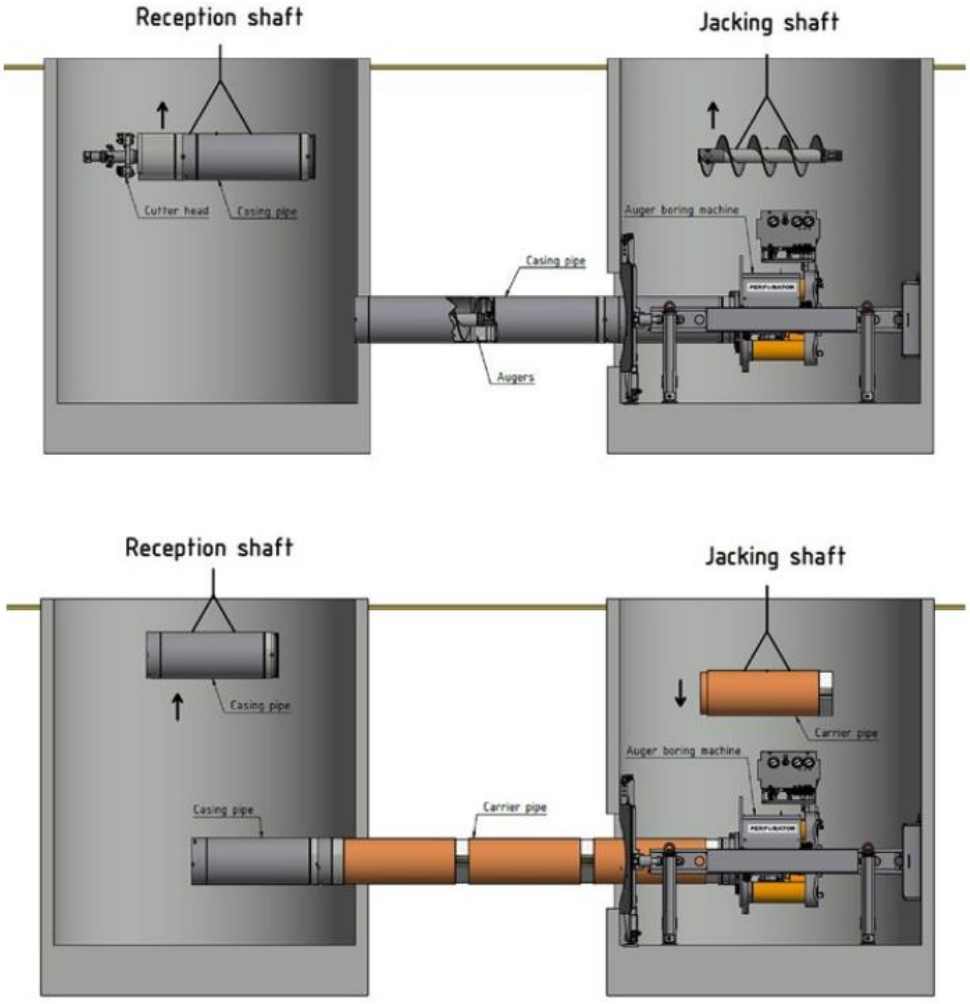
3.2.7.3 Auger Boring

Auger boring is a technique used to install pipelines by simultaneously removing the soil whilst jacking pipe into the ground. The installation can be guided or unguided as detailed below. The achievable length and accuracy are dependent on the method employed, the diameter of the pipeline to be installed and the anticipated ground conditions.

Un-guided Auger Boring

Unguided auger boring involves driving a casing pipe into the ground with an auger screw installed inside; a cutting head suitable for the ground being bored is located at the front of the lead auger.

The auger is rotated creating a void in the ground which allows the casing pipe to be advanced into the void created. Where a large diameter casing pipe is required the size of the auger is increased in increments. The pipeline can either be installed within the casing pipe, or the casing pipe can be replaced with the product pipeline. As indicated in the schematic below, for clarity auger boring can also be undertaken from suitably battered or supported excavations:



Unguided auger boring is suitable for lengths up to a maximum of 90m where line and level are not critical, although crossing lengths are dependent on pipe diameter and ground conditions. The initial set up of the machine is critical to permit the line and level to be as accurate as possible.

