

Environmental Impact Assessment Report (EIAR)

Volume 2 of 6: EIAR Main Report

(Chapter 5) Construction & Commissioning

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Acronyms and Abbreviations

Acronym	Meaning
BPS	Booster Pumping Station
BPT	Break Pressure Tank
CBR	California Bearing Ratio
CC	Construction Compound
CCTV	Closed-Circuit Television
CEMP	Construction Environmental Management Plan
CP	Cathodic Protection
DC	Direct current
DMP	Dust Management Plan
ECoW	Ecological Clerk of Works
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
ESBN	Electricity Supply Board Networks
FAT	Factory Acceptance Testing
FCV	Flow Control Valve
GDA WRZ	Greater Dublin Area Water Resource Zone
GPS	Global Positioning System
ha	Hectare
HLPS	High Lift Pumping Station
IFI	Inland Fisheries Ireland
INNS	Invasive Non-Native Species
kV	Kilovolt
LLO	Landowner Liaison Officer
LV	Low voltage
m	Metre
M&E	Mechanical and electrical
m ²	Square metre
m ³	Cubic metre
MEICA	Mechanical, Electrical, Instrumentation, Control and Automation
mg/l	milligram per litre
Mld	Megalitres per day
mm	Millimetre
mAOD	Metres Above Ordnance Datum
MV	Medium voltage
NVMP	Noise and Vibration Management Plan
OSEC	On-site Electrolytic Chlorination

Acronym	Meaning
PCAS	Peatlands Climate Action Scheme
PSD	Pipe Storage Depot
PV	Photovoltaic (Solar Panel)
REAC	Register of Environmental Actions and Commitments
RWBT	Raw Water Balancing Tank
RWI&PS	Raw Water Intake and Pumping Station
RWRMs	Raw Water Rising Mains
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SMP	Soil Management Plan
SWMP	Surface Water Management Plan
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
TPR	Termination Point Reservoir
uPVC	Unplasticized polyvinyl chloride
UV	Ultraviolet
WTP	Water Treatment Plant

5. Construction & Commissioning

5.1 Introduction

1. This chapter describes the Construction Phase (including testing and commissioning) of the Proposed Project as described in Chapter 4 (Proposed Project Description). It provides an outline of the proposed phasing of construction and commissioning and the measures which are proposed to reduce the impact of construction and commissioning activities on the environment.
2. The Construction Phase is anticipated to last five years including the testing and commissioning of the pipeline and the associated infrastructure. The construction of the pipeline would generally involve earthwork excavation to create a trench and then laying out the pipe and welding it together. This generally requires a 50m Construction Working Width with larger areas of land required for specific activities such as trenchless crossings and access and egress points from the public road network. There would also be additional land needed for matters such as surface water management, temporary abstractions and discharges, topography or soft ground.
3. In addition to the Construction Working Width there would be land provided for Construction Compounds and Pipe Storage Depots. These form larger temporary working areas. Eight Construction Compounds are proposed, and these would be necessary to provide administrative hubs, welfare facilities and materials/equipment storage. The Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the pipeline. There are nine Pipe Storage Depots proposed along the length of the Proposed Project.
4. The principal project elements are outlined in Table 5.1 and are described in full in Chapter 4 (Proposed Project Description).

Table 5.1: Outline Description of Principal Proposed Project Elements

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Permanent Infrastructure	
Raw Water Intake and Pumping Station (RWI&PS) (Infrastructure Site) County Tipperary	<ul style="list-style-type: none"> • The RWI&PS would be located on a permanent site of approximately 4ha on the eastern shore of Parteen Basin in the townland of Garrynatineel, County Tipperary. In addition, approximately 1ha of land would be required on a temporary basis during construction. • The RWI&PS has been designed to abstract enough raw water from the River Shannon at Parteen Basin to provide up to 300Mld of treated water by 2050. • The RWI&PS site would include a bankside Inlet Chamber, the Raw Water Pumping Station Building, two Microfiltration Buildings, an Electricity Substation and Power Distribution Building, and Dewatering Settlement Basins. The tallest building on the RWI&PS site would be the Microfiltration Buildings which would be 10.9m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power for the RWI&PS would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. • A new permanent access road from the R494 would be constructed to access the proposed RWI&PS site. This access road would be 5m in width and 670m in length. • The RWI&PS site boundary would be fenced with a stock proof fence and a 2.4m high paladin security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
<p>Raw Water Rising Mains (RWRMs) (Pipeline) County Tipperary</p>	<ul style="list-style-type: none"> The RWRMs would consist of two 1,500mm underground pipelines made from steel that would carry the raw water approximately 2km from the RWI&PS to the Water Treatment Plant (WTP) at Incha Beg, County Tipperary. The water would be pumped from the pumping station at the RWI&PS to the WTP. Twin RWRMs have been proposed so that one RWRM can be taken out of service for cleaning and maintenance while still providing an uninterrupted flow of raw water through the other RWRM. The RWRMs would include Line Valves, a Lay-By, Air Valves and Cathodic Protection. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the RWRMs.
<p>Water Treatment Plant (WTP) (Infrastructure Site) County Tipperary</p>	<ul style="list-style-type: none"> The WTP would be located on a permanent site of approximately 31ha at Incha Beg, County Tipperary, 2.6km north-east of the village of Birdhill, and 2km east of the proposed RWI&PS. In addition, approximately 2.5ha of land would be required on a temporary basis during construction. The WTP would treat the raw water received from the RWI&PS via the RWRMs. Once treated, the High Lift Pumping Station (HLPS) would deliver the treated water onwards from the WTP to the Break Pressure Tank (BPT) at Knockanacree, County Tipperary, via the Treated Water Pipeline. The WTP would comprise of a series of tanks and buildings including the Raw Water Balancing Tanks, Water Treatment Module Buildings, Sludge Dewatering Buildings, Sludge Storage Buildings, Clear Water Storage Tanks and HLPS, an Electricity Substation and Power Distribution Building, and the Control Building. The tallest building on the WTP site would be the Water Treatment Module Buildings which would be up to 15.6m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. There would also be a potential future water supply connection point at the junction between the permanent access road and the R445. Power for the WTP would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. Solar panels would be placed on the roofs of the Chemical Dosing Manifold Building, the Water Treatment Module Buildings, Clear Water Storage Tanks and Sludge Storage Buildings, and at a number of locations on the ground to supplement the mains power supply. A new permanent access road from the R445 would be constructed and would be 6m in width and 640m in length. The WTP site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
<p>Treated Water Pipeline from the WTP to the BPT (Pipeline) County Tipperary</p>	<ul style="list-style-type: none"> The Treated Water Pipeline from the WTP to the BPT would consist of a single 1,600mm underground steel pipeline which would be approximately 37km long. The water would be pumped through this section of the Treated Water Pipeline by the HLPS. The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection and Lay-Bys. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
<p>Break Pressure Tank (BPT) (Infrastructure Site) County Tipperary</p>	<ul style="list-style-type: none"> The BPT would be located on a permanent site of approximately 7ha in the townland of Knockanacree, County Tipperary. In addition, approximately 0.8ha of land would be required on a temporary basis during construction. The BPT would be located at the highest point of the pipeline. It marks the end of the Treated Water Pipeline from the WTP to the BPT and the start of the Treated Water Pipeline from the BPT to the Termination Point Reservoir (TPR) in the townland of Loughtown Upper, at Peamount, County Dublin. It would act as a balancing tank and would be required to manage the water pressures in the entire Treated Water Pipeline during flow changes, particularly during start-up and shut-down. The BPT site would include the BPT and a Control Building. The BPT would be a concrete tank divided into three cells covered with an earth embankment. The BPT tanks would be 5m in height and partially buried below finished ground levels. The Control Building would be 7.5m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Access to the BPT site would be via a new permanent access road from the L1064 which would be 5m wide and 794m in length. Power for the BPT would be supplied via an underground connection from the existing overhead power line. Solar panels would be placed on the south facing side of the control building roof, on the BPT and at ground level to the south of the site to supplement the mains power supply. The BPT site boundary would be bounded by the existing hedgerow / tree line with a 2.4m high palisade security fence around the permanent infrastructure. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
<p>Treated Water Pipeline from the BPT to the TPR (Pipeline) Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)</p>	<ul style="list-style-type: none"> The Treated Water Pipeline from the BPT to the TPR would consist of a single 1,600mm underground steel pipeline, approximately 133km long. The water would normally travel through the Treated Water Pipeline by gravity; however, flows greater than approximately 165Mld would require additional pumping from the Booster Pumping Station (BPS) in the townland of Coagh Upper, County Offaly. The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection, Lay-Bys and potential future connection points. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
<p>Booster Pumping Station (BPS) (Infrastructure Site) County Offaly</p>	<ul style="list-style-type: none"> The BPS would be located on a permanent site of approximately 2.6ha in the townland of Coagh Upper, County Offaly. It would be located approximately 30km downstream from the BPT. In addition, approximately 3ha of land would be required on a temporary basis during construction. The BPS would be required when the demand for water causes the flow through the pipeline to exceed approximately 165Mld. The BPS site would consist of a single-storey Control Building with a basement below. It would have a finished height of 7.6m above finished ground level. There would also be a separate Electricity Substation and Power Distribution Building. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Power to the BPS would be supplied from an existing 38 kV electricity substation at Birr, through cable ducting laid within the public road network. There would be ground mounted solar panels on the southern side of the BPS site to supplement the mains power supply. The site would be accessed directly from the L3003. The BPS site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence between 5m -12m inside the boundary. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
<p>Flow Control Valve (FCV) (Infrastructure Site) County Kildare</p>	<ul style="list-style-type: none"> The FCV controls the flows in the Treated Water Pipeline from the BPT to the TPR. It would be a small permanent site of approximately 0.5ha in the townland of Commons Upper in County Kildare. In addition, approximately 0.6ha of land would be required on a temporary basis during construction. It would consist of three 700mm diameter FCVs and three flow meters installed in parallel with the Line Valve and housed within an underground chamber. Access to the FCV site would be directly off the L1016 Commons Road Upper. Power supply to the FCV site would be provided from the existing low voltage network via a combination of overhead lines and buried cables. There would be ground mounted solar panels on the north-eastern side of the site to supplement the mains power supply. Kiosks at the FCV site would house the Programmable Logic Controller, telemetry and power supply for the Line Valve. There would also be a telemetry mast, the top of which would be 14m above finished ground level. The site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary.
<p>Termination Point Reservoir (TPR) (Infrastructure Site) County Dublin (within the administrative area of South Dublin County Council)</p>	<ul style="list-style-type: none"> The TPR would be located on a permanent site of approximately 8.3ha adjacent to an existing treated water reservoir in the townland of Loughtown Upper, at Peamount, County Dublin (within the administrative area of South Dublin County Council) and would have capacity for 75ML of treated water supply. In addition, approximately 1.1ha of land would be required on a temporary basis during construction. It would be located at the downstream end of the Treated Water Pipeline from the BPT to the TPR and would be the termination point for the Proposed Project. It would be at this location that the Proposed Project would connect to the existing water supply network of the Greater Dublin Area Water Resource Zone (GDA WRZ). The TPR would consist of an above-ground storage structure, associated underground Scour Water and Overflow Water tanks and a Chlorine Dosing Control Building. The TPR would be a concrete tank divided into three cells and covered with an earth embankment. The top of the TPR would be 11.2m above finished ground level. The Chlorine Dosing Control Building would be 8.4m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Power for the TPR would be supplied via an underground connection to the existing electricity substation at Peamount Reservoir. There would be solar panels on top of a portion of the northern cell of the TPR to supplement the mains power supply. A new permanent access road from the R120 would be constructed and would be 5m wide and 342m in length. The TPR site would be bounded by the existing hedgerow to the west and existing fence to the east with a 2.4m high palisade security fence around the permanent infrastructure. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.
<p>Proposed 38 kV Uprate Works – Power Supply to RWI&PS and WTP</p>	
<p>Proposed 38 kV Uprate Works Ardnacrusha – Birdhill (Power Supply) Counties Clare, Limerick and Tipperary</p>	<ul style="list-style-type: none"> The proposed 38 kV Uprate Works would be necessary to deliver adequate electrical power to the RWI&PS and WTP. The proposed works would include the uprating of the existing Ardnacrusha – Birdhill Line and the replacement of polesets/structures with an underground cable along a section of the Ardnacrusha – Birdhill – Nenagh Line. There would also be works at the existing Birdhill 38 kV electricity substation including the provision of a new 38 kV modular Gas Insulated Switchgear Modular Building, new electrical equipment and lighting, together with new fencing and associated works.
<p>Temporary Infrastructure – Required for Construction Phase Only</p>	
<p>Construction Working Width Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)</p>	<ul style="list-style-type: none"> A Construction Working Width would be temporarily required for the construction of the RWRMs and the Treated Water Pipeline, and the subsequent reinstatement of the land. The Construction Working Width would generally be 50m in width but would be locally wider near features such as crossings, access and egress points from the public road network, Construction Compounds and Pipe Storage Depots.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Construction Compounds Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	<ul style="list-style-type: none"> • Eight Construction Compounds would be temporarily required to facilitate the works to construct the Proposed Project. Five Construction Compounds would be located along the route of the Treated Water Pipeline at the following Infrastructure Sites: RWI&PS, WTP, BPT, BPS and TPR, with an additional three Construction Compounds located at Lisgariff (County Tipperary), Killananny (County Offaly) and Drummond (County Kildare). Construction Compounds would act as a hub for managing the works including plant/material/worker movement, general storage, administration and logistical support. • The Principal Construction Compound at the WTP would require 30ha of land during construction. • The other three Principal Construction Compounds would require land temporarily during construction ranging between approximately 12ha and 16ha. • The four Satellite Construction Compounds at the other permanent Infrastructure Sites (excluding the FCV) would require land during construction ranging between approximately 3ha and 12ha.
Pipe Storage Depots Counties Tipperary, Offaly and Kildare	<ul style="list-style-type: none"> • Nine Pipe Storage Depots would be temporarily required to supplement the Construction Compounds and would serve the installation of pipe between the WTP and the TPR. • Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the Construction Working Width. • The Pipe Storage Depots would vary in size and require land temporarily during construction generally ranging between approximately 2ha and 7ha but with one site being larger at 11ha.

* Note all land take numbers in this table are affected by rounding to one decimal place.

5. This chapter has been prepared alongside, and should be read in conjunction with, the following chapters and their appendices which expand on aspects of the Proposed Project:

- Chapter 3 (Consideration of Reasonable Alternatives)
- Chapter 4 (Proposed Project Description)
- Chapter 7 (Traffic & Transport)
- Chapter 9 (Water)
- Chapter 10 (Soils, Geology & Hydrogeology)
- Chapter 18 (Material Assets)
- Chapter 19 (Resource & Waste Management).

6. Figures which are referenced in the text are provided in Volume 5 of this Environmental Impact Assessment Report (EIAR).

7. This chapter is also supported by the following appendices:

- Appendix A5.1 (Construction Environmental Management Plan (CEMP)) (including a Surface Water Management Plan)
- Appendix A5.2 (Commissioning Strategy)
- Appendix A5.3 (Methods of Working in Peat)
- Appendix A5.4 (Schedule of Crossings).

5.1.1 Structure of This Chapter

8. Table 5.2 sets out the structure of this chapter. The sections broadly fall into two parts:

- Route-wide construction information in Sections 5.2 to 5.16
- Construction-specific information regarding the Infrastructure Sites and the pipeline in Sections 5.17 onwards.

Table 5.2: Structure of this Construction and Commissioning Chapter

Topic	Sub-Topic	Location Within This Chapter
Construction Terminology	-	Section 5.2
Overall Construction Delivery	-	Section 5.3
Environmental Management of Construction and Commissioning	-	Section 5.4
Construction and Commissioning Programme	-	Section 5.5
Working Logistics	Working Hours	Section 5.6
	Number of Workers	Section 5.7
Temporary Elements Required for Construction Phase only	Construction Compounds and Pipe Storage Depots	Section 5.8
	Construction Working Width	Section 5.9
	Working in Peat	Section 5.10
	Construction Access	Section 5.11
	Temporary Construction Roads	Section 5.12
	Construction Vehicles	Section 5.13
Materials	Temporary Fencing	Section 5.14
	Construction and Commissioning Materials	Section 5.15
Infrastructure Sites	Surplus Excavated Materials and Volumes of Waste	Section 5.16
	Raw Water Intake & Pumping Station	Section 5.17
	Water Treatment Plant	Section 5.18
	Break Pressure Tank	Section 5.19
	Booster Pumping Station	Section 5.20
	Flow Control Valve	Section 5.21
Termination Point Reservoir	Section 5.22	
Proposed 38 kV Uprate Works	Power Supply to RWI&PS and WTP	Section 5.23
Pipelines	-	Section 5.24
Pipeline – Features	Line Valves	Section 5.25.1
	Washout Valves	Section 5.25.2
	Air Valves	Section 5.25.3
	Potential Future Connection Points	Section 5.25.4
Pipeline – Ancillary Pipeline Infrastructure	System Control	Section 5.26.1
	Lay-Bys	Section 5.26.2
	Cathodic Protection (CP)	Section 5.26.3
Construction of Crossings	Temporary Bridges	Section 5.27.1
	Reintroduction of Gravels at Watercourse Crossings	Section 5.27.2
Handover of the Works	-	Section 5.28
References	-	Section 5.29

5.2 Construction Terminology

5.2.1 Identification Labels

9. To aid the reader throughout this EIAR, unique identification labels have been assigned to the following:
- Construction Compounds (CC)
 - Pipe Storage Depots (PSD)
 - Watercourse Crossings – watercourses with Environmental Protection Agency (EPA) segment codes (WCX)
 - Watercourse Crossings – smaller watercourses and streams (WBX)
 - Watercourse Crossings – ditches which have been noted as having some water during field surveys (WBP)
 - Washouts – Permanent Discharge Locations with permanent outfall (WA)
 - Watercourse Washout Location – Permanent outfall locations (WCW)
 - Washouts – Temporary Discharge Locations and Local Discharges (WB)
 - Road Crossings (RDX)
 - Rail Crossings (RYX)
 - High Voltage Overhead Power Crossings (OHX)
 - Access and Egress Points (AE)
 - Crossings of existing powerlines (ESB)
 - Gas pipeline crossings (GCN).
10. Each label is assigned a unique two or three-digit number, for example RDX001, RDX002. Generally, the numbering has been applied beginning at the RWI&PS and then increasing in number as the reader travels along the Proposed Project towards the TPR. In some cases, features do not appear in numerical order or numbering has become redundant due to design development.
11. For the Proposed 38 kV Uprate Works (see Section 5.23), a PSN prefix has been applied to the ID labels.

5.2.2 Terminology

12. Table 5.3 provides a quick reference glossary to some of the terminology used in this chapter. The brief descriptions are not intended to be exhaustive but to provide the reader with context on these terms, techniques and equipment. Where required, the techniques are discussed in greater detail within the chapter.

Table 5.3: Overview of Terminology Describing Construction Techniques and Equipment

Term	Description
Barge	A flat-bottomed boat for transport of plant and material.
Battered excavation	To form the face or side or wall of an excavation at an angle to the horizontal in which earth slippage or slumping would not occur.
Bituminous macadam (Bitmac)	Crushed stone in a bitumen binder.
Bog mat	A ground protection solution, generally made from timber, used to create long-term temporary access roads on construction sites located on or near fragile ground.
Bowser	Mobile tanker containing water.
Bulldozer	A large and heavy tractor equipped with a substantial metal plate (termed a blade) used to push large quantities of excavated material during construction. Only for use on the Infrastructure Sites.
Bunding	A constructed barrier for the retention or containment of liquid material.
Caisson	A watertight retaining structure used in construction.
Casing end seals	A means of closing the space between the carrier (steel) pipe, and the larger surrounding pipe ('sleeve') which serves to contain it, preventing ingress of moisture and debris into the void between the pipes which could possibly corrode or damage the carrier pipe.
Casting	A manufacturing process which uses moulds to create a product in a controlled environment.
Cathodic Protection	Cathodic Protection is a technique used to control the electrochemical corrosion of a metal surface. It is described in Section 4.13 of Chapter 4 (Proposed Project Description).
Centrifugal force	The apparent force felt by an object moving in a curved path that acts outwards and away from the centre of rotation.
Cofferdam	An enclosure built within or across a body of water to allow the enclosed area to be pumped dry.
Concrete batching plant	Equipment that combines various ingredients, e.g. water, air, sand, stone aggregate, cement, to form concrete.
Concrete revetment mats	A flexible mat of meshed thin concrete segments used for stabilisation of sloping structures and erosion control.
Conductor	Metal cables for the transmission of electric power.
Construction flexibility	This refers to the ability to manage the delivery of the Proposed Project within normal construction practice to overcome unknown site constraints / obstacles.
Construction Working Width	The works area required for the construction of the RWRMs and the Treated Water Pipeline would generally be 50m wide but would be locally wider near features such as crossings, access and egress points from the public road network and Pipe Storage Depots.
Contractor	Any reference to the appointed Contractor means any of the Contractors Uisce Éireann (or ESB Networks in the case of the Proposed 38 kV Uprate Works, see Section 5.23) may appoint for the Construction Phase of the Proposed Project.
Culvert	An enclosed structure that allows water to flow under an obstruction such as a road or railway.
Cut and fill operations	The process of earth moving where surplus excavated material from one part of a site is used to balance the soil material deficit in another part of the site.
Dense bitumen macadam	20mm or 28mm aggregate in a bitumen binder.
Dry well	A dry underground structure associated with a pumping station, easily accessible, for housing pump pipework, including pumps, and ancillary infrastructure.
Dump truck	Plant for transporting construction materials with a back part that can be raised at one end so that its contents can be deposited.
Excavator	Plant with a boom/arm and bucket/shovels for excavating large volumes of construction materials.
Formation layer	The surface level at which the excavation ceases, and construction starts.
Formation level	The deepest point of an excavation; the starting level, usually expressed as a depth below ground level, for the construction of a structure.
Gas Insulated Switchgear Modular Building	Prefabricated building for housing the Gas Insulated Switchgear.
Geogrid mattress	A synthetic material typically used to reinforce soils and subsoils below structures.
Graders	Plant with a long blade used for grading or defining the level of the material that is being graded.

Term	Description
Hardcore surface	A mass of solid materials used to create a firm and level working base or temporary road surface.
Haul Road	Part of the public road network for the movement of plant, labour and construction materials.
Horizontal directional drilling	A practice of drilling that uses steerable drilling rigs allowing horizontal alignment of straight or curved pipes and ducts without the need for open trenches.
Impact hammer	A piston or ram is dropped from a height onto an anvil block with a driving cap for driving sheet piles into hard soils. The impact hammer/pistol or ram/anvil block is supported within a heavy frame or chassis to maintain a vertical position during operation.
Jib	The horizontal part of a crane or other construction plant.
Launch pit	An excavated area at the beginning of a trenchless construction operation used to stage drilling operations including placement of the equipment and insertion of the drilling head.
Manifold	A piece of pipework containing multiple inlets/outlets.
Mobile Elevated Work Platform	A mobile machine used to move persons to working positions where they are carrying out work from the work platform.
Passive rock dowels	Reinforcing rods inserted into predrilled holes in the rock to provide structural stability.
Penstock	A hydraulic gate to control the flow of water within a channel or conduit.
Permeable geotextile membrane	Large sheets of fabric used for filtration.
Pile driver	A device used to drive piles into soil to provide foundation support for buildings or other structures.
Piling	The use of heavy stakes, posts or sheets installed to support foundations of a structure.
Pipe jacking	A trenchless pipe construction method used to install underground pipes by hydraulically pushing prefabricated sections through the ground from a launch shaft without the need for open trenches.
Pipeline Corridor	The Pipeline Corridor is a 20m width along the length of the pipeline (including both the RWRMs and the Treated Water Pipeline).
Pipeline features	The pipeline features refer to the ancillary infrastructure that is needed along the length of the pipeline to support its operation. This would include Air Valves, Line Valves, Washouts, Manways, Kiosks and Lay-Bys. It also includes potential future connection points.
Poleset	Vertical poles used to suspend electricity lines above the ground at a safe height.
Pontoon	A large flat-bottomed barge equipped with plant to carry out construction works from the lakeside.
Precast concrete	Concrete cast off site and delivered to site to be incorporated within the works.
Puddle clay	A watertight material based on clay and water mixed to be workable.
Pump sump	A pit serving as a receptacle for water and enabling the use of pumping equipment to remove it.
Reception pit	An excavated area at the end of a trenchless construction operation which receives the pipe. Used for removing the drilling head equipment.
Reciprocating driving head mounted	A form of pumping mechanism incorporating repetitive up-and-down or back-and-forth linear motion.
Reinforced concrete	Concrete in which steel is embedded in such a manner that the two materials act together in resisting forces. The reinforcing steel – rods, bars or mesh – absorbs the tensile, shear and sometimes the compressive stresses in a concrete structure.
Reprofiling	To change the profile of the existing ground from that which existed prior to construction.
Ripping claw	An attachment to an excavator with one or more sharp tooth-like tips for breaking up softer rock which is already fractured.
Road roller	A compactor-type plant used to compact soil, gravel/hardcore, or bituminous material in the construction of roads and foundations.
Rotary core drilling	A rotary coring system designed to drill deep boreholes.
Scarify	The process of breaking up soil by fracturing or tilling it.
Screening berm	A level space or raised barrier separating two areas.
Secant piles	Secant pile walls are formed by constructing intersecting reinforced concrete piles.
Sheet pile	A type of piling that has an interlocking section used to form a watertight retaining wall.
Stank	A buried 'dam' of material impervious to the passage of water.

Term	Description
Stay	Galvanised steel wire strands used for sustaining mechanical load. Generally made of several wires stranded around one wire and twisting together. Used to 'stay' polesets.
Steel fixing	Shaping and fitting steel rods, bars or mesh for incorporation within reinforced concrete.
Steel shuttering	Temporary moulds into which concrete is poured.
Steerable boring machine	Used in trenchless technology – a machine capable of being operated remotely allowing the operator to keep the material being cored through to the correct horizontal and vertical alignment.
Structural steelwork	A category of steel capable of supporting high loading without excessive sagging or bending.
Subsoil	The layer of soil immediately under the surface soil.
Substantially complete	The construction of the pipeline has finished, earthworks reinstated and the pipeline commissioned. Completion of activities such as planting and on-going maintenance of the reinstatement such as watering of planting could still be on-going.
Terram fabric	Permeable non-woven fabrics used in construction to separate, filter, reinforce, protect or drain a site.
Topsoil	The upper, outermost layer of soil with a typical depth of 150mm to 400mm.
Tracked vehicle	A self-propelled vehicle that moves on two tracks.
Tractor mounted flat lift rippers	Plant used for deep tillage, loosening, and breaking up of subsoil.
Tractor shovel	A tractor which has a bucket for digging, elevating and dumping its load at truck height.
Vegetation clearance	Removal of hedgerows, trees and scrub.
Vibratory hammer	A tool used to drive piles into or out of the ground using spinning counter-weights to create vibration to the pile causing it to 'liquify' and slip in the ground.
Vibratory rollers	A compactor having a horizontal cylinder used to compact soil, asphalt or other materials through the application of combined static and dynamic forces (weight and vibrations) to increase the load-bearing capacity of the surface.

5.3 Overall Construction Delivery

13. The delivery of the construction of the Proposed Project is based on the division of the works into geographical sections as outlined in Table 5.4. This is necessary to allow a linear project to be delivered efficiently.

Table 5.4: Assumed Geographical Sections for the Proposed Project

Geographic Section	Key Project Elements Included in geographical section of the Proposed Project	Associated Construction Compounds (CC) and Pipe Storage Depots (PSD)	Pipeline Features and Ancillary Pipe Infrastructure								
			Line Valves	Washout Valves	Air Valves	Flow Control Valve	Connection Points	System Control	Kiosks	Lay-Bys	Cathodic Protection
1	RWI&PS, RWRMs and WTP. Section includes approximately 2km of twin pipeline,	CC0 RWI&PS CC1 WTP	✓	-	✓	-	✓	✓	✓	✓	✓
2	Treated Water Pipeline between TW – 0 and TWA – 2000, including the BPT. Section includes approximately 39km of pipeline,	PSD1 Carrigatogher CC2 Lisgarriff CC3 BPT	✓	✓	✓	-	-	✓	✓	✓	✓

Geographic Section	Key Project Elements Included in geographical section of the Proposed Project	Associated Construction Compounds (CC) and Pipe Storage Depots (PSD)	Pipeline Features and Ancillary Pipe Infrastructure								
			Line Valves	Washout Valves	Air Valves	Flow Control Valve	Connection Points	System Control	Kiosks	Lay-Bys	Cathodic Protection
3	Treated Water Pipeline between TWA – 2000 and TWC – 7860 (R420), including the BPS Section includes approximately 62km of pipeline	PSD2 Toora PSD3 Boveen PSD4 Fortel CC4 BPS PSD5 Derrinboy CC5 Killananny PSD6 Derryweelan	✓	✓	✓	-	✓	✓	✓	✓	✓
4	Treated Water Pipeline between TWC – 7860 (R420) and TWE – 17870 (TPR) including the TPR Section includes approximately 69km of pipeline)	PSD8 Rathlumber CC6 Drummond PSD9 Graiguepottle PSD10 Barberstown Upper CC7 TPR	✓	✓	✓	✓	✓	✓	✓	✓	✓

14. Additional packages of work required include:

- The Proposed 38 kV Uprate Works
- Power connections to Line Valves and the BPS
- Commissioning the pipeline.

15. Each of the individual sections or phases of works would be scheduled so that substantial construction completion is achieved in good time to allow commissioning of the whole pipeline in the final year of the Construction Phase.

16. For each geographical sections of the Proposed Project summarised in Table 5.4 the main pipeline construction would be over a total period of three years (excluding testing and commissioning).

17. Therefore, for each of the geographical sections 2, 3 and 4 of the pipeline, as defined in Table 5.4, each Contractor would have three years of dry period working (assumed to be spring through to autumn) to lay approximately 40 - 70km of pipeline each. Therefore, each Contractor would, very approximately, need to build between 12 - 25km of pipeline each year of that three year period.

5.3.1 Sequential Delivery of Construction Works

18. It is anticipated that each section of works would broadly be delivered in a west to east sequence and that further, a Contractor would aim to complete a length of pipeline construction between two access points in a single year.

19. There would be exceptions to the general west to east delivery due to matters, such as, suitable access points and the requirements for trenchless crossing construction techniques. Table 5.5 provides a summary of the direction of the construction for these crossings.

Table 5.5: Direction of Trenchless Crossing Construction

Construction Matter	Direction of Construction
Trenchless crossing drives	<p>There would be 44 trenchless crossings along the length the pipeline (noting that there would be flexibility in the construction methodology for the MV/LV power line crossings as described in Section 5.3.3). Of these trenchless crossings, 11 would primarily be water crossings, 9 would primarily be road crossings, 18 would be overhead powerline crossings, 2 would be rail crossings, 3 would primarily avoid a steep slope and 1 would be due to existing land use. These crossings would typically be constructed from west to east unless otherwise specified:</p> <p>RDX001: This crossing would be for a road crossing and steep slopes and occurs between RW –800 to RW – 1100 and would extend in a north-easterly direction for approximately 300m to avoid very deep excavation.</p> <p>RDX003: This road crossing occurs at TW –1900 and would extend in a south-easterly direction for approximately 50m.</p> <p>WBX008/WBX009: This crossing would be for steep slopes and occurs between TW – 3600 to TW – 3900 and would extend in an east by north-easterly direction for approximately 300m.</p> <p>RDX007: This road crossing occurs at TW – 5500 and would extend in a south-easterly direction for approximately 200m. This trenchless section would be constructed broadly from east to west in a north-westerly direction.</p> <p>OHX001: This overhead powerline crossing occurs at TW – 7400 and would extend in an east by north-easterly direction for approximately 50m.</p> <p>OHX002: This overhead powerline crossing occurs at TW – 10500 and would extend in a north-easterly direction for approximately 60m.</p> <p>RDX013: This road crossing occurs at TW – 12700 and would extend in a north by north-westerly direction for approximately 40m.</p> <p>RDX015: This road crossing occurs at TW – 13100 and would extend in a northerly direction for approximately 70m.</p> <p>WCX016: This water crossing occurs at TW – 19500 and would extend in a north-easterly direction for approximately 60m.</p> <p>OHX003: This overhead powerline crossing occurs at TW – 24800 and would extend in a north-westerly direction for approximately 50m.</p> <p>OHX004: This overhead powerline crossing occurs between TW – 26200 and would extend in a north by north-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>RDX026 and RDX 128: This road crossing occurs at TW – 28900 and would extend in a north by north-easterly direction for approximately 100m.</p> <p>BPT: This tunnelled crossing is due to steep slopes and occurs between TWA – 0 to TWA – 200 and would extend in a north-easterly direction for approximately 200m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>WCX026: This water crossing occurs at TWA – 13000 and would extend in a north-easterly direction for approximately 60m.</p> <p>RDX044: This road crossing occurs at TWA – 14200 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX005: This overhead powerline crossing occurs at TWA – 21700 and would extend in a north-easterly direction for approximately 40m.</p> <p>WCX031: This water crossing occurs at TWA – 26000 and would extend in an east by north-easterly direction for approximately 80m.</p> <p>WCX032 / RDX053: This water and road crossing occurs between TWA – 27600 to TWA – 27950 and would extend in a north by north-easterly direction for approximately 350m. This trenchless section would be constructed broadly from east to west in a south-westerly direction.</p> <p>OHX006: This overhead powerline crossing occurs at TWB – 1700 and would extend in an easterly direction for approximately 50m.</p> <p>OHX007: This overhead powerline crossing occurs at TWB – 11700 and would extend in a north by north-easterly direction for approximately 50m.</p> <p>WCX036: This water crossing occurs at TWB – 12600 and would extend in a north-easterly direction for approximately 60m.</p> <p>WCX039: This water crossing occurs at TWB – 24900 and would extend in an east by north-easterly direction for approximately 70m.</p> <p>OHX008: This overhead powerline crossing occurs at TWB – 27800 and would extend in a north-easterly direction for approximately 50m.</p> <p>RDX071: This road crossing occurs at TWC – 100 and would extend in a north by north-easterly direction for approximately 40m.</p>

Construction Matter	Direction of Construction
	<p>RYX005: This rail crossing occurs at TWC – 4800 and would extend in a north-easterly direction for approximately 50m.</p> <p>RDX077: This road crossing occurs between TWC – 8900 and TWC-9000 would extend in a north-easterly direction for approximately 90m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>OHX024: This overhead powerline crossing occurs at TWC – 11800 and would extend in a north-easterly direction for approximately 50m.</p> <p>WCX056: This water crossing occurs at TWD – 4100 and would extend in an east by south-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p> <p>WCX057: This water crossing occurs at TWD – 6400 and would extend in a south-easterly direction for approximately 80m. This trenchless section would be constructed broadly from east to west in a north by north-westerly direction.</p> <p>WBX078: This water crossing occurs at TWD – 15100 and would extend in a north by north-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a south-westerly direction.</p> <p>OHX009: This overhead powerline crossing occurs at TWD – 15500 and would extend in a north by north-easterly direction for approximately 50m.</p> <p>OHX010: This overhead powerline crossing occurs at TWD – 15700 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX011: This overhead powerline crossing occurs at TWD – 22300 and would extend in an east by north-easterly direction for approximately 50m.</p> <p>OHX012: This overhead powerline crossing occurs at TWD – 25800 and would extend in a south by south-easterly direction for approximately 70m.</p> <p>OHX013: This overhead powerline crossing occurs at TWD – 29500 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX014 and OHX015: This overhead powerline crossing occurs at TWE – 2800 and would extend in a south by south-easterly direction for approximately 80m.</p> <p>OHX016: This overhead powerline crossing occurs at TWE – 5200 and would extend in an east by south-easterly direction for approximately 60m.</p> <p>OHX017: This overhead powerline crossing occurs at TWE – 6300 and would extend in a southernly direction for approximately 60m.</p> <p>RDX107: This road crossing occurs at TWE – 8500 and would extend in a southernly direction for approximately 70m.</p> <p>RDX108 / OHX018 / WCX076 / WCX073: This crossing occurs between TWE – 9600 to TWE – 9800 and would extend in a south-easterly direction for approximately 250m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p> <p>OHX019: This overhead powerline crossing occurs at TWE – 10200 and would extend in an east by south-easterly direction for approximately 50m.</p> <p>RYX006: This rail crossing occurs at TWE – 12400 and would extend in a south by south-easterly direction for approximately 60m.</p> <p>WBX088: This water crossing occurs at TWE – 14200 and would extend in a south-easterly direction for approximately 80m. This trenchless section would be constructed broadly from east to west in a north-westerly direction.</p> <p>RDX113 / RDX114: This crossing is due to the existing land use and occurs between TWE – 15400 to TWE – 15600 and would extend in an east by south-easterly direction for approximately 300m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p>

5.3.2 Assumptions on Ground Conditions

20. An extensive programme of Ground Investigation has been undertaken along the length of the Proposed Project. This has been used to inform the understanding of where along the pipeline the following activities would be required:

- Breaking out of rock
- Use of construction techniques to take account of alluvium or peat soils

- Piling or other techniques to provide geo-technical support for the proposed infrastructure including the pipe.
21. The Ground Investigation was undertaken at particular points along the route of the Proposed Project and therefore the data obtained has had to be interpreted to draw inferences about the material / soils along the length of the pipeline. For example, for some sections of peat, inferences on the peat depth have been drawn over lengths of up to 150m. To account for this, as set out in Chapter 4 (Proposed Project Description), design parameters have been defined to provide the necessary flexibility, in respect of the exact route of the pipeline, and ancillary features, within the Planning Application Boundary, to overcome potential obstacles or constraints.

5.3.3 Construction Flexibility

22. As described in Chapter 4 (Proposed Project Description) construction flexibility has informed the basis of the assessment to allow for a level of flexibility for the location of the pipeline, valves and the outfalls. This flexibility affects the corresponding construction activities needed to build the pipeline and valves as summarised in Table 5.6. This level of construction flexibility is within normal construction practice.
23. The assessment reported in this EIAR has considered all the likely significant effects that could arise from the construction flexibility as defined in Table 5.6.
24. The construction works necessary to deliver the permanent design, including the construction flexibility summarised in Table 5.6, would take place within the Construction Working Width which defines the extent of the Planning Application Boundary (described in Section 5.9). For the assessment reported in this EIAR this means that the construction works could take place anywhere within the Construction Working Width. On this basis, for the environmental assessment the following has been allowed for:
- Excavation, earthworks, storage of materials, temporary road construction, settlement ponds / temporary drainage, temporary lighting, temporary generators could be located anywhere within the Construction Working Width
 - Location specific activities such as temporary piling due to poor ground conditions or rock break out could take place at the required locations anywhere within the Construction Working Width
 - Removal of all vegetation within the Construction Working Width (excluding in some instances the perimeter boundary or trenchless crossings with no above ground disturbance)
 - Stripping of all topsoil within the Construction Working Width.

Table 5.6: Construction Flexibility Underpinning the Assessment Reported in this EIAR

Design Element	Construction Flexibility	Associated Construction Activities
Pipeline construction	Treated Water Pipeline and RWRMs horizontal alignment – to allow for construction flexibility to overcome site constraints or obstacles the pipeline could be anywhere within a 20m Pipeline Corridor as defined in Chapter 4 (Proposed Project Description).	Construction activities for building the pipeline would be within the Construction Working Width.
Pipeline construction	Treated Water Pipeline vertical alignment – to allow construction flexibility to overcome site constraints or obstacles, the vertical alignment of the pipeline could vary between 1.2m and 4.4m to the crown of the pipe. Exceptions would be at proposed trenchless crossing locations (which due to the construction approach would be deeper than 4.4m to crown) and where it has been identified that for hydraulic purposes, the crown of the pipeline would need to be deeper than 4.4m. These have been included in the vertical alignment set out in the Planning Application for the Proposed Project and consequently have been assessed for significant environmental effects as reported in this EIAR. These include e.g. TWB 27100 - 27700 and TWC 2600 - 2750. In these instances, the construction flexibility would be the crown of the pipe not being deeper than that shown in the Planning Application Drawings and not shallower than 1.2m. The excavation needed for the pipeline is assumed to be the largest needed for the lowest vertical parameter set out.	The excavations for the pipeline assumed to be the largest needed for the deepest vertical parameter set out.
Valve construction	The location of valves, and associated pipeline features, that need to be above the pipeline could change if there is a change in the vertical or horizontal alignment of the pipeline, as a result of the construction flexibility defined in the two rows above. The construction flexibility would allow them to move within the 20m Pipeline Corridor. However, the location of these pipeline features would be limited to remaining within the land parcels as identified and assessed within the EIAR (but still remaining within the 20m Pipeline Corridor).	Construction activities would be within the Construction Working Width.
Outfall construction	To construct the smaller connection pipes between washout valves and washout outfalls a small amount of construction flexibility would be required to overcome onsite obstacles or constraints. To allow for this the pipe could be anywhere within a 10m corridor. The outfall headwalls and discharge point would have to move with the alignment of the outfall pipeline, as set out above, and so the discharge point could move within the same 10m construction flexibility. To allow for the headwalls to move 10m either side of the current pipeline alignment a total construction flexibility width of 20m has been allowed for the headwalls.	Construction activities would be within the Construction Working Width.

5.3.3.1 Variations In Construction Methods

25. In addition to the construction flexibility defined in Table 5.6 there may also be the potential for variation in the method of construction to be used to build the Proposed Project. This variation would be necessary to deal with, for example, uncertainties in ground conditions or on-site constraints. This could include:

- Construction of the pipeline in areas of peat soils as described in Section 5.3.3.2
- Construction of the foundation of the WTP as described in Section 5.3.3.3
- Crossings of lower voltage power lines as described in Section 5.3.3.4
- Construction techniques for trenchless crossings as described in Section 5.3.3.5.

5.3.3.2 Methods of Working in Peat

26. As set out in Appendix A5.3 (Methods of Working in Peat), four slightly different methods for constructing the pipeline in areas of peat soils have been defined. To allow for variation in ground conditions it has been assumed for the purpose of the assessment reported in this EIAR that either Method 2, 3 or 4 could be used in areas where the depth of peat is greater than 1m. Where the depth of peat is less than 1m, Method 1 is proposed to be used and it is not expected that there would be any deviation from this methodology. The environmental effects from Methods 2, 3, and 4 would be similar. However, Methods 3 and 4 would result in additional permanent infrastructure in the form of stone pillars (Method 3) or piled supports (Method 4) below the pipeline. Method 4 would require piling and as such, would generally have a slightly greater environmental impact. Therefore, the EIAR is typically based on the application of Method 4 where the depth of peat is greater than 1m. However, in areas where Methods 2, 3, or 4 could be used, the environmental assessment has considered whether these different methods would result in different likely significant effects and therefore the assessment reported in this EIAR has identified the likely significant effects from any of the three methods.