Guided Auger Boring

Guided auger boring involves 'steering' a small diameter pilot bore along the pre-designed profile between two excavations before enlarging the bore to the required diameter in stages using auger screws located inside the casing pipe. Once the required diameter is achieved the casing pipe is pushed out and replaced with the product pipeline as indicated in the schematics below, for clarity guided auger boring can also be undertaken from suitability battered or supported excavations:

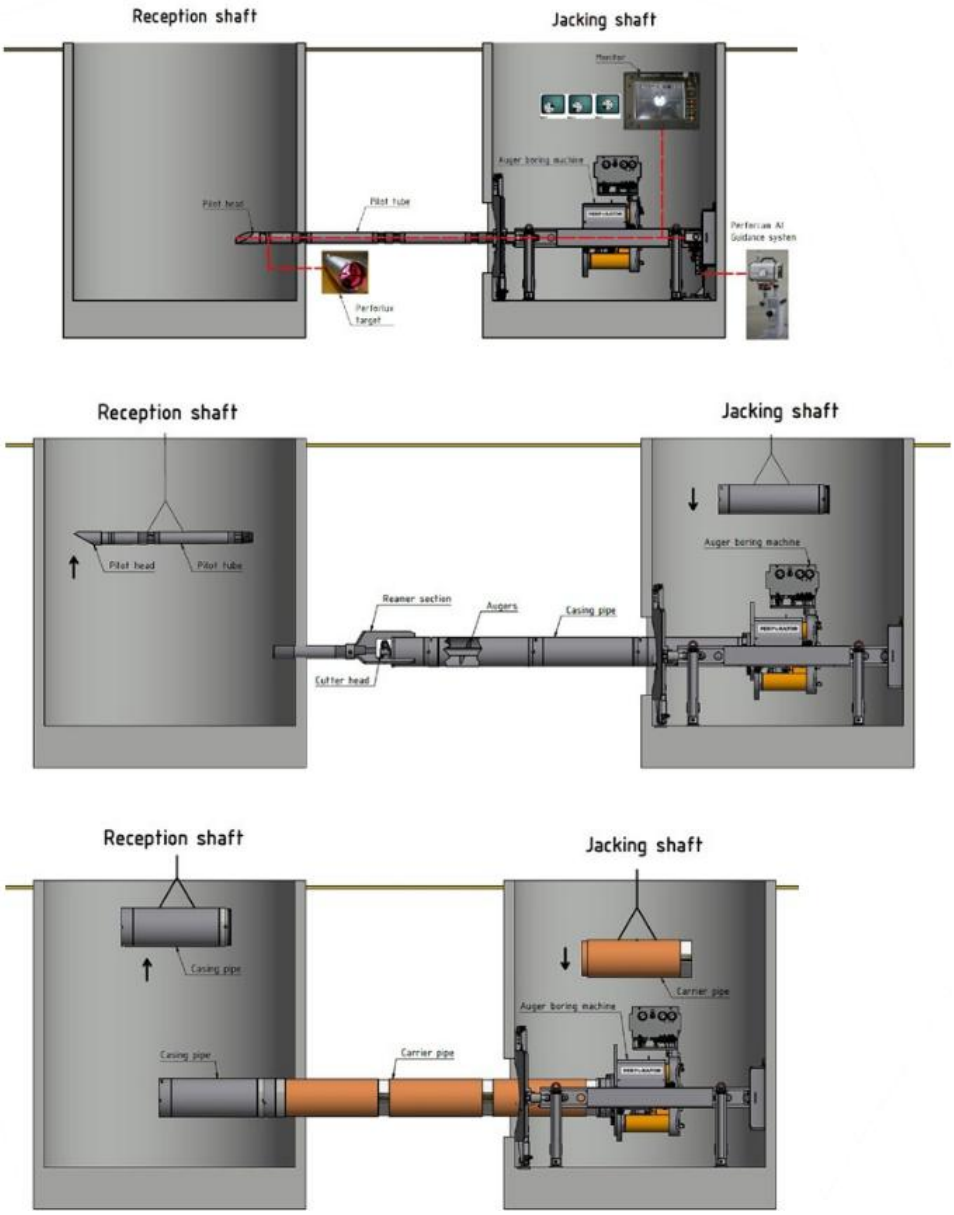


Figure 39: Guided Auger Bore Process Schematic.

Where line and level are considered critical, guided auger boring should be adopted. Guided auger boring is suitable for crossing lengths up to a maximum of 60m due to the ability to sight the guidance laser through the pilot pipe onto the target in the steering head. Crossing lengths are dependent on ground conditions, the presence of significant quantities of cobbles and boulders can preclude the use of guided auger boring.

The process begins by sinking a launch and reception shaft at either side of the crossing to the size required for the machine selected. The Guide Auger Boring machine comprises a jacking frame and usually a thrust backing located in the launch shaft and aligned on the desired bored route.

An optical (laser) guidance system is installed, and the task is a multi-phase operation comprising first a pilot bore (similar to the pilot bore used in HDD, but without slurry/mud). The drill head is angled to allow steering as it advances. Constant rotation provides a straight-line advance whilst a non-rotational advance steers the boring head in a desired direction using friction on the slanted face against the ground to force the steering action. This process continues until the pilot bore reaches the reception shaft where the pilot drill rod is replaced with a casing within which is an auger with a cutting head at the advancing end. This is pushed through the ground, excavating the bore to the desired final diameter for the pipe being installed.

Once this phase is completed the product/casing pipe is then placed in the jacking frame as shown in Figure 39 and advanced into the bore created by the auger assembly. As the pipe is advanced the auger assembly, including the casing, is dismantled and collected at the reception shaft/pit for reuse. Once the pipe string reaches the reception pit and all the auger and casing has been removed the installation is complete and the machine can be removed from the launch shaft. If being used directly as a product pipe the installed pipe is then tied-in to the network it is to become part of. If the pipe is to be a casing pipe (or sleeve) then the product pipe(s) or cables are inserted (or threaded) as necessary and in the normal way, as would be the case for an MT.

As well as the standard pilot/auger/pipe installation technique, in recent years the machine manufacturers have devised options that enable bores to be completed in hard ground and at larger diameters. These generally take the form of a powered cutter head (shown in the schematic above) that is used instead of the auger during the second phase of the installation process.

- The powered cutter head has a separate power feed that enables it to excavate larger diameters or harder ground than the standard, basic systems. This results in its application range overlapping with MT in certain ‘short’ unproblematic crossing situations, where in effect, the output is an MT sleeve suitable for threading with a HP Gas Pipeline, but without the high cost of authentic micro-tunnelling.

3.2.8 Temporary Bridge Structures

A temporary bridge structure will be installed over the Kilwarden River (RVX01) to facilitate construction access. A temporary bridge may also be utilised at other watercourse crossings. However, this is to be determined by the contractor as outlined in 3.2.6.7. Section 50 consent from OPW will be sought where required.

The temporary bridge structure is classified as temporary works and will be the responsibility of the construction contractor. Detailed designs for the temporary works will be developed and agreed upon with the GNI Construction Supervision Engineer and the PSDP as part of the Construction Stage Plan.

It is anticipated that the prefabricated bridge structure will rest on timber bogmats placed on each side to serve as temporary abutments. The typical temporary bridge installation and dismantling process is outlined in Table 7 for reference. The temporary bridge will remain operational for the duration of the pipeline construction works, with installation and dismantling phases expected to take approximately 4 weeks. During operations, regular maintenance and monitoring will be undertaken under the guidance of an Environmental Clerk of Works (ECoW) to ensure the crossing functions effectively and that any potential issues are promptly addressed.

There are no instream works associated with the Kilwarden and Yellow River crossings (RVX01 and RVX02) as the pipeline construction methods will be trenchless. Upon completion of the works, the area around both rivers will be reinstated to their original condition.

Table 7: Temporary Bridge Installation and Dismantling

Stage	Description
Site Preparation	Define and demarcate working areas, maintaining a minimum 10m clearance from the riverbank except for approach roads/ramps. Verify that working areas align with land acquisition and working width drawings. Conduct clearing works, including topsoil stripping and stockpiling for later reinstatement. Measures will be implemented to manage runoff and prevent sedimentation of nearby watercourses. All temporary works areas related to the crossing shall be designed to drain runoff away from the watercourse banks to prevent contamination of the watercourse.
Crane and Bridge Preparation	A stoned pad will be constructed adjacent to the river for a suitable crane. The pad will use compacted stone, avoiding the use of concrete. A crane will be positioned to facilitate efficient and safe lifting operations. Load-bearing checks will be carried out to confirm the stability of the crane pad and lifting equipment. The prefabricated bridge structure designed by the contractor, will feature safety elements such as guardrails, raised curbs, and safety rails.
Abutment Installation	Install a bogmat abutment on one side of the river. Abutments will be placed at least 2m back from the top of the riverbank, as required by Inland Fisheries Ireland (IFI). The crane will lift and place the bogmat abutment on the other side of the river.
Bridge Installation	The crane will lift the prefabricated bridge structure and position it on the abutment across the river. Construct approach ramps on both sides using stone materials. The ramps will be graded to match the bridge elevation and will be stabilised to prevent erosion.
Construction Activities	Transport materials and equipment across the bridge. Complete the haul road and establish a stoned working area on both sides. Fence off the working areas to maintain minimum 10m clearance from the riverbank. Conduct pipeline installation.
Dismantling and Removal	Once construction activities are completed, materials and equipment will be transported back across the bridge. Stone and other materials will be removed, using the bridge for transport.

	Use the crane to lift out the bridge and abutments.
Site Reinstatement	Both sides of the watercourse will be restored to their original condition. This includes re-grading the land to match pre-construction levels and re-grassing to replicate pre-existing vegetation. Stockpiled topsoil will be redistributed. All temporary structures, including fencing, will be removed. Post-reinstatement monitoring will be conducted to ensure the site has fully returned to its pre-construction state, with corrective actions taken if necessary. This includes confirming stabilisation of the riverbanks and absence of erosion or sedimentation.

3.3 AGI Construction

3.3.1 Site Establishment

A perimeter fence will be erected around the temporary construction compound located within the BnM site boundary. Temporary car parking, site offices and other facilities will be established to support the early works which will primarily consist of earth moving. Adequate space will be allocated to facilitate crane or HIAB access for the offloading of the PRS kiosk, PBU kiosk, E&I kiosk, Gas Chromatograph Kiosk, pipework, site offices and welfare facilities. It is expected that an approx. 90m x 55m temporary compound will be established adjacent to the Ballykilleen AGI development within the BnM site to accommodate construction.