5.3.3.3 Foundation for the WTP

27. As described in Section 5.18, the construction technique for the foundations of the WPT could be either a raft foundation, which uses battered excavations to reach formation level, or a piled foundation. The environmental effects have been assessed on either technique, which both use reinforced construction, being adopted.

5.3.3.4 Crossing of Low Voltage Power Lines

28. While some High Voltage power line crossings would be by trenchless construction, there is flexibility in how the 220kV – 38kV power lines would be crossed. These could be constructed using either trenchless or open-cut techniques. The length of the crossings would be very short, typically, 50m or less, therefore there would be no appreciable difference in the environmental effects from either technique within the overall level of construction disturbance.

5.3.3.5 Choice of Trenchless Crossing Technique

29. The below ground trenchless crossing could be pipe jacked, or auger bore, and this would be determined at detailed design. The environmental effects of the trenchless crossing techniques would all be similar and there would be no differences in the overall likely significant effects. The assessment has considered pipe jacking as the basis of the assessment.

5.4 Environmental Management of Construction and Commissioning

30. The Construction and Commissioning approach set out in this chapter has considered the potential environmental effects that could arise from building, testing and commissioning the Proposed Project and has sought to avoid or reduce these effects, in accordance with the mitigation hierarchy outlined in Chapter 2 (The Environmental Impact Assessment Process). This has included, for example, the use of Pipe Storage Depots to reduce the vehicle movements needed to deliver the sections of pipe to the Construction Working Width, use of standard hoarding/fencing of 2.4 metres (m) high with 2m of absorptive material to reduce temporary noise effects, and the siting of Construction Compounds away from residential areas, as far as reasonably practicable.

31. In addition, a CEMP has been produced and is contained in Appendix A5.1. This sets out standard, best practice measures that will be used to manage the potential environmental impacts of the Construction Phase of the Proposed Project. The CEMP sets out a Register of Environmental Actions and Commitments (REAC) (Annex G of Appendix A5.1) and a series of outline management plans. The CEMP includes commitments on general construction matters such as, but not limited to:

- Construction working hours
 - Seasonal restrictions
 - Haul routes
 - Abnormal loads
 - River works
 - Working in peat
 - Worksite layout and good housekeeping
 - Site lighting
 - Security
 - Emergency response plan.
32. The CEMP will be a 'live' document, subject to further amendment to take into account the requirements of conditions attached to statutory consents, or ground or weather conditions. This may include the revision and addition of content throughout the pre-commencement phase, and into the enabling works, Construction Phase and final commissioning of the Proposed Project. It will be expanded and updated by the Contractor prior to the commencement of any construction activities on site, including incorporating the requirements of conditions attached to statutory consents. Any updates or changes will not be permitted to reduce the level of environmental protection or environmental mitigation as defined in the CEMP in Appendix A5.1 and therefore, cannot result in a new or different adverse likely significant environmental effect from the Proposed Project, compared with those that have been assessed and reported in this EIAR.
33. The CEMP includes the following specific management plans, which will be updated by the Contractor prior to construction:
- Surface Water Management Plan (SWMP) (Annex A of Appendix A5.1)
 - Soil Management Plan (SMP) (Annex B of Appendix A5.1)
 - Construction Waste and By-Product Management Plan (Annex C of Appendix A5.1)
 - Noise and Vibration Management Plan (NVMP) (Annex D of Appendix A5.1)
 - Dust Management Plan (DMP) (Annex E of Appendix A5.1)
 - Invasive Species Management Plan (Annex F of Appendix A5.1).
34. A Traffic Management Plan (TMP) is also included in Appendix A7.2 of Chapter 7 (Traffic & Transport).
35. All appointed Contractors will be required to comply with all measures within the CEMP. This will include all principal contractors and any sub-contractors. There may be circumstances where a derogation can be sought whereby, for minor enabling works, not all management plans would be applicable, e.g. installing site fencing or undertaking ground investigation/archaeological investigation.
36. A number of the required management plans, as noted below, are particularly relevant to the description of the construction of the Proposed Project set out in this chapter.

5.4.1 Surface Water Management Plan

37. A SWMP has been prepared for the Proposed Project. A number of surface water management measures will be implemented along the Construction Working Width in order to manage runoff whilst construction is ongoing. These will include:

- Timing of the clearing and topsoil-stripping of each phase of works to minimise the duration of stockpiled material and exposure of bare surfaces
- Management of topsoil and subsoil stockpiles to prevent siltation of watercourses through runoff during rainstorms, e.g. through the use of cut-off drains and silt curtains
- Use of attenuation ponds along the whole length of the pipeline at low points within the Construction Working Width, sized appropriately for the expected runoff rates.

38. The SWMP is included as Annex A of Appendix A5.1 (CEMP).

5.4.2 Soil Management Plan

39. A SMP has been prepared for the Proposed Project which sets out the means by which topsoils and subsoils will be excavated and sustainably stored during the Construction Phase of the Proposed Project prior to their reinstatement following construction activities.

40. The SMP is included as Annex B of Appendix A5.1 (CEMP).

5.4.3 Construction Waste and By-Product Management Plan

41. A Construction Waste and By-Product Management Plan has been prepared in order to minimise waste and ensure correct handling and disposal of construction waste streams in accordance with the Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects (EPA 2021). It includes:

- Roles and responsibilities
- Estimated quantities and types of waste to be produced
- Management of waste and by-product streams
- Waste and by-product storage
- Procedures for waste minimisation
- Proposed targets for beneficial reuse of waste.

42. The Construction Waste and By-Product Management Plan is included as Annex C of Appendix A5.1 (CEMP).

5.4.4 Noise and Vibration Management Plan

43. A NVMP has been prepared setting out the means by which noise and vibration emissions from plant, machinery and general construction activities will be mitigated through good practice measures to achieve acceptable noise and vibration levels at nearby properties and other sensitive receptors.

44. The NVMP includes:

- Noise and vibration limits for linear features and infrastructure sites
- Selection of quiet plant
- Noise control at source and screening
- Control of traffic noise
- Night-time works
- Liaison with the public
- Monitoring.

45. The NVMP is included as Annex D of Appendix A5.1 (CEMP).

5.4.5 Dust Management Plan

46. A DMP has been prepared which sets out procedures for managing fugitive dust emissions from temporary working areas during construction. It includes procedures for:

- Site management and responsibilities
- Monitoring and inspections including trigger/alert levels
- Use of hoardings
- Trackout
- Operating machinery and vehicles; demolition; earthworks; waste handling
- Specific measures for certain Construction Compounds.

47. The DMP is included as Annex E of Appendix A5.1 (CEMP).

5.4.6 Traffic Management Plan

48. A draft TMP has been prepared (Appendix A7.2 of Chapter 7: Traffic & Transport) as a standalone document, separate to the CEMP. This will be further developed by the Contractor and put in place for the Construction Phase following consultation with Local Authorities. This includes measures that will be applied to all of the construction sites, including:

- Use of Haul Roads and restrictions on routes that cannot be used
- Tracking of vehicles.

5.4.7 Invasive Species Management Plan

49. An Invasive Species Management Plan has been prepared which sets out the measures to be used by the Contractor to control and prevent the spread of invasive non-native species (INNS). It includes:

- Incidental records of INNS from ecology surveys undertaken
- Desk study records of INNS
- Proposed control measures for both terrestrial and aquatic species.

50. The Invasive Species Management Plan is included as Annex F of Appendix A5.1 (CEMP).

5.5 Construction and Commissioning Programme

51. Construction works are anticipated to commence in Q1 2028, subject to planning approval from An Coimisiún Pleanála. The construction works are expected to be substantially complete at the end of 2032. The construction activities for the principal elements of the Proposed Project would encompass the following broad areas of work:

- Pre-construction surveys including for example, biodiversity surveys for species checks and ground investigation
- Site clearance, including removal of topsoil, trees and hedgerows as required
- Erection of temporary fencing
- Establishment of Construction Compounds including parking areas, storage areas, power supply and welfare facilities
- Establishment of Pipe Storage Depots

- Construction of site roads and temporary access roads
- Construction of Infrastructure Sites at all six sites
- Construction of pipelines including both the RWRMs and the Treated Water Pipeline
- Construction of pipeline features including Line Valves including chambers, Washout Valves, Air Valves, Lay-Bys and Potential Future Connection Points
- Ancillary works including system control infrastructure, lighting, fencing, kiosks, power supplies and Cathodic Protection
- Site landscaping and planting
- Testing and commissioning
- Site demobilisation
- Handover to the appointed Operator.

52. The indicative duration and phasing of the principal elements of the Proposed Project are shown in Image 5.1. These are detailed further under each section of this chapter.

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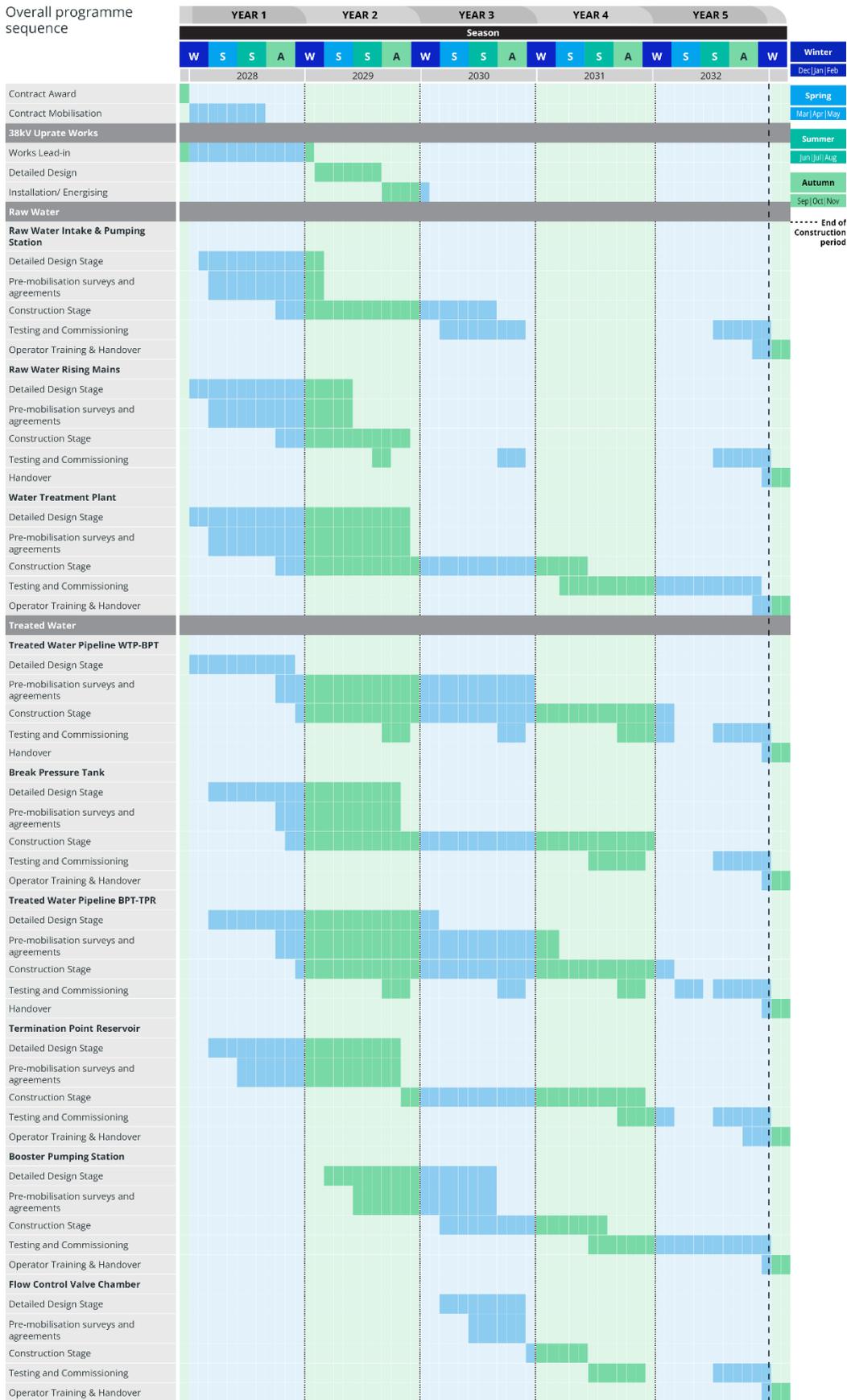


Image 5.1: Indicative Duration and Phasing of the Principal Elements of the Proposed Project

53. Over the estimated five-year Construction Phase of the Proposed Project, the construction activities would be sequentially scheduled by the appointed Contractor to optimise resources and programme.

5.6 Working Hours

54. The typical working hours during the Construction Phase are outlined in Table 5.7.

Table 5.7: Typical Working Hours During the Construction Phase

Start	Finish	Day
07:00	19:00	Monday to Friday
08:00	16:30	Saturday

55. However, certain construction activities would need to be undertaken outside typical working hours. This would include works associated with each trenchless crossing which would take place 24 hours a day and works to complete open-cut crossings of roads to minimise the length of time for temporary road closures or other traffic management measures.
56. Working outside of typical working hours may also be necessary for surface finishing in-situ concrete pours, for example with a power float to create a smooth and shiny surface which needs to be carried out when the concrete is partially set, or for attendance to an emergency on the works.
57. Occasionally, certain construction traffic would need to be moved outside typical working hours or at night. Such loads may include prefabricated tanks, large non-standard equipment (specials), or precast concrete units. This will be done in conjunction with Gardaí, Transport Infrastructure Ireland (TII) and Local Authorities. In addition, it has been requested by Kildare County Council that construction traffic movement through Celbridge be undertaken at night to avoid impacting traffic levels during the day.

5.7 Number of Workers

58. Throughout the Construction Phase, different skillsets would be required at different stages for each of the Infrastructure Sites (RWI&PS, WTP, BPT, BPS, FCV and TPR); the RWRMs, Treated Water Pipelines and the Proposed 38 kV Uprate Works. Table 5.8 presents the anticipated number of workers that would be deployed across the works at the peak of the Construction Phase.

Table 5.8: Number of Workers Deployed On-Site – Construction Phase (Peak)

Works Area	No. of Workers
RWI&PS	50
WTP	150
BPT	60
BPS	60
FCV	20
TPR	60
RWRMs	50
Treated Water Pipeline from the WTP to the BPT	200
Treated Water Pipeline from the BPT to the TPR	400
38 kV Uprate Works	15

59. Workers would include general operatives; plant operators; concrete and steel workers; pipe technicians and welders; Mechanical, Electrical, Instrumentation, Control and Automation (MEICA) engineers and technicians, project management staff and supporting staff.

60. Temporary welfare facilities and office accommodation would be installed on each of the Infrastructure Sites for the Construction Phase.

5.8 Construction Compounds and Pipe Storage Depots

5.8.1 Introduction

61. Construction Compounds and Pipe Storage Depots are temporary elements required by appointed Contractors to facilitate construction of the Proposed Project. There would be a Construction Compound for each of the geographical sections defined in Table 5.4. These are set out in Section 5.8.1.1. There would be several Pipe Storage Depots associated with the construction of the pipeline between the WTP and the TPR. These are defined in Section 5.8.1.2. The facilities at the proposed Construction Compounds and Pipe Storage Depots are outlined in Section 5.8.2, whilst Section 5.8.3 describes the associated enabling works.

5.8.1.1 Construction Compounds

62. The Principal Construction Compounds, would act as the appointed Contractor's central strategic (operational) hub for plant/material/worker movement, general storage, administration, logistical support, technical (design) staff, etc. The Principal Construction Compounds would generally provide space for management and welfare facilities, plant storage, vehicle parking and traffic circulation.
63. The four Principal Construction Compounds are proposed at the following locations:
- In the townland of Incha Beg, County Tipperary, within the WTP Site (shown in Figure 4.7). This is the proposed Principal Construction Compound (CC1) for the RWI&PS, RWRMs and WTP
 - In the townland of Lisgarriff, County Tipperary (shown in Figure 4.16). This is the proposed Principal Construction Compound (CC2) for the Treated Water Pipeline from the WTP to the BPT, the BPT itself and the section of trenchless construction to the east of the BPT including approximately 39km of the pipeline
 - In the townland of Killananny, County Offaly (shown in Figure 4.35). This is the proposed Principal Construction Compound (CC5) for the section of Treated Water Pipeline from the trenchless section east of the BPT, the BPS including approximately 62km of the pipeline
 - In the townland of Drummond, County Kildare (shown in Figure 4.50). This is the proposed Principal Construction Compound (CC6) for approximately 69km of the Treated Water Pipeline to the TPR, and the TPR itself.
64. In addition to these four Principal Construction Compounds, there would be four secondary Satellite Construction Compounds. These would be needed to build the other Infrastructure Sites and so have been located at the RWI&PS, BPT, BPS and TPR (the WTP is a Principal Construction Compound). These Satellite Construction Compounds would provide materials storage and support plant and workers along the route to allow for an efficient construction programme. This would for example, help to reduce traffic to and from Principal Construction Compounds.
65. The proposed Principal and Satellite Construction Compounds are presented in Table 5.9. Indicative layouts have been prepared for each of the proposed Principal and Satellite Construction Compounds and are shown in Figure 5.1 to Figure 5.8 inclusive.

Table 5.9: Proposed Construction Compounds

ID Reference and Compound Type	Description and Location	Access	Project Component Overview Figure Reference	Proposed Layout Figure Reference
CC0 Satellite	CC0 is a Satellite Construction Compound located at the RWI&PS site at Garrynatineel, County Tipperary. This Compound and works would be supported from the Principal Construction Compound (CC1), which would be located at the WTP.	Access would be provided via the proposed RWI&PS access road from the R494 Regional Road.	Figure 4.7	Figure 5.1
CC1 Principal	CC1 is a Principal Construction Compound within the proposed land acquisition at Incha Beg which is located north-east of Birdhill, County Tipperary for the WTP. The site is located immediately north of dense woodland but is itself made up of open fields.	It is proposed to construct a new permanent access road from the R445 Regional Road.	Figure 4.7	Figure 5.2
CC2 Principal	CC2 is a Principal Construction Compound located on a greenfield site which is currently used for agriculture at Lisgarraff, County Tipperary, between the N52 National Secondary Road and the Construction Working Width.	Access would be provided via a new site entrance off the N52 National Secondary Road.	Figure 4.16	Figure 5.3
CC3 Satellite	CC3 is a Satellite Construction Compound located at the BPT site at Knockanacree, County Tipperary. This Compound and works would be supported from Principal Construction Compound CC2.	Access would be provided via the proposed BPT access road off the L1064.	Figure 4.18	Figure 5.4
CC4 Satellite	CC4 is a Satellite Construction Compound located at the BPS site. This Compound and works would be supported from Principal Construction Compound CC5.	Access would be provided via the proposed BPS access road off the L3003.	Figure 4.27	Figure 5.5
CC5 Principal	CC5 is a Principal Construction Compound located in an area of farmland south-west of Killurin at Killananny, County Offaly, which is bisected by the R421 Regional Road.	Access to CC5 would be provided via new site entrances off both sides of the R421 Regional Road.	Figure 4.35	Figure 5.6
CC6 Principal	CC6 is a Principal Construction Compound located at Drummond, County Kildare, in an area of farmland directly accessed from the R403 Regional Road between Allenwood and Derrinturn.	Access to CC6 would be provided via a new site entrance off the R403 Regional Road	Figure 4.50	Figure 5.7
CC7 Satellite	CC7 is a Satellite Construction Compound located at the TPR site at Peamount, County Dublin. This Compound and works would be supported from Principal Construction Compound CC6.	Access would be provided via the proposed TPR access road off the R120 Regional Road.	Figure 4.60	Figure 5.8

5.8.1.2 Pipe Storage Depots

66. In addition to the Construction Compounds, Pipe Storage Depots would be used to manage the storage and transportation of the pipe itself, which would be in 13.5m lengths. The Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the pipeline. Given the volume of pipe material to be delivered and the logistical scale of the Proposed Project, it is not considered feasible to deliver pipe material directly to the point of installation. The pipe would be transported from the Pipe Storage Depot to its point of installation via either the Haul Road network or directly along the Construction Working Width.
67. Indicative layouts of the Pipe Storage Depots have been prepared and are shown in Figures 5.9 to 5.17 inclusive.
68. There would be capacity for pipe storage within the Construction Compounds. Specific Pipe Storage Depots are only proposed where necessary to support construction between the compounds. Construction Compound CC1 (WTP) would provide sufficient storage of pipe for the RWRMs. Pipe Storage Depots are required to augment those Principal Construction Compounds, namely CC2 (Lisgarriff), CC5 (Killananny) and CC6 (Drummond), which would serve the installation of pipe between the WTP and the TPR.
69. The locations of the proposed Pipe Storage Depots are explained in Table 5.10.

Table 5.10: Proposed Pipe Storage Depot Locations

ID Reference	Associated Construction Compound	Description and Location	Access	Project Component Overview Figure Reference	Proposed Layout Figure Reference
PSD1	Principal Construction Compound CC2, Lisgarriff, County Tipperary	Pipe Storage Depot (PSD1) at Carrigatogher, County Tipperary, would be located in an area of farmland accessed directly off the R445 Regional Road.	Access to PSD1 would be via new site entrances off the R445 Regional Road. As PSD1 straddles the R445 Regional Road, access would be required on both sides of the road.	Figure 4.11	Figure 5.9
PSD2	Principal Construction Compound CC5, Killananny, County Offaly	Pipe Storage Depot (PSD2) at Toora, County Offaly, would be located in an area of farmland, which would be accessed directly off the L4022 Local Road.	Access to PSD2 would be via a new site entrance off the L4022 Local Road.	Figure 4.20	Figure 5.10
PSD3		Pipe Storage Depot (PSD3) at Boveen, County Offaly, would be located in an area of farmland accessed directly off the N62 National Secondary Road.	Access to PSD3 would be via new site entrances off the N62 National Secondary Road.	Figure 4.22	Figure 5.11
PSD4		Pipe Storage Depot (PSD4) at Fortel, County Offaly, would be located in an area of farmland off L4004 Local Road between the R421 Regional Road and the R440 Regional Road.	Access to PSD4 would be via a new site entrance off the L4004 Local Road.	Figure 4.25	Figure 5.12
PSD5		Pipe Storage Depot (PSD5) at Derrinboy, County Offaly, would be located on agricultural land adjoining the Construction Working Width.	Access to PSD5 would be via a new site entrance off an unnamed local road which links the N52 National Secondary Road at Kilcormac with the R421 Regional Road.	Figure 4.32	Figure 5.13
PSD6		Pipe Storage Depot (PSD6) at Derryweelan, County Offaly, would be located in an area of forestry with relatively flat topography.	Access to PSD6 would be via a new site entrance off the R420 Regional Road between Geashill and Tullamore.	Figure 4.40	Figure 5.14
PSD8		Pipe Storage Depot (PSD8) at Rathlumber, County Offaly, would be located in an area of relatively flat agricultural land south-west of Edenderry.	Access to PSD8 would be via a new site entrance off the R402 Regional Road.	Figure 4.45	Figure 5.15
PSD9	Principal Construction Compound CC6, Drummond, County Kildare	Pipe Storage Depot (PSD9) at Graiguepottle, County Kildare, would be located in an area of agricultural land south of Kilcock.	Access to PSD9 would be via a new site entrance off the R407 Regional Road.	Figure 4.55	Figure 5.16
PSD10		Pipe Storage Depot (PSD10) at Barberstown Upper, County Kildare, would be located in an area of agricultural land north of Straffan.	Access to PSD10 would be via a new site entrance off the R406 Regional Road.	Figure 4.57	Figure 5.17

5.8.2 Construction Compounds and Pipe Storage Depot Facilities

70. Table 5.11 provides an overview of the typical facilities required at the Construction Compounds and Pipe Storage Depots.

Table 5.11: Overview of Facilities at Construction Compounds and Pipe Storage Depots

Facilities	Principal Construction Compound		Satellite Construction Compound		Pipe Storage Depots	
		Notes		Notes		Notes
Offices	✓	Significant multi-storey prefab offices including space for the appointed Contractors, design teams, administration staff, etc.	✓	Small number of single-storey prefab offices to accommodate the appointed Contractors, design teams, administration staff, etc.	✓	Single-storey prefab building to accommodate site and delivery staff.
Canteen	✓	Prefab buildings to accommodate site staff, visitors, construction staff and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.
Welfare facilities	✓	Prefab buildings to accommodate site staff, visitors, construction staff and delivery staff.	✓	Single-storey prefab buildings to accommodate site staff, visitors and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.
Security hut	✓	Controlled access at all times. Full-time security provided at common site entrance/exit. Closed-Circuit Television (CCTV) would also be in place. Gates closed when not in use.	✓	Controlled access at all times. Full-time security provided at common site entrance/exit. CCTV would also be in place. Gates closed when not in use.		Controlled access during working hours. Access gate locked outside of working hours. No full-time security provided. CCTV would be in place. Gates closed when not in use.
Access and internal roads/ vehicle turning areas/ coach pick-up and drop-off point	✓	Internal roads to allow circulation where possible. Road layout enabling vehicle turning. Includes coach pick-up and drop-off areas.	✓	Internal roads to allow circulation where possible. Road layout enabling vehicle turning.	✓	Internal circulation roads provided to maintain one-way traffic flow, wherever possible.
Material storage areas	✓	Multiple storage areas provided.	✓	General storage areas provided.	✓	General storage areas provided.
Pipe storage areas	✓	Capacity varies according to site extents. Multiple defined areas allocated within each site. Site layouts accommodate loading/unloading pipe within individual sites.		There is no specific provision for pipe storage. Capacity for storage of materials, generally, on-site has been provided. This is suitable for storing pipes and fittings which are to be incorporated into the works at this location only.	✓	Capacity varies according to site extents. Multiple defined areas allocated within each site. Site layouts accommodate loading/unloading pipe within individual sites.
Segregated waste management areas	✓	Defined areas within each site. Segregated waste skips provided.	✓	Defined areas within each site. Segregated waste skips provided.	✓	Defined areas within each site. Segregated waste skips provided.
Parking spaces staff	✓	Typically allow for 250 car parking spaces.	✓	Staff parking allocated for typically up to 60 parking spaces.	✓	Staff parking allocated for typically up to 25 parking spaces.
Parking spaces visitors	✓	Typically allow for 50 car parking spaces.	✓	Included within staff parking.		No visitor spaces. Parking provided for off road delivery vehicles.
Septic tank	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.
Bunded refuelling areas	✓	Two provided in each site.	✓	Provided	✓	Provided adjacent to designated parking areas

Facilities	Principal Construction Compound		Satellite Construction Compound		Pipe Storage Depots	
		Notes		Notes		Notes
Plant cleaning area	✓	Two provided in each site.		Not applicable		Not applicable
Plant service area	✓	Two provided in each site.		Not applicable		Not applicable
Wheel wash area	✓	Provided adjacent to the common site entrance/exit	✓	Provided adjacent to the common site entrance/exit	✓	Provided adjacent to the common site entrance/exit
Topsoil and subsoil stockpile area	✓	Separate stockpile areas provided – limited to maximum 2m high	✓	Separate stockpile areas provided – limited to maximum 2m high	✓	Separate stockpile areas provided – limited to maximum 2m high

5.8.3 Construction Compounds and Pipe Storage Depots – Temporary Works Infrastructure

71. The length of time that a Construction Compound would be retained for would be directly related to the extent, and sequencing, of construction activities for which the compound would be established, up to the full five year construction period for those sites needed throughout this phase. Construction activities, their duration and phasing are discussed in detail for each Infrastructure Site and the pipelines in Section 5.17 to Section 5.24.
72. Enabling works would be required at each Construction Compound and Pipe Storage Depot to establish the sites. These works are described in Section 5.8.3.1 to Section 5.8.3.10.

5.8.3.1 Pre-Construction Surveys

73. Prior to the site establishment there would be appropriate surveys undertaken to inform the finalisation of the site layout and the detailed design of the permanent works. These would be likely to include, but may not be limited to:
- Archaeological investigation (intrusive and non-intrusive)
 - Ground Investigation (including for example, boreholes and trial pits)
 - Biodiversity pre-construction surveys such as, e.g. badger, bat or reptile surveys
 - Water quality monitoring and level / flow monitoring.

5.8.3.2 Site Establishment

74. Initially, topsoil would be stripped across the required site area to its full depth, as determined by the Agronomist engaged by Uisce Éireann, and records would be kept of the depths stripped in each of the parcels of land. Topsoil typically has a depth of between 150mm and 400mm across the Construction Compounds and Pipe Storage Depots depending on the rooting depth of the plants growing there. The upper level of subsoil, typically 300mm to 400mm in depth, would also be stripped across the site area. Soil stripping would be carried out during favourable weather conditions when the soil is drier and more friable. Soil handling would be avoided during periods of persistent rainfall.

75. Topsoil and subsoil would not be mixed and would be stored in separate stockpiles positioned within designated areas. Stockpiles would also be kept free from the passage of vehicles and plant. No rubbish would be left on the topsoil stockpile and first layer of subsoil stockpile. Typically, the stockpiles would be up to 2m in height. A minimum separation distance of at least 1m would be kept between stockpiles of topsoil and subsoil to prevent cross contamination. Stockpiles would be built neatly and well-shaped to ensure, as far as possible, they are weatherproof. Other measures may be implemented to improve the protection of spoil heaps from construction activities, wind/water erosion or for weed management. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses. The location of stockpiles would follow the guidelines outlined in the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland (IFI) 2016).
76. The method and level of protection would be dictated by the prevailing weather conditions, level of exposure and operational activities near the stockpiles. Some of these measures may include exclusion zones/fencing, plastic sheeting, weed spraying, or sowing of grass/oats. If weed spray is required or if new seeds are being introduced, then the details would be discussed and agreed with the landowner in advance of the measure being implemented.
77. Stone and hardcore materials would be kept separate from topsoil and subsoil storage.
78. Any existing land drains crossing the works area would be recorded and temporarily culverted.

5.8.3.3 Fencing

79. The Construction Compounds and Pipe Storage Depots would be bounded by a 2.4m high hoarding fence on all sides, examples of these are shown in Image 5.2 and Image 5.3. This would act a physical noise reduction barrier. To supplement this a 2m tall sound barrier, typically a noise reduction tarpaulin affixed to the rear elevation of the hoarding, would be installed to further reduce noise levels.



Image 5.2: Typical Timber Hoarding Fence – Rear Elevation



Image 5.3: Typical Steel Hoarding Fence – Front Elevation

80. At the Infrastructure Sites, the permanent fencing, which would generally be 2.4m polyester powder coated palisade security fencing¹, and a stock proof post and rail fence, or equivalent, to mark the boundary of the permanent site² would be installed at the end of the Construction Phase as part of the completion of the works.

¹ Except at the RWI&PS which would be a paladin fence and at the entrance to the WTP and BPT access roads which would also be paladin fencing.

² Except for some of the boundaries at the BPT and TPR which would be marked by existing hedgerows.

5.8.3.4 Roads, Parking and Walkways

81. Permeable access road, internal circulation road, car parking areas and designated walkways consisting of temporary geogrid mattress, or equivalent structural interface with the subsoil formation overlain in stone, would be provided for the duration of the Construction Phase. An impermeable pavement, which typically would comprise 75mm-thick dense bitumen macadam (bitmac) would only be provided next to the offices/canteen/welfare facilities.

5.8.3.5 Drainage

82. Generally, the surface of the Construction Compounds and Pipe Storage Depots would be permeable as they are overlain in stone, which would allow surface water to percolate through to the underlying subsoil, as happens currently, and to maintain the existing drainage pattern. Those areas with impermeable pavement would be graded to a fuel/oil separator for collection of any surface water runoff contaminants.

83. The Satellite Construction Compound (CC0) for the RWI&PS would also require the construction of lined Dewatering Settlement Basins for the purposes of ground water management and site runoff.

84. Similarly, the Principal Construction Compound (CC1) at the WTP would require the early construction of its Tank Draindown Management and Commissioning Lagoons to act as temporary Construction Phase lagoons for surface water drainage from exposed excavations.

85. At CC3, CC4 and CC7, located at the permanent Infrastructure Sites for the BPT, BPS and TPR, the permanent drainage ponds would be built at the start of the works to contribute to managing surface water runoff during construction.

86. All sites would include refuelling and plant servicing areas. These would be impermeable, bunded and would incorporate a forecourt separator for any potential spillages which may occur during vehicle refuelling and road tanker delivery. No refuelling would take place within 10m from any surface water drain or watercourse or within 50m from a borehole or well.

87. The retained contents of the fuel/oil separators would be collected for disposal by a licensed operator to a licensed waste disposal/recovery facility.

5.8.3.6 Electricity Supply

88. A temporary connection to an existing electricity supply would be required for each of the Construction Compounds and Pipe Storage Depots for the duration of the works. Table 5.12 provides an overview of the available power near each of the Construction Compounds and Pipe Storage Depots.

89. Where an existing overhead power line traverses a Construction Compound or Pipe Storage Depot, it would be diverted or placed underground prior to commencement of the main construction works, as agreed with ESB Networks.

Table 5.12: Existing Power – Proximity to Construction Compounds and Pipe Storage Depots

Location	Available Power	Description of Proposed Temporary Power Connection
RWI&PS, Satellite Construction Compound (CC0)	Low voltage (LV) / medium voltage (MV) overhead lines	Nearest connection to the existing power line 310m east of the site. This would be a temporary connection. There would also be a poleset to be moved along the permanent access road requiring a very minor realignment of the existing line.
WTP, Principal Construction Compound (CC1)	LV/MV overhead lines	Existing power line crossing the north-west corner of the site. This would be diverted as part of the permanent works. A temporary connection to the same line (as the diversion) would be required during the construction of the WTP.

Location	Available Power	Description of Proposed Temporary Power Connection
Lisgarraff, Principal Construction Compound (CC2)	LV/MV overhead lines	Nearest connection is in field other side of the N52 National Road, 75m west of the site. This would be a temporary connection.
BPT, Satellite Construction Compound (CC3)	MV overhead lines	Existing power line north of site and crossing the access road to the BPT. There would be a poleset to be moved along the permanent access road requiring a very minor realignment of the existing line. Connection to existing power line at interface with access road and new cabling routed along the access road to the BPT site. Whilst initially a temporary connection, this would become the permanent power connection to the site for the operation of the BPT.
BPS, Satellite Construction Compound (CC4)	LV/MV overhead lines	Existing power lines (two) traversing the site. These would be diverted as part of the permanent works. A temporary connection to the diverted power line would be required to serve the construction works.
Killananny, Principal Construction Compound (CC5)	LV/MV overhead lines	Existing power line traversing north–south across the site. A temporary connection would be made to this line.
Drummond, Principal Construction Compound (CC6)	LV/MV overhead lines	Existing power line traversing north–south across the site. A temporary connection would be made to this line.
TPR, Satellite Construction Compound (CC7)	LV/MV overhead lines	Existing power line crossing the site. This would be diverted as part of the permanent works. Within the existing Uisce Éireann site, there is an existing substation powering the existing pumping station adjacent to the site. A connection is to be made, for the Proposed Project to the existing supply. There is available capacity within the existing network to supply temporary and permanent connections to the TPR.
Carrigatogher (PSD1)	LV/MV overhead lines	Existing power line traversing south-east corner of the site. A temporary connection would be made to this line.
Toora (PSD2)	LV/MV overhead lines	Nearest connection to the existing power line 300m north-west of the site. A temporary connection would be made to this line.
Boveen (PSD3)	LV/MV overhead lines	Existing power line traversing east–north of the site. A temporary connection would be made to this line.
Fortel (PSD4)	LV/MV overhead lines	Nearest connection to the existing power line in road 400m west of the site. A temporary connection would be made to this line.
Derrinboy (PSD5)	LV/MV overhead lines	Nearest connection to the existing power line in road 150m north of the site. A temporary connection would be made to this line.
Derryweelan (PSD6)	LV/MV overhead lines	Nearest connection to the existing power line in field 400m east of the site. A temporary connection would be made to this line.
Rathlumber (PSD8)	LV/MV underground cables	Nearest connection to the existing power line in field 20m south of the site. A temporary connection would be made to this line.
Graiguepottle (PSD9)	LV/MV overhead lines	Nearest connection to the existing power line in road 75m north-west of the site. A temporary connection would be made to this line.
Barberstown Upper (PSD10)	LV/MV overhead lines	Nearest connection to the existing power line in field 150m east of the site. A temporary connection would be made to this line.

5.8.3.7 Lighting

90. Lighting would be provided for all circulation areas (vehicle and pedestrian) within the Construction Compounds and Pipe Storage Depots. Task lighting would also be provided as required.
91. Security lighting would be provided at the gates and within the Construction Compounds.

5.8.3.8 Employment/Welfare Facilities

92. Temporary welfare facilities, including toilets/washrooms/shower facilities, and office accommodation would be installed on-site for the duration of the Construction Phase. Provision would also be made for waste collection with segregated skips provided for separate waste types at each Construction Compound and Pipe Storage Depot.

5.8.3.9 Foul Water

93. Foul water arising from toilets, washrooms, shower and canteen facilities during the Construction Phase would be collected and discharged to a storage tank which would be emptied by a suction tanker periodically to the nearest Wastewater Treatment Plant. There would be no outlet from the storage tank.

5.8.3.10 Water Supply

94. A service connection would be made to the potable water supply in the public road where appropriate. Table 5.13 identifies the potable water supplies near the Construction Compounds and Pipe Storage Depots.

Table 5.13: Existing Watermains – Proximity to Construction Compounds and Pipe Storage Depots

Construction Compound	Existing Watermain Nominal Pipe Diameter and Material	Description of Proposed Temporary Water Supply
RWI&PS, Satellite Construction Compound (CC0)	200mm (unplasticized polyvinyl chloride (uPVC))	The existing watermain is located on the R494 adjacent to the compound. The connection would be constructed in conjunction with the new permanent access road to the RWI&PS (Section 5.17.2). Whilst initially a temporary connection, this would become the permanent connection to the site for the operation of the RWI&PS. This new pipe would be of polyethylene material.
WTP, Principal Construction Compound (CC1)	100mm (uPVC)	The existing watermain is located on the R445 Regional Road adjacent to the compound. A connection would be constructed in conjunction with the new permanent access road to the WTP (Section 5.18.2). Whilst initially a temporary connection, this would become the permanent connection to the site for the operation of the WTP. This new pipe would be of polyethylene material.
Lisgariff, Principal Construction Compound (CC2)	50mm (unknown)	The existing watermain is located on the N52 adjacent to the compound. A temporary connection can be made to the existing main near the south-west corner of the Construction Compound. This new pipe would be of polyethylene material.
BPT, Satellite Construction Compound (CC3)	100mm (uPVC)	There is no suitable watermain to connect to for the BPS. The existing watermain is located on the L1064 Local Road west of the BPT site. During the Construction Phase potable water would have to be transported to site by water bowzers and stored on-site in potable water tanks. Water bowzers would be filled from the nearest fire hydrant on the existing watermain.
BPS, Satellite Construction Compound (CC4)	150mm (cast iron)	There is no suitable watermain to connect to for the BPS. The existing watermain is located on the R440 Regional Road south of the BPS site, 1.2km away. During the Construction Phase potable water would have to be transported to site by water bowzers and stored on-site in potable water tanks. Water bowzers would be filled from the nearest fire hydrant on the existing watermain.
Killananny, Principal Construction Compound (CC5)	No public water supply nearby	There is no public water supply scheme near the Construction Compound. The nearest potable water supply is Killeigh, Cloneygowan and Killurin Group Water Scheme to the north of the compound site. In the absence of an existing public watermain, potable water would be transported to site by water bowzers and stored on-site in potable water tanks during construction. Water bowzers would be filled from the nearest fire hydrant on the existing watermain.

Construction Compound	Existing Watermain Nominal Pipe Diameter and Material	Description of Proposed Temporary Water Supply
Drummond, Principal Construction Compound (CC6)	250mm (asbestos cement)	The existing watermain is located on the R403 and is immediately adjacent to the compound. A temporary connection would be made to the existing watermain west of the compound. This new pipe would be of polyethylene material and would only be required for the duration of the construction works.
TPR, Satellite Construction Compound (CC7)	Not applicable	The site would be supplied from the adjacent operational service reservoir at Peamount.
Carrigatogher, County Tipperary (PSD1)	50mm (unknown)	The existing watermain is located on the R445 Regional Road which bisects the proposed Pipe Storage Depot site. A temporary connection would be made to the existing watermain. This new pipe would be of polyethylene material and would only be required for the duration of the construction works.
Toora, County Offaly (PSD2)	100mm (uPVC)	The existing watermain is located on an unnamed local road 1.4km from the site, and alternative arrangements would be required for servicing the site. In the absence of an existing public watermain, potable water would be transported to site by water bowsers and stored on-site in potable water tanks. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
Boveen, County Offaly (PSD3)	75mm (unknown)	The existing watermain is located on the N62 National Road west of, and immediately adjacent to, the depot. A temporary connection would be made to the existing watermain. This new pipe would be of polyethylene material and would only be required for the duration of the construction works.
Fortel, County Offaly (PSD4)	100mm (uPVC)	The existing watermain is located on the unnamed local road 1.6km from the site, and alternative arrangements would be required for servicing the site. In the absence of an existing public watermain, potable water would be transported to site by water bowsers and stored on-site in potable water tanks during construction. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
Derrinboy, County Offaly (PSD5)	100mm (uPVC)	The existing watermain is located on the L6041 Local Road 1.5km from the site, and alternative arrangements would be required for servicing the site. In the absence of an existing public watermain, potable water would be transported to site by water bowsers and stored on-site in potable water tanks during construction. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
Derryweelan, County Offaly (PSD6)	80mm (unknown)	The existing watermain is located on the R420 Regional Road. Whilst removed from the site, a connection would be made to this existing watermain, and a new polyethylene pipe would be laid along the Construction Working Width to the site; it would only be required for the duration of the construction works.
Rathlumber, County Offaly (PSD8)	100mm (uPVC)	The existing watermain is located on the R400 Regional Road, 4.4km away from the site, and alternative arrangements would be required for servicing the site. In the absence of an existing public watermain, potable water would be transported to site by water bowsers and stored on-site in potable water tanks during construction. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
Graiguepottle, County Kildare (PSD9)	400mm (ductile iron)	The existing watermain is located on the R407 Regional Road and is immediately adjacent to the Pipe Storage Depot. A temporary connection would be made to the existing watermain. This new pipe would be of polyethylene material and would only be required for the duration of the construction works.
Barberstown Upper, County Kildare (PSD10)	150mm (uPVC)	The existing watermain is located on the R406 Regional Road and is immediately adjacent to the Pipe Storage Depot. A temporary connection would be made to the existing watermain. This new pipe would be of polyethylene material and would only be required for the duration of the construction works.

5.8.3.11 Reinstatement of Temporary Working Areas

95. On completion of the Proposed Project, all temporary works facilities would be removed, and the sites reinstated to their pre-existing condition, with the exception of the fixed Infrastructure Sites (further information is provided in Section 5.9.1). Principal Construction Compounds CC2, CC5 and CC6 and all Pipe Storage Depots would be returned to the landowners. The other Principal Construction Compound (CC1) and the Satellite Construction Compounds (CC0, CC3, CC4 and CC7) would remain part of the permanent Infrastructure Sites and would be developed and landscaped accordingly.
96. Generally, the reinstatement operations would start with the removal of any temporary structures, e.g. temporary roads / geotextile, as may be applicable. The remediation of the subsoil would be undertaken by scarifying/ripping it with tractor mounted flat lift rippers to a minimum uniform depth of 600mm, taking care not to damage the field drainage and other services. The depth of ripping would be selected to scarify/loosen any material compacted during construction. In all cases the depth of ripping shall exceed the depth of subsoil compaction. All stones and roots over 150mm in diameter would be picked up and removed from the subsoil. Re-grading subsoil using excavators/graders would be carried out and would include side slopes, where applicable.
97. The spreading of subsoil and later topsoil would be carried out during favourable weather conditions when the soil is drier and more friable. The subsoil stockpiled for reinstatement would be pushed evenly across the site area using excavators (with tractor shovels) and graders to leave it generally level. Then, the separately stockpiled topsoil would be similarly spread to present a neat and level appearance.
98. At the same time as the site is being restored, excavator(s) would be used for the reinstatement of ditch banks, and boundary fences/walls. All stones/roots more than 50mm in diameter would be removed from the topsoil. The topsoil would then be given a final inspection, and corrected accordingly, to ensure it is neat and level in appearance. Generally, all areas would be reinstated to pre-existing ground conditions allowing for some settlement.
99. If it is necessary to import topsoil onto the site, the topsoil would be screened for invasive species, weeds and roots, checked for quality, consistency, and soil structure ensuring that no stones more than 50mm in diameter, or debris, are contained within the topsoil. An Agronomist engaged by Uisce Éireann would inspect and approve the source and supplier of the topsoil for the suitability of the proposed location. In all situations, the topsoil from the site which was cleared, stockpiled and protected during construction would be the priority for use during reinstatement.
100. Reseeding would be carried out on completion of the topsoil spreading, if required; the rate of seeding, and the time and method of sowing, including application of fertiliser, shall be in accordance with best agricultural practice. Driving over the land, where topsoil has been put back, would be monitored by an Agronomist engaged by Uisce Éireann and kept to a minimum, particularly in wet weather. Mechanical equipment heavier than standard tractors and trailers would not be allowed to travel back over the topsoil.
101. The machines used for the reinstatement of topsoil and subsoil would be of a suitable ground bearing pressure to minimise compaction as much as is practicable.

5.9 Construction Working Width

102. The Construction Working Width refers to the extent of temporary works area required for the construction of the RWRMs and the Treated Water Pipeline and their subsequent reinstatement. It would typically be 50m in width.
103. The Construction Working Width needs to be 50m in width in order to provide sufficient space for:
 - Excavating the trench for the pipeline

- Storing material that has been excavated including the separation of topsoil and sub-soil
- Managing surface water including drainage channels
- An internal Temporary Construction Road to move construction vehicles up and down the construction corridor.

104. Exceptions to this are areas where it has been narrowed in a localised area to avoid areas such as watercourses or archaeological features, or in areas where it has been widened due to a greater land extent being required to facilitate certain construction activities. Activities and areas which require widening of the Construction Working Width include:

- Access and egress to the public road network (Section 5.11.3)
- Construction of trenchless crossings for high voltage power lines, railway, road and watercourse crossings (see Section 5.24.2)
- Areas required for surface water management including attenuation ponds (Section 5.4.13)
- Temporary abstraction and discharge points
- Additional working width for ground conditions such as topography and soft ground, such as peat.

105. The Construction Working Width would only be required during the Construction Phase. The 20m wide Permanent Wayleave as described in Chapter 4 (Proposed Project Description) would be positioned within this Construction Working Width. The 20m wide Permanent Wayleave would be required to facilitate access to the pipeline for operational purposes.

106. Access to the Construction Working Width would be via the public road network and along the Construction Working Width, where practicable.

107. A typical cross section of the Construction Working Width for the pipeline between the WTP and the TPR is shown in Image 5.4. The Construction Working Width would include surface water filter drains which would intercept land drainage and direct it away from the trench towards the settlement ponds which are described in further detail in Section 5.24. Filter drains would be sited depending on the adjacent topography and may be located either side of the Construction Working Width. These filter drains would be temporary and removed on completion of the Proposed Project.

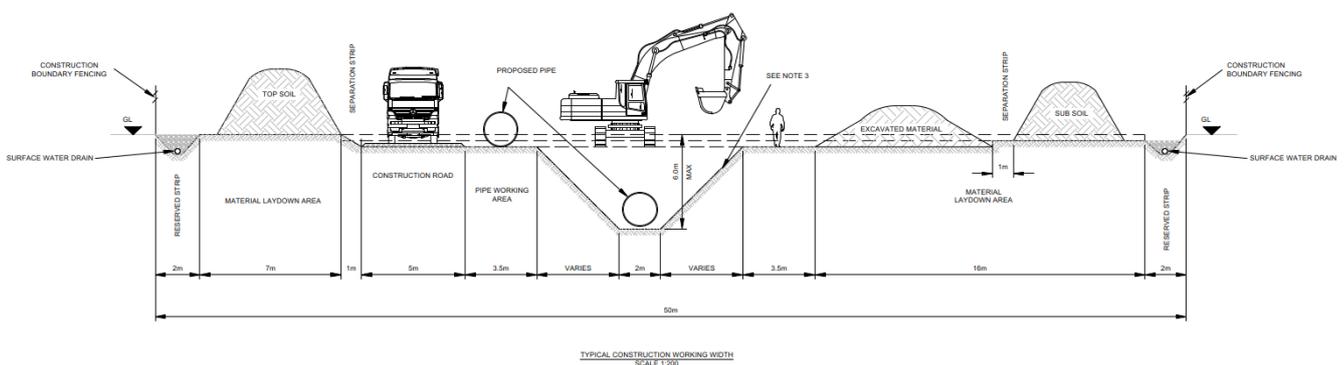


Image 5.4: Indicative Construction Working Width Cross Section³

108. A typical cross section of the temporary Construction Working Width for the RWRMs is shown in Image 5.80.

³ Not to scale

5.9.1 Temporary Use of Land

109. As described in Section 5.3 for each geographic section of the pipeline construction set out in Table 5.4 the pipeline construction would be over a total period of three years (excluding testing and commissioning).
110. However, not all land would be required for the whole three-year period and further sub-division of the sections or phases into smaller, more manageable lengths (works packages) would allow this to be achieved. For example, the Contractors would aim to complete a length of pipeline construction between two designated access points in a single year.
111. As a result the works would be planned to reduce the period of time that land is out of agricultural use so that each landowner would not be affected for a period of more than 18–24 months (excluding returning to the land during the commissioning phase of the works).

5.9.2 Demolitions within the Construction Working Width

112. The alignment of the pipeline has been developed specifically to avoid existing properties and consequently there are no properties to be demolished in order to construct the pipeline itself. However, four buildings need to be removed at the WTP as described in Section 5.18.2. These are not occupied properties but three derelict buildings at the former petrol station on the R445 and an agricultural shed within the site itself.
113. A further barn needs to be demolished in order to provide an access over the Grand Canal to the Construction Working Width.
114. Therefore, in total five buildings are proposed to be demolished for the Proposed Project.

5.9.3 Reinstatement of the Construction Working Width

115. Following completion of the construction works the general principle is that the land within the Construction Working Width would be reinstated to the conditions which existed on site prior to the construction of the Proposed Project. This would be based on the material, habitat, on-site features and surface water management measures that were on site before the works commenced. This would include the reinstatement of the soils, drainage, fencing and vegetation. However, this would be subject to:
- Variations agreed with the relevant landowner regarding matters such as the location or type of gates, fencing or drainage
 - Restrictions on structures that can be placed above the pipeline
 - Restrictions on the type of planting that can be put over the top of the pipeline including, specifically not planting trees that would grow to more than 4m in height. A mosaic habitat would be reinstated in place of, for example, woodland / forestry plantations that would include such tree species.

5.9.3.1 Habitat Reinstatement and Landscaping

116. The proposals for the landscape planting and habitat creation at each of the Infrastructure Sites are set out in Chapter 4 (Proposed Project Description) and Chapter 16 (Landscape & Visual) and shown in Figures 4.89 to 4.99 within Volume 5 of the EIAR.
117. These proposals are underpinned by the general approach to habitat reinstatement and planting that will be adopted along the length of the Construction Working Width.

5.9.3.1.1 *Reducing Effects*

118. In accordance with the mitigation hierarchy, the Proposed Project has been designed to avoid or reduce environmental effects where reasonably practicable. The mitigation hierarchy will continue to be applied during subsequent stages of the project. As set out in the CEMP (Appendix A5.1), opportunities to avoid or reduce the potential environmental effects of the Proposed Project will be identified at each of the subsequent phases of the development of the Proposed Project, including detailed design and construction. This will include, but will not be limited to:

- Seeking opportunities to avoid removing all habitat within the Construction Working Width (i.e. retaining more habitat within the Planning Application Boundary). In particular, avoiding or reducing the loss of high value habitat, such as woodland, and habitat that supports protected species (such as Devil's-bit scabious, which supports marsh fritillary)
- Seeking opportunities to avoid removing, damaging or disturbing breeding sites of protected species such as badger setts, otter holts and bat roosts
- Seeking opportunities to retain vegetation or other features that provide visual screening or landscape value.

119. Any habitats, including trees, scrub or hedgerows adjacent to, or within, the Proposed Project which are intended to be retained will be afforded adequate protection, by complying with National Roads Authority Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority 2006), prior to construction works commencing. The mitigation measures related to this are set out in the Register of Environmental Actions and Commitments, which is Annex G of the CEMP (Appendix A5.1).

5.9.3.1.2 *Route-wide principles*

120. The general route-wide principles for the landscape strategy for the Proposed Project are:

- Retain existing landscape features and biodiversity assets, including existing habitat, as far as reasonably practicable, taking account of the overall requirements of the Project Proposed and the construction works needed to deliver it
- The reinstatement earthworks and planting should be in keeping with, and integrated into, the surrounding landscape
- The planting proposals should promote habitat creation and biodiversity using native species that will support, compliment and connect into existing habitat beyond the Planning Application Boundary.

121. The general principles for reinstatement involve the replacement of the excavated soils in the order in which they were excavated. The following measures will be observed during this phase of the works:

- Reinstatement will occur as soon as reasonably practicable upon completion of the works in order to minimise the time for which soil or peat are required to be stored and the period of exposed excavations. However, this will be subject to careful planning by the Contractor to avoid the necessity to track back over areas of previously restored ground or further disturbance of recovering areas
- As far as reasonably practicable, creation of slopes at gradients suitable for the placement of soils/peat and where necessary, suitable slope stabilisation measures to assist revegetation and prevent erosion
- Replacement of soils/peat in the correct horizons
- Avoidance of compaction of soil or peat
- Adoption of a phased approach to avoid tracking back or disturbing areas previously reinstated

- Natural regeneration of vegetation, where feasible, by reusing the stored topsoil seedbank from its original location for reinstatement
- For semi-natural grassland habitats, where necessary, the locally sourced seedbank present within the surrounding land will be used for grassland restoration following the green hay transfer method (as per Great Irish Grassland guidance), to assist the natural regeneration
- Where natural regeneration is not feasible, or where specific plant species need to establish quickly, habitats will be reinstated by preparing the soil appropriately (i.e. with the existing soil geographic factors, including soil type, soil pH and nutrient content) and reseeded with native locally sourced species specific to the habitat in question.

5.9.3.1.3 Pipeline

122. Within the Construction Working Width along the length of the pipeline, including areas of land required temporarily for construction including the Construction Compounds and Pipe Storage Depots, the following approach will be adopted:

- Retain hedgerows / tree lines that form the linear boundary of the Planning Application Boundary as far as reasonably practicable
- Retain hedgerows / tree lines that cross the Planning Application Boundary as far as reasonably practicable
- Reinstatement habitats and linear habitats as far as reasonably practicable
- Reinstatement areas disturbed temporarily to the pre-construction conditions.

123. Where avoidance and minimisation are not feasible, in order to mitigate for the temporary loss of habitats and reduce significant negative effects, following completion of the construction works the general principle is that the land would be reinstated/restored to the pre-construction position, based on the habitat/features that were on site before the works commenced.

124. The replanting of habitats will be in accordance with recommendations by an Ecological Clerk of Works (ECoW), taking into consideration the All-Ireland Pollinator Plan 2021-2025 (NBDC 2021) and the Pollinator Friendly Planting Code (NBDC 2022), to ensure locally sourced appropriate native species which are in line with the existing genetic strain are used. Replanting of vegetation and general landscaping will be monitored by the ECoW.

125. The exception to this would be the 20m Permanent Wayleave over which trees growing to more than 4m in height would not be planted (as per Uisce Éireann Tree Protection Guidance (Uisce Éireann (2022))). Therefore, in areas of existing woodland a mosaic habitat species mix of scrub and native trees would be planted. The mosaic species mix has been developed to maximise habitat creation, biodiversity and native species planting that would be appropriate for the surrounding habitat, allow for flexibility in which species are planted in which location along the route of the pipeline in order to take account of local / regional diversification or appropriateness of planting whilst taking account of the restrictions on the planting above the permanent pipeline.

126. Furthermore, habitats which cannot be reinstated like-for-like due to their unique nature, complex underlying processes which contribute to their existence, and/or time required to re-establish (such as degraded raised bog) will be replaced with lower ecological value habitat (e.g. cut over bog), as described in EIAR Chapter 8 (Biodiversity) and shown on the Environmental Masterplan (Figure 4.106 to 4.184).

5.9.4 Infrastructure Sites

127. Within the permanent Infrastructure Sites the following will be adopted:

- Retain hedgerows / tree lines that form the linear boundary of the Infrastructure Sites as far as reasonably practicable
- Retain habitat specifically identified at the BPT
- Implement screen planting to reduce visual effects, as per the Landscape Plans (Figures 4.89 to 4.99) for each Infrastructure site
- Implement planting / habitat creation to replace habitat lost as a result of the permanent infrastructure at each of the Infrastructure Sites, as per the Landscape Plans (Figures 4.89 to 4.99) for each Infrastructure site
- Seek opportunities for habitat creation within each of the Infrastructure Sites taking account of the overall requirements of the Project Proposed and the construction works needed to deliver it.

5.9.5 Monitoring / Management

128. Habitat removal and creation on-site would be subject to agreement and supervision of an ECoW.

129. No more habitat or vegetation would be removed than identified on pre-commencement vegetation removal plans.

130. Opportunities to increase or improve habitat created or reinstated will be proactively sought.

131. Habitats reinstated post-construction will be monitored to determine the overall success of the reinstatement process. The monitoring programme will require annual monitoring, for a minimum period of five years to confirm viable growth is occurring, to undertake remedial works if deemed necessary, and to determine any need to extend the monitoring.

5.10 Working in Peat

132. In areas of land along the route of the pipeline where peat could be encountered it is expected that a slightly different construction method would be used compared with that described in Section 5.9. Appendix A5.3 (Methods of Working in Peat) describes the various proposed techniques involved in working in these areas based on the depths of peat that might be expected to be encountered and the experience of Bord Na Móna in traversing these areas.

133. There is approximately 53km of the pipeline construction which would be within areas identified as peat soils (a further 2km would be in alluvium/soft ground requiring the same construction methods as those for peat soils, as described in Appendix A5.3 (Methods of Working in Peat). Approximately 47km of the 53km has been verified by Teagasc data and ground investigation albeit that inferences have had to be drawn for lengths of up to around 150m of the alignment of the Proposed Project from individual points of ground investigation. A further approximately 6km was based on Ground Investigation only. This is summarised in Table 5.14.

134. Approximately 16km of the alignment in peat soils would be peat of less than 500mm in depth. A further, approximately, 14km would be more than 500mm but less than 1m in depth. Therefore, around 30km of the 53km in peat soils is in a depth of soil less than 1m which would generally have been drained and the construction approach to be adopted would be very similar to the general construction for the rest of the pipeline.

135. As a result of the overall 53km of the pipeline within peat soils, there is approximately 23km of deeper peat (greater in depth than 1m) and this is generally within areas of land that have been subject to peat extraction including within Bord Na Mona lands. (Approximately 19km of the pipeline would pass through Bord Na Mona land and of this, approximately 13km would be deeper than 1m).

136. Four similar but different construction methods for working in peat have been set out in Appendix A5.3. These are referred to as Methods 1-4. The selection of which of those methods would be used for each section of the pipeline will be undertaken during detailed design. These decisions will be based on the depth of the peat and the conditions on site at the time of construction.
137. Method 0 is a reference to the construction approach in areas of peat that would be less than 0.5m. This would not be a construction method specific to peat rather the construction approach for the pipeline within these sections would be the same general pipeline construction approach as described in Section 5.24. The reference to Method 0 is necessary to explain the difference between the total length of the pipeline proposed to be constructed using Methods 1-4 compared with the total length of pipeline within areas of peat soils as summarised in Table 5.14.
138. Method 1 is proposed to be used where the peat is 0.5m–1m deep and it is not expected that there would be any deviation from this methodology. Method 1 would involve the excavation of the peat down to good ground below which could then support the pipe (and the temporary construction road). It has been assumed that Method 1 will be used in all instances where it is shown in Figures 5.35 to 5.85.
139. However, as summarised in Section 5.3.3, for sections of peat greater than a depth of 1m it is uncertain which method may be adopted. Therefore, in areas where Methods 2, 3, or 4 are proposed, as shown in Figures 5.35 to 5.85, the environmental assessment has considered that any of these methods could be adopted. Methods 2 to 4 all use a 'floating road' as described in Section 5.12.2. The difference between Methods 2 to 4 is whether support would be required for the pipeline. For Method 2 it would not, because suitable ground below the peat would provide the support. In comparison, for Method 3 and Method 4 there would be the installation of stone pillars or concrete piles, respectively, at intervals along the length of the pipeline to provide sufficient support in the poor ground conditions. The environmental effects from Methods 2, 3, and 4 would be similar. However, Methods 3 and 4 would result in additional permanent infrastructure in the form of stone pillars (Method 3) or piled supports (Method 4) below the pipeline. Method 4 would require piling and as such, would generally have a greater environmental impact. Therefore, the EIAR is typically based on the application of Method 4 where the depth of peat is greater than 1m. However, in areas where Methods 2, 3, or 4 could be used, the environmental assessment has considered whether these different methods would result in different likely significant effects and therefore the assessment reported in this EIAR has identified the likely significant effects from any of the three techniques.

Table 5.14: Summary of the Length of the Pipeline in Peat Soils

Description	Length (km)*	Construction Method	Proportion of whole pipeline (%)	Proportion of length of pipeline in peat (%)
Pipeline length (km) (the Raw Water Rising Mains and Treated Water pipeline)	172.0	-	-	-
Pipeline length identified as potentially within peat soils using Teagasc dataset (km)	49.0	-	29%	-
Length in pipeline route within Teagasc dataset not considered to be peat based on the results of Ground Investigation	1.8	-	-	-
Overall length of pipeline route within Teagasc dataset that is verified as peat by the Ground Investigation	47.2	-	-	-
Length of route not identified as potentially peat by Teagasc dataset but is identified as such based on Ground Investigation	5.7	-	-	-
Total length of pipeline in peat (combining Teagasc dataset and results of Ground Investigation)	52.9	-	31%	-
The length of pipeline where the peat depth is less than 0.5m	16.3	Method 0	9%	31%
The length of pipeline where the peat depth is greater than 0.5m but less than 1m	14.0	Method 1	8%	27%
The length of pipeline where the peat depth is greater than 1m but less than 2.5m	15.7	Method 2	9%	30%
The length of pipeline where the peat depth is greater than 2.5m but less than 4.5m	5.7	Method 3	3%	11%
The length of pipeline where the peat depth is greater than 4.5m.	1.1	Method 4	0.6%	2%
No data available	None			

*Sub-total affected by rounding

** In addition to the lengths of peat set out in this table there would be a further 2.2km of alluvium / soft ground where Methods 1 – 4 would be used for the construction of the pipeline. These are set out in Appendix 5.3A (Methods of Working in Peat)

140. Some of the general working arrangements such as only undertaking earthworks in suitable weather conditions (as set out in Section 5.24.2) and keeping the pipeline excavation open for the shortest period practicable would be important for the sections of the pipeline in peat soils.

141. Similarly, consistent with the general construction approach a surface water filter drain would be used to intercept land drainage and direct it away from the trench towards the settlement lagoons which are described in further detail in Section 5.24.

142. However, in addition there are a number of key differences compared with the installation for non-peat areas. These are:

- Use of a 'floating road' for access to avoid removing peat for the purpose of the Temporary Construction Road. The 'floating road' would be removed after construction
- Some areas of peat would not require topsoil stripping and so construction working areas that would usually be used for topsoil storage could be used for storage of layers of peat material, widened

excavation and additional drainage, where required. Note that some areas of peatland do have topsoil, notably where grassland overlies peat in agricultural areas. Where this would be the case topsoil or other overlaying material that has to be excavated would be stored separately

- During the construction of the pipeline the excavated peat would be stored separately to any acrotelm layer or amorphous layer / vegetated fibrous layer, kept wetted (if appropriate) and the different layers, where they exist reinstated in the same order that it was extracted
- Additional temporary surface water measures / land required due to the saturated nature of the ground
- De-watering only for deep sections >2.5m depth of peat
- De-watered water would be treated through temporary treatment facilities such as a 'silt buster' prior to discharge through the existing on-site drainage
- Greater use of side-boom cranes or gantry cranes to lift the pipe into place rather than using standard excavators
- Side slope angles would be made shallower to allow for safe construction in less stable ground conditions
- Retaining measures, such as temporary sheet piles or a trench box may be adopted if slacker side slopes were not sufficient
- The cover over the permanent concrete collars would be a minimum of 0.8m and 1.2m over the top of the pipe itself
- Piling may also be installed under the pipe for areas where Method 4, as described in Appendix A5.3, is adopted. As an alternative to piling there could be additional excavation for the stone piles to be placed under sections of the pipe in deeper peat; this is Method 3, as described in Appendix A5.3
- The pipeline is not anticipated to create new preferential flow paths; however, as a precautionary measure drain 'plugs' would be installed to prevent this.

143. A typical cross section of the temporary Construction Working Width for the pipeline in peat areas is shown in Image 5.5 and this shows the slacker side slopes on the excavation and material storage compared with the standard cross section for the Construction Working Width.

144. Localised peat instability within exposed trenches would be a risk and the construction approach for sections of peat has been developed in response to this. In particular, in order to prevent peat movements into the trench the following approach would be adopted:

- Work in dry weather conditions as far as reasonably practicable with earthworks planned for summer months and movement of machinery to be suspended during heavy rainfall / high water levels (other than as required to respond to a potential incident).
- Interceptor drains on the perimeter of the Construction Working Width and dewatering of the excavation for the pipeline, will be used as part of the temporary drainage plan in areas of peat and / or land with high ground water table to create 'dry' conditions as far as reasonably practicable, (definition of 'dry' as per (CIRIA 2001))
- Slacken side slopes on the batter of the trench excavation as informed by peat probes / further Ground Investigation undertaken as part of the preparation of the construction phase. This is to be as determined through a detailed slope stability assessment by a competent temporary works designer and is to be set out in construction Method Statement for each section of pipeline construction within peat soils
- Utilise land within the Construction Working Width upstream and downstream of the section of pipeline being constructed for activities which there is flexibility over their location such as the temporary stock piling of material and drainage ponds. This would be done to maximise the land available at the section of pipeline being built that could be utilised in slackening side slopes

- For sections of construction where there would be deep peat and/or dewatering proves not to be effective, or slacker side slopes cannot be adopted the contractor would adopt a trench box / temporary sheet piled coffer dam (this would be installed using a vibratory plate method / press piling⁴) in order to retain the side slopes
- Each section of excavation is to be left open for as short a period of time as reasonably practicable.

145. In addition, the following would be adopted:

- Limiting stockpiling of materials in any specific areas
- No stockpiling in areas of degraded raised bog
- Excavated material to be removed to designated deposition areas
- Implementation of monitoring regime for peat movement
- Frequent monitoring and inspection during construction and operation of access roads and temporary peat storage areas
- If required, additional site investigations inclusive of in situ testing and laboratory testing in specific risk areas on the site
- Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement
- Approved Contractor to provide toolbox talks and on-site supervision prior to and during the works
- Daily sign-off by supervising staff on completed works
- Implementation of emergency plan and unforeseen event plan by the approved Contractor.

146. An assessment of peat stability has been undertaken as is summarised in Appendix A5.3 (Methods of Working in Peat). This concluded that with the proposed construction management measures including specifically the measures to reduce water levels and try to create as 'dry' conditions as possible there was not a risk of side slope collapse within the excavation. This was based on an excavation with a 1:2 side slope up to 4.5m in depth, with an overall peat depth of 5m and allowing for a temporary stockpile of 1m high (with a side slope of 1:3 and an offset of 1m from the top of the excavation). This analysis relied on the benching of the side slope of the trench excavation using 0.5m wide benches at approximately 1.5m height intervals. This is consistent with the proposed construction approach as shown in Image 5.5. Further, the current vertical alignment does not go below 4.5m deep in areas of peat based on the data available.

147. In the event that, the excavation was in very deep peat (deeper than 4.5m), the peat depth was deeper than 5m or conditions on-site were affected by prolonged wet weather, then either, the side slope angles would have to be reduced, stockpiling moved further from the excavation and / or temporary retaining measures such as temporary sheet piles would have to be adopted.

148. Following completion of the construction works the general principle is that the areas of peat would be reinstated in a manner consistent with the Bord na Móna's rehabilitation plans where such plans exist. This would be on the basis of the conditions which existed on site prior to the construction of the Proposed Project including the material, habitat, on-site features and surface water management measures that were on site before the works commenced. The aim of the reinstatement of the Construction Working Width is:

- To get the post-construction conditions back to the pre-construction conditions in terms of the material, surface water management measures and water level
- Not to inhibit the longer term delivery of the Rehabilitation Plans / Enhanced Rehabilitation Plans.

⁴ Press piling (or press-in piling) is a civil engineering technique for installing foundation piles or sheet piles using a static hydraulic press instead of dynamic hammering or vibrating. This would be adopted where there were receptors in close proximity that could be at risk of vibration effects as detailed further in Chapter 6 (Noise and Vibration) of the EIAR.

149. This would mean that the excavated peat material would be used to backfill the excavation around the pipeline in approximately the same layers and depths that it was excavated. The reinstatement would include material being reinstated over the top of the pipeline. Hydraulic connectivity would be reinstated over the top of the pipe, where it existed prior to construction and this would include reinstating permanent drainage and drain blocks over the top of the pipe in order to reinstate the surface water management and water levels back to the condition that existed pre-construction.

150. In many areas the peat has already been worked and so is already degraded or 'cut-over'. However, there would be sections of raised peat bog that will be affected by the works. Excavating the peat, storing it and reinstating it would affect the integrity of the peat and result in some degradation and therefore, as part of the reinstatement additional measures would be employed including:

- Ditch/Gully blocking
- Ditch reprofiling
- Removing any scrubs/trees and/or ground smoothing
- Habitat creation
- Surface bunding.

151. This work would be undertaken as soon as reasonably practicable following the placement and connection of the pipes within the trench.

152. Suitable surplus excavated peat materials would be used as part of Bord na Móna rehabilitation plans. Agreement has been reached, in principle with Bord na Móna that surplus material can be re-used within their lands. Material would only be re-used within the bog that it was excavated from.

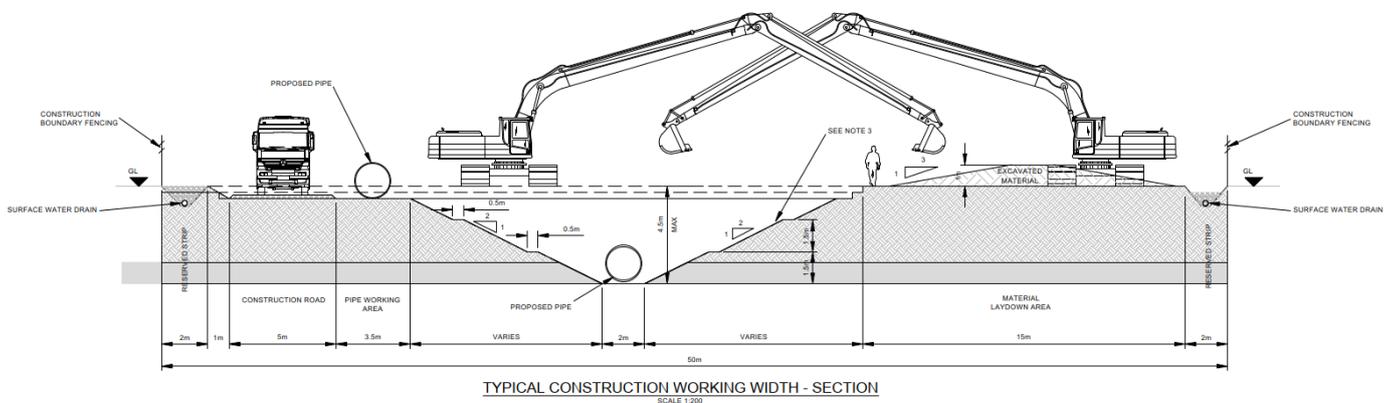


Image 5.5: Indicative Construction Working Width Cross Section in Peat Areas

5.11 Construction Access

5.11.1 Construction Vehicle Access

153. Access to the works areas would be via designated Haul Roads only.

5.11.2 Haul Roads

154. Haul Roads are part of the public road network which have been designated for the movement of construction materials, plant and workers to, from and between the six Infrastructure Sites, the pipeline and temporary works areas such as the Construction Compounds and Pipe Storage Depots. They include national, regional and local roads. Details on the construction traffic movements can be found in Chapter 7 (Traffic & Transport). The use of the Haul Roads would be managed through the measures set out in the TMP that has been prepared (Appendix A7.2 of Chapter 7: Traffic & Transport).
155. The Haul Roads have been determined based on a review of all potential road crossings/access points for traffic to and from the Infrastructure Sites, Construction Working Width, and temporary works areas; and based on the identification of those road crossings/access points with the potential capacity to accept a large number of vehicle movements.
156. These Haul Roads considered suitable for the construction of the Proposed Project have been determined in consultation with TII and the Local Authorities most directly affected by the Proposed Project. Figures 5.18 to 5.26 show the Haul Roads by authority area, as follows:
- South Dublin County Council (Figure 5.18)
 - Kildare County Council (Figure 5.19)
 - Laois County Council (Figure 5.20)
 - Offaly County Council (Figure 5.21)
 - Tipperary County Council (Figure 5.22)
 - Galway County Council (Figure 5.23)
 - Clare County Council (Figure 5.24)
 - Limerick County Council (Figure 5.25)
 - Cork County Council (Figure 5.26).
157. Engagement on the Haul Roads was undertaken with:
- South Dublin County Council
 - Kildare County Council
 - Laois County Council
 - Offaly County Council
 - Tipperary County Council
 - Clare County Council
 - Limerick County Council.
158. For the construction of the proposed 38 kV Uprate Works, the public road network (including regional and local roads) would be used for the delivery of materials, plant and equipment from an ESNB depot to the development corridor and individual infrastructure locations. The proposed Haul Roads in the immediate vicinity of the 38 kV Uprate Works are indicated in Figure 5.24. All other proposed Haul Roads for the 38 kV Uprate Works are as for the wider Proposed Project (Figure 5.18 to Figure 5.26 inclusive). The proposed Haul Roads for the 38 kV Uprate Works have been discussed and agreed with the relevant Local Authorities.

5.11.3 Construction Access and Egress

159. There would be an access/egress point to and from the Construction Working Width where each Haul Road intersects it. The access/egress points would allow construction traffic (plant, workers and materials) to move between the public road and the works areas and would incorporate visibility splays based on sight lines appropriate to the speed limit of the road. They would allow construction traffic to easily turn off the public road, which would reduce delays to other traffic users.
160. In the event that a full visibility splay cannot be achieved then alternative measures would be adopted e.g. banksman / temporary traffic controls.
161. Section 5.11.5 provides further information on the vehicles arriving at access points.
162. The access/egress points would be secured at all times and manned during working hours.
163. The access/egress points to the Construction Working Width, Infrastructure Sites, Construction Compounds and Pipe Storage Depots, are shown in the Project Component Overview (shown in Figure 4.2 to Figure 4.60 inclusive) and are listed in Table 5.15.

Table 5.15: Access and Egress Locations to the Construction Working Width (and Other Works Sites)

Access and Egress ID	Crossing Reference	Chainage (approx.)	Project Component Overview Figure
AE051	N/A	N/A	Figure 4.7
AE052	N/A	N/A	Figure 4.7
AE053	N/A	N/A	Figure 4.6
AE054	N/A	N/A	Figure 4.6
AE001	R494	Access Road for the RWI&PS	Figure 4.7
AE002	R494	RW – 800	Figure 4.7
AE004	R445	TW – 1900	Figure 4.8
AE005	R445	TW – 12700	Figure 4.11
AE006	R494	TW – 16700	Figure 4.12
AE007	R495	TW – 18500	Figure 4.13
AE008	R493	TW – 21500	Figure 4.14
AE049	N/A	TW – 28900	Figure 4.16
AE009	N52	TW – 29000	Figure 4.16
AE010	R490	TW – 34700	Figure 4.18
AE011	L1064	Access Road for the BPT	Figure 4.18
AE012	R491	TWA – 2000	Figure 4.19
AE013	R491	TWA – 5000	Figure 4.20
AE014	Unnamed Local Road	TWA – 5700	Figure 4.20
AE015	Unnamed Local Road	TWA – 6100	Figure 4.20
AE016	R492	TWA – 11500	Figure 4.21
AE017	N62	TWA – 14200	Figure 4.22
AE018	Unnamed Local Road	TWA – 23600	Figure 4.25
AE019	R440	TWA – 27900	Figure 4.27
AE047	L3003	TWB – 1200	Figure 4.27
AE020	Unnamed Local Road	TWB – 7400	Figure 4.32
AE021	R421	TWB – 18700	Figure 4.35

Access and Egress ID	Crossing Reference	Chainage (approx.)	Project Component Overview Figure
AE022	N80	TWC – 100	Figure 4.38
AE023	R420	TWC – 7800	Figure 4.40
AE024	Unnamed Local Road	TWC – 13400	Figure 4.41
AE025	R402	TWC – 19200	Figure 4.43
AE026	R400	TWC – 19800	Figure 4.43
AE027	R402	TWC – 24700	Figure 4.45
AE028	R401	TWD – 3600	Figure 4.46
AE029	R403	TWD – 16200	Figure 4.50
AE030	L5025	TWD – 21600	Figure 4.51
AE031	L1017	TWD – 26500	Figure 4.53
AE032	L1017	TWD – 28800	Figure 4.53
AE033	R407	TWE – 100	Figure 4.55
AE034	R408	TWE – 3800	Figure 4.56
AE035	R406	TWE – 7800	Figure 4.57
AE036	R403	TWE – 8500	Figure 4.57
AE037	L1016	TWE – 12100	Figure 4.58
AE038	L5064	TWE – 12700	Figure 4.59
AE039	R405	TWE – 14900	Figure 4.59
AE040	R120	Access Road for the TPR	Figure 4.60
AE041	R445 / Private Road	TW-4100	Figure 4.9
AE042	R499	TW-6000	Figure 4.9
AE044	L8014	TWA-25100	Figure 4.26
AE043	Unnamed Local Road	TWB-11800	Figure 4.33
AE048	Unnamed Local Road	TWB-24700	Figure 4.37
AE045	Unnamed Local Road	TWB-25200	Figure 4.37
AE050	L1020	TWC-9000	Figure 4.40
AE046	Unnamed Local Road	Over Grand Canal	Figure 4.49
AE051	R445	Railway Line Crossing	Figure 4.7
AE052	R445	Railway Line Crossing	Figure 4.7
AE053	R494	Railway Line Crossing	Figure 4.6
AE054	R494	Railway Line Crossing	Figure 4.6
AE055	R494	Kilmastulla River	Figure 4.7
AE056	R494	Kilmastulla River	Figure 4.7

5.11.4 Survey of Haul Roads

164. A pre-condition survey would be carried out⁵ prior to commencement of the Construction Phase. The pre-condition survey is an inspection of the existing condition of the infrastructure impacted by the Proposed Project and would include Haul Roads, property boundaries, adjacent buildings and structures, etc.

⁵ During discussions with Local Authorities on the identification of Haul Roads, no specific improvement measures were requested in advance of the works. The Local Authorities conduct routine inspections of their road network and undertake necessary maintenance to ensure road standards.

165. Haul Roads would be maintained during the construction works insofar as the condition of the local Haul Roads would be monitored, and any deterioration of the road surface, or potholing, would be continuously repaired.
166. A post-works condition survey would be carried out on the Haul Roads on completion of the Construction Phase. Where required, reinstatement works to Haul Roads, as agreed with the Local Authorities, would be carried out to bring them back to the standard that existed prior to the commencement of works.

5.11.5 Worker Access

167. Workers would start their working day at one of the Construction Compounds/Infrastructure Sites. Workers required on the pipelines would be bussed to the various pipeline works.
168. No parking for construction workers would be available at the pipeline works areas. The only vehicles expected to be arriving at the access points for the construction of the pipeline would be:
- Mini-buses dropping off / picking up workers
 - Delivery vehicles including Light Goods Vehicles., Ordinary Goods Vehicle Type 1 and Type 2
 - Intermittent car journeys for site staff not based full time at the construction site, e.g. foreman, Environmental Clerk of Works, etc.
169. Workers would travel from home or use local accommodation, e.g. hotels/bed and breakfast/rental properties. There would be no provision for worker accommodation anywhere within the works areas. All accommodation would be off site. Travel to Construction Compounds would be from these locations.

5.12 Temporary Construction Road

5.12.1 Temporary Construction Road

170. An internal Temporary Construction Road would be constructed within the Construction Working Width to facilitate the movement of plant, workers and materials.
171. These roads would be formed by stripping the topsoil and upper level of subsoil across the Temporary Construction Road to its full depth, as determined by the Agronomist engaged by Uisce Éireann. Records would be kept of the depths stripped in each of the parcels of land that the Construction Working Width passes through.
172. Where the ground conditions are suitable the construction vehicles would run directly on the formation layer i.e. directly on top of the lower level of subsoil. This would be the approach for the majority of the length of Temporary Construction Road that would be required for the pipeline.
173. However, where the ground conditions would not be suitable for direct running on the lower level of subsoil, then a geogrid mattress and stone would be laid to form the Temporary Construction Road for vehicles to run on.

174. This would incorporate a layer of coarse stone (e.g. 75mm grading), up to approximately 1m deep, overlain on a geogrid mattress to prevent material sinking into the soil below. This type of Temporary Construction Road would be removed, and the land reinstated, on completion of the works. Image 5.6 shows a Temporary Construction Road being constructed in poor ground. Based on the length of pipeline to be constructed each year it would be expected that a maximum of approximately 10km of Temporary Construction Road would be used in each section of the pipeline at any one time. This is based on the three geographical sections 2-4 as set out in Table 5.4. Once the relevant section of the Temporary Construction Road is no longer required then the material within the road would be removed and re-used on the next section along the route.
175. However, if the ground conditions demand, for example, the poor ground material is particularly deep, or the underlying soils are weak, such as very soft silts, then a 'floating road' would be used to provide the temporary access. This approach is described in Section 5.12.2.



Image 5.6: Typical Temporary Construction Road in Poor Ground

5.12.2 Floating Roads

176. A 'floating road' was an engineering solution developed in Scotland during the construction of several kilometres of roads in very poor, organic materials such as peat, and it is used where it is impracticable to remove the underlying soft material. Peat is a very compressible and decaying material which is the worst possible subgrade for a road and is too unstable to support the movement of plant and machinery. The 'floating road' is a raised stone platform, or embankment, where stability is provided by interlocking geogrids (as shown in Image 5.7) and provides a stable surface for the trafficking of construction plant and machinery.

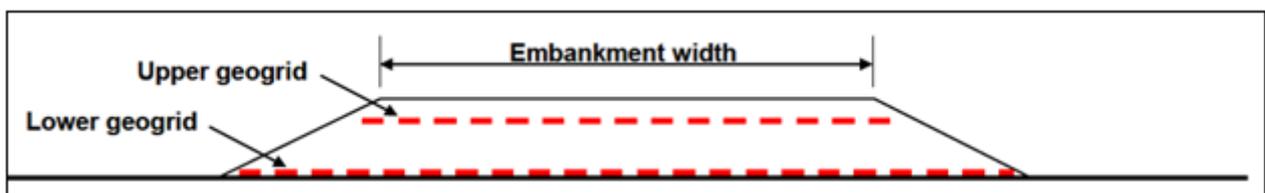


Image 5.7: Typical Stabilised 'Floating Road' Cross Section with Geogrids

177. The 'floating road' does not require any excavation of the poor ground material and is laid directly on top of it at ground level. This limits the impact on the underlying vegetation. It is standard practice to use at least two layers of geogrid: a lower one directly on the existing surface and an upper one to support the embankment created. Whilst the precise make-up of the floating road would depend on the ground conditions at a particular location, a typical representation is shown in Image 5.8.