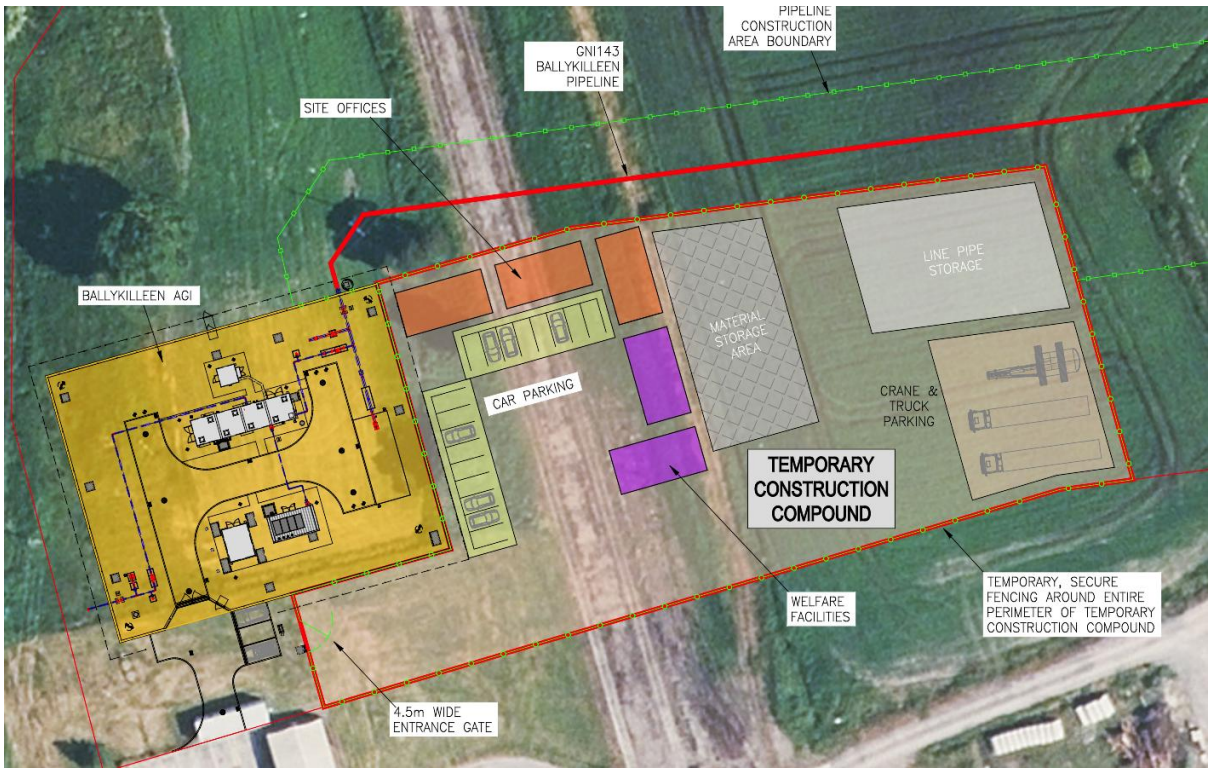


Figure 40: Ballykilleen AGI Construction Compound (refer to drg. no. GNI143-GNI-PL-TCC-0005-01)

The topsoil of the site will be cleared to a typical depth of 300 mm. The topsoil will be stored separately to the subsoil for future reinstatement. Topsoil will be kept free from disturbance for the duration of construction to reduce risk of physical damage and compaction. All

excavated material will be used onsite, and no import of soil is expected. Excess material is anticipated to be used in the laydown area. Excess excavated material will be stockpiled for use as engineering fill, landscaping and other uses throughout the site.

Site Investigations (SI) have been completed at the Ballykilleen AGI location. The results of these investigations have directly informed the civil design of the compound. Subsurface conditions were found to be predominantly wet and peaty, which are unsuitable for supporting civil structures and roadways without remediation.

To address this, a dig and replace method has been proposed to ensure a stable foundation with adequate bearing capacity. All peat material will be excavated and replaced with a suitable granular fill, such as 6F2 or equivalent. Additionally, a Terram geotextile membrane will be installed to enhance ground stability and separation between layers.

This approach will provide a reliable base for the installation of civil foundations and access roads, ensuring long-term structural integrity.

A single laydown area will be established during the earthworks and site preparation phase which will be used by the main follow-on contractors to accommodate temporary construction facilities such as site offices, parking, storage of construction materials and temporary sheds/workshops. Laydown will be constructed of excess cut material and a layer of stone will be placed over a layer of geotextile membrane as required. The laydown area will be suitably drained and any areas which will involve the storage of fuel and refuelling will have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems. During the removal of the topsoil and placement of the stone for the laydown area precautions will be taken to minimise run-off into ditches and drains.