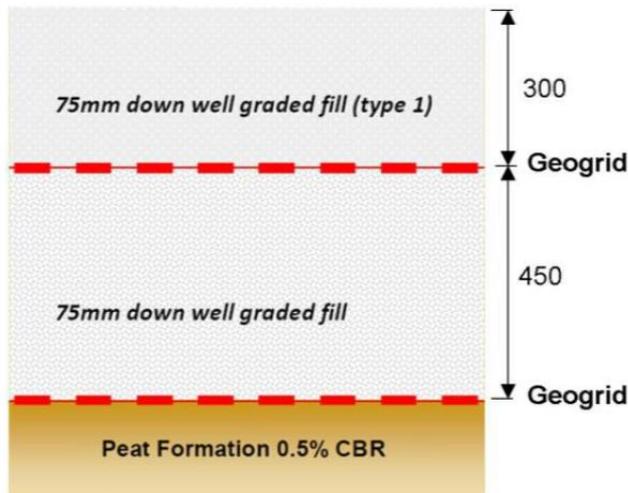


Image 5.8: 'Floating Road' – Potential Make-up⁶

178. The 'floating road' is temporary and would be removed when a section of works is completed, and it is no longer required. Based on the Ground Investigation for the Proposed Project it is estimated that approximately 25km of the total pipeline length could be subject to a floating road and the associated use of imported stone (allowing for the combined length of peat and soft ground as set out in Appendix A5.3 (Methods of Working in Peat)).

5.12.3 Reinstatement and Re-Use of Material

179. It is proposed that on completion of sections of the works in a given area the Temporary Construction Roads would be lifted and removed to the next required location to limit the amount of imported stone required for the works. The stone would be moved via the Temporary Construction Road within the Construction Working Width, described in Section 5.12.1 and / or via the Haul Roads, described in Section 5.11.2.

5.13 Construction Vehicles

180. A range of vehicle types would be used during the construction of the works. This includes vehicles which would travel on the public road network via Haul Roads, and construction traffic. Vehicles on the public road network would include cars, passenger vehicles such as minibuses, Light Goods Vehicles such as transit and delivery vans; Ordinary Goods Vehicle Type 1 such as rigid vehicles with two or three axles including tractors, box vans, backhoe diggers and trucks which have double rear wheels; and Ordinary Goods Vehicle Type 2 such as rigid vehicles with four or more axles.

181. The types of construction vehicles deployed in constructing the works are described in the following sections of this chapter. Where a vehicle would be unsuitable on the public road, e.g. crawler cranes and front loaders, these would be transported by Ordinary Goods Vehicle Type 2 to designated access/egress points which are gateways to the working areas.

⁶ CBR is the California Bearing Ratio and is a measure of the *in situ* stiffness of the peat.

5.14 Temporary Fencing

182. The type of fencing provided along the Construction Working Width would be site specific, dependent on the particular farming methods at each location and agreed with landowners in advance of the works commencing. It would typically be put in place a week or two before commencement of pipeline construction and removed following reinstatement of the land.

183. Where access across the Construction Working Width is required, access gates for livestock would be provided (shown in Image 5.9). All access across land would be agreed in advance through consultation with the landowner and would need to be coordinated with ongoing construction activities.

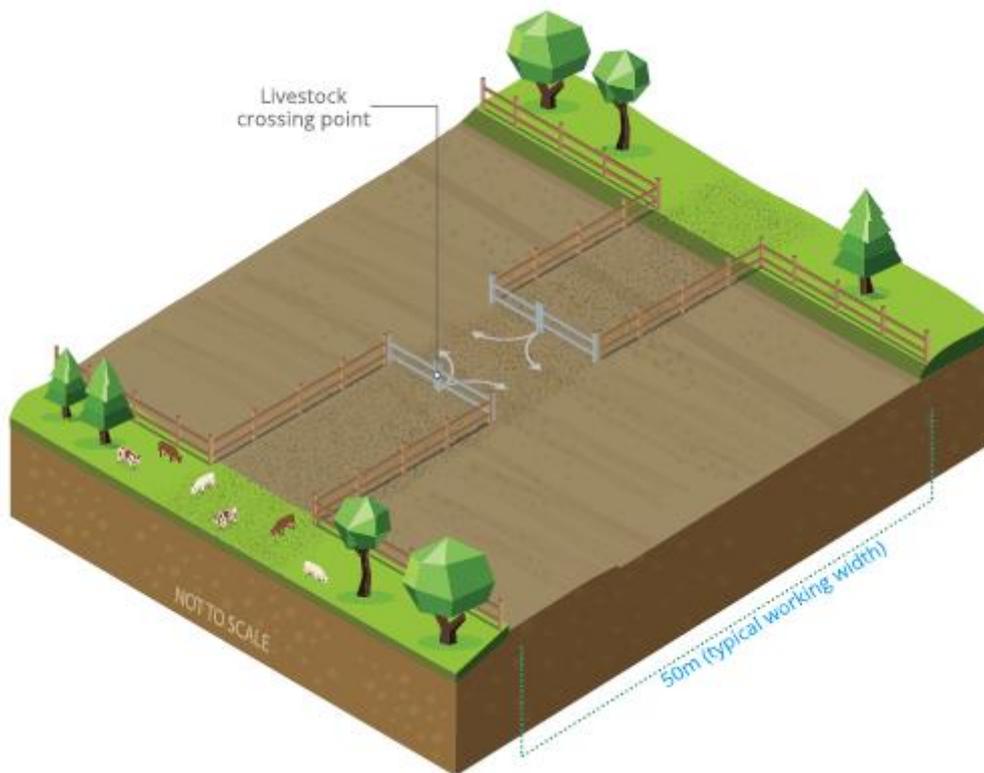


Image 5.9: Construction Working Width – Typical Crossing Point

184. The sequence for construction of the fence would be as follows:

- Set out the fence perimeter along the outer extents of the Construction Working Width and mark the fence post locations
- Dig holes for the fence posts using a post hole digger or two-person auger
- Position wooden fence posts and fix in situ with quick-set concrete mix
- Attach rails and affixed wire.

185. Access gates would typically be galvanised steel or timber construction. Fencing would be standardised as per standard Uisce Éireann wayleave details and would be suitable for its intended use, e.g. stock proof (as per the example in Image 5.10).



Image 5.10: Stock Proof Fencing

5.15 Construction and Commissioning Materials

186. The Construction Phase of the Proposed Project would require significant volumes of construction materials. Table 5.16a provides an overview of typical construction materials and identifies areas of the Proposed Project where it is proposed to use these materials. This list is not exhaustive.

Table 5.16a: Overview of Construction Materials Required for the Proposed Project

Material Type		Relevant Project Elements													
		RWI&PS	RWRMs	WTP	Treated Water Pipelines	BPT	BPS	FCV	TPR	Permanent Access Points/Lay-Bys	Temporary Accesses	Construction Compounds and Pipe Storage Depots	Ancillary Pipe Infrastructure	Power Supply Infrastructure	Proposed 38 kV Uprate Works
Concrete	Precast	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Site cast	✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓
Steel	Pipe	✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	-
	Framing	✓	-	✓	-	-	✓	-	-	-	-	-	-	-	-
	Cladding	✓	-	✓	-	-	✓	-	-	-	-	-	-	-	-
Soil	Virgin topsoil	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
	Subsoil	✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	-
Bricks, tiles, etc.		✓	-	✓	-	✓	✓	✓	✓	-	-	-	-	-	-
Stone		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sand		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ducting		✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓
Cabling		✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓
Metals		✓	-	✓	-	✓	✓	✓	✓	-	-	-	-	-	-

Material Type	Relevant Project Elements													
	RWI&PS	RWRMs	WTP	Treated Water Pipelines	BPT	BPS	FCV	TPR	Permanent Access Points/Lay-Bys	Temporary Accesses	Construction Compounds and Pipe Storage Depots	Ancillary Pipe Infrastructure	Power Supply Infrastructure	Proposed 38 kV Uprate Works
Timber	✓	-	✓	-	✓	✓	-	✓	-	-	-	-	-	-
Plastics	✓	-	✓	-	✓	✓	-	✓	-	-	✓	-	-	✓
Glass	✓	-	✓	-	✓	✓	-	✓	-	-	-	-	-	-

187. Table 5.16b provides estimated quantities of construction materials required for the permanent works during the Construction Phase of the Proposed Project.

Table 5.16b: Estimated Quantities of Construction Materials Required for the Proposed Project

Material Type	Tonnage	m ³
Blinding concrete (150–300mm)	22,621	16,158
Brick and blockwork	1,980	N/A
Concrete	1,007,738	419,891
Granular material (aggregate)	174,800	87,400
Glass	10	N/A
Kerbing	1,530	N/A
Mortar	950	500
Geotextiles – ground stabilising matting	8,230	N/A
Ground anchorage	2,910	N/A
Grout (bentonite)	27,666	16,406
Hot rolled asphalt	14,838	8,728
Insulation	40	N/A
Iron	67,570	N/A
Reinforcing steel	131,407	N/A
Plastics	1,470	N/A
Portal frames	81,220	N/A
Steel piles	158	N/A
Steel pipe	60,830	N/A
Aluminium	23,480	N/A

5.16 Surplus Excavated Materials and Volumes of Waste

189. Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended allows an economic operator to decide, under certain circumstances, that material is a by-product and not a waste. This is discussed further in Chapter 19 (Resource & Waste Management).

190. It is envisaged that a significant portion of the surplus excavated material would be suitable for reuse within the Proposed Project for landscaping, non-structural fill and similar uses, subject to further geotechnical testing at detailed design stage. Where material is not reusable within the Proposed Project, then options for the reuse of the clean suitable material as a by-product under Article 27 of the European Communities (Waste Directive) Regulations 2011 would be sought. Where excavated material is not reusable within the Proposed Project and is not classified as a by-product in accordance with Article 27 or recoverable on-site, this material would then be classified as a 'waste'. Only when all other options to prevent, reuse or recycle excess excavated material have been ruled out, would recovery or disposal be considered.

191. Table 5.17 gives an indication of the volume of surplus excavated material generated on the works.

Table 5.17: Estimated Volumes of Surplus Excavated Material

	RWI&PS	RWRMs	WTP	Treated Water Pipeline from the WTP to the BPT	BPT ²	Treated Water Pipeline from the BPT to the TPR	BPS ¹	FCV	TPR	38 kV Uprate Works	TOTAL
Approximate total excavated material (m³)	50,100	46,500	541,500	865,300	59,300	3,421,700	21,200	3,600	64,800	1,500	5,075,500
Expected reused (m³)	5,000	39,200	641,000	750,000	18,300	3,022,500	2,000	600	5,600	1,500	4,485,700
Expected surplus excavated material (m³)	45,100	7,300	(Minus 99,500) ¹	115,300	41,000	399,200	19,200	3,000	59,200	0	589,800

¹Material would have to be imported from other parts of the Proposed Project to complete the landscaping at the WTP:

- Surplus excavated material from the construction of the RWI&PS would be transported to the WTP for landscaping and fill or to licensed/permitted facilities
- Surplus excavated material would be imported to the WTP site from the RWI&PS site, from the Construction Working Width of the RWRMs, and from nearby sections of the Treated Water Pipeline from the WTP to the BPT.

²BPS includes the material for the associated power line from Birr.

5.17 Raw Water Intake & Pumping Station (RWI&PS)

5.17.1 Construction Phase Activities, Duration and Phasing – RWI&PS

192. The construction of the RWI&PS would involve extensive excavation of the site to construct the Pumping Station, Microfiltration Buildings and below ground pipework. The works would be carried out in the Parteen Basin adjacent to the shore to enable the construction of the Raw Water Intake Basin. The resulting permanent works would incorporate the intake structure and revetment mats such as those shown in Image 5.18.
193. Other construction activities would include landscaping, an access road and internal circulation roads, car parks and walkways, security fencing, mechanical and electrical (M&E) plant, instrumentation and control systems, and building services. In addition, a new mains supply would be provided off the electrical grid, to power the various plant and equipment in the RWI&PS.
194. The principal construction materials for the RWI&PS would include reinforced concrete poured in situ, structural steelwork, building work, prefabricated steel tanks, and above and below ground steel pipework.
195. General environmental protection measures (e.g. for sediment, flora, fauna and fish) would be put in place at the beginning of the Construction Phase. Acoustic noise barriers, adjacent to the water body, would be employed to mitigate nuisance caused by construction of the main Pumping Station and other structures on dry land. The construction of the Intake Chamber would require temporary works and the use of protective silt curtains to prevent sediment escape into Parteen Basin. Any environmental protection measures specific to a particular activity or phase of construction would be put in place in advance of those works commencing.
196. The total duration of construction activity at the RWI&PS would last approximately 4 years 11 months from pre-site establishment activities such as site investigation through to the completion of the commissioning of the whole system. However, as shown in Image 5.11 there would be a period of time between the completion of the main infrastructure at the site and the completion of the construction of the rest of the Proposed Project to allow the final testing and commissioning to be undertaken. Consequently, the majority of the construction works including the main earthworks and building the structures would be completed by the end of the end of Year 3. These construction activities would take approximately two years and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be from winter at the end of Year 1 to the winter at the end of Year 3. The main earthworks and structures would be concentrated in the 12 month period in Year 2. Advanced works including surveys and site preparation would take place in Year 1. The construction activities associated with the RWI&PS are listed in Image 5.11 along with estimated durations for each activity.
197. During the construction period the site will act as a Satellite Construction Compound (CC0). A temporary works site layout plan for the RWI&PS is shown in Figure 5.1.

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RWI & PS

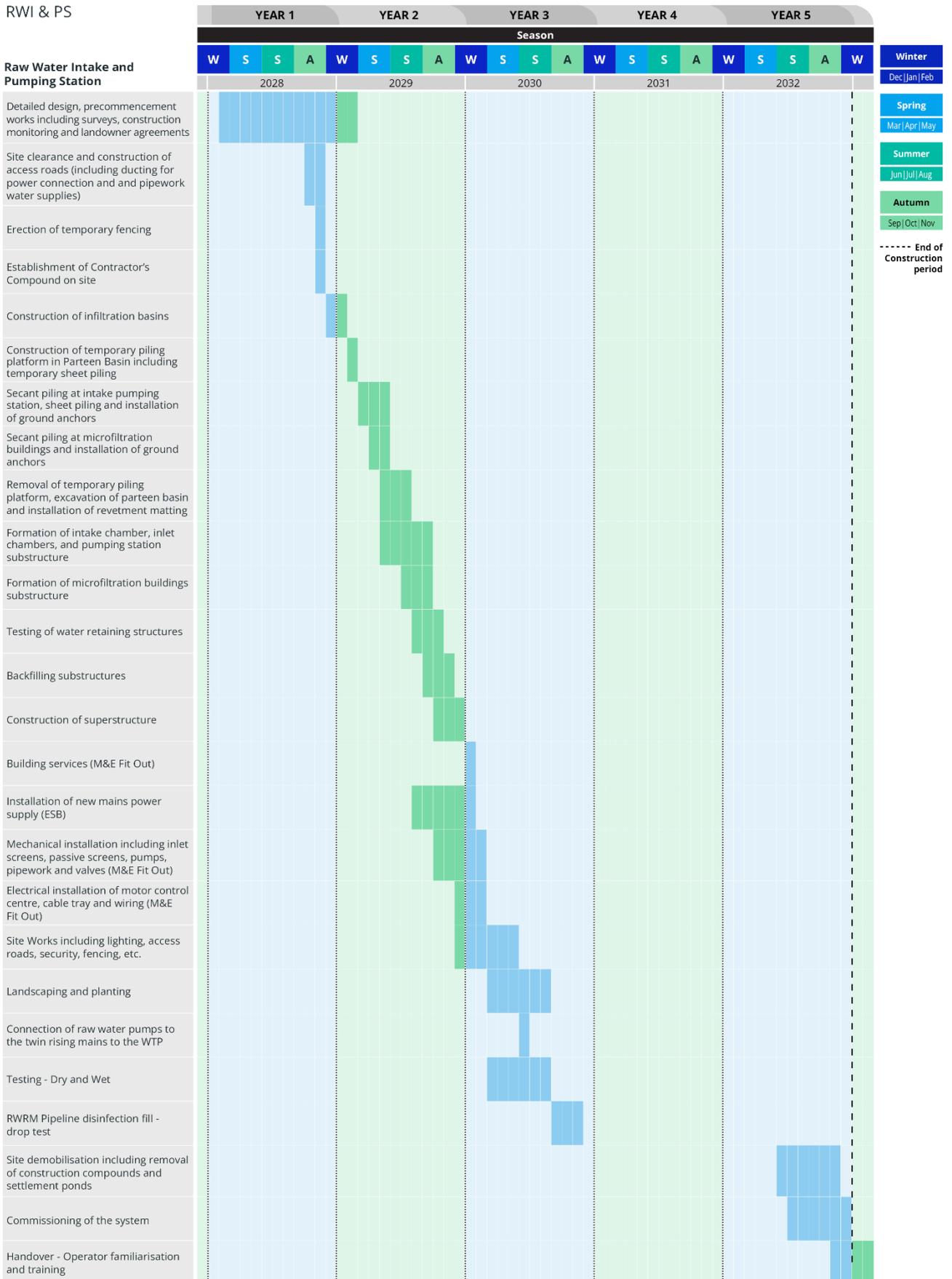


Image 5.11: Construction Phase Activities, Duration and Phasing for the RWI&PS

5.17.2 Construction Methodology – RWI&PS

5.17.2.1 Sequence of Construction

198. The RWI&PS would be constructed in the sequence outlined in Table 5.18.

Table 5.18: Sequence of Construction Activity – RWI&PS

Sequence	Construction Activity
1	Pre-construction surveys, site investigation, establish monitoring sites for ground movement and groundwater levels
2	Site preparation works, including building the access road, temporary fencing, installing the double silt curtain, tree felling and vegetation clearance, topsoil and subsoil stripping, and setting up the Construction Compound. It would also include site drainage, installing temporary power, a power line diversion and a potable water connection
3	Excavation of groundwater settlement basins and construction of Wastewater Holding Tank (for use as temporary pump sump for returning settled groundwater to Parteen Basin). Use excavated material to raise ground levels
4	Installation of secant piling, ground anchors and sheet piling. This will include building a temporary piling platform in Parteen Basin to work from. This would be necessary to allow the secant pile, permanent sheet piles and ground anchors construction along Basin shoreline. The platform would be constructed using temporary sheet piles in Parteen Basin to contain the platform
5	Construction of Raw Water Intake including the Intake Chamber including the retaining wall, Inlet Chambers and Raw Water Pumping Station Building substructure
6	Removal of the temporary platform including the associated temporary sheet piles within Parteen Basin, and excavation/reprofiling of Raw Water Intake Basin, including breaking through some ground anchors (having installed an additional containment barrier) and place of concrete revetment mats over reprofiled Parteen Basin bed
7	Construction of Raw Water Rising Mains Scour Tank, Microfiltration Buildings substructure, and Invasive Species Debris Retention Tank
8	Construction of Raw Water Rising Main Swab Chamber, Flow Meter Chamber, Oil Interceptor and Stormwater Attenuation Tank
9	Construction of RWI&PS and Microfiltration Buildings superstructure
10	MEICA installation
11	Construction of 20 kV electricity substation and connection to electricity supply
12	Commissioning of the works
13	Complete site works in preparation for Operational Phase including final site access, final surfacing, landscaping and planting, and boundary treatment
14	Demobilisation of the construction site

5.17.2.2 Pre-Commencement Activities

199. The proposed site for the RWI&PS is adjacent to the Fort Henry Embankment, which forms part of the Parteen Basin impoundment. Prior to construction works commencing on site a monitoring plan for the works will be implemented. This would include:

- Installing piezometers, in agreement with ESB to monitor groundwater during construction and into the Operational Phase of the Proposed Project. These would be connected individually to a modem logger, and this would allow the data to be transferred over a mobile phone network to a shared platform for relevant stakeholders
- Ground movement monitoring and vibration monitoring.

200. During this pre-commencement phase further ground investigation would also be undertaken to inform the detailed design process. This may require temporary site access and supporting facilities.

201. There would also be environmental surveys and checks completed prior to the ground investigation and then the full site establishment.

202. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

5.17.2.3 Site Preparation Works

203. The site preparation works would include the establishment of the site including setting up access, clearing vegetation, creating the temporary facilities and installing the temporary fencing to secure the area.

204. The main RWI&PS site, which is partly located within the Lower River Shannon Special Area of Conservation (Site Code 002165) is currently used for forestry. As a result, extensive tree felling, and site clearance would be required before main construction work can commence. This would be carried out either before 1 March or after 31 August in the year in which work commences. Currently this is expected to be the autumn of Year 1 as shown in Image 5.11.

205. Once clearance has been undertaken, the new access road to the RWI&PS site would be constructed and a working space for the construction works would be created. Temporary traffic management would be required to establish this area, details of which are discussed in Section 5.17.2.8 and Chapter 7 (Traffic & Transport) of the EIAR.

206. The access road would serve a dual purpose as it would initially serve as a temporary road, becoming a permanent road at the end of construction.

207. The construction sequence for the temporary access road and the temporary, internal circulation roads would be as follows:

- A road would be levelled and cleared of all obstructions
- A 500mm deep layer of stone hardcore (typically 75mm in size) overlaying a geogrid mattress would be placed along the full length of the access road alignment, and compacted with a road roller
- The hardcore would then be topped off with a stone dust and compacted again. Enough stone dust would be added to ensure that there is a clean level surface for trafficking.

208. As part of the construction of the access to the site, the third party access that needs to cross it would also be built.

209. Topsoil would be stripped across the required site area to its full depth. The top layer of sub-soil would also be removed. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3.2. Any existing land drains crossing the works area would be recorded and culverted. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.

210. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking, and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.

211. The site preparation would include installing the double silt curtain in the Parteen Basin as described in Section 5.17.2.8. It would also include constructing the settlement basins as described in Section 5.17.2.6 and any areas that involve the storage of fuel would have paved areas with bunding (designed to capture the contents of the bunded fuel tank) and hydrocarbon interceptors to ensure that no spillages get into the surface or groundwater systems. The fuel storage areas would be a minimum of 50m from the Parteen Basin shoreline.

212. The Satellite Construction Compound (CC0) area would be established as described in Section 5.8.3 and as shown on Figure 5.1.

5.17.2.4 Temporary Foul and Potable Water Connections

213. During the Construction Phase, potable water would be taken to the site along the access road from a temporary connection to the public watermain in the R494 Regional Road from Birdhill to Ballina/Killaloe. This connection would be installed as part of the construction of the access road as part of the site establishment as described in Section 5.17.2.3.

214. There would be no foul water connection at the site for construction purposes and so foul wastewater generated on the site from the welfare facilities and canteen would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP.

5.17.2.5 Temporary and Permanent Power Supply

215. The permanent power supply for the RWI&PS would be taken from the existing Birdhill 38 kV Substation as described in Section 5.23. Two 125mm diameter uPVC ducts have been installed as part of the Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme, which facilitate the installation of a 20 kV cable along the R494 from the Birdhill 38 kV Substation to the RWI&PS. In the event that access to these ducts cannot be made available for the Proposed Project, provision has been made within the Proposed Project for the construction of alternative ducting from the Birdhill 38 kV Substation along the R494 to the RWI&PS.

216. The ducting would be laid in the same trench, along the eastern side of the R494, for a length of approximately 1.4km from the existing Birdhill 38 kV Substation to the entrance of the proposed RWI&PS access road. The ducting would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with ESB standards (Appendix A4.2: Standard Specification for ESB 38 kV Networks).

217. The 20 kV ducting would cross the Limerick to Nenagh railway line (RYX003) and the Kilmastulla River (WCX077). In both instances the crossing would be carried out using horizontal directional drilling trenchless methods.

218. The trenchless crossing of the Limerick to Nenagh railway line would be approximately 26m long and would be carried out in accordance with Iarnród Éireann's guidelines.

219. The trenchless crossing of the Kilmastulla River would be approximately 20m in length. The level of the ducting would be 1.0m below the invert level of the river at the crossing point.

220. Approximately 1.4km north of the Birdhill 38 kV Substation, the ducting would be brought off the R494, turning west along the proposed RWI&PS access road. The ducting would be laid along the length of the access road, into the RWI&PS site itself, connecting into the electricity substation on the site.

221. The construction of the new permanent connection along the R494 and the permanent access road would be consistent with that described in Section 5.23.4.4 and shown in Images 5.53 and 5.54.

222. The temporary power supply during construction would be via mobile generator combined with a temporary connection to one of the overhead lines crossing the RWRM. The overhead line connection would be constructed as described in Section 5.23.4.3.

223. In addition to the power supply to the site there are three existing MV lines which cross the access track to the RWI&PS. One of these would need a minor permanent diversion because there is a poleset that would be affected by the alignment of the permanent access track. The poleset would be relocated to the edge of the access track which would very slightly change the alignment of the overhead line. This would be undertaken as an early stage of the construction of the access road. The new pole and line would be installed first and then the line switched across. This would be undertaken in accordance with ESB standards and would be constructed as described in Section 5.23.4.3. There would be no permanent works required for the second overhead line. A third line crosses underneath the access road and no permanent works would be required for this line either.

5.17.2.6 Temporary and Permanent Drainage

224. The temporary drainage, during construction, would, primarily be required during the earthworks excavation and secant piling and therefore, is described in Section 5.17.2.7. In summary it would consist of the use of settling ponds for dewatered water and surface water and then a discharge into the Parteen Basin. Further information is provided in Section 5.17.2.7 and in the SWMP (Appendix A5.1 Annex A).

225. The permanent drainage from the RWI&PS would be conveyed via a drainage system to a stormwater attenuation tank from which drainage would be discharged at greenfield runoff rates to a local watercourse along the permanent access track to the RWI&PS. The drain to do this would be constructed and used as part of the temporary surface water drainage during construction and then completed at the end of the Construction Phase.

5.17.2.7 Earthworks

226. It is proposed that finished levels across the site would generally match existing ground levels, with the exception of the western area adjacent to Parteen Basin, where existing ground levels of approximately 31.5mAOD⁷ (34.2m Poolbeg) would be raised to 32.3mAOD (35.0m Poolbeg) to match the crest level of the Fort Henry Embankment. All temporary works on-site would be designed to this same minimum level in order to protect the site from any flooding during construction.

227. The main earthworks operations would entail excavation of the areas of the groundwater settlement basins, the footprint of the RWI&PS intake chamber and substructures, and the Raw Water Rising Mains Scour Tank, Microfiltration Buildings and Invasive Species Debris Retention Tank. The below ground excavation needed for the Intake Chamber, Inlet Chamber and Pumping Station as well as Microfiltration Buildings would be facilitated by the secant pile and ground anchors described further in Section 5.17.2.7, (this section). The maximum depth of the excavation would be 14.2m.

228. The earthworks operations would also include the removal of excavated material off site to the WTP site and stockpiling of the volume of material required to backfill excavations on the RWI&PS site once the substructures are complete. Filling operations would involve using bulldozers and vibratory rollers.

229. Preliminary site investigation work in the form of ground penetrating radar surveys and the drilling of two boreholes were undertaken in 2019, and a further eight boreholes were drilled in 2022. Details of the ground conditions encountered are contained in Chapter 10 (Soils, Geology & Hydrogeology). In summary the boreholes encountered silty sand and gravel, to depths between about 4.0m and 6.5m, overlying very stiff, slightly gravelly sandy clay with cobbles, to rockhead. Rockhead was generally encountered 11.30m to 14.60m below ground level, rising locally to between 8.4m and 9.8m depths in two boreholes towards the southern site boundary. The rock encountered was weak to very strong limestone.

⁷ Levels in metres Above Ordnance Datum (mAOD) refer to the Malin Head Ordnance Datum

230. Based on tests carried out on rock samples extracted from the boreholes, the rock can be removed by mechanical means. To reduce the potential for vibration affecting the Fort Henry Embankment the rock breaking towards the southern boundary will be done using:
- Hydraulic rock breaking equipment
 - Lower vibration emitting breakers.
231. Given the proximity of the excavations to the Fort Henry Embankment, blasting of rock would not be permitted.
232. The quantity of material moved off site would be reused to make up levels on the WTP site and would be of the order of 45,100m³.
233. The main earthworks activities would be expected to take place primarily during Year 2. This would include the excavation required prior to the construction of the structures and the backfilling afterwards. This would take place for a duration of approximately seven months in parallel with the activities described in Section 5.17.2.8. There would be smaller scale earthworks outside of these periods for example, associated with construction of the access to the site, Dewatering Settlement Basins, general drainage and the final landscaping.
234. During this period dewatering would be required to ensure dry working conditions within the secant piling. The proposed design will exclude shallow inflows from the permeable sand horizons. Based on the permeability testing undertaken in the bedrock, the permeability ranges from 2x10⁻⁷m/s to 9x10⁻⁸m/s.
235. The findings of permeability tests at the boreholes on the RWI&PS site indicate dewatering flows of 5m³/hr to 15m³/hr need to be catered for on the RWI&PS site. This flow has been assumed for the purposes of this EIAR and the SWMP in Annex A of the CEMP (Appendix A5.1).
236. The appointed Contractor would maintain pumps in any deep excavations, and these would pump water that enters the excavation into two lined Dewatering Settlement Basins operating in sequence. The Dewatering Settlement Basins would have the estimated dimensions and volumes shown in Table 5.19.

Table 5.19: Estimated Dimensions and Volumes of Dewatering Settlement Basins

Basin No.	Total Length	Width	Average Water Depth	Average Volume
1	55m	15m	1.5m	851m ³
2	153m	15m	1.5m	2,606m ³

237. The retention time of water within the Dewatering Settlement Basins would be in excess of 24 hours, allowing particles to settle. The TII Drainage Design for National Road Schemes – Sustainable Drainage Options (TII 2014) recommends a 24-hour retention time in sizing sedimentation ponds for pollution control. This capture of fine material would be further enhanced by filtering the water through fine mesh textile fabric before pumping the settled water back to Parteen Basin.
238. The second of the Dewatering Settlement Basins would drain through Oil Interceptors to a temporary pumping station from where the settled water would be pumped back to Parteen Basin above the flood level of 31.30m AOD (34.0m Poolbeg).

5.17.2.8 Main Raw Water Intake and Pumping Station Site Substructures and Superstructures

239. The main substructures on the RWI&PS site are the main Raw Water Intake and Pumping Station, the Raw Water Rising Mains Scour Tank and Microfiltration Buildings, and the Invasive Species Debris Retention Tank. The construction of the substructures would be expected to take place during Year 2 for a duration of approximately 7 months over the spring and summer. This would be in parallel to on-going earthworks activities described in Section 5.17.2.7.
240. Given the depth of the excavation below ground level required at the main Raw Water Pumping Station Building substructure, up to 14.2m, the construction techniques that would be employed would be piling and excavation, as shown in Image 5.12 and Image 5.13. The boundary of the structure would be constructed by secant piles to minimise the extent of excavation. The material inside the piled walls would then be excavated and the Raw Water Pumping Station Building substructure could be constructed, examples of this are shown in Image 5.14 and Image 5.15.



Image 5.12: Example of Construction of Below Ground Substructures Using Secant Piled Wall Construction



Image 5.13: Example of Construction Within Temporary Retaining Wall



Image 5.14: Example of Construction Using Segmental Precast Construction for the Outer Structure and *In Situ* Concrete Construction for Internal Structural Elements



Image 5.15: Examples of Construction Using *In Situ* Concrete Construction

241. In order to construct the secant pile walls a shallow guide wall would first be constructed at ground level around the perimeter of the underground structures, to set out the position of the secant piles. On the southern and northern sides of the Pumping Station and Microfiltration Building the secant piles would be offset by 3m from the concrete substructures. For the eastern and western sides of both buildings the secant piles and the concrete substructure would be adjacent to each other. The primary piles would then be formed by first drilling a series of boreholes into the ground down to the bedrock level (at every second pile location) and then filling the boreholes with concrete. The primary piles would be drilled using a standard bored piling rig, operating from a temporary piling platform. Once the primary piles are cast the secondary piles would be formed using the same hydraulic bored piling rig as for the primary piles but with a toothed cutting edge to cut through the edges of the primary piles and to remove the soil between the primary piles. A steel reinforcement cage would be lowered into the secondary borehole and then it would be filled with concrete to form the secondary pile, which intersects with the primary piles, as shown in Image 5.16, to form a continuous structure. This process would be repeated around the perimeter of the structure until the secant pile wall is complete. The area within the pile wall would then be excavated and the Raw Water Intake and Pumping Station Building substructure can be constructed. Ground anchors would be installed sequentially, in three rows, as the excavation is progressed. The exception to this is the western side of the Intake Chamber which would have one row. Continuous dewatering facilities would be provided until the structure is watertight. The dewatering water would be passed through a silt buster prior to discharge.

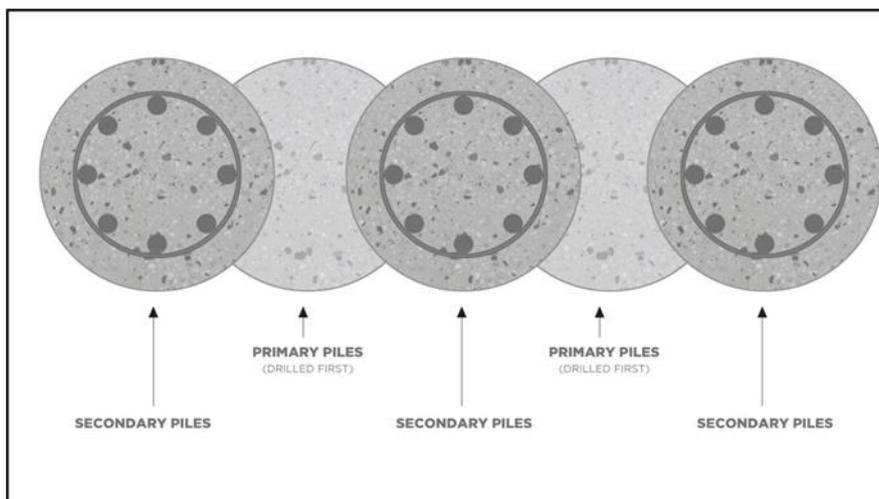


Image 5.16: Secant Pile Wall Construction

242. This secant piled wall method of construction would be used for all of the building substructures. The sequence of the construction for these would be the raw water Intake Chamber and Raw Water Pumping Station substructure first, then the Raw Water Rising Mains Scour Tank and Microfiltration Buildings basements, and finally the Invasive Species Debris Retention Tank.

243. The shoreline would be stabilised using a sheet pile retaining wall, north and south of the Intake Chamber. The piles would be pre-augered to facilitate installation. Following pre-augering the sheet piles would be driven (using vibratory piling) to the required depth. When the sheet piles are in place a capping beam would be cast along the top of the retaining wall.

244. All of the underground structures inside the secant piles would be constructed with in situ reinforced concrete.

245. Superstructures would be constructed with structural steel frames, blockwork and cladding. Images 5.31 and 5.32 provide examples of the construction of the building frames, that would be used at the RWI&PS, as well as at the WTP.

246. The twin 1,500mm rising mains would be laid sequentially as working areas become available, working from the Pumping Station through to the Microfiltration Buildings and Raw Water Rising Main Scour Tanks and on to the Flow Meter and Swabbing Chambers.
247. In the event that local concrete suppliers are unable to deliver concrete within the allowable time for deliveries, typically 90 to 120 minutes depending on concrete mix design and temperature, concrete would be sourced from the mobile, temporary, concrete batching plant at the WTP, which is described in Section 5.18.2.8.
248. A temporary piling platform would be constructed in Parteen Basin to accommodate the placing of the secant piles along the existing shoreline in constructing the Intake Chamber. This platform would consist of an inner and outer sheet pile wall, containing stone fill between the two walls. The inner sheet pile wall would be tied into the sheet pile of the retaining wall along the shoreline such that a dry working area is formed to allow the secant piles along the platform to be constructed. The piling platform would be removed once the secant pile wall has been installed.
249. A double row of heavy-duty Type 3 silt curtains would be placed around the construction area to prevent silt from entering the main Parteen Basin body of water. Beyond the silt curtains, total suspended solids would be kept within the prescribed limit (i.e. $\leq 25\text{mg/L}$, in accordance with the Quality of Salmonid Waters Regulations 1988). Turbidity measurements (suspended sediment concentration) would be taken inside and outside the curtain to assess its effectiveness in containing sediment.
250. Accumulated sediment/silt behind the first curtain would be removed periodically to maintain the curtain's effectiveness. The rate of silt accumulation would vary depending on factors such as water currents, the type of sediment, and the depth of the curtain. Silt curtains would be inspected daily during construction activities with the potential to generate silt and immediately after heavy rainfall/flooding to assess the curtain's condition and identify sediment buildup and excessive drag. Monitoring would be weekly at other times.
251. The silt curtains would be:
- Designed to be able to withstand the water velocity of a 1 in 100 flood flow (with an allowance for Climate Change)
 - Buoyant along the top edge of the curtain in order to move with fluctuations in the water level up to a 1:100 flood event (with an allowance for Climate Change)
 - Secure along the bottom edge of the curtain in order to prevent silt egress underneath. This would be done using a steel ballast chain or equivalent to maintain the curtain's vertical position in the water.
252. The intention is that the works can be sequenced to reduce the dependency on the double silt curtain as follows:
- Install double silt curtain around the working area as part of site mobilisation
 - Install temporary sheet piling to retain the temporary piling platform (this would be on both sides of the piling platform and must form a continuous barrier around the temporary works at the intake)
 - The silt curtain would be used to manage silt during the temporary sheet piling; however, the piling platform becomes the primary silt retention barrier with the two silt curtains providing back-up during the secant piling and all constructions works required for the intake and pumping station (except for the installation of the rock revetment)
 - When the temporary works on the 'wet side' of the intake are completed the piling platform would be removed. During this phase the silt curtains act as the primary containment measure
 - In preparation for the dredging and placement of the revetment matting a physical barrier consisting of a silt curtain or a structure performing an equivalent function would be placed around, and close

to the perimeter of the dredging / rock revetment area. This provides the primary containment, and the double silt curtain provides the back-up.

253. Once the Intake Chamber and Pumping Station substructure is completed, the Parteen Basin bed would be reprofiled in the area immediately outside the Intake Chamber. Dredging equipment would be used for the reprofiling over an area of approximately 55m long by 27m wide to accommodate revetment mats. The silt curtains would remain in place until this operation has been completed, and silt has settled out.

254. In order to reduce the construction traffic movements on the road network the option of using a boat / barge to remove excavated material would be explored.

255. Once the bed has been reprofiled, a concrete revetment mat (a flexible mat of meshed thin concrete segments with voids) would be threaded by non-corroding heavy duty nylon rope and lifted into place by a crane and lifting bracket of the kind shown on Images 5.17 and 5.18. It would be placed on the reprofiled bed and used for erosion control in the area immediately outside the Intake Chamber. It can be provided with a small cover layer of granular or other native bed material to provide a surface, which can be recolonised by native fauna.

256. Once the revetment matting has been completed and all works on site completed the double silt curtain can be removed.



Image 5.17: Revetment Mat Being Lifted into Position (Wet Installation)



Image 5.18: Stacked Multiple Concrete Revetment Mats (with Pontoon Crane and Suction Dredger)

257. The construction of the Intake Chamber would likely be from land, as described above, but it is also possible that this work would be facilitated from moored pontoons on Parteen Basin using working barge(s) brought to Parteen Basin from elsewhere on the River Shannon or through Limerick and Ardnacrusha. Examples of the types of barges that would be used are shown in Image 5.19 and Image 5.20, with example pontoons shown in Image 5.21 and Image 5.22.



Image 5.19: Maintenance Barge in Limerick

(Photo Courtesy of Waterways Ireland)



Image 5.20: Working Barge at Limerick Sea Lock

(Photo Courtesy of Waterways Ireland)



Image 5.21: Pontoon Mounted Pile Driver at Dromineer

(Photo Courtesy of Waterways Ireland)



Image 5.22: Pontoon at Rooskey

(Photo Courtesy of Waterways Ireland)

258. Barge access to Parteen Basin from Limerick Docks downstream would be through Ardnacrusha Lock on the River Shannon. Ardnacrusha Lock is a double lock managed by the ESB, with an overall level drop of 31.1m, in two chambers.

259. From the sea lock at Limerick, the route is via the Abbey River into the Tailrace from the Ardnacrusha Generating Station, and from there into the lower lock canal to enter the lock. Image 5.23 and Image 5.24 show the Ardnacrusha Lock and a vessel on the River Shannon negotiating the canal lock system.



Image 5.23: Ardnacrusha Lock (Canal Left) and Tailrace (Right)

(Photo Courtesy of Inland Waterways Association Ireland and ESB)

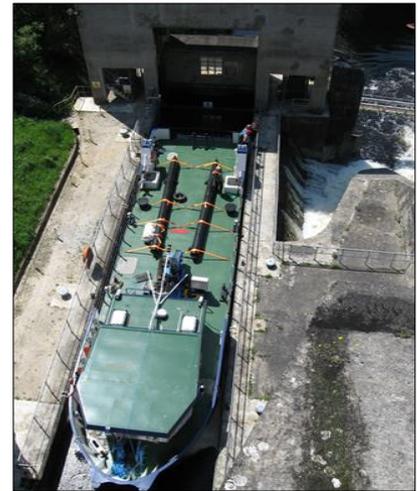


Image 5.24: Working Barge in Ardnacrusha Lock Lower Chamber

(Photo Courtesy of Waterways Ireland and ESB)

260. Once the vessels have negotiated Ardnacrusha Lock and entered Parteen Basin, they would help construct the RWI&PS.

5.17.2.9 MEICA Fit Out

261. Pipework sections within the Raw Water Pumping Station Building substructure and other below ground tanks would be cast into openings left in walls for that purpose. Manifold pipework would be craned into position and assembled. Pump casings would be installed on pedestals, using travelling cranes on down shop rails in the basement. Grouting of cast-in pipework would be sealed for watertightness. MEICA fit out of buildings and tanks would be undertaken by the appointed Contractor once the construction of the substructure has been completed, and later second-fix work with enclosure of the superstructure. With the sequence of construction and the sequenced availability for first-fix MEICA work, and subsequent stages of fit out, it is expected that the MEICA fit out would take approximately 5 months, with different elements running in parallel with civil/building works. The permanent power supply to the site would be brought from the existing Birdhill Substation, as described in Section 5.17.2.5.

5.17.2.10 Internal Roads, Parking and Walkways

262. The permanent internal circulation road, car park and walkways would be constructed to facilitate access to the RWI&PS during operation. These would be formed from the temporary roads as described in Section 5.17.2.3, once the main construction works had been completed. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with bituminous binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm in depth.

5.17.2.11 Permanent Site Access

263. At the end of the construction the temporary site access would have to be converted into the permanent site access road. This would include scarifying the surface, regrading it and surfacing with asphalt. In addition, the permanent junction on to the R494 Regional Road would be completed including the splayed junction boundaries, final fencing / boundary treatment and planting.