3.3.2 Civil Works

SI works at the Ballykilleen AGI location have revealed wet and peaty subsurface conditions. The findings from the investigations have directly informed the civil design of the compound. To achieve the specified ground bearing capacity of 150 kN/m^2, in accordance with AD/SP/005, excavations shall be required to a maximum depth of 2m or to firm strata, whichever is shallower. A geomembrane layer shall be installed at excavation and T1 material fill placed to achieve the proposed FGL.

Pipe trenches will be excavated prior to the arrival of the pipework on site using a tracked excavator as with the pipeline. Excavated material will be stored on site for re-use. Refer to Figure 41 which shows the trenches excavated for installation of Ballykilleen AGI pipework.

Figure 41: Typical Excavations for AGI Below Ground Pipework

Following the installation and backfilling of all pipework, the site will be brought up to the agreed formation level.

Concrete will be poured and levelled for the civil support bases of the following components:

- Temporary Pig Trap (Approx. 5m x 12m)
- Future Bypass Valve (Approx. 1.2m x 1.2m)
- PRS Kiosk (Approx. 20.2m x 6.3m)
- PBU Kiosk (Approx. 9m x 8m)
- E&I Kiosk (Approx. 6m x 8m)
- Gas Analyser Kiosk (Approx. 6.4m x 5.2m)

A 2.4 m high palisade security fence and 1.2 m high mesh fence shall be erected around the Ballykilleen AGI site boundary, including all associated access and emergency gates, please refer to drg. no. 14303-GNI-01-PL-SLA-0001-01.

A concrete roadway is proposed for construction within the site boundary. In conjunction with this, a site drainage system will be installed. Gullies and manhole covers will be installed and checked for level. Footpaths will be prepared for subsequent concreting and will be finished with a brushed texture.

As has been agreed with the customer, the Ballykilleen AGI drainage system will be connected to the Bord na Mona existing drainage infrastructure. The connection point will be at a manhole located external to the Ballykilleen AGI compound and is shown in drg. no. 14303-GNI-01-PL-SLA-0001-01.

A layer of stone chip will be placed across the entire site to complete the surface finish.

Figure 42 illustrates the Ballykilleen AGI layout incorporating all the elements described above.

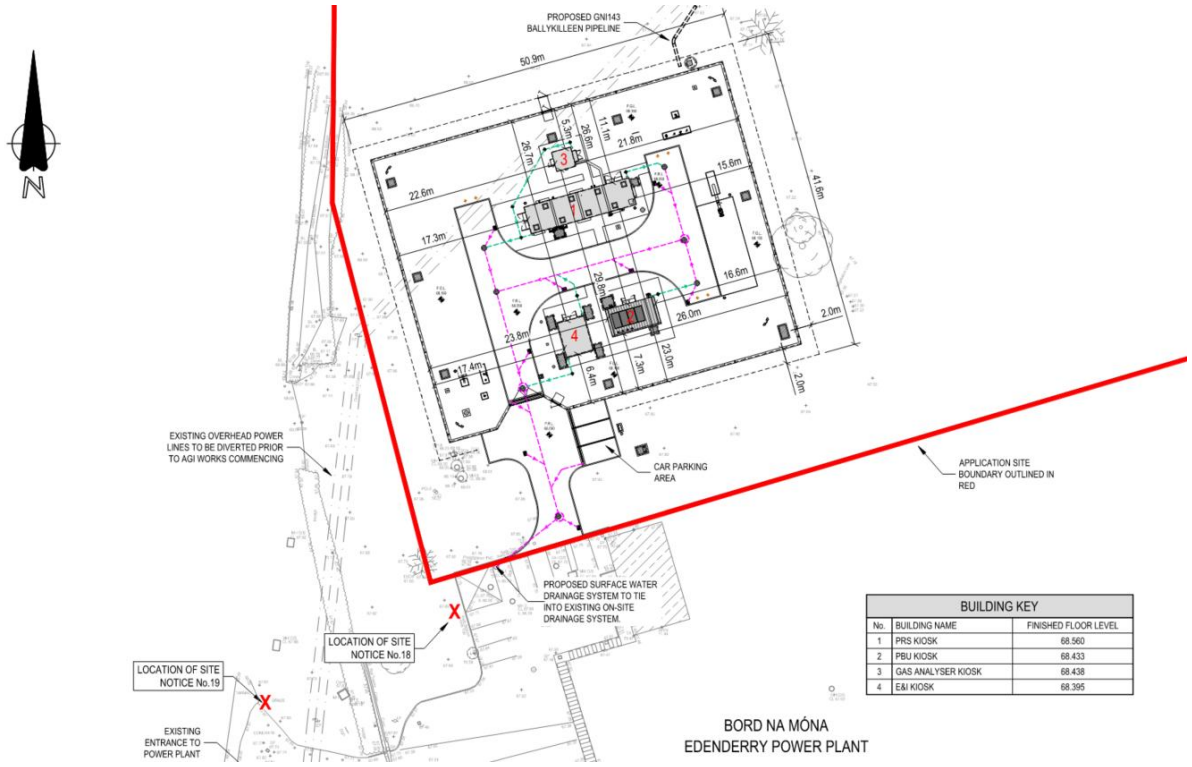


Figure 42: 14303-GNI-01-PL-SLA-0001-01 Site Layout Plan Containing the Elements Discussed in Section 3.3.2 and 3.3.3