264. The access road junction would include a pull-in area before the security gates and appropriate signage when emerging onto the R494, in accordance with TII's Geometric Design of Junctions (DN-GEO-03060) (TII 2023). Sightlines at the access track entrance on the R494 have been facilitated by the recent R494 Improvement Scheme. These would also comply with DN-GEO-03060 (TII 2023). No further works or land would be required to provide these sight lines.

5.17.2.12 Landscape and Boundary Treatment

265. As part of the earthworks activities to achieve the finished ground levels, surplus excavated material from the construction of the RWI&PS would be transported to the WTP for landscaping and fill or to suitable off-site re-use or licensed/permitted facilities in accordance with relevant regulations and the Construction Waste and By-Product Management Plan.

266. At the end of the Construction Phase the landscape planting and habitat creation would be undertaken in accordance with the permanent reinstatement plans. This would include woodland planting on the south-eastern part of the site and mosaic habitat planting on the north-eastern part of the site (due to restrictions on planting as a result of below ground infrastructure including the RWRMs) as shown in Figures 4.89 and 4.90. Any remaining temporary fencing would be replaced with the final boundary treatment including at the permanent access. This would include the installation of the post and rail fence, or equivalent which would mark the ownership boundary of the site. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual).

267. Along the boundary facing the Parteen Basin, the perimeter of the site would be a concrete wall, and this would be faced in local stone. The paladin security fence would be on top of the wall.

5.17.2.13 Construction Site De-Mobilisation

268. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.17.3 Commissioning the RWI&PS

269. Following dry inspection of the Raw Water Intake Basin and Intake Chamber, and of the functioning of the penstocks in the chambers, the Intake Chamber would be filled with water from Parteen Basin. The area outside the Raw Water Intake Basin in Parteen Basin would be subsequently inspected by divers for integrity of the concrete revetment mats. The Raw Water Intake Basin would remain full, as far as closed penstocks on the Inlet Chambers, until the wet wells are flooded immediately prior to commissioning.

270. The membrane filters and ultraviolet (UV) units would be commissioned so that water pumped forward is free of invasive species.

271. ESNB would be informed of a time profile of test/commissioning loads and, following this, pumps would be commissioned individually and in parallel. Raw water drawn into the intake would be used to commission the pumps and RWRMs. The water would be reused to test both RWRMs initially, i.e. transferred from one main to the other. Once the pump sets and RWRMs have been tested individually, more water would be drawn in and commissioning and testing in parallel would take place. This phase would include for example:

- Monitoring the velocity of the intake
- The effectiveness of the bubble curtain
- Monitoring ground water levels.

5.18 Water Treatment Plant (WTP)

5.18.1 Construction Phase Activities, Duration and Phasing – WTP

272. The construction of the WTP would involve extensive excavation and reprofiling of the site to construct various structures and below ground pipework including the storage tanks, treatment module buildings and visitors' centre.
273. Other construction activities would include landscaping, constructing an access road and internal circulation roads, car parks and walkways, security fencing, M&E plant, instrumentation and control systems, and building services. In addition, a new permanent mains power supply would be provided off the electrical grid, to power the various plant and equipment in the WTP.
274. The principal construction materials for the WTP would involve reinforced concrete poured in situ, precast concrete sections, structural steelwork, building work including the use of steel prefabricated panels, prefabricated steel tanks, and above and below ground steel pipework.
275. Environmental protection measures for the crossing of the tributary of the Kilmastulla River, to address e.g. pollution risk and to manage site drainage, as set out in the SWMP in Annex A of the CEMP (Appendix A5.1) would be put in place early in the Construction Phase.
276. Construction at the WTP would last the 5 years between pre-site establishment activities such as site investigation to demobilisation and commissioning the whole system. The majority of the construction activities including earthworks and building the structures would take approximately three years and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be from winter at the end of Year 1 to winter at the end of Year 4. The main earthworks and structures would be concentrated in the 18 month period in Year 2 and Year 3. The typical sequence and duration of construction activities is outlined in Image 5.25. During the construction period the site will act as a Principal Construction Compound (CC1). A temporary works site layout plan for the WTP is shown in Figure 5.2.
277. The earthworks needed at the beginning of the construction programme for the WTP in order to re-profile the site would rely on surplus material from other areas of construction including the RWRMs and RWI&PS. This would take place during Year 2. Excavation work at the RWI&PS site would take place at the beginning of Year 2, at which time material would be stockpiled at the WTP site. The earthworks at the WTP would be phased in a series of stages as shown in the Construction Sequence in Figure 5.29.

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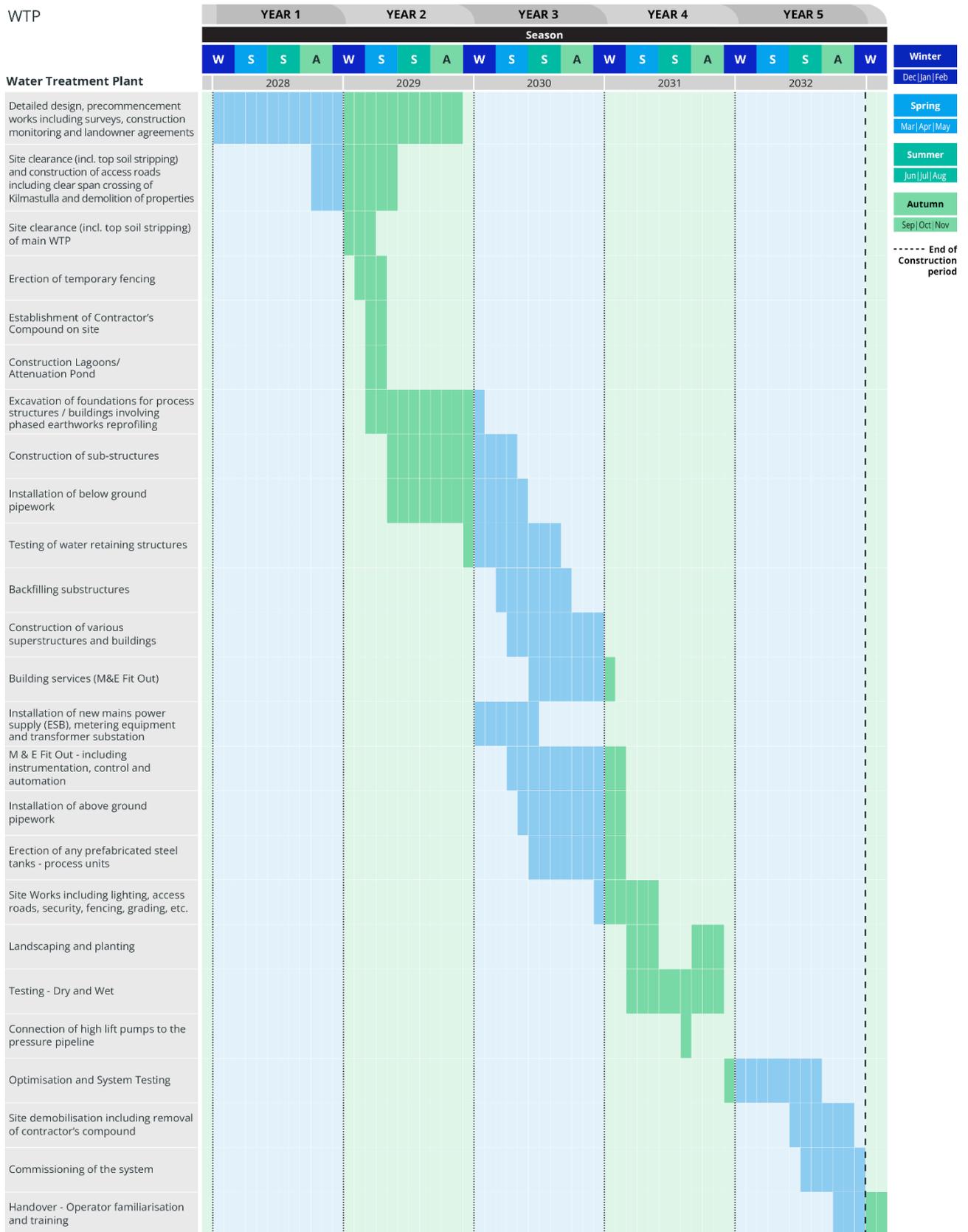


Image 5.25: Construction Phase Activities, Duration and Phasing for the WTP

5.18.2 Construction Methodology – WTP

5.18.2.1 Sequence of Construction

278. The WTP would be constructed in the sequence outlined in Table 5.20.

Table 5.20: Sequence of Construction Activity – WTP

Sequence	Construction Activity
1	Pre-construction surveys and site investigation
2	Site preparation works including vegetation clearance, topsoil and subsoil stripping, temporary fencing and setting up the Construction Compound and access road including the permanent embankment and bridge crossing of the Kilmastulla river. This would include installing a temporary power connection, a power line diversion and a potable water connection as well installing the site drainage including the settlement lagoons.
3	Earthworks to reduce existing high ground levels in the western and eastern areas of the site and raise levels at the Water Treatment Module Buildings locations
4	Installation of site drainage and construction of Tank Draindown Management and Commissioning Lagoons. Raising of levels at the Water Treatment Module Buildings using excavated material.
5	Construction of Raw Water Balancing Tanks (RWBTs), Chemical Dosing Manifold Building. Raising of levels at treatment buildings using excavated material.
6	Construction of Backwash Water Tank and Pumping Station, Clear Water Storage Tanks and HLPS. Raising of levels at Water Treatment Module Buildings using excavated material.
7	Construction of Used Washwater Equalisation and Settlement Tank
8	Construction of Water Treatment Module Buildings
9	Raise levels around Used Washwater Equalisation and Settlement Tank to finished ground levels
10	Construction of Sludge Dewatering Buildings
11	Construction of Sludge Storage Buildings
12	Complete site works in preparation for Operational Phase including final site access, landscaping and planting, and boundary treatment
13	Demobilisation of the construction site

5.18.2.2 Pre-Commencement Activities

279. During this pre-commencement phase at the WTP further ground investigation would be undertaken to inform the detailed design process. Part of these pre-commencement activities would include investigation of the disused petrol station at the entrance to the permanent access and the bank / channel of the tributary to the Kilmastulla River. This may require temporary site access and supporting facilities.

280. There would also be environmental surveys and checks completed prior to the ground investigation and then the full site establishment.

281. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

5.18.2.3 Site Preparation Works

282. The first phase of the site set up would be to construct the access. Similar to the RWI&PS, the access road for the WTP would serve a dual purpose as it would initially serve as a temporary road, providing construction access before becoming a permanent road upon completion of construction. This would then be the permanent access to the WTP during the operation of the Proposed Project.

283. The construction sequence for the temporary access road would be as follows:

- Site preparation works would include fencing off boundaries and any environmentally sensitive areas around the Kilmastulla River or its tributaries
- Demolition of properties at the former petrol station and filling of the underground tanks at the junction between the access road and the R445.
- A temporary Bailey bridge or similar would be put in place to provide initial access over the tributary of the Kilmastulla River
- A route of the access road up to the WTP would be levelled and cleared of all obstructions. There is existing commercial forestation along approximately 425m of the access road route, and the trees along this section would be felled and the site cleared to allow for construction of the road. Temporary traffic management would be required to establish this area and a comprehensive TMP would be put in place for the Construction Phase. This would incorporate removal of overhanging tree branches and removal of overhead cables which cross the route of the road.
- Surplus excavated material would be used to create the earth embankment on which the access track would sit
- Pre-cast concrete culverts would be brought to site and placed within the formation of the embankment
- Cable ducts and the 1050mm diameter pipe for the future connection would be laid within the embankment
- The open span bridge would be constructed using either precast concrete or steel sections, (as described in Section 5.18.2.13). There would not be any in-stream works required. The bridge abutments would be constructed at least 5m back from each bank of the stream.
- A 500mm deep layer of stone hardcore, typically 75mm in size, overlaying a geogrid mattress would be placed along the full length of the access road alignment, and compacted with a road roller
- The hardcore would then be topped off with a stone dust and compacted again. Enough stone dust would be added to ensure that there is a clean level surface for trafficking.

284. Residents along the R445 Regional Road would be consulted as part of a consultation programme before works commence. Further details are provided in Appendix A5.1 (CEMP) and Chapter 7 (Traffic & Transport).

285. In order to construct the proposed access, it is necessary to remove three buildings and above ground petrol pumps associated with a disused petrol station that are on land at the junction of the access road and the R445 Regional Road. The buildings in question are a derelict stone building, a roofed storage shed/garage, and a roofed office building. The disused petrol station is located on the southern bank of a local stream which is a tributary of the Kilmastulla River. Only the above ground structures need to be cleared from the petrol station site, to allow construction of the access road junction and provide the required safe sight distances. The proposed works include cleaning out and backfilling the tanks with either sand and cement or foam concrete.

286. Preliminary, non-intrusive site investigation works indicate that the tanks are located less than 0.5m from the southern bank of the adjacent watercourse and that the tops of the tanks are approximately 0.75m below existing ground level.

287. The underground fuel storage tanks and surrounding soils at the disused petrol station could potentially be contaminated with hydrocarbons and therefore works would be monitored to prevent any pollution incident. However, site investigation has indicated the risk would be low as soil and water sampling around the tanks and in the adjacent watercourse has indicated no presence of contamination.

288. Nevertheless, in order to protect the watercourse immediately adjacent to the buildings, the watercourse would be dammed and flow diverted either by fluming or over pumping, as described in Section 5.24.2.12, for the duration of the demolition works. This would involve constructing a dam (using sandbags and suitable clay material) across the existing watercourse upstream of the proposed demolition works. A suitably sized pump sump would then be used to extract the water and convey it around the demolition works area to a point downstream of the works. Alternatively, the flows could be conveyed by a suitably sized pipe to downstream of the works.
289. A single farm shed located toward the centre of the WTP site would also be demolished to accommodate construction of the WTP itself. Therefore, in total there are four buildings to be demolished at the WTP.
290. As part of the construction of the access to the site the third party accesses across it would also be built.
291. Temporary internal circulation roads would be constructed in the same way as for the ones at the RWI&PS, as described in Section 5.17.2.3.
292. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.
293. The laydown areas would be drained and any areas that involve the storage of fuel would have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems.
294. Topsoil would be stripped across the required site area to its full depth. The top layer of sub-soil would also be removed. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3.2.
295. Any existing land drains crossing the works area would be recorded and diverted to the perimeter of the site. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.
296. Topsoil and subsoil would be stored separately, sloped and weather-proofed in areas of the site where disturbance would be least, pending final landscaping. In this regard, an area immediately north of the Water Treatment Module Buildings would be available as shown in Figure 5.2. Once the topsoil has been stripped, the high ground in the south-western and north-eastern areas of the site would be reduced in level to accommodate construction of the RWBTs at the western side and the Clear Water Storage Tanks, HLPS, and Backwash Water Tank and Pumping Station at the eastern side of the site as shown in the Construction Sequence 1 in Figure 5.29.
297. The Principal Construction Compound (CC1) area would be established as described in Section 5.8.3 and as shown on Figure 5.2.

5.18.2.4 Temporary Foul and Potable Water Connections

298. The permanent water supply to the WTP would be constructed as part of the site establishment and so would also act as the temporary water supply needed during construction. This would be made from the existing 100mm diameter watermain located on the R445 Regional Road. The connection would be constructed in conjunction with the new permanent access road to the WTP.
299. During construction periods with peak water demand this would be supplemented with temporary on-site storage of water and use of bowsers.

300. There would be no foul water connection at the site for construction purposes and so foul wastewater generated on the site from the welfare facilities and canteen would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP.

5.18.2.5 Temporary and Permanent Power Supply

301. The permanent power connection for the WTP would, like the RWI&PS, be taken from the existing Birdhill 38 kV Substation as described in Section 5.23. Eight 110mm diameter uPVC cable ducts, arranged in accordance with the ESB Standard Specification Detail 1B (Appendix A4.2: Standard Specification for ESB 38 kV Networks), would be laid in open trench cutting with a minimum depth of cover of 750mm to the uppermost ducts.

302. From the existing Birdhill 38 kV substation, the ducting would be laid for the most part in the south-eastern margin of the R445 Regional Road. Approximately 1.4km east of the Birdhill 38 kV Substation, the ducting would run south of the Limerick to Nenagh railway line before crossing under the railway line (RYX004) using trenchless technology (horizontal directional drilling). The length of this trenchless crossing would be approximately 26m.

303. North of the railway crossing the ducting would be brought back onto the R445 and continue eastward as far as the Kilmastulla River. The ducting would be brought off the road to the south-east of the R445. A trenchless crossing of the Kilmastulla River (WCX001) would be undertaken using horizontal directional drilling. This crossing would be approximately 14m in length. No construction works would be undertaken within the boundary of the Lower River Shannon SAC at this location.

304. Once across the river, the ducting would be brought along the proposed WTP access road, on to the WTP site and into the 38 kV Substation which is to be constructed on the WTP site.

305. The construction of the new connection permanent connection along the R445 and the permanent access road would be consistent with that described in Section 5.23.4.4 and shown in Images 5.53 and 5.54.

306. The temporary power supply for use during construction would be made to an overhead line on the western side of the site. The overhead line connection would be constructed as described in Section 5.23.4.3 and would be installed as part of the site establishment. This would also be supplemented with generators, as required.

307. The overhead line from which the temporary connection would also need to be permanently diverted along the north-western side of the site. This would be buried underground and the method of construction would be consistent with that described in Section 5.23.4.4 and shown in Images 5.53 and 5.54. The new diversion would be built and then the supply switched across so that there would not be a loss of supply. This would be undertaken as part of the site establishment.

5.18.2.6 Temporary and Permanent Drainage

308. The appointed Contractor would be required to partition the sequence of works at the WTP site to optimise the drainage of the site, as the Tank Draindown Management and Commissioning Lagoons would be relied on to act initially as efficient construction site drainage/settlement lagoons. This would allow the WTP site drainage to be managed during construction, resulting in the least possible earthworks and bare soil face being exposed at a given time. This would be consistent with the necessary sequence of construction of the various units.

309. In constructing a WTP of this scale, the appointed Contractor would not simultaneously open all work areas. Efficient working, with repeated use of formwork, would require the work to be sequenced, with tasks on similar units to be carried out sequentially by experienced teams working near full capacity. Consequently, contour draining of the WTP site would be employed. This would partition the upper undisturbed soil areas of units to be built later and would direct their drainage around the construction site to the natural drainage system.
310. Further details on the management of surface water at the WTP site are described in the SWMP (Appendix A5.1 Annex A).

5.18.2.7 Earthworks

311. Earthworks operations would entail large scale excavations and reprofiling of ground levels across the site. Operations would generally be carried out using excavators and dump trucks that would transport excavated material to locations on the site where levels are to be raised. Filling operations would involve using bulldozers and vibratory rollers. Surplus excavated material would be imported to the WTP site from the RWI&PS site, from the Construction Working Width of the RWRMs, and from nearby sections of the Treated Water Pipeline from the WTP to the BPT.
312. Suitable excavated material would be reused on-site in cut and fill operations and reprofiling the site. This material would be selected and managed for storage, and consolidated properly at the correct moisture content, and soils at source would be verified as free of contamination arising from any previous land use, before being reused. This would allow for excavated material from construction on the WTP site to be effectively managed, as the quantities of excavated material and imported material would balance the fill material required to make up finished levels on-site, and site landscaping. It is expected that all excavated material arising on the WTP site would be reused there.
313. The appointed Contractor for geographic section 1 as summarised in Table 5.4 would sequence the construction to optimise the use of resources and to minimise the area of ground disturbed at any one time.
314. The Tank Draindown Management and Commissioning Lagoons would be excavated and formed early in the works (shown in Construction Sequence 1 in Figure 5.29) and lined with a permeable liner, working as settlement lagoons for surface water drainage from exposed excavations and for dewatering flows. The material from these earthworks and the subsequent excavation for the construction of these tanks would be used to raise levels around the site where the Water Treatment Module Buildings would be constructed (shown in Construction Sequence 2 in Figure 5.29).
315. It is anticipated that the Construction Phase of the WTP would result in a material deficit of approximately 99,500m³. This shortfall would be made up using surplus excavated material from the RWRMs, RWI&PS, and other imported material.
316. Imported fill brought to the WTP site would be firstly deposited in the area denoted as Construction Sequence 2 in Figure 5.29, to raise site levels to the required level to allow construction of the Water Treatment Module Buildings. Once this has been achieved, further imported material would be deposited in the area denoted as Construction Sequence 3 shown in Figure 5.29, bringing the site levels in this area up to that required to allow construction of the Used Washwater Equalisation and Settlement Tanks and other tanks, the Sludge Storage Tanks, the Sludge Dewatering Buildings and the Sludge Storage Buildings, and the UV Treatment and Post Filtration Chemical Dosing Building.

317. The earthworks activities would be expected to take place for a duration of approximately 18 months from spring Year 2 to summer Year 3. This would include the excavation required prior to the construction of the structures and the backfilling afterwards. There would be smaller scale earthworks outside of these periods for example, associated with construction of the access to the site, Tank Draindown Management and Commissioning Lagoons, general drainage and the final landscaping.

5.18.2.8 WTP Foundations

318. Construction of the WTP would involve excavation for the foundations of the building and tanks as described in Chapter 4 (Proposed Project Description). This would include reinforced concrete works and the erection of structural steel/concrete building frames, building walls (concrete/blockwork), prefabricated cladding panels to walls and roofs of buildings and prefabricated steel tanks. The construction of the WTP structures including the substructures/foundations and the superstructures would be expected to take approximately 22 months from spring Year 2 to winter at the end of Year 3. This includes and is parallel with activities described in Section 5.18.2.9.

319. A temporary concrete batching plant would be required on-site in the event that local concrete suppliers are unable to deliver concrete within the allowable time for deliveries, typically 90 to 120 minutes depending on concrete mix design and temperature. Such batching plants are mobile, as they are delivered to site via a Heavy Goods Vehicle in a collapsible form which is compact for haulage by road. The batching plant is computerised and self-contained, so it can batch materials to precise design mixes and quantities. At the days' end, the mixing drum must be cleaned by rinsing the sides of the drum into a 'lagoon' where washings are left to 'go off'. After 7–10 days, the weak concrete residue left behind is broken out and the material can subsequently be used as a general fill under roads and buildings elsewhere on the site.

320. Demand for potable water for use by construction staff, and potentially in concrete production on-site at the batching plant, would likely exceed the capacity of the temporary water connection which would be taken along the access road from the public mains. If demand does exceed the capacity, then the potable water supply from the temporary water connection would be reserved for site staff and would be supplemented with on-site storage tanks filled overnight from the potable supply and the use of water bowsers.

321. There would be several different structures on-site, and different techniques would be needed to construct their foundations depending on the ground conditions at their specific locations. The two principal types of foundations are as follows:

- A raft foundation which uses battered excavations to reach formation level. The raft foundation is a homogenous mass reinforced concrete slab
- Piled foundations and reinforced concrete construction.

322. A battered excavation relies on sloping the sides of the excavation to achieve safe working conditions and requires a greater footprint to ensure that slope stability is maintained as shown in Image 5.26.

323. The foundations may need to be reinforced as shown in Image 5.29 and the excavation for the foundations to structures may also be protected using a temporary sheet pile wall, as shown in Image 5.30.

324. Within the excavation, the foundations, depending on ground conditions, would be constructed either using reinforced concrete slabs bearing directly on the formation layer (shown in Image 5.26), or piling to a greater depth to obtain adequate bearing conditions.

325. If a piled foundation is used, the piles would be driven into the ground using a reciprocating driving head mounted on a tracked vehicle as shown in Image 5.27. Alternatively, in situ cast concrete piles may be used, and then cut down to level, as shown in Image 5.28.

326. Once the required bearing depth of the pile is reached, they are cut to suit, and an in situ concrete pile cap is placed, acting as the loading point for the structure. The pile cap is tied into the reinforced concrete foundations and concrete is pumped into the reinforcement to form the base of structures.



Image 5.26: Battered Excavation Construction Technique



Image 5.27: Driven Concrete Piles in Progress



Image 5.28: Exposed Continuous Flight Auger Piles Prior to Being Cut to Required Length

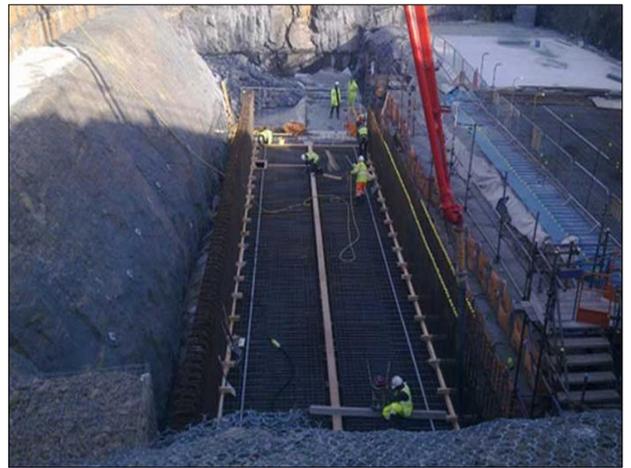


Image 5.29: Reinforced Concrete Foundations in Construction



Image 5.30: Example of Construction of Below Ground Substructures Using Sheet Piled Temporary Works

5.18.2.9 WTP Structures

327. The likely sequence is that the Tank Draindown Management and Commissioning Lagoons in the south-eastern area of the site would be constructed first, followed by the construction of the RWBTs at the western boundary of the site and then the Clear Water Storage Tanks, HLPS and the Backwash Water Tank and Pumping Station. All suitable excavated material would be used to fill the area at the Water Treatment Module Buildings first. Once the material has been brought up to the required levels in this area, the Water Treatment Module Buildings can be constructed on short 5–6m piles driven through the fill material to achieve adequate bearing capacity in existing subsoils. All substructures and tanks would be constructed using in situ reinforced concrete or prestressed concrete. Superstructures would be constructed using structural steel frames, blockwork and cladding.

328. The Used Washwater Equalisation and Settlement Tanks in the central area would be constructed on existing ground levels with imported material being used to raise levels around these tanks to the proposed finished ground levels at a later stage (shown in Figure 4.63). Imported fill would be required to make up the ground in the central area of the site to the required finished ground levels.

329. The walls of the WTP structures and where applicable, sub-structures, would be formed from the base by concrete within steel shuttering; wall starter reinforcing steel bars would be tied into the foundation slab and would continue to create the wall steel reinforcement. The latter would be contained within steel shutters and filled with concrete as shown in Image 5.31. Various superstructures can be constructed over the completed reinforced concrete structures as shown in Image 5.32.

330. The construction of the WTP structures including the substructures/foundations and the superstructures would be expected to take approximately 22 months from spring Year 2 to winter Year 3. This includes and is parallel with activities described in Section 5.18.2.8.



Image 5.31: Construction of Reinforced Concrete Walls



Image 5.32: Superstructure Construction in Progress

5.18.2.10 Pipework

331. The WTP would incorporate extensive pipework both above and below ground level. The pipework would be installed sequentially as working areas become available, working from the RWBTs through to the Water Treatment Module Buildings and into the Clear Water Storage Tanks and the HLPS. This work would run sequentially in different areas of the site to allow pipework to be laid, tested and backfilled in sequenced sectors of the site, and would take approximately 22 months, largely in parallel with the activities described in Sections 5.18.2.8 and 5.18.2.9.

5.18.2.11 MEICA Fit Out

332. MEICA fit out of buildings and tanks would be undertaken by the appointed Contractor once the construction of the structures has been completed. With the sequence of construction of tanks and buildings, and their sequenced availability for first-fix MEICA work and subsequent stages of fit out, it is expected that the MEICA fit out would take approximately 9 months with different elements running in parallel with civil/building works elsewhere.
333. The installation of PV solar panels with Battery Energy Storage System would be undertaken as part of the fit out with panels erected on the top of multiple buildings and at ground level.

5.18.2.12 Internal Roads, Parking and Walkways

334. The permanent internal circulation road, car park and walkways would be constructed to facilitate access to the WTP during operation. These would be formed from the temporary roads as described in Section 5.18.2.3, once the main construction works had been completed.
335. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with bituminous binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm depth.

5.18.2.13 Permanent Site Access

336. Construction Phase and Operational Phase access for the WTP would be from the R445 Regional Road and would require a new permanent access road to be constructed to the site with weighbridge facilities near the entrance gate. The R445 Regional Road comprises two 3.25m wide traffic lanes, two 1.9m wide cycle lanes and 1.5m wide grass verges at the proposed access point.
337. The access road to the WTP site would cross a tributary of the Kilmastulla River, immediately north of the junction of the access road with the R445 Regional Road. The bridge would be constructed as a single span structure using precast concrete or steel sections such that there would not be any in-stream works required. The bridge abutments would be constructed at least 5m back from each bank of the stream.
338. The permanent site access road and access bridge would be constructed at the beginning of the Construction Phase; however, the temporary site access would have to be converted into the permanent site access road. This would include scarifying the surface, regrading it and surfacing with asphalt as part of completing construction. In addition, the permanent junction on to the R445 Regional Road would be completed including the final surfaces, splayed junction boundaries for sight lines, final fencing / boundary treatment and planting.

5.18.2.14 Landscape and Boundary Treatment

339. As part of the earthworks activities to achieve the finished ground levels, excavated material from the construction of the WTP would be used on-site to raise finished ground levels and to reprofile the site during the Construction Phase.
340. The permanent boundary treatment would be the security fencing installed at the end of the construction phase along with the post and rail fence, or equivalent, which would mark the ownership boundary of the site. The existing hedgerows and tree lines around the perimeter of the site will be retained, as far as reasonably practicable and the fencing would be installed inside these features.

341. As part of the demobilisation of the site, habitat planting including wet grassland and native species rich meadow would be planted. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual) and Figures 4.91 and 4.92.

5.18.2.15 Construction Site Demobilisation

342. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.18.3 Commissioning the WTP

343. Following the completion of construction and the cleaning and dry inspection of all tanks, penstocks and chambers, the commissioning phase would begin with RWBTs being filled by forward pumping from the RWI&PS and from the surface water lagoons.

344. Initial commissioning of the WTP would be carried out incrementally using only a fraction of the ultimate flow. The process commissioning would begin with a single treatment sub-stream, using a single settlement tank with two rapid gravity filters at 50% of their design capacity.

345. Commissioning would be possible, at a low rate (approximately 10Mld), in the initial first stage, and initially that water would be recirculated.

346. This would be achieved by discharging the treated water to one cell of the CWST, from which it would be pumped back to the lagoons on-site using the CWST scour pumps and recirculated to the RWBTs at the head of the works.

347. When the water quality has reached a sufficient standard, it would be used initially as test water for tanks throughout the WTP site, and finally, the through-flow would be discharged forward to the CWSTs for pumping into the Treated Water Pipeline toward the BPT. For the rest of the process commissioning, flows would gradually be increased (by activating further treatment sub-streams) until all waste treatment streams are operational.

348. In the second stage of the commissioning process, the flow would be increased from 10Mld to 20Mld and flows at this level would be monitored and brought into supply over a further two to three-week period. Following this, the flow would be increased as required so that by the end of the commissioning period the flow from one full treatment stream would be available to enter supply.

349. The same procedure would be followed over an additional four-week period, with a second treatment stream and then again for the third. Once the third treatment stream had been commissioned at full capacity this would mark the completion of the commissioning of the WTP.

5.19 Break Pressure Tank (BPT)

5.19.1 Construction Phase Activities, Duration and Phasing – BPT

350. The BPT provides the connection between the Treated Water Pipeline from the WTP and the Treated Water Pipeline to the TPR in Peamount. The construction would involve extensive excavation of the site and reprofiling for the below ground tanks. The main construction elements would therefore be earthworks and the construction of the permanent structures including the tanks themselves and the control building.

351. Other construction activities would include landscaping, an access road and internal circulation roads, car parks and walkways, security fencing, M&E plant, instrumentation and control systems, and building services. In addition, a new mains supply would be provided off the electrical grid, to power the plant and equipment.

352. The principal construction materials for the BPT would include reinforced concrete poured in situ, structural steelwork, building work, and above and below ground steel pipework.
353. Environmental protection measures will include retaining existing habitat on the south-west side of the site and northern boundary and around a historic monument on the eastern side of the site. Protective fencing will be put in place around these areas at the outset of the Construction Phase to achieve this. There would also be temporary monitoring and controls required for grouting below the BPT as set out in Section 5.19.2.
354. The total duration of construction activity at the BPT would last approximately 4 years 10 months from pre-site establishment activities such as site investigation to the completion of the commissioning of the whole system. However, as shown in Image 5.33 there would be a period of time between the completion of the main infrastructure at the site and the completion of the construction of the rest of the Proposed Project to allow the final testing and commissioning to be undertaken. Consequently, majority of the construction works including the main earthworks and building the structures would be completed by the end of the end of Year 4. These construction activities would take approximately 22 months and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be from spring of Year 3 to the winter at the end of Year 4. Advanced works including surveys and site preparation would take place in Year 1 and 2.
355. The construction activities associated with the BPT are listed in Image 5.33 along with estimated durations for each activity.
356. During the construction period the site will act as a Satellite Construction Compound (CC3). A temporary works site layout plan for the BTP is shown in Figure 5.4.

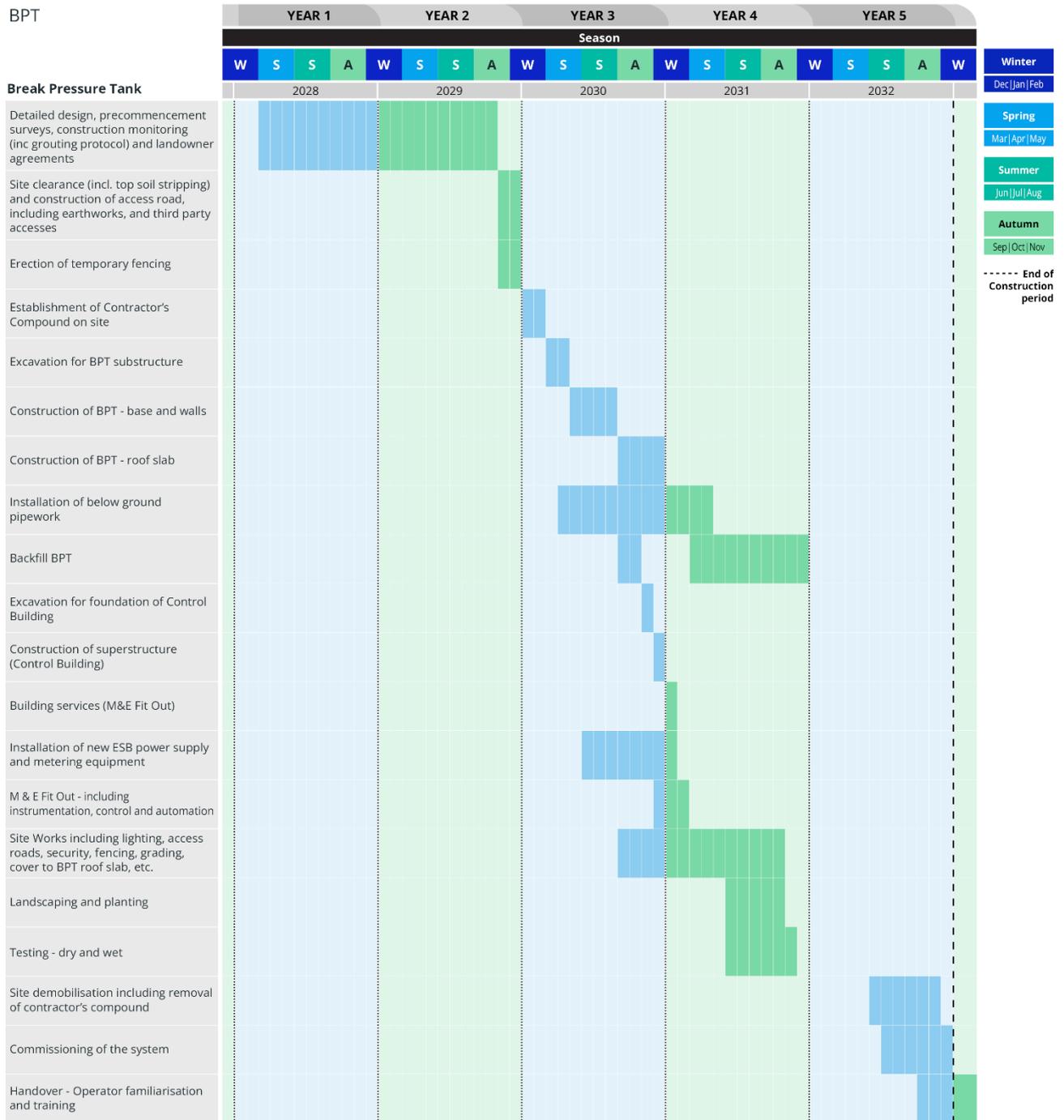


Image 5.33: Construction Phase Activities, Duration and Phasing for the BPT

5.19.2 Construction Methodology – BPT

5.19.2.1 Sequence of Construction

357. The BPT would be constructed in the sequence outlined in Table 5.21.

Table 5.21: Sequence of Construction Activity – BPT

Sequence	Construction Activity
1	Pre-construction surveys, site investigation, establish monitoring sites for ground movement and groundwater levels
2	Site preparation works including vegetation clearance, topsoil and subsoil stripping, temporary fencing and setting up the Construction Compound and the access road. It would also include the site drainage including the infiltration pond. The overhead power lines would be diverted and the power connection to the site installed.
3	Earthworks to reduce existing ground levels for the BPT substructure to formation level including excavation of the higher area on the northern side; rock stabilisation to this northern side because of exposed rock face and grouting
4	Construction of the outlet tunnel for the pipeline from BPT to TPR
5	Construction of BPT and installation of below ground pipework
6	Backfill around BPT to finished formation level
7	Installation of electricity supply
8	Construction of Control Building
9	Complete site works in preparation for Operational Phase including final site access, landscaping and planting, and boundary treatment
10	Demobilisation of the construction site

5.19.2.2 Pre-Commencement Activities

358. Prior to the full site establishment at the BPT there would be further ground investigation undertaken to inform the detailed design process. This would include the site itself and the permanent access track. This may require temporary site access and supporting facilities. There would also be environmental surveys and checks completed prior to the ground investigation and then the full site establishment.

359. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions. This would include the temporary access to the radio mast during construction.

5.19.2.3 Site Preparation Works

360. Similar to the access road for the RWI&PS, the access road for the BPT would serve a dual purpose as it would initially serve as a temporary road, becoming a permanent road towards the end of construction. Due to the location of the BPT site and the length of the access track installing the access would be the first part of the site establishment. The temporary access road and internal circulation roads would be constructed in the same way as the ones for the RWI&PS, as described in Section 5.17.2.3. Temporary traffic management would be required to establish the entrance and access, details of which are described in Chapter 7 (Traffic & Transport) and measures specific to the BPT are described in Section 5.19.2.3.1. At the same time the access for the landowner to the land east of the permanent access road to the site would be built, as would the third party access to the existing radio mast.

361. Site preparation works would include fencing off boundaries and a temporary fence would be erected around the perimeter of the site at the outset of construction. In addition, protective temporary fencing would be installed on areas of woodland within the site boundary that is to be retained during construction and inside hedgerows to be retained on the boundary of the site. Protective fencing would also be installed around the historic monument on the eastern side of the site.

362. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.

363. The laydown areas would be drained and any areas that involve the storage of fuel would have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems.
364. Topsoil would be stripped across the required site area to its full depth. The subsoil would be removed to the depth needed to create the temporary working area. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3. Any existing land drains crossing the works area would be recorded and culverted. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.
365. Topsoil and subsoil would be stored separately, This would be in sloped and weather-proofed areas of the site where disturbance would be least, pending final landscaping.
366. A Satellite Construction Compound (CC3) area would be established as described in Section 5.8.3 and as shown on Figure 5.4.

5.19.2.3.1 Traffic Management Plan

367. Access to the BPT would be via the L1064 Local Road, L1060 Local Road and R490 Regional Road. A comprehensive TMP would be put in place to manage construction traffic movements during the Construction Phase. A Draft TMP has been prepared and is included in Appendix A7.2 of Chapter 7 (Traffic & Transport).
368. Residents along the L1064 Local Road, L1060 Local Road and R490 Regional Road would be consulted as part of a consultation programme before works commence.
369. Given the narrow width of the L1064 Local Road, the TMP would include a vehicle control system that would mitigate the impact of construction material deliveries, whilst ensuring that disruption to flow of local traffic is minimised.
370. To assist the movement of large vehicles during construction, five Temporary Passing Bays would be constructed along the L1064. These Passing Bays are intended for use during the construction of the BPT only and would be removed when construction is complete, with existing hedgerows / boundaries reinstated.
371. The spacing between these Passing Bays has been estimated, based on the vertical and horizontal alignment of the L1064 Local Road and in accordance with TII's (2013) Guidance on Minor Improvements to National Roads. The dimensions for typical Passing Bays are shown in Image 5.34.

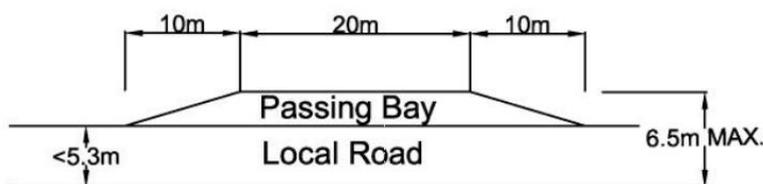


Image 5.34: BPT – Typical Passing Bay Dimensions

(Diagram Courtesy of TII)

372. Details on the construction traffic movements to the BPT site can be found in Chapter 7 (Traffic & Transport).

5.19.2.4 Temporary Foul and Potable Water Connections

373. During construction potable water would have to be transported to site by water bowsers and stored on-site in potable water tanks. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
374. There would be no permanent water connection to existing watermains constructed for the BPT.
375. There would be no foul water connection at the site for construction purposes and so foul wastewater generated on the site from the welfare facilities and canteen would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP.