3.3.3 Mechanical Works

As discussed in Section 3.3.2 trenches will be excavated in preparation for the following pipework to be installed:

- Inlet Gas Pipework
- Outlet Gas Pipework
- Fuel Gas Pipework
- Low Temperature Hot Water Pipework
- Site Electrical and Instrumentation Ducting

The pipework listed above will connect the following site buildings/units:

- PRS Kiosk – refer to Figure 43
- PBU Kiosk – refer to Figure 44
- E&I Kiosk – refer to Figure 45
- Gas Analyser Kiosk – refer to Figure 46

Welded joints shall be made and inspected in accordance with the latest edition of EN 12732, AD/SP/002, and AD/SP/007.

All high-pressure welds shall be subject to 100% non-destructive testing as per AD/SP/002 Clause 8.3.

The pipework shall be surveyed in its final position, with all above ground pipework will being painted in accordance with AD/SP/009 while all below ground pipework shall be coated in accordance with AD/SP/008.

Where a pipe is in contact with a mechanical jack or ring type support, the pipe will be coated in MCL (Refer to AD/SP/008), at 100 mm either side of the contact area. The supports will have min 1.6 mm thick neoprene, grade C70 to BS 2752 at the contact point as per BGE/ST/1003

Any damage to existing coating during the works shall be repaired to the same specifications.

Following installation, coating and surveying the new pipework will be backfilled. CL503 will be transported to the excavation and placed around all pipework and valves during the backfilling process.

Figure 43: Typical PRS Kiosk

Figure 44: Typical PBU Kiosk

Figure 45: Typical E&I Kiosk

Figure 46: Typical Gas Analyser Kiosk

Storage of Plant and Machinery

The construction phase of the proposed development will involve site clearance, excavation and the construction of the proposed Ballykilleen AGI and GNI134 Ballykilleen Pipeline. A variety of plant will be in use, such as excavators, breakers, lifting equipment, dumper trucks, compressors, generators and pile drivers. All plant, machinery and equipment will be stored on site within the works area or within the temporary construction compounds mentioned in Section 2.4.

Oils and fuels will not be stored on the AGI site and will be stored in an appropriate bunded area within the temporary works compound.

Expected Site Personnel and Construction Duration

It is expected that the construction of the Ballykilleen AGI and GNI143 Ballykilleen Pipeline will be completed during normal construction hours i.e., 7am to 7pm Monday to Friday, and 8am to 2 pm on Saturdays. However, it is possible that the contractor may wish to carry out certain operations outside these hours i.e., Sunday or evening hours during long summer days etc. Such occurrences will be kept to a minimum and take place over a short timeframe and as such are unlikely to cause excessive disturbance.

It is estimated that there will initially be 30-40 site personnel on site on a typical day, however during peak construction periods this is expected to fluctuate up to a maximum of 80 site personnel and contractors on site per day. Site personnel will include management, engineers, construction crews, supervisors, environment health and safety personal, and pipeline specialist contractors.

Estimates for the duration of the construction works are included in Table 8 below. The overall start-to-finish duration could take up to 22 months if the construction activities for the hot tap, pipeline and AGI do not run concurrently. Construction is anticipated to commence in Q1 2028. A typical 10-month pipeline construction schedule is shown in Table 9.

Table 8: Estimated Construction Duration

Project Element	Estimated Construction Duration
Hot Tap	4 months
Pipeline	10 months
AGI	8 months

Table 9: Typical Pipeline Construction Programme (10 Months)

	FEBRUARY '28					MARCH '28				APRIL '28				MAY '28					JUNE '28				JULY '28				AUGUST '28					SEPTEMBER '28				OCTOBER '28				
	01-Feb	08-Feb	15-Feb	22-Feb	29-Feb	07-Mar	14-Mar	21-Mar	28-Mar	04-Apr	11-Apr	18-Apr	25-Apr	02-May	09-May	16-May	23-May	30-May	06-Jun	13-Jun	20-Jun	27-Jun	04-Jul	11-Jul	18-Jul	25-Jul	01-Aug	08-Aug	15-Aug	22-Aug	29-Aug	05-Sep	12-Sep	19-Sep	26-Sep	03-Oct	10-Oct	17-Oct	24-Oct	31-Oct
HEDGE/TREE REMOVAL	■	■	■	■	■																																		
MOBILISE / SET UP					■	■	■	■	■	■																														
SURVEY & SET OUT						■	■	■	■	■	■																													
TEMPORARY FENCING										■	■	■	■	■	■	■																								
TOPSOIL STRIP											■	■	■	■	■	■	■																								
BOGMAT CREW												■	■	■	■	■	■	■	■																						
HAUL & STRING LINE PIPE														■	■	■	■	■	■	■																				
LINE PIPE BENDING															■	■	■	■	■	■	■																				
WELDING																■	■	■	■	■	■	■	■																			
DITCH																		■	■	■	■	■	■	■	■																
LOWER & LAY																		■	■	■	■	■	■	■	■																
BACKFILL																			■	■	■	■	■	■	■	■															
CROSSINGS																■	■	■	■	■	■	■	■	■	■	■	■														
TIE-INS																				■	■	■	■	■	■	■	■	■	■												
REGRADE																							■	■	■	■	■	■	■												
LAND DRAINAGE																								■	■	■	■	■	■	■											
REPLACE TOPSOIL																									■	■	■	■	■	■	■										
TEST																										■	■	■	■	■	■	■	■								
PIG																																		■						
DRY																																			■	■				
PERMANENT FENCES / TRIM																												■	■	■	■	■	■	■	■	■	■			

Material Sourcing and Transportation

Construction material will be sourced locally as much as possible to minimise the environmental impact of transportation. It is intended that all suitable stone recovered on the site will be reused as hardcore in the building construction. For this purpose, rock crushing and screening plant will be provided. Additional rock, stone and sand materials will be procured from local quarries as required.

The methods of transport of construction materials have not been finalised yet. All the materials are likely to be transported to the site by road.

Some of the process equipment and structural elements will arrive on site as complete units or sub-assemblies which will be larger than normal construction loads. Some of the units may be “extra-large loads” and a Garda escort may be required when they are on the road network. The timing of their transport to the site will be chosen to minimise disruption to other roads users.

Waste Management Plan

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts caused by transporting it. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme (implemented by the Environmental Protection Agency) and material exchange networks, for example 'Freecycle'.

All waste removed from the site will be collected only by contractors with valid waste collection permits (under the Waste Management (Collection Permit) Regulations 2001 as amended). All facilities, to which waste will be taken, will be checked in advance, to ensure that they have appropriate waste licences or permits allowing them to accept the type of waste that is to be sent there (under the Waste Management Act 1996 as amended by the Protection of the Environment Act 2003, and the regulations thereunder). Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the Waste Management (Hazardous Waste) Regulations 1998 and 2000.

Traffic Management

Traffic management and road signage for site access will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Westmeath, Meath and Offaly County Councils. The contractor will prepare detailed traffic management plans for the project. For works on private land, traffic management plans and signage will incorporate requirements from the landowner.

The Construction Traffic Management plan will be regularly reviewed and updated to take into account the changing patterns of both the existing traffic and the construction traffic following consultation with Westmeath, Meath and Offaly County Councils and the Gardai. The routing of any exceptional loads will require liaison with the Local Authorities and the Garda Síochána.

The traffic generated by the construction phase shall be based on the following assumptions regarding the peak number of personnel employed on-site and the quantity of construction vehicles needed to service the construction site.

- 80 on-site construction workers at peak
- 2 visitor vehicles to the site per day
- 5 light goods vehicles (LGV) deliveries per day
- 5 heavy goods vehicles (HGV) deliveries per day

Commissioning

Following completion of construction and installation of equipment, and before the Ballykilleen AGI and associated works commence operations, there will be a testing and commissioning phase. This phase will comprise:

- Installation compliance checks
- Commissioning tests
- Performance demonstration tests

9.1 Installation Compliance Checks

This will be a process of systematically checking that all systems and equipment have been constructed, assembled, aligned and installed correctly, in accordance with the design specifications and drawings, and that all interconnecting pipe work, cabling and wiring has been installed in compliance with the design specifications and drawings.

9.2 Commissioning Tests

The pipework will be cleaned and tested in accordance with the I.S. 328:2021, AD/SP/006, and AD/SP/007. Prior to the commencement of the hydro test, the pipeline will be swabbed with pigs to clean out any debris and a gauge pig will be used to prove the pipelines internal diameter.

The GNI143 Ballykilleen Pipeline, Kilwarden Offtake Installation and Ballykilleen AGI pipework is then hydrotested to prove strength and integrity after construction. Following successful completion of the hydro test, the pipeline and AGI pipework will be dried using foam pigs and desiccant air. The pipeline and pipework will then be gassed up.

The function of each item of equipment and each system in the Ballykilleen AGI will be tested and verified also, in a systematic manner, as being in accordance with the design and specifications. All the alarm and control systems and instrumentation will be tested to demonstrate that they are functioning correctly. Following these tests, each system will be checked to ensure that it is ready to be commissioned under operating conditions including using real materials, temperatures, pressure and voltages.