5.19.2.5 Temporary and Permanent Power Supply

376. A new power supply would be required to supply the BPT site. There is an existing MV overhead power line to the north of the site as shown on Figure 4.67 and crossing perpendicular to the BPT access road. It is proposed that a connection be made to this power line, and that ducting would be provided in the BPT access road to route it to the proposed Control Building on the south side of the BPT site as shown in Figure 4.18.
377. Two 20 kV MV cables would be laid in two 125mm diameter uPVC ducts and laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with the ESB standards.
378. The construction overhead line work would be undertaken as described in Section 5.23.4.3. The ducting within the roadway would be undertaken as described in Section 5.23.4.4.
379. This would also form the temporary supply during construction and would be supplemented with generators.
380. The power supply to the radio mast would also be altered and a poleset moved along the access road to the site. These diversions and the relocation of the poleset would be undertaken as described in Section 5.23.4.3.

5.19.2.6 Temporary and Permanent Drainage

381. The appointed Contractor would construct temporary drainage measures to minimise risk of pollution during earthworks construction and other elements of work. This would include the construction of soakaway chambers and filter drains to disperse surface water in a controlled manner. The soakaway would be a permeable structure such as precast rings with holes or plastic crates. The inlet and chamber would be backfilled with a granular material such as per gravel. Filter drains are gravel-filled trenches.
382. In addition, the proposed site layout would include an infiltration basin which would be used for control of any surface water runoff. The latter would be lined with a permeable geotextile membrane/filter material shown in Image 5.35. Runoff from imperious areas such from temporary structures such as the roof and roadways would be directed through pipework to the basin where it temporarily stores the water. The stored water percolates into ground through the permeable membrane. This infiltration basin would also be used to control sediment from the excavation.
383. The construction of the drainage would primarily be an earthworks activity and the main plant would be excavators.

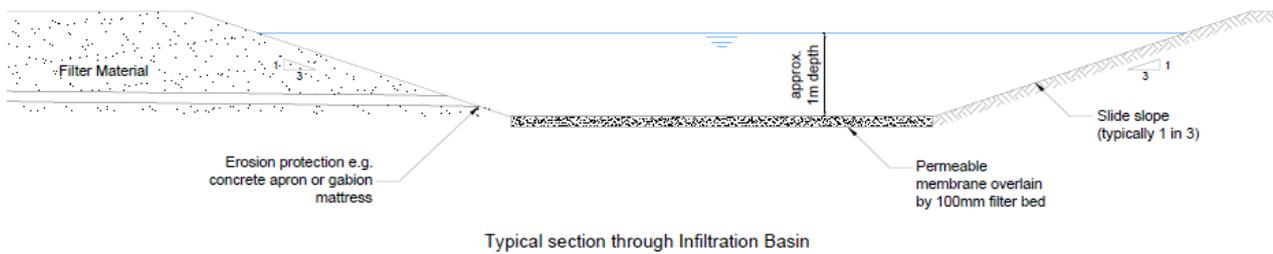


Image 5.35: BPT – Typical Section Through Infiltration Basin

384. Further details on the management of surface water at the BPT site are described in the SWMP (Appendix A5.1 Annex A).

5.19.2.7 Earthworks

385. Earthworks operations would entail moving earth around the site to achieve the required elevation and profile. Operations would generally be carried out using excavators and dump trucks that would transport material to identified filling locations. Filling operations would involve using tractor mounted flat lift rippers, bulldozers and vibratory rollers.

386. Construction of the proposed BPT would involve excavating the slope of the hill on which it is to be sited, which involves extracting overburden and rock. The tank would be partially recessed into the hill side, and the excavated topsoil would be used to cover the roof of the tank. The excavated material would be reused on-site to backfill the BPT once water testing has been carried out and for landscape earthworks including screen bunds. The quantities of excavated material re-used on site would be maximised in order to reduce the volume of surplus excavated material removed from site.

387. It is anticipated that the Construction Phase of the BPT would result in an excess of material of approximately 41,000m³ which would require removal off site and would either be put to appropriate re-use or disposed of, at a licensed facility. The depth of excavation for the BPT would be variable given the existing ground profile but is approximately 15m at its deepest point. The main earthworks activities including the ground treatment described in Sections 5.19.2.8 and 5.19.2.9 would take place over approximately 22 month period between spring Year 3 and winter at the end of Year 4. This would include the excavation required prior to the construction of the BPT structure and the backfilling afterwards. There would be smaller scale earthworks outside of these periods for example, associated with construction of the access to the site, the infiltration pond and drainage and the final landscaping.

388. Part of the excavation and earthworks would include the construction of the outlet tunnel from a shaft that would be sunk in the north-west corner of the site to facilitate the installation of the start of the pipeline from the BPT to the TPR.

389. The excavation of the hill slope would expose rock close to the surface. The rock face would only be exposed temporarily to allow the construction of the BPT structure before it is backfilled and the ground level reprofiled to integrate the proposed structure into the landscape. The exposed rock face would act as a stable face for construction along the north-eastern side of the BPT structure but may need to be stabilised depending on rock discontinuity. This may involve drilling and grouting in of passive rock dowels and finishing in hexagonal wire mesh to contain any possible loose debris on the face (shown in Image 5.36). As an additional precaution, it may also be sprayed with concrete or mortar (i.e. pneumatically projected at high velocity onto the surface of the rock face). In addition, a subsurface drain would be placed at the foot of the rock slope to catch any surface water or water seeping from rock joints, directing it to the infiltration pond on-site via appropriate treatment in accordance with the SWMP (Appendix A5.1 Annex A).
390. These works would be planned and undertaken using a methodology that will take account of the proximity of the radio mast and associated building. In particular, the distance between rock break activities will be maximised as far as reasonably practicable and hydraulic rock breaking equipment or lower vibration emitting breakers will be used at the points closest to the buildings in order to keep the potential level of vibration below 8mm/s ppv. Further information on vibration is provided in Chapter 6 (Noise and Vibration).
391. The preliminary ground investigation did not record any groundwater in the proximity of the proposed BPT works. Indeed, the ground conditions are characterised by rock close to the surface, towards the top of Knockanacree Hill. The ground slopes away rapidly from the top of the hill, with increasing depth of overburden, particularly on the eastern-facing slope where this overburden (primarily firm to stiff, well-drained limestone till) is more than 10m, within a few metres outside of the BPT works area. Further information from the ground investigation of the BPT site is provided in Chapter 10 (Soils, Geology & Hydrogeology).



Image 5.36: Temporary Construction Works – Rock Stabilisation

392. In addition to the ground stabilisation, ground treatment would also be required beneath the BPT. This is because non-intrusive, geophysical surveys, undertaken along transects through the proposed BPT site identified chimney features from the surface to depth which are considered to be infilled karst features. An intrusive Ground Investigation was also undertaken which concurs with the previous assessment that the limestone is shallow and that potential Karst features are present. The intrusive ground investigation (i.e. rotary cored boreholes) shows significant variation in engineering rockhead (i.e. described as a rock to BS 5930 (BSI 2015) and Solid Core Recovery >50%) below the proposed BPT as shown in Image 5.37.

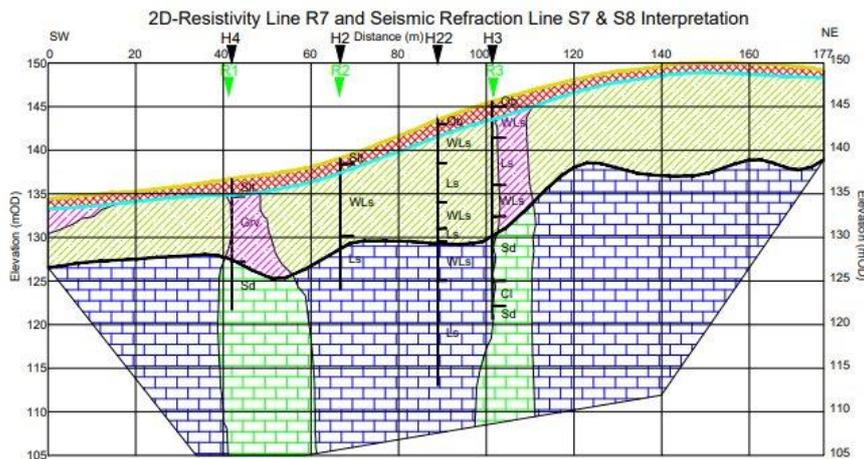


Image 5.37: Interpretation of Ground Investigation Showing Karst Features Beneath BPT

393. These features could result in differential settlement and in order to prevent this a combination of compensation grouting and excavation and replacement would be used to stabilise the ground conditions.

5.19.2.8 Grouting

394. Compensation grouting involves injecting cement slurry into the soil, filling any voids and densifying the surrounding soil. Compensation grouting the infilled karstic features would likely improve the homogeneity of the formation, reducing the risk of settlement to the BPT.

395. The site is underlain by Limestone, a principal aquifer so bespoke mitigation will be adopted to prevent aquifer pollution. Specifically, a karst protocol will be employed during construction. This would involve a series of steps and methodologies to ensure stability in karst areas. The karst feature inspection protocol is documented by Madden and O'Hara (Madden and O'Hara 2016). Where weathered limestone or karst is encountered at formation level, the feature will be mapped in detail. The stabilisation measure will be approved by a geotechnical engineer. Where infilling or grouting is undertaken, works will be supervised by a suitably qualified hydrogeologist to ensure there is no effect on groundwater.

5.19.2.9 Excavate and Replace

396. This would involve earthworks to excavate the karstic infill material and replace it with a suitable aggregate. The BPT tank formation level is between 1m –15m below the shallow rockhead, as such the limestone excavated to achieve tank formation level could be processed and utilised as backfill material.

5.19.2.10 BPT Structure

397. The Treated Water Pipeline from the WTP to the BPT would enter the BPT site from the north-west and would connect to the inlet side of the BPT. The Treated Water Pipeline from the BPT to the TPR would exit the BPT site to the north-east. The north side of the hill would be excavated, and the excavated material would be retained as fill for the BPT after construction.

398. The BPT structure would be built in-situ using standard civil engineering construction techniques as described in Section 5.18.2.8 (WTP Foundations) and Section 5.18.2.9 (WTP Structures). A mass reinforced concrete slab would be used for the foundation and there would be no requirement for piling.
399. The BPT would be constructed in sections, for the floor, walls and roof using reinforced concrete poured in situ. A concrete foundation slab base using steel shuttering would be formed first, wall starter reinforcing steel bars would then tie into the foundation slab and would be continued in order to create the wall steel reinforcement. The latter would be contained within steel shutters and filled with concrete. These techniques are outlined in Section 5.18.2.8 and 5.18.2.9 and shown in Images 5.29 and 5.31. Depending on the design, internal columns may be required to support the concrete roof slab similar to those shown in Image 5.38.
400. Excavated soil and rock would be required to backfill the new structure. The rock would be recycled by passing it through a tracked semi-mobile crusher to grade it for suitability. The earth embankments would be made up of selected excavated material. Initially, an impermeable membrane would be applied to the roof structure before the green roof is laid. Light load bearing plant would be used to place the materials on top of the structure. The earthen side slopes would be formed in layers with the use of earth-moving equipment such as excavators; vertical drainage would be incorporated into the earthen slopes. This would ensure the stability of the side slopes.
401. The construction of the BTP structure would be expected to take approximately 8 months from spring Year 3 to winter Year 3.
402. A small concrete batching plant may need to be established at the BPT site if local concrete suppliers are unable to deliver concrete within the allowable time for deliveries, typically 90 to 120 minutes depending on concrete mix design and temperature. Such batching plants are mobile, as they are delivered to site via a Heavy Goods Vehicle in a collapsible form which is compact for haulage by road. The batching plant is computerised and self-contained, so it can batch materials to precise design mixes and quantities. At the days' end, the mixing drum must be cleaned by rinsing the sides of the drum into a 'lagoon' where washings are left to 'go off'. After 7–10 days, the weak concrete residue left behind is broken out and the material can subsequently be used as a general fill under roads and buildings elsewhere on the site.
403. Potable water for the batching plant would have to be transported to site by water bowsers as set out in Table 5.13 and stored on-site in potable water tanks. Water bowsers would be filled from a fire hydrant on the nearest existing watermain.



Image 5.38: Typical Tank Roof Support Structure



Image 5.39: Typical Internal Process Pipework

5.19.2.11 Control Building

404. The Control Building would be a single-storey pitched roof building of brick/blockwork construction, founded on concrete strip footing. For the latter, the overburden would be removed to the shallow rock underneath. Construction of the control building structure would be approximately two months at the end of Year 3.

5.19.2.12 Process Pipework

405. The BPT would incorporate process pipework and ducting; an indicative illustration is shown in Image 5.39. This would include internal and buried external piping/ducting and would be developed during the detailed design stage to carry elements such as surface water, sample water for testing, dosing, power and telemetry cables.

5.19.2.13 MEICA Fit Out

406. MEICA fit out of structures and chambers would be undertaken by the appointed Contractor once the construction of the civil works has been substantially completed. It is expected that the fit out would be carried out over a three-month period over the winter at the end of Year 3 / beginning of Year 4 and would include:

- On-site Electrolytic Chlorination (OSEC) disinfection system
- Sample pumps and dosing pumps
- Water quality monitors
- Valves, actuators, meters, level and other instrumentation, cabling
- Supervisory Control and Data Acquisition (SCADA) and telemetry
- Surface water drainage pumping station
- Auxiliary services (water, heating, lighting, welfare, security).

407. The installation of PV solar panels with Battery Energy Storage System would be undertaken as part of the fit out with several ground mounted panels erected on the south facing roof of the control building, on the non-trafficked areas of the site to the south, and also on the roof of the BPT.

5.19.2.14 Internal Roads, Parking and Walkways

408. The permanent internal circulation road, car park and walkways would be constructed to facilitate access to the BPT during operation. These would be formed from the temporary roads as described in Section 5.19.2.3, once the main construction works had been completed.
409. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with bituminous binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm depth.

5.19.2.15 Permanent Site Access

410. Construction Phase and Operational Phase access for the BPT would be from the L1064 Local Road. The L1064 Local Road is approximately 4.5m wide with no verge at the proposed access point. The temporary site access would have to be converted into the permanent site access road at the end of construction. This would include scarifying the surface, regrading it and surfacing with asphalt. In addition, the permanent junction on to the L1064 would be completed including the final surfaces, splayed junction boundaries for sight lines, final fencing / boundary treatment and planting.

5.19.2.16 Landscape and Boundary Treatment

411. During construction screening embankments / berms would be constructed by the appointed Contractor using surplus excavated material from the tank excavation in the hillside to reduce visual effects.
412. As part of the earthworks activities to achieve the finished ground levels, surplus excavated material from the construction of the BPT would be transported to suitable off-site re-use or licensed/permitted facilities in accordance with relevant regulations and the Construction Waste and By-Product Management Plan.
413. The permanent security fencing would be erected around the permanent infrastructure as part of the completion of the Construction Phase. Any remaining temporary fencing would be replaced with the final boundary treatment including at the permanent access. This would include the installation of the post and rail fence, or equivalent which would mark the ownership boundary of the site.
414. The existing hedgerows and tree lines on the perimeter of the site will be retained, as far as reasonably practicable and as part of the demobilisation of the site habitat planting including a new woodland to the east of the site will be planted. There is further woodland and mosaic habitat to be planted to the north of the site. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual) and Figure 4.93 and 4.94.

5.19.2.17 Construction Site Demobilisation

415. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.19.3 Commissioning of the BPT

416. As part of the testing and commissioning of the Proposed Project all power, control and instrumentation systems would need to pass the Factory Acceptance Testing (FAT) and once installed, Site Acceptance Testing (SAT). These would all be undertaken 'dry'. This would include all comms links to the other Infrastructure Sites.

417. Full 'wet' commissioning of the BPT can only take place once the pipeline from the WTP to the BPT is operational and water available from the WTP. A pre-requisite of this would be, at least partial commissioning of the RWI&PS, WTP and pipeline in order to provide water for testing.
418. A hydraulic test would be required on the completed BPT structure to confirm that there are no leaks in the structure. The hydraulic procedure for testing the BPT is set out in Appendix A5.2 (Commissioning Strategy) and would be carried out in the following sequence:
- Step 1 – Conduct a water ingress test on the structure, especially the roof
 - Step 2 – Thoroughly clean the structure of all construction materials, dirt and dust
 - Step 3 – Clean the internal faces with high pressure water jets
 - Step 4 – Disinfect the internal faces of the structure with super chlorinated water
 - Step 5 – Fill one cell to the overflow level with water from the WTP via the Treated Water Pipeline from the WTP to the BPT. Each cell would be tested independently, and the same water would be used for the three cells
 - Step 6 – Leave cell for a minimum 24-hour period as there would be a certain degree of absorption by the concrete structure, and then take a water level measurement
 - Step 7 – Begin test for a set period (typically seven days) and then remeasure the water level. If the water level drop is within the set limits, then the structure has passed the hydraulic test. If not, identify cause of water loss, remedy and repeat Step 7 until a successful test has been concluded.
419. The BPT would then be available as a balancing and storage tank for both testing the HLPS and for providing water to fill the pipeline from the BPT to the TPR.

5.20 Booster Pumping Station (BPS)

5.20.1 Construction Phase Activities, Duration and Phasing – BPS

420. The BPS boosts the flow on the Treated Water Pipeline from the BPT to the TPR and is required when the demand for water increases above approximately 165Mld.
421. The site is relatively flat and so major earthworks would not be required. The main construction would involve excavation of the below ground pumping station and then constructing the control building over the top.
422. Other construction activities would include landscaping, an access road and internal circulation roads, car parks and walkways, security fencing, M&E plant, instrumentation and control systems, and building services. In addition, a new mains supply would be provided off the electrical grid, to power the plant and equipment.
423. The principal construction materials for the BPS would include reinforced concrete poured in situ, structural steelwork, building work, and above and below ground steel pipework.
424. Environmental protection measures during construction include protecting a known archaeological feature and the watercourse on the site boundary.
425. The total duration of construction activity at the BPS would last approximately 3 years and 10 months from pre-site establishment activities such as site investigation to the completion of the commissioning of the whole system. The main construction activities including earthworks and building the structures would take approximately 12 months and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be from summer of Year 3 to spring of Year 4. Advanced works including surveys and site preparation would take place in Year 2.

426. Image 5.40 shows the estimated duration and phasing of construction activities associated with the BPS.

427. During the construction period the site will act as a Satellite Construction Compound (CC4). A temporary works site layout plan for the BPS is shown in Figure 5.5.

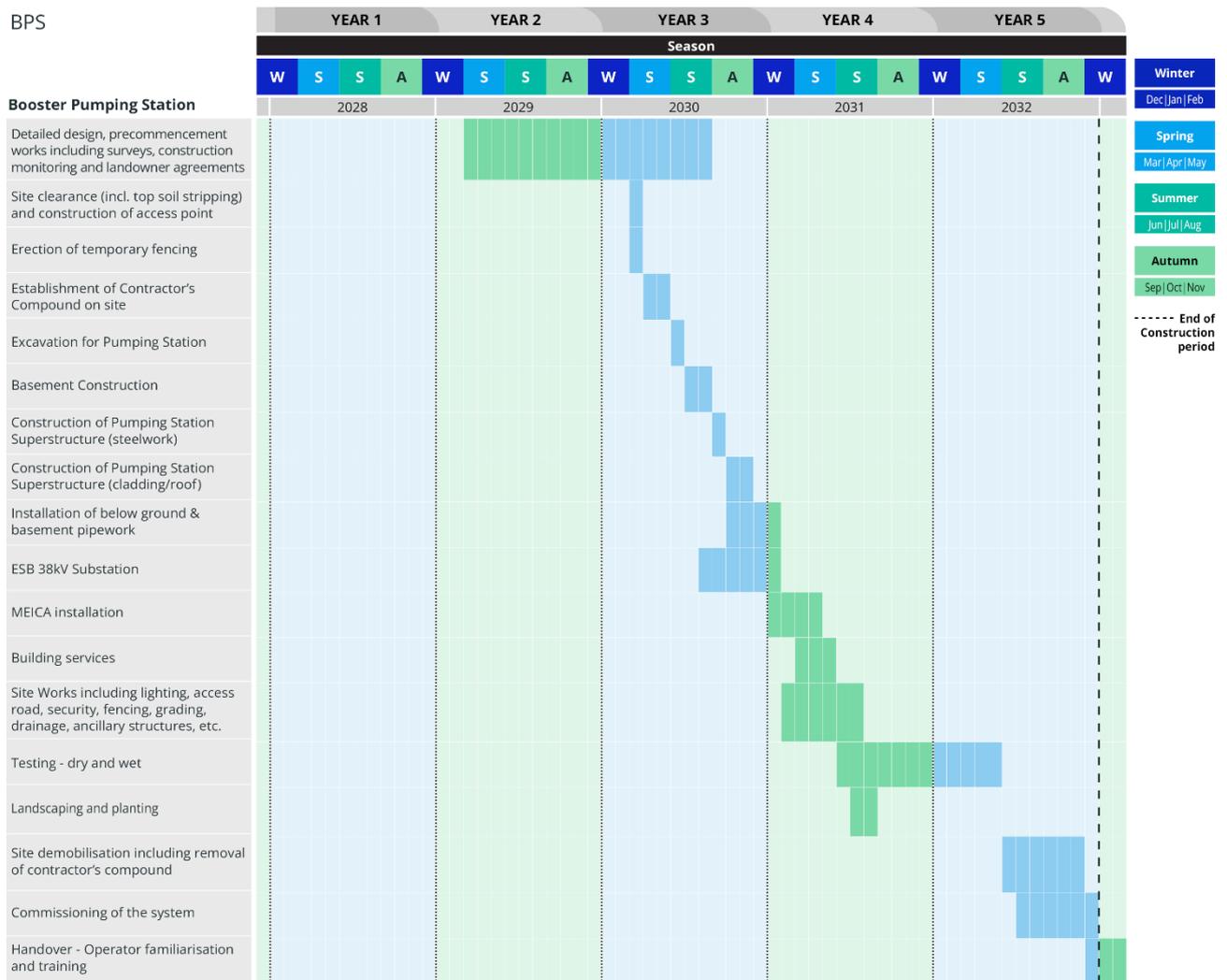


Image 5.40: Construction Phase Activities, Duration and Phasing for the BPS

5.20.2 Construction Methodology – BPS

428. A typical layout of the BPS works area is shown in Figure 5.5.

5.20.2.1 Sequence of Construction

429. The BPS would be constructed in the sequence outlined in Table 5.22.

Table 5.22: Sequence of Construction Activity – BPS

Sequence	Construction Activity
1	Pre-construction surveys, site investigation, establish monitoring sites for ground movement and groundwater levels
2	Site preparation works including vegetation clearance, topsoil and subsoil stripping, temporary fencing and setting up the Construction Compound and access road. This would include installing a temporary power, power line diversions and site drainage including the attenuation pond.
3	Earthworks, excavation and fill of the land to suitable levels for construction of structures on-site. Excavation for BPS substructure.
4	Construction of BPS substructure and installation of below ground pipework
5	Construction of BPS superstructure
6	Construction of electricity substation including MV room and installation of electricity supply from Birr
7	Complete site works in preparation for Operational Phase including final site access, landscaping and planting, and boundary treatment
8	Demobilisation of the construction site

5.20.2.2 Pre-Commencement Activities

430. Prior to the full site establishment there would be further ground investigation undertaken to inform the detailed design process for the BPS. This may require temporary site access and supporting facilities. There would also be environmental surveys and checks completed prior to the ground investigation and the site establishment.

431. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

5.20.2.3 Site Preparation Works

432. The BPS site is in a field adjacent to the L3003 Local Road. A new entrance to the field would be constructed off the L3003 Local Road. Similar to the other infrastructure sites, the access for the BPS would serve a dual purpose as it would initially serve as the temporary access before becoming the permanent access towards the end of construction. The access and the temporary, internal circulation roads would be constructed in the same way as the ones for the RWI&PS, described in 5.17.2.3.

433. A comprehensive TMP would be put in place for the Construction Phase including the new power connection to Birr substation. Residents along the L3003 Local Road would be consulted as part of a consultation programme before works commence.

434. Details on the construction traffic movements to the BPS site can be found in Chapter 7 (Traffic & Transport).

435. Site preparation works would include fencing off boundaries, and a temporary fence would be erected around the perimeter of the site at the outset of construction. In addition, protective temporary fencing would be erected inside the site in order to fence off a buried circular fossilised archaeological feature in the north-west corner of the site and the watercourse around the southern perimeter of the site

436. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.

437. The laydown areas would be drained and any areas that involve the storage of fuel would have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems.
438. Topsoil would be stripped across the required site area to its full depth. The subsoil would be removed to the depth needed to create the temporary working area. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3.2. Any existing land drains crossing the works area would be recorded and culverted. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.
439. Topsoil and subsoil would be stored separately, sloped and weather-proofed in areas of the site where disturbance would be least, pending final landscaping.
440. A Satellite Construction Compound (CC4) area (shown in Figure 5.5) would be established as described in Section 5.8.3.

5.20.2.4 Temporary Foul and Potable Water Connections

441. During construction potable water would have to be transported to site by water bowsers and stored on-site in potable water tanks. Water bowsers would be filled from the nearest fire hydrant on the existing watermain.
442. There would be no permanent water connection to existing watermains constructed for the BPS.
443. There would be no foul water connection at the site for construction purposes and so foul wastewater generated on the site from the welfare facilities and canteen would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP.

5.20.2.5 Temporary and Permanent Power Supply

444. Temporary power for the BPS site would be provided by looping a 38 kV cable from the existing 38 kV overhead line network in the locality. There are two existing lines traversing the site and as part of the site set up these would need to be diverted. A temporary connection would be made to the diverted lines to provide a supply during construction. These overhead line works would be undertaken as described in Section 5.23.4.3 and the ducting would be undertaken as described in Section 5.23.4.4. This temporary supply would be supplemented with on-site use of generators.
445. The permanent power supply to the BPS would need to be sufficient to be able to operate the pumps when the site was called upon during operation. This permanent supply would be via a new connection along a 9km route from the Birr substation site along regional and local roads including the R440 and L3003 (as shown in Figure 4.27 to Figure 4.30 inclusive). The cabling for the new connection to Birr substation would be below ground in the edge or road and the ducting would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with ESB standards (Appendix A4.2: Standard Specification for ESB 38 kV Networks). The method of construction would be consistent with that described in Section 5.23.4.4 and shown in Images 5.53 and 5.54.

5.20.2.6 Temporary and Permanent Drainage

446. The appointed Contractor would construct temporary drainage measures to minimise risk of pollution during earthworks construction and other elements of work. This would include the construction of soakaway chambers and filter drains to disperse surface water in a controlled manner as described in Section 5.19.2.6. In addition, the proposed site layout would include an attenuation lagoon which would be used to control any surface water runoff, to greenfield runoff rates.

447. Further details on the management of surface water at the BPS site are described in the SWMP (Appendix A5.1 Annex A).

5.20.2.7 Earthworks

448. Earthwork operations at the BPS site would be similar to the other Infrastructure Sites in terms of the nature of the works and the machinery / equipment to be used. Therefore, the activities would be similar to those described for the BPT in Section 5.19.2.6. However, the scale of the earthworks operations would be significantly smaller than the BPT. This is because the BPS site does not need extensive re-profiling and so only very small scale earthworks operations would be needed to achieve the required elevation and profile. The main earthworks operation would be the excavation of the substructure of the Control Building that would form the below ground chamber for the pumps and this would not be large, compared with the excavations at other sites such as the WTP and BPT. The substructure would involve an excavation approximately 5.5m deep.

449. No ground stabilisation would be required at the site.

450. The operations would generally be carried out using excavators and dump trucks that would transport material to identified filling locations. Filling operations would involve using tractor mounted flat lift rippers, bulldozers and vibratory rollers.

451. It is anticipated that the Construction Phase of the BPS would result in an excess of material of approximately 19,200m³ which would require removal off site and would either be put to appropriate re-use or disposed of, at a licensed facility.

452. The main earthworks activities at the BPS would be relatively short and would be expected to take place over a one month period in summer Year 3. There would be smaller scale earthworks outside of these periods for example, associated with backfilling of the structures, construction of the access to the site, the site drainage and the final landscaping.

5.20.2.8 BPS Substructure

453. The Treated Water Pipeline from the BPT would enter the BPS site from the south and would connect to the dry well of the BPS. The Treated Water Pipeline to the TPR would exit the BPS site to the north. The BPS would be built using standard civil engineering construction techniques described in Section 5.18.2.8 (WTP Foundations) and Section 5.18.2.9 (WTP Structures). The BPS substructure would be constructed in sections for the basement, walls and ground floor using reinforced concrete poured in situ.

454. The BPS would be constructed in sections, for the floor, walls and roof using reinforced concrete poured in situ. A concrete foundation slab base using steel shuttering would be formed first, wall starter reinforcing steel bars would then tie into the foundation slab and would be continued in order to create the wall steel reinforcement. The latter would be contained within steel shutters and filled with concrete. These techniques are outlined in Section 5.18.2.8 and 5.18.2.9 and shown in Images 5.29 and 5.31.

455. A small concrete batching plant may need to be established at the BPS site if local concrete suppliers are unable to deliver concrete within the allowable time for deliveries, typically 90 to 120 minutes depending on concrete mix design and temperature. Such batching plants are mobile, as they are delivered to site via a Heavy Goods Vehicle in a collapsible form which is compact for haulage by road. The batching plant is computerised and self-contained, so it can batch materials to precise design mixes and quantities. At the days' end, the mixing drum must be cleaned by rinsing the sides of the drum into a 'lagoon' where washings are left to 'go off'. After 7–10 days, the weak concrete residue left behind is broken out and the material can subsequently be used as a general fill under roads and buildings elsewhere on the site.

456. The BPS underground structure would be a water-excluding reinforced concrete box structure with the wall and base constructed monolithically.

457. The construction of the BPS structure including the substructures/foundations would be expected to take approximately 2 months over the summer of Year 3.

5.20.2.9 Control Building (Superstructure)

458. The superstructure for the BPS would be constructed over the underground structure and would be constructed using structural steelwork, blockwork and cladding.

459. The construction of the BPS superstructure would be expected to take approximately 3 months over the autumn of Year 3.

5.20.2.10 Process Pipework

460. The BPS would incorporate extensive pipework below ground level including valves and flow metres. The pipework would be installed inside the BPS and then connected into the 1,600mm Treated Water Pipeline to the TPR. This would be as shown in Image 5.39.

461. The duration of this work would be approximately four months starting in parallel with the construction of the superstructure being carried out in autumn and winter at the end of Year 3.

5.20.2.11 MEICA Fit Out

462. MEICA fit out of the BPS and electricity substation, which includes the ESB, would be undertaken by the appointed Contractor once the construction of the structures has been substantially completed. With the sequence of construction of buildings and their sequenced availability for first-fix MEICA work, and subsequent stages of fit out, it is expected that the M&E fit out would include:

- Incoming power supply, HV switchgear, transformers, distribution boards and cabling
- Pump and motor sets
- Variable speed drives
- Instruments, valves, actuators and flow meters
- SCADA and telemetry
- Surge vessels complete with air compressors and controls
- Auxiliary services (water, heating, lighting, welfare, security).

463. This would take approximately four months at the end of Year 3 and beginning of Year 4.

464. The installation of PV solar panels would be undertaken as part of the fit out with ground mounted panels erected in the non-trafficked areas of the site to the east of the main building.

5.20.2.12 Internal Roads, Parking and Footpaths

465. The permanent access road, internal circulation road, car park and walkways would be constructed to facilitate access to the BPS during operation. This would be formed from the temporary internal roads as described in Section 5.20.2.3, once the main construction works had been completed.

466. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm depth. The main site entrance road would be 5m wide to facilitate articulated. Access to the electricity substation would be via a separate 5m wide road.

5.20.2.13 Permanent Site Access

467. Construction Phase and Operational Phase access for the BPS would be from the L3003 Local Road and requires a new permanent access road to be constructed to the site complete with entrance gates. The L3003 Local Road is approximately 4.5m wide and has 0.5m wide grass verges at the proposed access point. The site access would have been constructed for the Construction Phase but as part of completing construction it would have to be converted into the permanent junction onto the L3003 including the splayed junction boundaries for sight lines, final surfaces, final fencing / boundary treatment and planting.

5.20.2.14 Landscape and Boundary Treatment

468. Excavated material from the construction of the BPS would be used on-site to reprofile the site during construction and reinstate the construction working area and achieve finished ground levels.

469. Surplus excavated material from the construction of the BPS would be transported to suitable off-site re-use or licensed/permitted facilities in accordance with relevant regulations and the Construction Waste and By-Product Management Plan.

470. The permanent security fencing would be erected around the permanent infrastructure as part of the completion of the Construction Phase. Any remaining temporary fencing would be replaced with the final boundary treatment including at the permanent access. This would include the installation of the post and rail fence, or equivalent which would mark the ownership boundary of the site.

471. As part of the demobilisation of the site, habitat planting including the screen planting will be planted. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual) and Figure 4.95.

5.20.2.15 Construction Site Demobilisation

472. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.20.3 Commissioning of the BPS

473. As part of the testing and commissioning of the Proposed Project all control systems would need to pass the FAT and once installed, SAT. These would all be undertaken 'dry'. This would include all comms links to the other Infrastructure Sites.

474. Full 'wet' commissioning of the BPS can only take place once the pipeline from the BPT to the TPR is operational and water available from the WTP. A pre-requisite of this would be the full commissioning of the RWI&PS, WTP, pipelines, BPT, FCV and TPR.

475. Following disinfection of pipework, the next step would be commissioning the surge protection system.

476. The BPS pumps would then be commissioning individually, first spinning against closed valves and then in various combinations and finally into supply with combinations of three pumps to achieve the full range of flows.

477. Finally, acceptance testing would include an endurance test whereby the pumps are required to successfully run for extended period.

5.21 Flow Control Valve (FCV)

5.21.1 Construction Phase Activities, Duration and Phasing – FCV

478. The FCV controls the flow of water through the Treated Water Pipeline and would be a much smaller construction site compared with the other Infrastructure Sites. In particular, there would be no permanent above ground building and the FCV would not function as a Construction Compound during construction. The main construction activity at this site would be excavating and installing the below ground valves.

479. Other construction activities would include landscaping, an access road and internal circulation roads, car parking, security fencing, M&E plant, instrumentation and control systems, and services. In addition, a new mains supply would be provided off the electrical grid, to power the plant and equipment.

480. The principal construction materials for the FCV would include reinforced concrete poured in situ, and below ground steel pipework.

481. The total duration of construction activity at the FCV would last approximately 2 years 10 months from pre-site establishment activities such as site investigation through to the completion of the commissioning of the whole system. However, the FCV would be constructed as part of the pipeline construction sequence rather than as a standalone site and as shown in Image 5.41 there would be a period of time between the completion of the main infrastructure at the site and the completion of the construction of the rest of the Proposed Project to allow the final testing and commissioning to be undertaken. The main construction activities would take approximately one year and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be in Year 4. Advanced works including surveys and site preparation would take place in Year 3. The construction activities associated with the FCV are listed in Image 5.41 along with estimated durations for each activity.

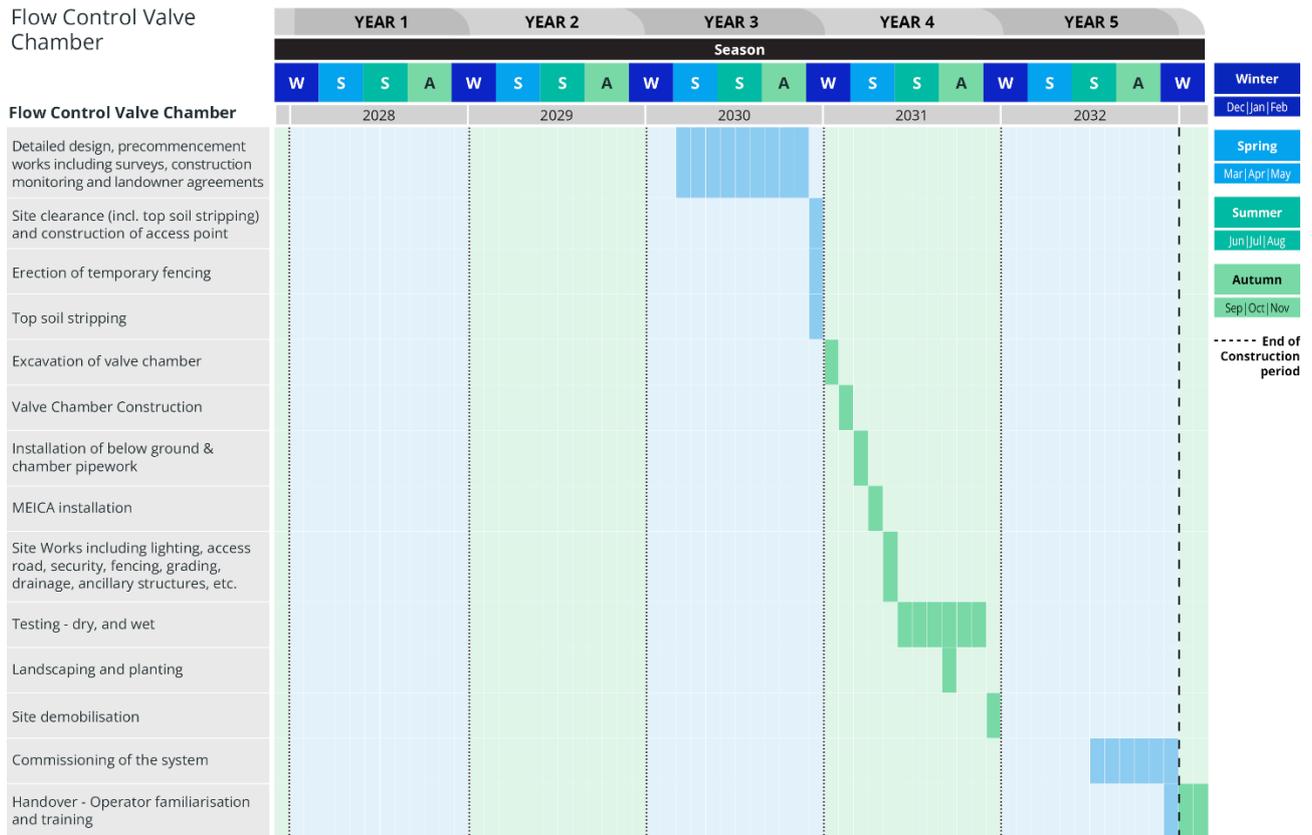


Image 5.41: Construction Phase Activities, Duration and Phasing for the FCV

5.21.2 Construction Methodology – FCV

5.21.2.1 Pre-Commencement Activities

482. Prior to the full site establishment there would be further ground investigation undertaken to inform the detailed design process for the FCV. This may require temporary site access and supporting facilities. There would also be environmental surveys and checks completed prior to the ground investigation and then the full site establishment.

483. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

5.21.2.2 Site Preparation Works

484. The FCV would be accessed directly off the L1016 Local Road via a 5m wide access road which would loop around the chamber. The access would be facilitated by a Lay-By adjacent to the public road to allow for safe parking during access and egress. The access point onto the L1016 would be the first part of the site set up in order to provide access to the site. The access and the internal circulation roads would be constructed as described in Section 5.17.2.3 for the RWI&PS. Similar to the other infrastructure sites, the access road for the FCV would serve a dual purpose as it would initially serve as the temporary access before becoming the permanent access towards the end of construction

485. A comprehensive TMP would be put in place for the Construction Phase and details on the construction traffic movements to the FCV site can be found in Chapter 7 (Traffic & Transport).

486. Site preparation works would include fencing off boundaries and a temporary fence would be erected around the perimeter of the site.
487. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.
488. The laydown areas would be drained and any areas that involve the storage of fuel would have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems.
489. Topsoil would be stripped across the required site area to its full depth. The subsoil would be removed to the depth needed to create the temporary working area. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3. Any existing land drains crossing the works area would be recorded and culverted. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.
490. Topsoil and subsoil would be stored separately, sloped and weather-proofed in areas of the site where disturbance would be least, pending final landscaping.

5.21.2.3 Temporary Foul and Potable Water Connections

491. There would be no temporary foul or potable water connection at the FCV.

5.21.2.4 Temporary and Permanent Power Supply

492. A new ESB power supply would be required for the FCV. There is an existing LV overhead power line traversing the south-western perimeter of the site. It is proposed that a connection be made to this power line, via a combination of overhead lines and buried cables routed to a control kiosk on the site. The overhead line works would be undertaken as described in Section 5.23.4.3 and the ducting would be undertaken as described in Section 5.23.4.4
493. This supply may also be supplemented during construction by the use of on-site generators.

5.21.2.5 Temporary and Permanent Drainage

494. The appointed Contractor would construct temporary drainage measures to reduce the risk of pollution during earthworks construction and other elements of work. This would include the construction of an infiltration (soakaway) chamber and filter drains to disperse surface water in a controlled manner as described in Section 5.19.2.6.
495. Further details on the management of surface water at the FCV site are described in the SWMP (Appendix A5.1 Annex A).

5.21.2.6 Earthworks

496. Earthwork operations at the FCV site would be similar to the other Infrastructure Sites in terms of the nature of the works and the machinery / equipment to be used. Therefore, the activities would be similar to those described for the BPT in Section 5.19.2.7. However, the scale of the operations would be significantly smaller. This is because the site does not need extensive re-profiling and so only very small scale earthworks operations would be needed to achieve the required elevation and profile. The main earthworks operation would be the excavation of the below ground chamber for the below ground valves and this would not be large, compared with the other sites. No ground stabilisation would be required at the FCV.
497. The operations would generally be carried out using excavators and dump trucks that would transport material to identified filling locations. Filling operations would involve using tractor mounted flat lift rippers, bulldozers and vibratory rollers.
498. The excavated material would be reused on-site to backfill the chamber once testing had been carried out. The quantities of excavated material re-used on site would be maximised in order to reduce the volume of surplus excavated material removed from site.
499. It is anticipated that the Construction Phase of the FCV would result in an excess of material of approximately 3,000m³ which would require removal off site and would either be put to appropriate re-use or disposed of, at a licensed facility.
500. The main earthworks activities at the FCV would be relatively short and would be expected to take place over a one month period in winter at the beginning of Year 4. There would be smaller scale earthworks outside of these periods for example, associated with backfilling of the structures, construction of the access to the site, the site drainage and the final landscaping.