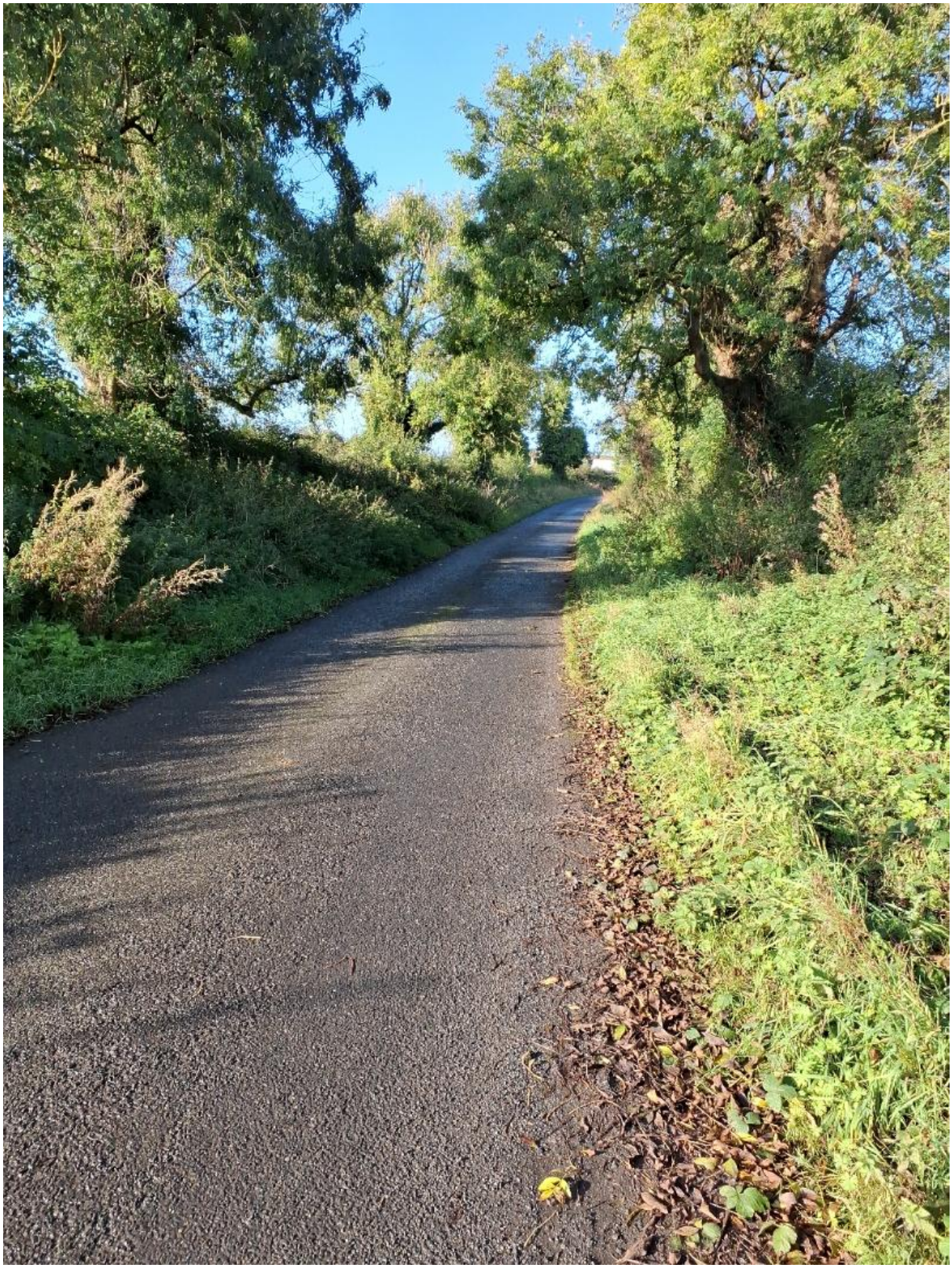
9.3 Performance Demonstration Tests

In this commissioning phase the individual items of equipment and systems will be tested under operating conditions using the materials, temperatures, pressure and voltages to which they will be subjected when in operation. Once the operation of all equipment and systems has been tested and verified individually, they will be integrated, and the operation of complete systems will be tested.

APPENDIX A: Images of Roads and Water Course Crossings

1: RDX01

2: RDX02



3: RDX03

4: RDX04

5: RDX05

6: RDX06

7: RDX07

8: RDX08

9: RDX09

10: RDX10

11: RDX11

12: RDX12

13: RDX13

14: RDX14

15: RDX15

16: RDX16

17: RDX17

18: RVX01

19: RVX01

20: WCX01

21: WCX02

22: WCX03

23: WCX04

24: WCX05

25: WCX06

26: WCX07

27: WCX08

28: WCX09

29: WCX10

30: WCX11

31: WCX12

32: WCX13

33: WCX14

34: WCX15

35: WCX16

36: WCX17

37: WCX18

38: WCX19

39: WCX20

40: WCX21

41: WCX22

42: WCX23

43: WCX24

44: WCX25

45: WCX26

46: WCX27

47: WCX28

48: WCX29

49: WCX30