5.21.2.7 FCV Structure

501. The FCV complex would be housed within an underground chamber to provide fine control of the flows in the Treated Water Pipeline from the BPT to the TPR and consist of three 700mm diameter FCVs and three flow meters installed in parallel with a Line Valve.
502. The formation level for the FCV complex would be prepared using similar excavation techniques described for the pipelines in Section 5.24.2. A stone hardcore base would be laid with an excavator and compacted. The base and walls of the FCV complex would be constructed in reinforced concrete, with concrete being applied in situ whereby the chute of the concrete lorry discharges to an excavator with a concrete bucket attachment, or to a crane complete with a concrete skip. Flow control from the bucket is via a hydraulically operated butterfly valve, or manually operated discharge gate, respectively. The chamber would be capped with a precast lid, and openings would be provided in the top of this lid for securing with metal covers. All other materials would be manoeuvred into position, or placed, with cranes and excavators.
503. Ducting would be provided within the site. Ducts would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with the ESB standards.
504. One kiosk would house the ESB power connection and other kiosk at the FCV site would house the control Programmable Logic Controller and SCADA. There would be no above ground structures other than the kiosks which would be formed on precast concrete plinths.
505. The construction of the FCV substructure would be relatively short and would be expected to take place over a one month period in winter at the beginning of Year 4.

5.21.2.8 Process Pipework

506. The FCV would incorporate pipework below ground level including valves and flow meters. This would be similar to that shown in Image 5.39. The installation would be relatively short approximately one month in the spring of Year 4.

5.21.2.9 MEICA Fit Out

507. MEICA fit out of the FCV would be undertaken by the appointed Contractor once the construction of the structures has been substantially completed. With the sequence of construction of buildings and their sequenced availability for first-fix MEICA work, and subsequent stages of fit out, it is expected that the M&E fit out would take up to one month, with different elements running in parallel with civil/building works elsewhere. It would include

- Valves, actuators, meters, pressure and other instrumentation, cabling
- SCADA and telemetry
- Surface water and chamber sump drainage pump
- Auxiliary services (power connections, frost protection, lighting, security).

508. The installation of PV solar panels would be undertaken as part of the fit out with ground mounted panels erected in the non-trafficked areas of the site to the north.

5.21.2.10 Internal Roads, Parking and Footpaths

509. The permanent access road, internal circulation road, car park and walkways would be constructed to facilitate access to the FCV during operation. This would be formed from the temporary internal roads as described in Section 5.21.2.2, once the main construction works had been completed. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with bituminous binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm depth.

5.21.2.11 Permanent Site Access

510. Construction Phase and Operational Phase access for the FCV would be from the L1016 Local Road and requires a new permanent access road to be constructed to the site complete with entrance gates. The L1016 comprises two 2.4m wide traffic lanes and has 1.5m wide grass verges at the proposed access point. The site access would have been constructed for the Construction Phase but as part of completing construction it would have to be converted into the permanent junction onto the L1016 including the splayed junction boundaries for sight lines, final surfaces, final fencing / boundary treatment and planting.

5.21.2.12 Landscape and Boundary Treatment

511. Excavated material from the construction of the FCV would be used on-site to reprofile the site during construction and reinstate the construction working area and achieve finished ground levels.

512. Surplus excavated material from the construction of the FCV would be transported to suitable off-site re-use or licensed/permitted facilities in accordance with relevant regulations and the Construction Waste and By-Product Management Plan.

513. The permanent security fencing would be erected around the permanent infrastructure as part of the completion of the Construction Phase. Any remaining temporary fencing would be replaced with the final boundary treatment including at the permanent access. This would include the installation of the post and rail fence, or equivalent which would mark the ownership boundary of the site.

514. As part of the demobilisation of the site, habitat planting including native species meadow planting would be completed. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual) and Figure 4.96.

5.21.2.13 Construction Site Demobilisation

515. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.21.3 Commissioning of the FCV

516. As part of the testing and commissioning of the Proposed Project all control systems would need to pass the FAT and once installed, SAT. These would all be undertaken 'dry'. This would include all comms links to the other Infrastructure Sites.

517. Full 'wet' commissioning of the FCV can only take place once the pipeline is fully charged with water. A pre-requisite of this would be the full commissioning of the RWI&PS, WTP, pipeline, BPT and TPR.

518. The three individual FCVs would then be commissioned individually then in various combinations and finally into supply with combinations of two out of three operating to achieve the full range of flows.

5.22 Termination Point Reservoir (TPR)

5.22.1 Construction Phase Activities, Duration and Phasing – TPR

519. Construction of the TPR would involve the excavation of the site to allow a Treated Water Pipeline connection to the TPR structures. The existing site is relatively flat and the tanks would only be partially below ground. Therefore, the main activities would be, the earthworks needed to excavate the ground for the pipework, reservoir tanks and the Emergency Overflow Storage Tank, the construction of the tanks themselves and then the earthworks to cover then over.

520. The principal construction materials for the TPR would include reinforced concrete poured in situ, and below ground steel pipework.

521. Other construction activities would include the construction of screening berms, access road to the site and an internal circulation road, car park and footpaths, landscaping and final planting. Mains power for the TPR instrumentation, controls and building services shall be derived by separate connection from the existing mains supply.

522. Environmental protection measures during construction would include management of noise levels to avoid effects on Peamount Hospital which is adjacent to the TPR site.

523. The total duration of construction activity at the TPR would last approximately 4 years 10 months from pre-site establishment activities such as site investigation to the completion of the commissioning of the whole system. The main construction activities including earthworks and building the structures would take approximately 18 months and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be from spring of Year 3 to the end of summer of Year 4. Advanced works including surveys and site preparation would take place in Year 1 and Year 2.

524. Image 5.42 shows the estimated duration and phasing of construction activities associated with the TPR.

525. During the construction period the site will act as a Satellite Construction Compound (CC7). A temporary works site layout plan for the TPR is shown in Figure 5.8.

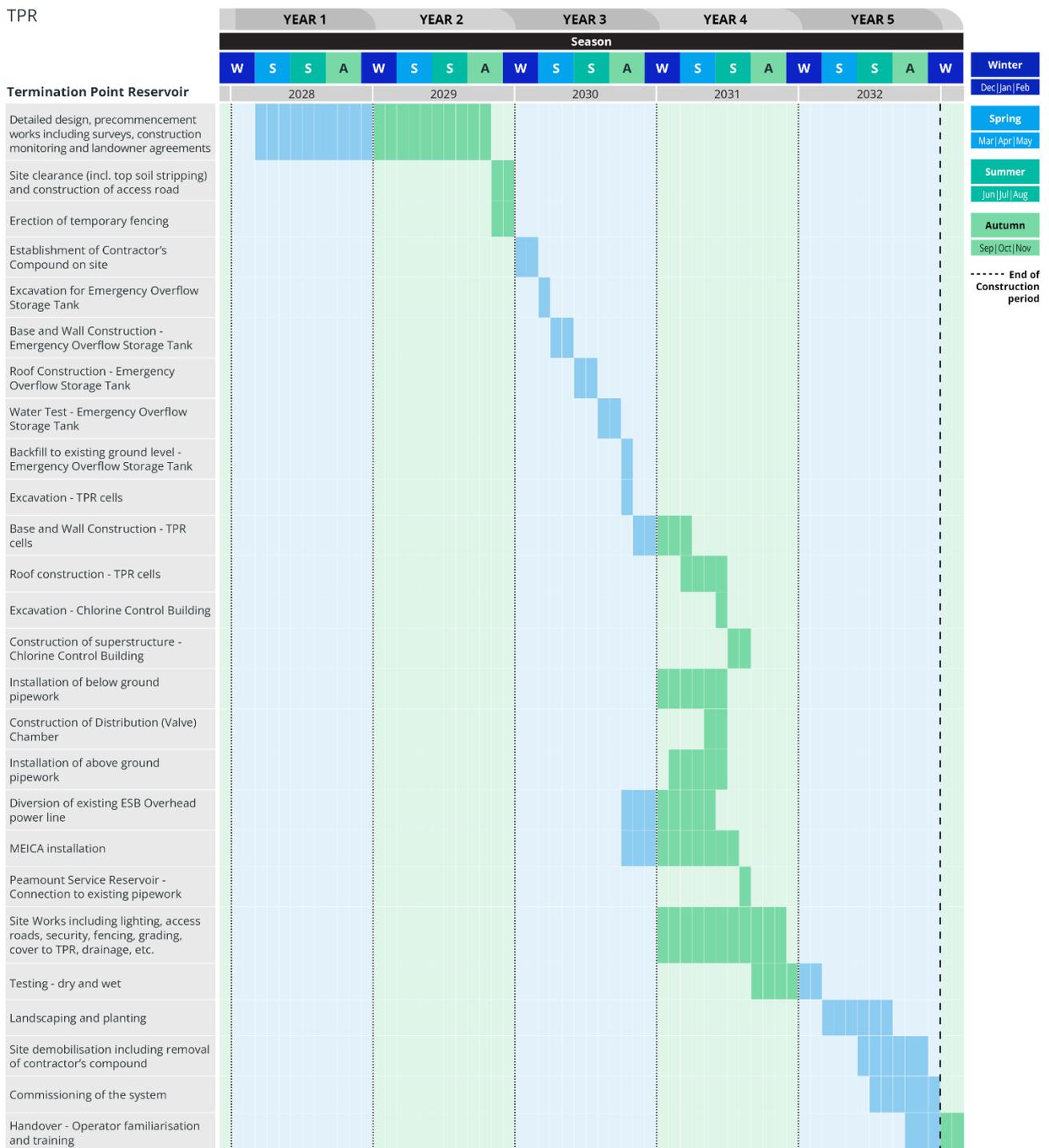


Image 5.42: Construction Phase Activities, Duration and Phasing for the TPR

5.22.2 Construction Methodology – TPR

5.22.2.1 Sequence of Construction

526. The TPR would be constructed in the sequence outlined in Table 5.23.

Table 5.23: Sequence of Construction Activity – TPR

Sequence	Construction Activity
1	Pre-construction surveys, site investigation, establish monitoring sites for ground movement and groundwater levels
2	Site preparation works including vegetation clearance, topsoil and subsoil stripping, fencing and setting up the Construction Compound and access road. This would include diverting an overhead line, installing the temporary power and water connection. It would also include installing the site drainage including attenuation ponds.
3	Excavation for Emergency Overflow Storage Tank, and earthworks to formation of TPR
4	Construction of Emergency Overflow Storage Tank and installation of pipework
5	Construction of TPR and installation of pipework
6	Construction of Chlorine Dosing Control Building
7	Connection to electricity supply and connections to existing pipework
8	Complete site works in preparation for Operational Phase including final site access, landscaping and planting, and boundary treatment
9	Demobilisation of the construction site

5.22.2.2 Pre-Commencement Activities

527. Prior to the full site establishment there would be further ground investigation undertaken to inform the detailed design process for the TPR. This may require temporary site access and supporting facilities. There would also be environmental surveys and checks completed prior to the ground investigation and then the full site establishment.

528. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

529. In addition, the CEMP requires, among other matters, an Aspergillus Prevention Plan to be developed by a suitably qualified specialist prior to commencement of works on the site to prevent Aspergillus spores spreading (Appendix A5.1 including measures in Annex G).

5.22.2.3 Site Preparation Works

530. Similar to the access road for the RWI&PS, the access road for the TPR would serve a dual purpose as it would initially serve as a temporary road and then becoming the permanent access road towards the end of construction.

531. The existing access road to Peamount Reservoir, which is on the northern perimeter of Peamount Hospital, would continue to be used for the operational requirements of the existing facility only and would not be used for construction traffic.

532. The access road and internal circulation roads would be constructed in the same way as the other sites, including the RWI&PS and this is described in Section 5.17.2.3. Temporary traffic management would be required to establish this area, details of which are discussed in Section 5.17.2.11 and Chapter 7 (Traffic & Transport).

533. Temporary fencing would be provided to separate the works area from the existing and operational service reservoir site at Peamount. This is required to demarcate the areas of responsibility for each of the appointed Contractors for the Proposed Project and the operator of the existing service reservoir.
534. Rock breaking will not be undertaken along the south east perimeter of the site and activities generating high levels of airborne noise will also be restricted in this area. This would be to avoid disturbance effects on properties adjacent to the Planning Application Boundary. As part of the site set up these restrictions will be identified through a combination of signage and where appropriate and necessary, temporary fencing. Arrangements for localised hoarding or noise screening will also be put in place during site establishment in accordance with the CEMP (Appendix A5.1 including measures in Annex G).
535. Laydown areas would be established, which would be used by the appointed Contractor to accommodate temporary construction facilities such as site offices, parking and storage of construction materials. The laydown areas would be constructed by stripping back the topsoil and subsoil and placing a layer of stone over a layer of geotextile membrane, as required.
536. The laydown areas would be drained and any areas that involve the storage of fuel would have paved areas with bunding and hydrocarbon interceptors to ensure that no spillages get into the surface water or groundwater systems.
537. Topsoil would be stripped across the required site area to its full depth. The subsoil would be removed to the depth needed to create the temporary working area. Topsoil and subsoil management would be carried out as has been described for the Construction Compounds and Pipe Storage Depots in Section 5.8.3. Any existing land drains crossing the works area would be recorded and culverted. The topsoil and top layer of subsoil stockpiles would be located away from drains and watercourses.
538. Topsoil and subsoil would be stored separately, sloped and weather-proofed in areas of the site where disturbance would be least, pending final landscaping.
539. An existing 225mm diameter foul sewer traverses the site. This would be abandoned and replaced by a new section of sewer, following the alignment of the new access road within the site.
540. A Satellite Construction Compound (CC7) area would be established as described in Section 5.8.3 and as shown in Figure 5.8.

5.22.2.4 Temporary Foul and Potable Water Connections

541. To provide a water supply during construction a connection would be made into the supply to the existing site. After construction this would become the permanent supply to the TPR.
542. There would be no foul water connection at the site for construction purposes and so foul wastewater generated on the site from the welfare facilities and canteen would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP.

5.22.2.5 Temporary and Permanent Power Supply

543. There is an existing power line crossing the site. This is to be diverted as part of the permanent works, and this would be undertaken as part of the site establishment. There is an existing substation powering the existing pumping station at the existing 40MI reservoir adjacent to the site. There is available capacity within the existing network to supply temporary and permanent connections. This would be used during construction, supplemented with generators, as required.

544. The overhead line works would be undertaken as described in Section 5.23.4.3 the ducting for the diversion would be undertaken as described in Section 5.23.4.4

5.22.2.6 Temporary and Permanent Drainage

545. The appointed Contractor would construct temporary drainage measures to minimise the risk of pollution during earthworks construction and other elements of work. This would include the construction of soakaway chambers and attenuation basins, as described in Section 5.19.2.6, to disperse surface water in a controlled manner and limit it to greenfield runoff rates.

546. Further details on the management of surface water at the TPR site are described in the SWMP (Appendix A5.1 Annex A).

5.22.2.7 Earthworks

547. Earthwork operations at the TPR site would be similar to the other Infrastructure Sites in terms of the nature of the works and the machinery / equipment to be used. Therefore, the activities would be similar to those described for the BPT in Section 5.19.2.6. The main earthworks operation would be the excavation of the substructure of the Chlorine Dosing Control Building, Emergency Overflow Storage Tank and for the TPR tanks themselves. Pipe chambers will involve the deepest excavation on site and be approximately 7.5m deep.

548. The main earthworks activities would take place in spring and autumn in Year 3. This would include the excavation required prior to the construction of the TPR structure and the backfilling afterwards. There would be smaller scale earthworks outside of these periods for example, associated with construction of, the access to the site, the Chlorine Dosing Control Building, drainage and the final landscaping.

549. The preliminary ground investigation indicated limestone rock close to the surface and an overburden depth at approximately 1.2m. The upper 400mm of limestone is weathered and is thereafter generally characterised as very strong. No ground stabilisation would be required at the site. The groundwater levels recorded at the time of the ground investigation indicated that there was good drainage at the site below the overburden.

550. It is anticipated that the Construction Phase of the TPR would result in an excess of material of approximately 59,200m³ which would require removal off site and would either be put to appropriate re-use or disposed of, at a licensed facility.

551. The excavated material would be drawn from the excavations to the access road, foundations for the TPR structure, various pipelines and from the Emergency Overflow Storage Tank. Most of this material would be rock and generally unsuitable for reuse in other areas of the site. The embankments to the TPR are one part of the works where surplus excavated material can be reused, but it would still require the import of approximately 53,000m³ of suitable material.

552. The operations would generally be carried out using excavators and dump trucks that would transport material to identified filling locations. Filling operations would involve using tractor mounted flat lift rippers, bulldozers and vibratory rollers.

553. Once the TPR has been hydraulically tested, suitable excavated material would be reused on-site for embankments, and for any landscaping required around the site.

5.22.2.8 TPR Structure

554. This site is located adjacent to the existing service reservoir site at Peamount, County Dublin, on agricultural land shown in Image 5.43. It would be integrated to connect with pipework associated with the existing structures and would be similar in shape and form (i.e. a covered reinforced concrete structure in earthen embankment). It would have the same cover level (88.90mAOD) as the existing Peamount Reservoir. The site is shown in Figure 4.70.

555. The TPR would form the eastern extremity of the Proposed Project, and it would be the discharge point for the Treated Water Pipeline from the BPT to the TPR. The TPR would be supplied by a 1,600mm nominal diameter pipe.



Image 5.43: Existing 40MI Service Reservoir Site at Peamount

556. The TPR would be constructed using reinforced concrete, with three baffled and discrete cells for the Proposed Project. Given that bedrock is at a shallow depth, the overburden would be removed, and the structure would be founded on mass reinforced concrete over its footprint. In addition, there would be a below ground Emergency Overflow Storage Tank. The construction of this tank would require excavation in rock.

557. The TPR would be built using standard civil engineering construction techniques described in Section 5.18.2.8 (WTP Foundations) and Section 5.18.2.9 (WTP Structures). The TPR would be constructed from reinforced concrete poured in situ, with sequential segments. A mass reinforced concrete slab would be used for the foundation, piling would not be used.

558. The TPR would be constructed in sections, for the floor, walls and roof using reinforced concrete poured in situ. A concrete foundation slab base using steel shuttering would be formed first, wall starter reinforcing steel bars would then tie into the foundation slab and would be continued in order to create the wall steel reinforcement. The latter would be contained within steel shutters and filled with concrete. These techniques are outlined in Section 5.18.2.8 and 5.18.2.9 and shown in Images 5.29 and 5.31. Depending on the design, internal columns may be required to support the concrete roof slab similar to those shown in Image 5.38.

559. Imported soil would be required to build the earthen embankments. Initially, an impermeable membrane would be applied to the roof structure before the green roof is laid. Light load bearing plant would be used to place the materials on top of the structure. The earthen side slopes would be formed in layers with the use of earth-moving equipment such as excavators; vertical drainage would be incorporated into the earthen slopes. This would ensure the stability of the side slopes. The drainage off the reservoir would be collected by the internal site drainage.

560. The construction of the TPR structure would be expected to take approximately 8 months from autumn Year 3 to summer Year 4.

5.22.2.9 Chlorine Dosing Control Building

561. The Chlorine Dosing Control Building would be 40m wide by 40m long and approximately 8.4m high with a flat roof design to tie in with the reservoir. It would be founded on concrete strip footing requiring removal of the overburden to the shallow rock underneath.

562. The superstructure for the Chlorine Dosing Control Building would be constructed over the underground structure and would be constructed using structural steelwork, blockwork and cladding. The construction duration would be relatively short approximately 2 months in summer of Year 4.

5.22.2.10 MEICA Fit Out

563. MEICA fit out of structures and chambers would be undertaken by the appointed Contractor for MEICA works once the construction of the civil works has been substantially completed. It is expected that the fit out would be carried out over a ten-month period as structures become available and would include the following:

- OSEC disinfection system
- Sample pumps and dosing pumps
- Water quality monitors
- Valves, actuators, meters, level and other instrumentation, cabling
- SCADA and telemetry
- Surface water drainage pumping station
- Auxiliary services (water, heating, lighting, welfare, security).

564. The installation of PV solar panels with a Battery Energy Storage System would be undertaken as part of the fit out with an array of panels erected on the roof of the TPR.

5.22.2.11 Internal Roads, Parking and Footpaths

565. The permanent access road, internal circulation road, car park and walkways would be constructed to facilitate access to the TPR during operation. This would be formed from the temporary internal roads as described in Section 5.22.2.3, once the main construction works had been completed. For internal roadways and parking areas a 500mm base layer of stone fill would be constructed at formation level and would be overlaid with bituminous binder course of 60mm in depth and 45mm surface asphalt course. Pathways around buildings would consist of a 500mm base layer of stone fill, overlaid by a concrete footpath of 100mm depth.

5.22.2.12 Permanent Site Access

566. Construction Phase and Operational Phase access for the TPR would be from the R120 Regional Road. The R120 comprises two 2.4m wide traffic lanes and has a grass verge greater than 3m on the far side and a 1.2m wide footpath on the nearside, at the proposed access point. The temporary site access would have to be converted into the permanent site access road at the end of construction. This would include scarifying the surface, regrading it and surfacing with asphalt. In addition, the permanent junction on to the R120 would be completed including the final surfaces, splayed junction boundaries for sight lines, final fencing / boundary treatment and planting.

5.22.2.13 Landscape and Boundary Treatment

567. Excavated material from the construction of the TPR would be used on-site as part of the construction of the earth banks around the reservoir and to reinstate the construction working area and achieve finished ground levels.

568. Surplus excavated material from the construction of the TPR would be transported to suitable off-site re-use or licensed/permitted facilities in accordance with relevant regulations and the Construction Waste and By-Product Management Plan.

569. The permanent security fencing would be erected around the permanent infrastructure as part of the completion of the Construction Phase. Any remaining temporary fencing would be replaced with the final boundary treatment including at the permanent access. This would include the installation of the post and rail fence, or equivalent which would mark the ownership boundary of the site.

570. As part of the demobilisation of the site, habitat planting including a new woodland and native species rich meadows would be planted. Further details on the landscaping treatment of the site can be found in Chapter 16 (Landscape & Visual) and Figure 4.97 and 4.98.

5.22.2.14 Construction Site Demobilisation

571. On completion of the Construction Phase, all construction facilities and equipment, such as plant, materials, site offices, signage and laydown areas, would be removed from site.

5.22.3 Commissioning of the TPR

572. As part of the testing and commissioning of the Proposed Project all power, control and instrumentation systems would need to pass the FAT and once installed, SAT. These would all be undertaken 'dry'. This would include all comms links to the other Infrastructure Sites.

573. Full 'wet' commissioning of the TPR can only take place once the pipeline from the BPT to TPR is operational and water available from the WTP. A pre-requisite of this would be at least partial commissioning of the RWIPS, WTP, BPT and pipelines in order to provide water for testing.

574. A hydraulic test would be required on the completed TPR structure to confirm that there are no leaks in the structure. The hydraulic procedure for testing the TPR is set out in the Appendix A5.2 (Commissioning Strategy) and would be carried out in the following sequence:

- Step 1 – Conduct a water ingress test on the structure, especially the roof
- Step 2 – Thoroughly clean the structure of all construction materials, dirt and dust
- Step 3 – Clean the internal faces with high pressure water jets
- Step 4 – Disinfect the internal faces of the structure with super chlorinated water

- Step 5 – Fill one cell to the overflow level with water from the WTP via the Treated Water Pipeline from the WTP to the BPT, BPT, BPS and Treated Water Pipeline from the BPT to the TPR. Each cell would be tested independently, and the same water would be used for the three cells
- Step 6 – Leave cell for a minimum 24-hour period as there would be a certain degree of absorption by the concrete structure, and then take a water level measurement
- Step 7 – Begin test for a set period (typically seven days) and then remeasure the water level. If the water level drop is within the set limits, then the structure has passed the hydraulic test. If not, identify cause of water loss, remedy and repeat Step 7 until a successful test has been concluded.

575. The TPR would then require a sweetening flow to prevent stagnation and, subject to acceptable water quality testing, this flow can be passed forward into supply via the existing Peamount Reservoir.

576. The TPR would then be available to facilitate commissioning of the FCV and subsequently, the BPS.

5.23 Proposed 38 kV Uprate Works – Power Supply to RWI&PS and WTP

577. The Proposed 38 kV Uprate Works would be completed by ESNB, who would be obliged to comply with all the commitments set out in this EIAR and the accompanying Natura Impact Statement. In addition, ESNB would be required to comply with any conditions that may be attached by An Coimisiún Pleanála to any planning approval that may be granted for the Proposed Project.

5.23.1 Proposed Construction and Commissioning Programme

578. Based on ESNB’s experience of previous similar works on 38 kV infrastructure, it is anticipated that the proposed uprate works would take up to 12 months to construct. It is anticipated that, subject to planning approval from An Coimisiún Pleanála, the Proposed 38 kV Uprate Works would commence in 2029.

579. Over the 12-month construction period, the works would be carried out by dedicated ESNB crews and/or appointed Contractors working on behalf of ESNB and would be scheduled sequentially to optimise ESNB resources. An indicative construction schedule for the key elements is shown in Image 5.44.

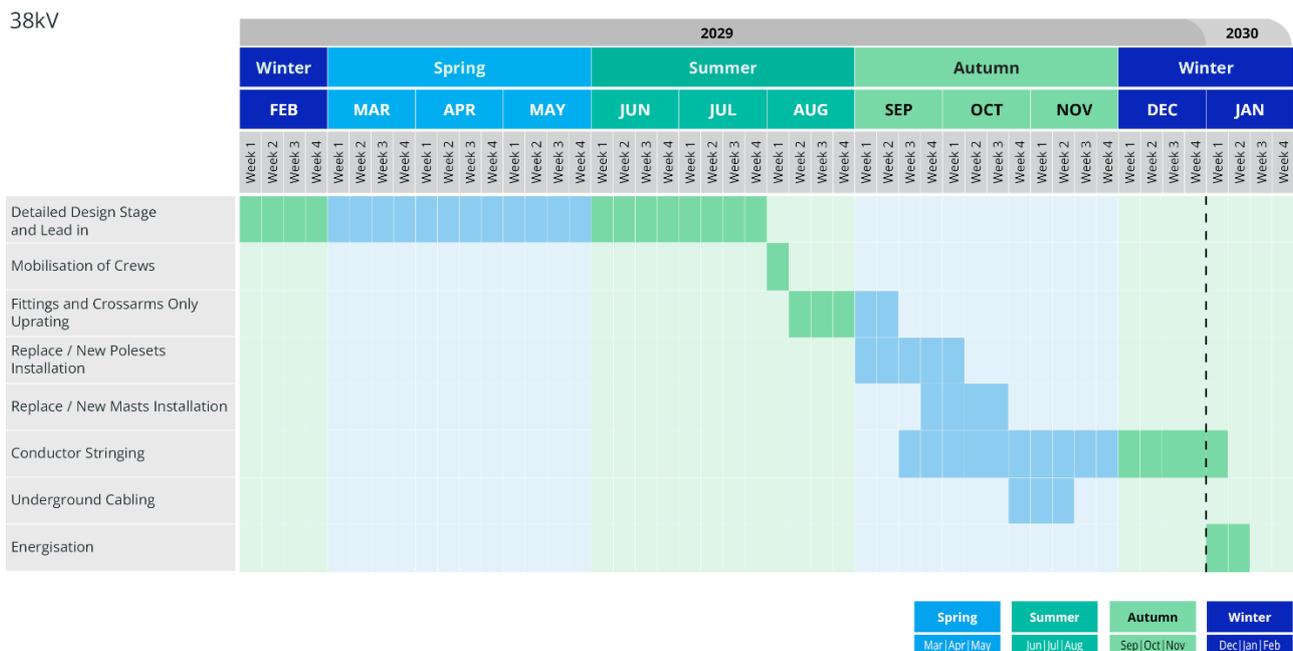


Image 5.44: Indicative Duration and Phasing of the Proposed 38 kV Uprate Works

5.23.2 Construction Compounds

580. The existing ESBN Depot on Rosbrien Road in Limerick would be used to store construction materials prior to transfer to the required locations on an as-needed basis. It is located to the south-west of Limerick City Centre and is approximately 6km south-west of the Ardnacrusha Generating Station. The depot would act as ESBN's operational hub for plant/material/worker movement and general storage required during the Proposed 38 kV Uprate Works. Administration, logistical support and technical design input would be carried out by ESBN staff from existing depots, either local to the area or nationally, as appropriate.
581. In addition to the use of the existing ESBN Depot, and as is typical of ESBN works where staff are expected to be present at a location for a number of consecutive days, the construction crew may set up temporary construction facilities at the location of the specific worksites. These would typically include sanitary and welfare facilities but may, on occasion, include additional services (such as desk workspace or printing facilities) as deemed necessary. Any temporary construction facilities would be located so as not to cause an obstruction on the road or to landowners.

5.23.3 Access and Temporary Construction Roads

582. A key element in the construction planning is identifying suitable access routes to all structures where works need to be undertaken. The public road network would be used in the first instance to gain access to the general vicinity of the proposed works. Access to each individual structure, which would be typically located on private land, would use an access route identified by ESBN.
583. ESBN endeavour to use existing farm entrances and tracks and/or tracking across farmland where land conditions are suitable. Accesses to structure locations would be carefully selected to avoid adverse impacts on the surrounding area. Careful and considered local consultation would be carried out with all affected landowners to ensure that the minimum amount of disturbance would be caused. Indicative access routes are shown on Figures 8.4 to 8.10 inclusive.
584. The method of access, whether simply traversing across existing fields or laying surface protection materials such as aluminium bog mats, would depend on the nature of the works to be undertaken at each site, the plant and equipment to be used, the local ground conditions and the ecological sensitivity of the area. Existing trackways would be used where suitable and available. If a proposed access route should become unavailable during construction, an alternative access route would be identified by the Project Team, developed in accordance with the relevant method statements and agreed with the relevant Local Authority. The duration for constructing the access track would differ from site to site. It would typically take a day to construct but may take longer depending on the length required and the prevailing site conditions.
585. Access in any peat area or wetland would be achieved using wide tracked, low ground pressure vehicles to minimise damage to the surrounding ground. In particularly sensitive or wet areas, aluminium bog mats would be installed to mitigate any possible damage to the terrain used to access, and within, the proposed works (as shown in Image 5.45).
586. The temporary access routes may need to cross watercourses, which would use the same methods as described in Section 5.27 such as clear span bridging. There is no requirement to provide temporary crossing infrastructure for the River Shannon or the Headrace as existing public road crossings would be used throughout the works for these watercourses.



Image 5.45 Example of Aluminium Bog Mats in Poor Ground Conditions

5.23.4 Construction Methodology

5.23.4.1 Overview

587. The construction works to the existing 38 kV line would need to be undertaken during agreed outages, i.e. a period of time where the line is switched off for safety reasons. However, the outages would not affect customers/users, as they would remain supplied using alternative parts of the network. This is the approach ESNB adopted to the recent upgrading of the southern line, in the same geographic location as the Proposed 38kV Uprate Works and has been confirmed with ESNB.

588. The proposed works involve alterations to most of the existing structures and a detailed list of the uprate works proposed is provided in Chapter 4 (Proposed Project Description). The typical methodology and equipment to be used for the proposed works is provided in this section. Appendix A4.3 (Pole Details and Works for the Proposed 38 kV Uprate Works) details the precise work to be carried out at each poleset.

5.23.4.2 Substation

589. The works required at the existing Birdhill 38 kV Substation would largely lie within the existing site footprint. The work would include site clearance and removal of the existing poles to allow these to be replaced with new poles. A new 38 kV Gas Insulated Switchgear Modular Building would be constructed. This would be a maximum of 4.8m high and have 28m² of floor area with associated lighting and drainage. The site would be served by a new access road within a new 2.6m high palisade fence.

5.23.4.3 New and Replacement Overhead Lines

5.23.4.3.1 Enabling Works

590. Before commencing works to the 38 kV lines, existing power infrastructure such as LV or MV distribution lines, public roads and other features would be 'guarded' to protect them from the conductor works. This typically requires two guard poles to be erected on either side of the 'conflict' and at a slightly lower height than the 38 kV line structures as shown in Image 5.46. The guard poles are generally stayed with stay wire and stay blocks to secure them in place. Once erected, these prevent the conductor from coming in contact with the live LV/MV lines or with vehicles using public roads should the conductors drop during installation. Once stringing is complete, the guard poles and stays are removed and the ground reinstated.

591. An alternative method involves the use of preformed concrete blocks weighing several tonnes, which are placed at the guarding locations. The guard poles are installed into the blocks and additional concrete stay blocks are used to secure the structure. The guarding poles and concrete blocks are removed and the ground reinstated when stringing works are completed.



Image 5.46: Typical Guard Pole Arrangement

5.23.4.3.2 Wooden Poleset Replacement/New Wooden Poleset

592. The replacement or installation of a wooden poleset requires the transportation of two wooden poles, crossarms and fittings to the construction site immediately adjacent to and in line with the poleset to be replaced or existing alignment of the overhead track. These would be brought to site by a low ground pressure tracked excavator along the access track.

593. The average working area would extend 15m around the base of the poleset. Two trenches would be excavated to a depth of 2.3m. The top layer would be excavated first and stockpiled adjacent to the construction area on bog mats or other suitable material. The lower subsoil would be stored in a similar fashion separately. Each pole would be buried to a depth of about 2.3m in the ground with the excavation carried out using a tracked excavator and would be pushed into a vertical position. The pole would be supported at all times while the excavation is backfilled using a smaller tracked excavator. Prior to erection, a new crossarm may be attached to the wooden pole.

594. A 0.8m deep trench is also required perpendicular to the direction of the line to install wooden sleepers. These sleepers add additional stability to the poleset and are attached to the poles using a U-bolt. Where replacement of stays is required, these would be anchored into concrete or wooden stay blocks which are buried underground to a depth of about 1m.

595. In the case of replacement polesets, the old poleset would be cut down to 0.5m below ground level and would be lifted out of the ground before backfilling the hole with topsoil on the surface. All old equipment would be removed from site and would be returned to the ESNB Depot at Rosbrien Road for future reuse or disposal as waste in accordance with existing procedures at the depot.

5.23.4.3.3 Angle/End Mast Erection/Replacement

596. Angle/end mast steel structures may need to be replaced in some locations. In such cases, it would be necessary to detach the conductor from the existing structures and to use temporary structures while the works are undertaken. The temporary poles would be erected in the same manner as the replacement/new wooden poles described in Section 5.23.4.3.2 and may be stayed in position, depending on ground conditions.

597. Once the body of the existing angle mast has been restrained (braced to the mobile crane), the legs would be cut at ground level using a specialised saw before removing the mast body from the foundation. The mast body would be dismantled, and the steel members removed off site to the ESNB Depot on Rosbrien Road for recycling or reuse as appropriate. An excavator would then excavate around the existing foundation blocks so that they can be removed. A rock breaker attachment would be used to break out the foundation, and a tipper lorry would be used to transport the waste concrete material from site for disposal/recovery at an appropriate licensed facility.

598. Following removal of the old foundations, the locations of the new foundations would be set out by a surveyor before excavation. An excavator would excavate each of the four foundation bases to the required dimensions (approx. 2.3m x 2.3m x 2.3m) and formation level. Excavated material would be segregated into topsoil and subsoil and stored on bog mats for future backfilling.

599. Following the installation and curing of the new foundation, a mobile crane would erect the body of the angle/end mast. The mobile crane would operate from a suitable location and, if required, bog mats would provide a platform for the crane around the structure base. Mast sections would be assembled on the ground adjacent to the foundation and lifted into place and fixed using bolts.

600. Access to and from the sites of angle/end mast replacement works would be as described in Section 5.23.3.

5.23.4.3.4 Crossarm and Fittings Replacement

601. The crossarms link the structures and the fittings and are what the conductors are attached to. An example of crossarm replacement works is shown in Image 5.47. A Mobile Elevated Work Platform would typically be used to gain access at the required height to replace the crossarm fitting.



Image 5.47: Example of 110 kV Crossarm Replacement Works (Same Principle Applies to 38 kV) (Photo Courtesy of ESNB)

602. New fittings would need to be installed on every structure to allow the clamping and isolation of the conductors to the crossarm and structures. The equipment can be transported by quad bike to the poleset location. Where space allows, a Mobile Elevated Work Platform may be used to lift the workers to the required working height. Where the space is limited, the construction workers would manually climb the poles where fittings need to be replaced. Construction activities would be of a manual nature only with pulleys and chains being used and no heavy equipment is required.

5.23.4.3.5 Stringing of Conductor

603. Stringing of overhead lines refers to the installation of phase conductors (line part) onto the structures supporting the distribution line (poles). The Proposed 38 kV Uprate Works involve restringing the entire route with new conductor. Stringing occurs in straight sections, typically up to a maximum of 2km, between structures, with each section completed before the next section is started.

604. The methodology involves connecting the new conductor to the existing conductor using stringing stockings (shown in Image 5.48) and using the existing conductor as a pilot line. The new conductor is then pulled from the start of the section to the finish through the pulleys mounted on the structures. The use of the existing conductor as a pilot line minimises the potential for ground disturbance, as installing a dedicated pilot line would require stringing from structure to structure to allow the new conductor to be pulled through.



Image 5.48: Indicative Example of Stringing Stockings (Used on Cables Installed in a Trench Here) (Source: Thorne & Derrick International (2024))

605. The conductor is kept clear of all obstacles along the straight section by applying sufficient tension. Once the new conductor is connected to the new or replacement structures, the temporary poles are then removed. A typical tension stringing layout is shown in Diagram 5.48. The process of stringing typically requires the use of mechanical equipment to apply sufficient tension to the conductor. This equipment is referred to as a ‘puller-tensioner machine’ and a typical example is shown in Image 5.50. The puller-tensioner machine is ideally located at either end of the section of line being strung (as shown in Image 5.49) but, depending on local conditions, may be located between the start and end of the section being strung. This less preferred arrangement is referred to as back-stringing.

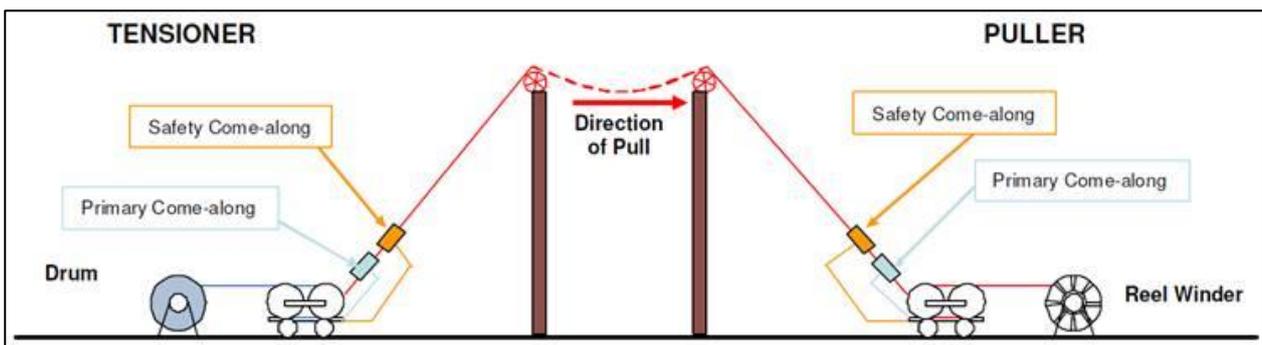


Image 5.49: Typical Tension Stringing Layout (Illustration Courtesy of ESNB)



Image 5.50: Example of a 'Puller-Tensioner Machine' and Stringing Set Up (Photo Courtesy of ESNB)

606. The lengths of conductor wire are brought to site in a reel, referred to as a 'conductor drum' (see Image 5.51). Puller-tensioner machines and conductor drums would be located on matted platforms at locations behind the structures at each end of the section to be strung.



Image 5.51: Example of Electrical Cable Drums (Source: Reka Cables (2021))

607. The conductor is pulled into position before being cut from the puller-tensioner machine and sagged or cut to the correct length for its final position. Once the line section has been tensioned, the conductor is removed from the pulley wheels and clamped to the insulators at each structure. The pulley wheels are removed from the structures and taken off site.
608. The average duration of stringing works is typically two weeks per straight section. This would not vary significantly with the length of the straight section as the most time-consuming aspect is the movement and setup of the stringing equipment. Construction crews may be up to 15 workers.
609. Although there are no known records of bird collisions with the existing power lines, new bird flight diverters would be installed at the River Shannon and Headrace crossings to help reduce the likelihood of bird collisions. The markers are typically fitted on the two phases (lines) at 20m intervals staggered in relation to each other by 10m. A typical example of a spiral-type bird flight diverter is shown in Image 5.52. The flight diverters would be installed by two people: one person installing on the line and one person spotting from the ground. The installer would typically climb up the nearest pole structure and the spotter would pass up, using ropes and pulleys, the diverters to be fitted and the installer would travel along the line using a bicycle and fit the diverters.



Image 5.52: Flight Diverters Installed on Overhead Line (Inset: Typical Spiral-Type Flight Diverter) (Photo Courtesy of EirGrid)

5.23.4.4 Underground Cable

610. As shown on Figure 4.6, a section of the southern line (Ardnacrusha – Birdhill – Nenagh Line) (east of the R494) running in a northerly direction to the Birdhill 38 kV Substation would be placed underground. Traffic management would be required for the works to the local road network, in the same manner as described in Section 5.27.

611. The underground cable installation would require the provision of three cable ducts. These would be laid in a trench excavated using a backhoe or excavator and typically measuring 0.6m wide by 1.2m deep, as shown in Image 5.53. The ducts would be held in place by a cement-bound granular mixture. On top of this, plastic warning strips would be laid (for health and safety requirements) and two further ducts laid side by side within which communication cables would be contained. The remainder of the trench would then be backfilled and the surface reinstated to a condition agreed with the relevant landowner. The cables would be installed at a later date by pulling these in sections through the installed ducts.



Image 5.53: Typical Layout of Underground Cable Trenching and Ducting (Source: EirGrid)

612. Underground joint bays would be required typically every 600m to 800m where separate cable lengths are joined together. These would typically be 4.5m by 2.0m and 1m in depth and would be backfilled and reinstated. An example of a joint bay is shown in Image 5.54.



Image 5.54: Typical Joint Bay Construction Adjacent to Public Road

5.24 Pipelines

613. There would be three sections of pipeline along the length of the Proposed Project. These would be

- The RWRM
- The Treated Water Pipeline between the WTP and the BPT
- The Treated Water Pipeline between the BPT and the TPR.

614. The Treated Water Pipeline between the BPT and TPR has then be further sub-divided into sections for ease of reference.

615. This is shown in Image 5.55.

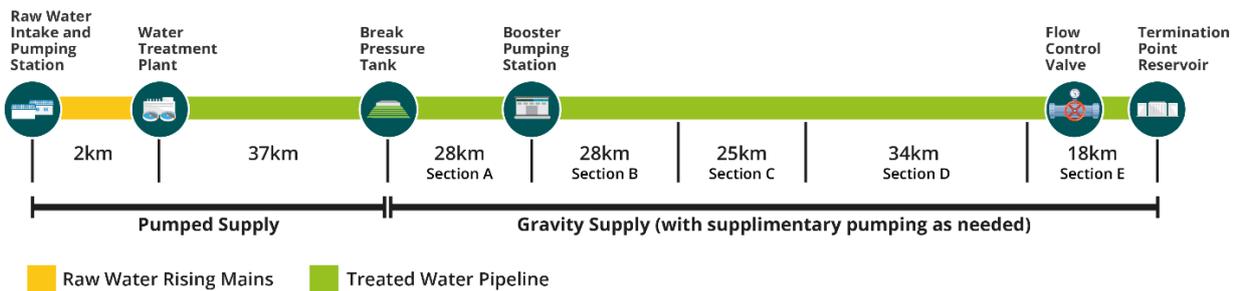


Image 5.55: RWRMs, Treated Water Pipeline from the WTP to the BPT and Treated Water Pipeline from the BPT to the TPR

5.24.1 Construction Phase Activities, Duration and Phasing

5.24.1.1 RWRMs

616. Twin 1,500mm diameter RWRMs would convey raw water from the Raw Water Pumping Station Building at the RWI&PS to the WTP. Access to the RWRMs Construction Working Width would be from the RWI&PS and WTP sites only.

617. The construction of the RWRM would take five years from pre-commencement activities to commissioning. However, as shown in Image 5.56 the RWRM would be constructed early in the overall construction programme and there would be a period of time between the completion of the main infrastructure and the completion of the construction of the rest of the Proposed Project to allow the final testing and commissioning to be undertaken. The main earthworks and laying of the pipe would be approximately eleven months and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be in 2029. Image 5.56 outlines the duration and phasing of construction activities associated with the construction of the RWRMs.

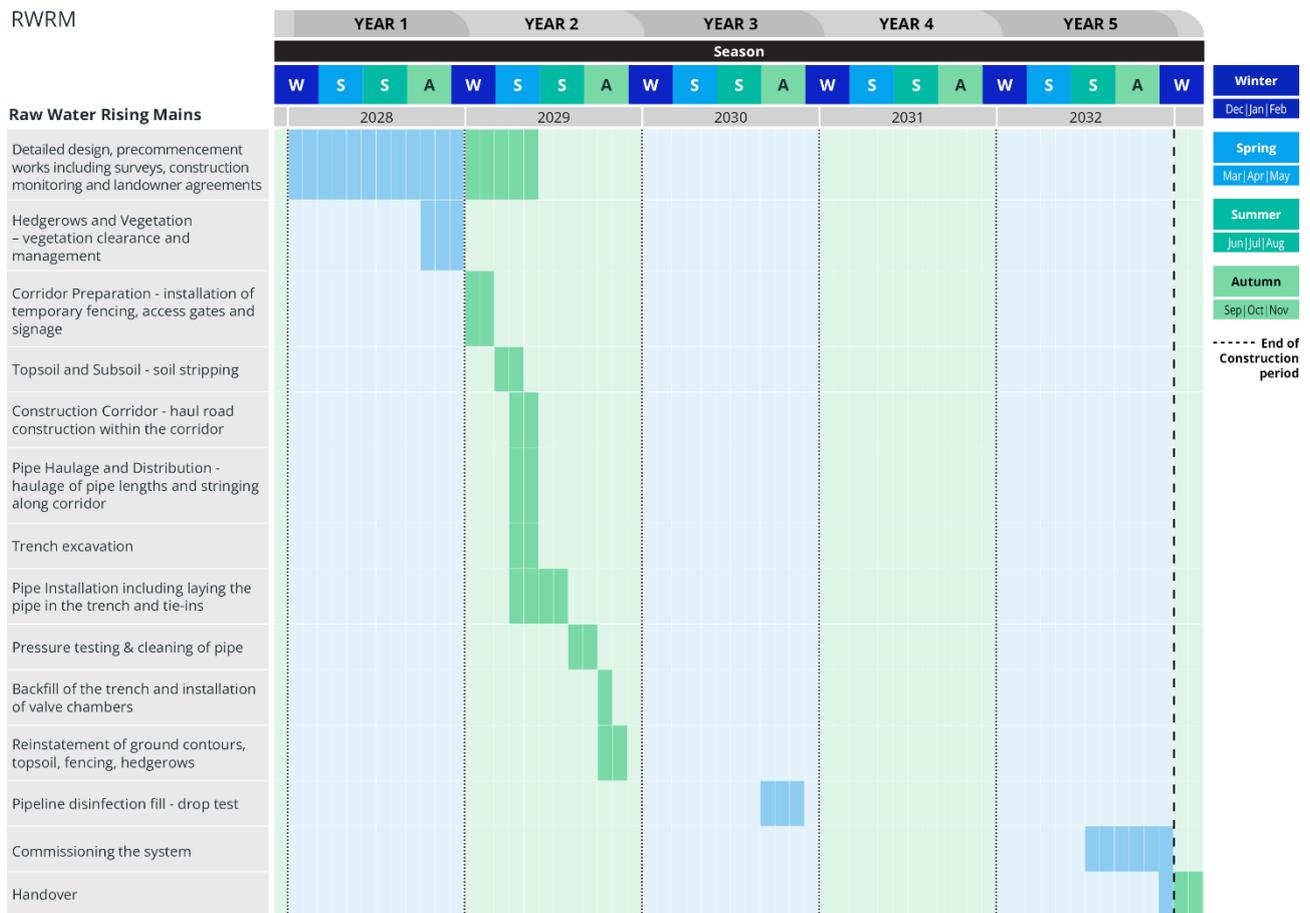


Image 5.56: Construction Phase Activities, Duration and Phasing for the RWRMs

618. The timeframe of specific activities would be outlined in the detailed construction schedule produced prior to the commencement of construction works. Landowner Liaison Officers (LLOs) would engage with the landowners to keep them informed on the proposed schedule for the works on their land. The detailed construction schedule would also identify the sequencing as to whether the works can be constructed from the RWI&PS, from the WTP, or from both directions simultaneously towards the R494 Regional Road.

5.24.1.2 Treated Water Pipeline from the WTP to the BPT

619. The Treated Water Pipeline from the WTP to the BPT would be constructed in a number of manageable lengths to coincide with completion in a single pipe laying season. A new portion of the Construction Working Width would be ‘opened up’ once works in the previous construction area are suitably progressed and nearing completion. The length of Construction Working Width that would be opened up would vary depending on the location, and access points, from the public road (as described in Section 5.11.2) but would typically be between 5km and 15km.

620. Construction may not always occur in sequence along the Construction Working Width. The order in which each portion is opened for construction would be selected based on operational constraints such as weather, ground conditions, resource availability and other construction considerations. This would minimise the risk of opening a portion of the Construction Working Width and then not being able to complete the construction of that portion in a reasonable timeframe in any given single pipe laying season due to construction constraints.

621. The order and timeframe for construction would be outlined in a detailed construction schedule prior to the commencement of construction works, and the LLOs would continue to engage with the landowners to keep them informed on the proposed schedule for the works on their land.

622. As described in Section 5.3 the Treated Water Pipeline would be constructed over three years and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be Year 2 to Year 4. The total duration of construction for the pipeline from on-site pre-commencement activities to demobilisation would be 5 years. The duration of the effect on a single landowner during this period is described further in Section 5.24.1.4.

623. Image 5.57 lists the duration and phasing of construction activities associated with the construction of the Treated Water Pipeline from the WTP to the BPT. Section 5.24.1.5 provides further details on the restrictions on the timing of earthworks during the construction of the pipeline.



Image 5.57: Construction Phase Activities, Duration and Phasing for the Treated Water Pipeline from the WTP to the BPT

5.24.1.3 Treated Water Pipeline from the BPT to the TPR

624. The approach to the construction of the Treated Water Pipeline from the BPT to the TPR is similar to the Treated Water Pipeline from the WTP to the BPT; see further Section 5.24.1.2, Section 5.24.1.4 and Section 5.24.1.5.

625. As described in Section 5.3 the Treated Water Pipeline would be constructed over three years and it is anticipated that, subject to planning approval from An Coimisiún Pleanála, this would be Year 2 to Year 4. The total duration of construction for the pipeline from on-site pre-commencement activities to demobilisation would be 5 years. The duration of the effect on a single landowner during this period is described further in Section 5.24.1.4.

626. Image 5.58 lists the duration and phasing of construction activities associated with the construction of the Treated Water Pipeline from the BPT to the TPR. Section 5.24.1.5 provides further details on the restrictions on the timing of earthworks during the construction of then pipeline.

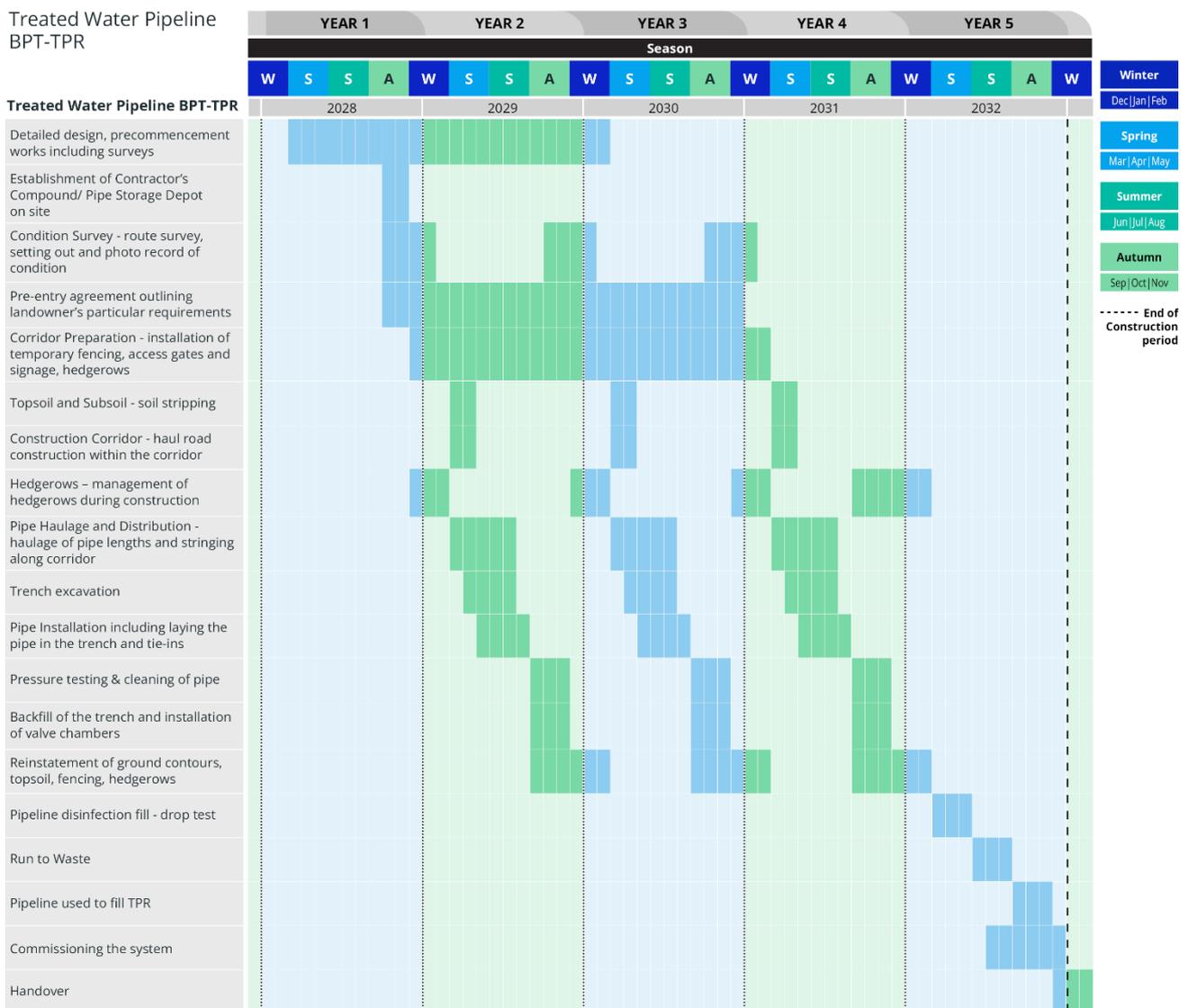


Image 5.58: Construction Phase Activities, Duration and Phasing of the Treated Water Pipeline from the BPT to the TPR

5.24.1.4 Hand Back of Construction Corridor

627. The overall construction of the Proposed Project is estimated to be five years. However, based on the approach outlined in Section 5.24.1.1 to Section 5.24.1.3, and as described in Section 5.3 the timescales in the majority of locations would be shorter, with approximately 24 months between the initial occupation of the land and subsequent 'hand back' subject to any seasonal constraints for reinstatement. Image 5.59 shows a typical duration and phasing of construction activities associated with initial possession of land and subsequent hand-back to the landowner (not including commissioning).
628. Whilst the return of lands occurs within approximately 24 months, the appointed Contractor would require access to the 20m wide Permanent Wayleave during the final year of the programme and the commissioning phase to access the Air Valves, Manways, Washout Valves and Line Valves. This would involve localised excavation at Manways and Air Valves to gain access to the pipe to insert/extract the super chlorination spraying rigs (Appendix A5.2: Commissioning Strategy). It would also be necessary to access a limited number of Washouts to maintain a sweetening flow through the previously filled sections of the pipeline during this commissioning phase. These are listed in Appendix 5.2 Commissioning Strategy.

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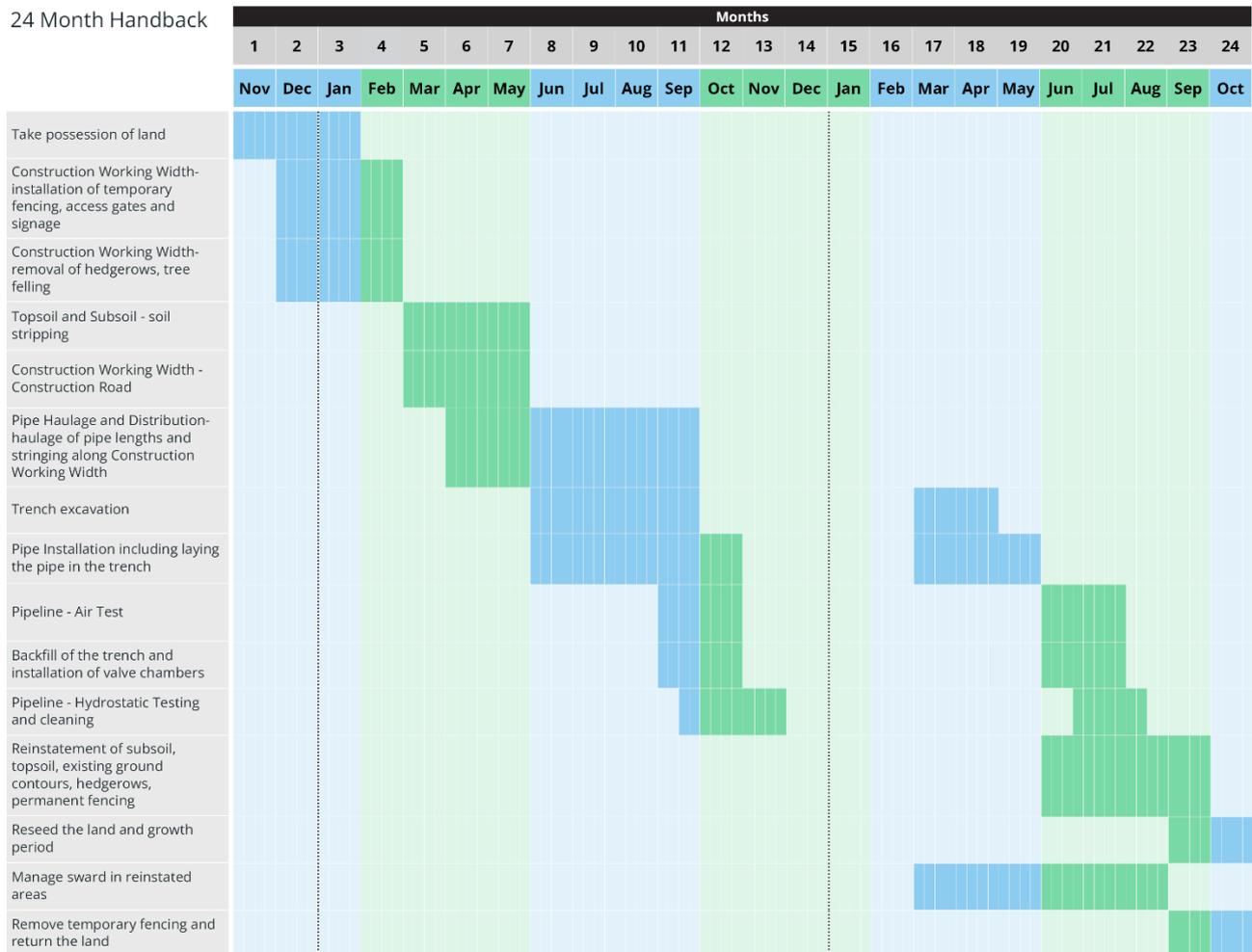


Image 5.59: Construction Activities – Initial 24-Month Hand-Back Period

5.24.1.5 Suitable Working Conditions for Terrestrial Pipelines

629. The earthworks associated with the construction of the pipeline, including topsoil stripping and excavation would only be undertaken in suitable weather conditions. This means they would not be undertaken during periods of heavy rainfall where the ground would be water-logged and / or frozen. For the purpose of planning the works this has meant that the earthworks associated with the pipeline, and therefore, the construction of the pipeline generally would be completed outside of the winter period. The 'winter' has been defined as the period from December to February inclusive.

630. In addition, land would not be handed back during this time, as the Proposed Project would still be considered to be 'in construction' until a time when it can be reinstated appropriately and sufficient time has passed for the land to recover.

631. However, preparatory works such as pre-construction surveys, the removal of sections of hedgerow for pipeline crossings, demarcation of the Construction Working Width with wayleave fencing, establishing construction access to the Construction Working Width, installing pre-construction drainage, and other advanced works such as pipeline installation by trenchless construction techniques at major crossings may take place during the winter to allow the pipelines to be constructed efficiently. Installation and fit out of valves, washouts and outfalls, power connections and the welding of pipeline could also take place during the winter period provided earthworks were not needed, during that period, to facilitate such works.

5.24.2 Construction Methodology – Pipelines

632. This section discusses the construction approach, methods and techniques that would be employed for the pipelines. Section 5.24.3 outlines the specific measures for the RWRMs that differ from the general approach to pipeline construction.

633. The proposed pipeline would incorporate several associated components, such as:

- Valves including Line Valves, Washout Valves, Air Valves, FCV (described in Section 5.25)
- Ancillary infrastructure such as valve chambers, Cathodic Protection and kiosks (described in Section 5.26).

5.24.2.1 Sequence of Construction

634. The general construction sequence for the pipelines is outlined in Table 5.24.

Table 5.24: Sequence of Construction Activity – Pipelines

Sequence	Construction Activity
1	Initial Pipe Storage Depots and Construction Compounds set up to support advanced works
2	Pre-condition surveys, site investigation, boreholes, trial pits, establish monitoring sites for ground movement and groundwater levels
3	Corridor preparation works including vegetation clearance, hedge netting, badger sett and bat roost relocation, topsoil and subsoil stripping, fencing and constructing temporary Construction Road. Completion of Pipe Storage Depots and Construction Compounds set up to support the phased installation of the pipeline
4	Early commencement of trenchless sections so they are ready for when the pipeline arrives at the trenchless location (if feasible)
5	Pegging out of the pipe centreline and elevation survey points for trench depth
6	Lay out sections of the pipeline (pipes and bends and tees for Washouts and Air Valves) and weld short sections together including 100% non-destructive testing of welds and wrap joints externally
7	Excavate the trench for the pipe
8	Lift pipe sections into the trench and weld sections together

Sequence	Construction Activity
9	Partial backfilling of trench
10	Low pressure air test on installed sections
11	Fill pipe from temporary abstraction points and pressure test the pipe
12	Install Air Valves, Washout Valves and chambers
13	Internally swab clean the pipe section
14	Commence reinstatement of land in completed section
15	Install Line Valve infrastructure including power supply
16	Reinstate around Line Valves
17	Remove surface water interceptor drains and reinstate land drains
18	Complete site works in preparation for Operational Phase including final site access, landscaping and planting, and boundary treatment
19	Demobilisation of site
20	Temporary re-mobilisation for commissioning the pipeline
21	Re-excavation of Manways to facilitate disinfection by spray rig
22	Undertake commissioning including discharge of sweetening flow
23	Complete commissioning
24	Final demobilisation including demobilisation of PSDs and Construction Compounds

635. The pipeline material would be steel. The attributes of steel in construction as a pipeline material are summarised in Table 5.25. Coated steel pipes allow suitable excavated material to be reused in bedding and surround and limits the quantity of material to be disposed of off-site.

Table 5.25: Pipeline Material Summary

Features of Pipeline Construction	
Material	Steel with circa 12.5mm wall thickness
Typical pipe length	13.5m
Corrosion Protection	Externally a three layer continuously extruded polyethylene coating is applied. Internally a holiday-free fusion-bonded epoxy lining is applied During installation an impressed current CP system is added. CP is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell.
Jointing	Welded pipe and fittings. Flanges for valves and meters. Pipe welding usually carried out at ground level creating pipe 'strings' which are subsequently lowered into the excavated trench. Typically, pipe 'strings' are three or more standard pipe lengths, limited only by site constraints and suitability of plant/workers to carry out the operation.
Pipe restraint at bends	Welded joints.
Bedding (placed on bottom of trench)	Suitable excavated materials can be used as bedding.
Side fill (compacted side support fill material – between pipe and side of excavation)	Suitable excavated materials can be used. Requires compaction – need suitable soil.
Surround (typically to 300mm above crown of pipe)	Suitable excavated materials can be used as surround. Requires compaction. Alternatively, provide reinforced cement/mortar coating to pipe.

5.24.2.2 Pre-Commencement Activities

636. Prior to full site establishment there would be further ground investigation undertaken along the length of the pipeline to identify sub-surface constraints and inform the detailed design process. This would include investigation of major crossings including rivers and monitoring ground water. It would also include checks on services and archaeological investigation. To complete this work there would be temporary site access required, and temporary supporting facilities put in place. As part of this work there would also be environmental surveys and checks completed both prior to the ground investigation or other intrusive surveys and in advance of the full site establishment.

637. During this phase of the Proposed Project there would also be confirmation of arrangements with landowners including matters such as access during the works and temporary drainage diversions.

638. Any measures set out under the REAC would also be implemented during the site set up for the relevant section of the pipeline to which they relate. This will include, but is not limited to:

- Measures to manage potential vibration disturbance in sections of rock break out, trenchless crossing construction or temporary piling in areas of peat material
- Measures to manage airborne noise including night-time effects of trenchless crossing construction
- Measures to manage groundwater including the specific measures set out for Geashill Group Water Scheme.

639. Further information on these measures are set out in Chapter 6 (Noise and Vibration), Chapter 10, (Geology and Soils) and the CEMP (Appendix A5.1 including Annex G).

5.24.2.3 Cover to Pipeline

640. The engineered rise and fall of the pipeline along its longitudinal length would generally follow the existing ground profile to limit depths of excavation. The pipeline would be laid at a minimum depth of cover of 1.2m above the crown of the pipe. Generally, the depth to the top of the pipe would not exceed 4.4m except where required for specific crossings such as, trenchless crossing, (including those proposed for railway lines, strategic roads or a river) or where required by the hydraulic gradient in the pipeline. In areas of peat the maximum depth has generally been constrained to 2.5m to the top of the as far as reasonably practicable.

5.24.2.4 Surplus Excavated Material

641. During the Construction Phase, the total volume of surplus excavated material displaced from the trenches for the RWRMs and Treated Water Pipelines would be of the order of 521,800m³.

642. Table 5.26 provides an estimate of when surplus excavated material from the pipelines would be generated during the Construction Phase. However, there is a deficit of approximately 99,500m³ of fill material required at the WTP. This shortfall can be partially made up from the surplus soil and would be supplemented by imported material brought into the WTP where it is deemed more practicable than drawing off from the Construction Working Width given the haulage distances involved.

643. The residual waste (surplus and unsuitable spoil) would be processed in a way that follows the waste hierarchy, ranging from reuse to recycling to disposal, in descending order of preference and in compliance with applicable laws and regulations and in accordance with any of the relevant Local Authority Waste Management Plans. The Construction Waste Management Plan would be implemented to minimise waste and ensure correct handling and disposal of construction waste streams (including surplus soil) in accordance with the Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects (EPA 2021) (refer to Chapter 19: Resource & Waste Management).

Table 5.26: Estimated Programme for the Creation of Surplus Excavated Material (Pipelines)

Year 1				
Quarter	Summer	Autumn	Winter	Spring
Volume of Surplus Excavated Material (m ³)	-	-	-	-
Year 2				
Quarter	Summer	Autumn	Winter	Spring
Volume of Surplus Excavated Material (m ³)	7,300	205,800	-	-
Year 3				
Quarter	Summer	Autumn	Winter	Spring
Volume of Surplus Excavated Material (m ³)	-	205,800	-	-
Year 4				
Quarter	Summer	Autumn	Winter	Spring
Volume of Surplus Excavated Material (m ³)	-	102,900	-	-
Year 5				
Quarter	Summer	Autumn	Winter	Spring
Volume of Surplus Excavated Material (m ³)	-	-	-	-

5.24.2.5 Condition Survey

644. Before any construction work commences, a team of experienced surveyors would survey the Construction Working Width of all features that have the potential to be impacted or affected by the Proposed Project. Uisce Éireann would prepare a written record of the condition of any affected property, which would describe the type and condition of boundary fences, any as-laid drainage from existing landowner plans and the type and quality of the land affected. In addition, the locations of any private water supplies and boreholes would be recorded, as would the conditions of any tracks or private roads crossed by the pipeline. This written record would be supported by photographs where appropriate.

645. Uisce Éireann would also prepare a written record of the landowner's particular requirements in relation to, for example, temporary fencing, the provision of access across the Construction Working Width, alternative water supply and electric fences.

646. The Construction Working Width would be pegged out, as required, for the given location. Prior to anyone undertaking excavation works, the Dial Before You Dig services (Gas Networks Ireland 2021) provided by the various utilities would be used to obtain information on the location of underground pipes and cables in and around any proposed dig site. The contract-stage ground investigation would include mapping and electronic verification of the position of known services, and at the Construction Phase the position of these services would be exposed and marked before works commence near them. In addition, landowners would be consulted to help identify known services on their lands. The full Construction Working Width would be scanned using a cable avoidance tool to confirm the positions of existing services and infrastructure which may affect the works. These services would be marked with hi-vis plastic fencing (e.g. Netlon) or bunting (for overhead cables), in accordance with ESB Networks Code of Practice for Avoiding Danger from Overhead Electricity Lines (ESB Networks 2019), and warning signage and bog mat protection where required.

647. Where unforeseen services are encountered, the landowner, and if relevant the service provider, would be contacted by the LLO to discuss and help identify the service so that controls can be put in place. Where land drains which must be reinstated are encountered, their position would be marked and recorded by Global Positioning System (GPS) with wooden drain pegs on either side of the trench and referenced back onto the fence lines, with marker tape or some similar system, so that they can be suitably managed during construction and post construction.

5.24.2.6 Corridor Preparation

5.24.2.6.1 Fencing/Gates

648. All agreed access gates would be installed before the secured fencing is completed to ensure that any required landowner access is not impeded as described in Section 5.14.

5.24.2.6.2 Drainage

649. Additional drainage would be required in some locations to prevent deterioration of the working areas and to prevent excess water collecting in the trench during construction. Existing drainage lines may also be rerouted using a drainage trenching machine so that they continue to function during construction works. These would be installed in accordance with the individual landowner agreements.

650. The construction methodology would ensure that the drainage pattern of either the surface water or groundwater is not altered because of the pipelines. This would be achieved by using the native excavated material as backfill and avoiding the use of imported granular bedding or surround materials where possible. It would also be achieved using clay 'stanks' (illustrated in Image 5.60), which are sections of backfill across the trench in a low permeability material, to prevent unintended longitudinal drainage along the trench.

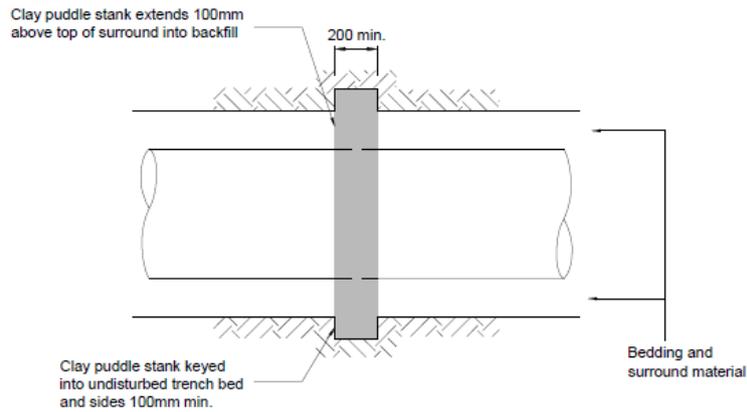


Image 5.60: A Typical ‘Stank’ – Impervious Membrane to Trench Longitudinal Drainage

651. In addition, settlement/attenuation lagoons would be located along the whole of the length of the pipeline at low points within the Construction Working Width as set out in the SWMP (Appendix A5.1 Annex A), and during pipeline construction trenches would not be left open for extended periods of time to prevent pooling of surface waters within open trenches. Further details on attenuation ponds are provided in Section 5.24.2.13.1 and on trench durations in Section 5.24.2.9.

5.24.2.6.3 Vegetation – Advanced Works Preparation

652. Vegetation would be removed as part of the preparatory works outside of bird nesting season (between 1 September and 28 February). Table 5.27 contains a schedule of commitments and summary of mitigation measures in relation to the removal of trees and hedgerows during the pre-construction works. A schedule of commitments and summary of mitigation measures in relation to the management of existing hedgerows during the Construction Phase is included in the CEMP (Appendix A5.1).

653. The National Roads Authority’s, Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority 2006), in relation to tree felling and hedgerow removal, would be followed throughout the site clearance phase of the Proposed Project.

Table 5.27: Hedgerows and Trees – Pre-Construction Objectives and Mitigation Measures

Mitigation Objective and Commitment	Mitigation Measure	Monitoring to Ensure Effectiveness of Mitigation
Minimise impacts to breeding birds	Where feasible, scrub, hedgerow or tree removal/trimming will be undertaken outside of the bird nesting period, which begins on 1 March and continues until 31 August, to protect nesting birds. All birds and their nesting places are protected under the Wildlife Act 1976 (as amended).	Monitored by Ecological Clerk of Works
Minimise impacts to bats	Confirmatory bat surveys/monitoring of specific mature trees identified for felling will be undertaken by a bat specialist prior to tree cutting (refer to Chapter 8: Biodiversity for more detail). Should it prove necessary, a derogation licence from the National Parks & Wildlife Service for the felling of any trees identified as bat roosts will be obtained.	

5.24.2.6.4 Preparation Works (Miscellaneous)

654. Other Construction Working Width preparation works may consist of the following:

- Erecting advance warning signs at road crossings in accordance with the Temporary Traffic Management Design Guidance (Department of Transport, Tourism and Sport 2019a) and Temporary Traffic Management Operations Guidance (Department of Transport, Tourism and Sport 2019b)
- Ensuring that services are well protected, including by erecting goal posts and bunting across the spread at overhead cable locations (these govern the height at which plant can pass safely underneath) in accordance with ESB Networks Code of Practice for Avoiding Danger from Overhead Electricity Lines (ESB Networks 2019) and excavation of trial holes or slit trenches to identify the depth, location and condition of existing services
- Preparation of the temporary Construction Roads within the Construction Working Width for the movement of the appointed Contractor's plant, materials and workers, and, if necessary, laying of bog mats on the access from the road into fields
- Excavation of trial holes to determine ground conditions, such as ground water levels, and identify bedrock locations
- Installing watercourse crossings, such as flume pipes, as appropriate to maintain uninterrupted drainage flows
- Tree pruning and tree protection in accordance with any landowner agreements before the works
- Generally carrying out any preparatory work identified by the LLO from any discussions with landowners to preserve hedges, trees, buildings or features within the Construction Working Width.

5.24.2.7 Topsoil and Subsoil

655. Soil stripping would be carried out during appropriate weather conditions when the soil is drier and more friable. Soil handling would be avoided during periods of persistent rainfall. This is described further in Section 5.8.3.2.

656. The topsoil would be stripped across the required works area to its full depth, or to a depth determined by the Agronomist/LLO engaged by Uisce Éireann, as described in Section 5.8.3.2 for the Construction Compounds and Pipe Storage Depots. The top layer of subsoil over the trench and the haulage area of the Construction Working Width would also be stripped to a depth determined by the Agronomist engaged by Uisce Éireann.

657. The topsoil would be kept separate from subsoil and stockpiled to one side of the working strip on unstripped land. A minimum separation distance of at least 1m would be kept between heaps of topsoil and subsoil to prevent cross contamination. Banksmen would watch over the stockpile of topsoil and separately the subsoil being preserved to ensure that mixing of the two does not occur and that material does not get pushed outside the Construction Working Width. The stockpiles would be up to 2m in height. Stockpiles would be built neatly and well-shaped to ensure, as far as possible, they are weatherproof. Topsoil removed from the banks of watercourses and ditches would be stockpiled separately to other topsoil.

658. The stockpiles would be located away from drains and watercourses and would follow the guidelines outlined in the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI 2016). The guidelines state that '*a buffer zone should remain between the silt trap and watercourse with natural vegetation left intact*' and that a riparian buffer zone must be sufficiently wide to protect the river. To achieve this, where the Proposed Project crosses a watercourse, stockpiles would not be located within 10m of a non-sensitive watercourse, or within 50m of a sensitive watercourse. The land topography (e.g. slope), soil type, channel width/gradient and critical habitats/species to be protected would be reviewed by the Ecological Clerk of Works (see Chapter 8: Biodiversity) to determine the exact width of the buffer zone, in consultation with IFI. For watercourses within or adjacent to the Proposed Project, but not crossed by the Proposed Project, where feasible, a buffer zone width would be maintained for larger river channels (>10m) of 35m to 60m, and for smaller channels (<10m) of 20m or greater, as per the recommendation in the Planning for Watercourses in the Urban Environment (IFI 2020), or as otherwise agreed with IFI during the Construction Phase. The stockpiles would also not be stored under overhead services or over underground services and gaps will be left at intervals along the topsoil and subsoil heaps to permit the maintenance of public permanent wayleaves and surface water management.
659. Once the topsoil and a portion of the subsoil have been suitably stockpiled, the remaining ground level may be further graded or benched to give a level surface and working platform along the side of the trench. The stockpiles would also be protected during construction activities and kept free from the passage of vehicles and plant and kept free of rubbish. The stockpiles would be kept free of weeds by chemical spraying with the landowner's consent or by other means of control requested by the landowner in advance of the measure being implemented. Other measures may be implemented to improve the protection of spoil heaps from construction activities or wind/water erosion. The method and level of protection would be dictated by the prevailing weather conditions, level of exposure and operational activities near the stockpiles. Some of these measures may include exclusion zones/fencing, plastic sheeting, weed spraying or sowing of grass/oats.
660. Image 5.61 shows a typical Construction Working Width with topsoil stripped and also includes several special crossings, a pipe storage area and a site laydown area for plant and offices.



Image 5.61: Construction Working Width – Topsoil Stripping

5.24.2.8 Pipe Haulage and Distribution

661. Pipes would be stored temporarily in the Construction Compounds or Pipe Storage Depots before being transported to the pipe laying area within the Construction Working Width for unloading when conditions allow. The pipe would be transported to site by lorry, or tractor and trailer, in individual lengths of a maximum of 13.5m. The pipe lengths would then be unloaded and placed along the corridor adjacent to the pipe trench in which they are to be laid. Image 5.62 shows pipe being unloaded.



Image 5.62: Steel Pipe Lengths Being Unloaded Using a Vacuum Lift

662. The pipe haul vehicles used would be suitable for the condition of the Haul Road in that location. Pipe lengths would be offloaded by vacuum lift excavator and laid end to end, parallel to where the trench in which they would be laid would be excavated (shown in Image 5.63). The pipe lengths would be cleaned, prepared and inspected prior to being welded together and then sections of pipe being lowered into the trench.



Image 5.63: Pipe Stringing along the Construction Working Width

5.24.2.9 Trenching (Generally)

663. The pipeline would mainly be installed using open-cut trenching. This is where a trench is dug using an excavator, or other plant appropriate to the soils and ground conditions, and the pipe then laid within the trench and backfilling it (shown in Image 5.64). The trenching operation would be conducted only once the pipeline installation and backfill crew are ready to install the pipeline in that location to minimise the duration that the trench is opened for, which at any given location may only be one to three days.

664. Before trenching commences, dewatering of groundwater may be required to ensure safe working conditions. Material from the trench would be stored next to the excavation at a suitable distance from it and separated from the stockpiled topsoil and subsoil reserved for reinstatement. This would be conducted in accordance with the final CEMP prepared by the appointed Contractor. As described in Section 5.4 this will be based on the CEMP contained within Appendix A5.1 and any updates or changes will not be permitted to reduce the level of environmental protection or environmental mitigation as defined in the CEMP in Appendix A5.1.



Image 5.64: Trenching Using Excavators

5.24.2.9.1 Trenching in Rock

665. Where the pipeline needs to be constructed through soft or fragmented rock, this would be broken up by excavators fitted with a ripping claw. Harder rock would be broken up by large hydraulic breakers fitted to excavators to break up the rock to formation level. Alternatively, due to rock strength or composition, a rock saw may be used to cut a trench along the centreline to trench bottom depth. In areas of extremely high strength rock, it may be necessary to use other methods of rock breaking. One such method involves drilling holes, typically less than 50mm nominal diameter in a grid pattern spacing of 200mm to 400mm, into the rock and injecting an expansive mortar which expands rapidly causing the rock to fracture.

666. Chapter 6 (Noise And Vibration) sets out measures that will be adopted where rock breaking would be required in proximity to residential receptors and which could have the potential to result in disturbance. This would include use of hydraulic rock breaking equipment or lower vibration emitting breakers for the rock breaking.

667. The broken-up rock from the above methods may not be excavated at the time of trench formation and may remain in situ until the pipe trenching/laying crews need to extract it. If the material is excavated and removed during trench formation, then suitable pegging, bunting and signage would be established for safety around the open excavation.

668. In areas where rock is encountered, it may be broken further, graded, and used during construction, such as in pipe bedding and surround material or for Temporary Construction Roads within the Construction Working Width, or transported off site to appropriately regulated facilities in accordance with the Waste Management Act 1996 (as amended).

5.24.2.9.2 Trenching in Peat

669. Trenching at locations where peat is present would be undertaken as described in Section 5.10 and in accordance with Appendix A5.3 (Methods of Working in Peat). Section 5.10 defines the length of the pipeline in peat materials, the proposed approach to construction, management of the risk of peat instability and reinstatement of the Construction Working Width. The construction techniques for trenching in poor ground would apply to areas peat material insofar as they relate to the Methods of Working in Peat (Appendix 5.3).

5.24.2.9.3 *Trenching in Poor Ground Material*

670. Where the poor ground material is relatively shallow and the subsoil is structurally sound, the poor material on top would be removed entirely over the width of the trench where it is feasible to do so, and the remaining subsoil would be excavated, and the pipe would be installed in a conventional manner.

671. In areas where poor ground material is deep, and it is not viable to remove to sound subsoil, a pipeline support system may be required, such as piled foundations. This method may also require use of a ground stabilisation process in which a cement-based grout is injected into the poor ground material to provide a more stable trench excavation before the pipe support piles are installed as shown in Image 5.65).



Image 5.65: Piling Machine in Operation

672. There are different piling methods that can create a firm base on which to lay the pipes. One method is to drive and cast in situ an end load-bearing pile, which is represented schematically in Image 5.66. This is where steel casings (circular tubes with a reinforced point) are driven into the ground by a reciprocating weight running inside it until they achieve the required 'set pressure' either by friction or being driven into a rock formation. The steel casings are fitted with a steel reinforcing cage (shown in Image 5.67) and backfilled with concrete. Some piles may be 20–30m in depth subject to the depth of the poor ground material.

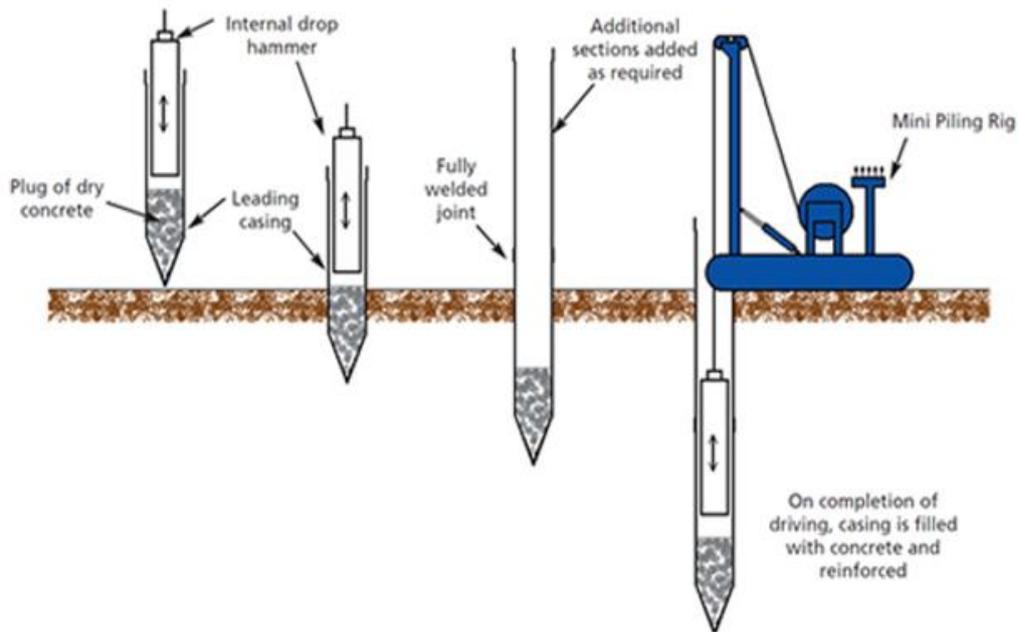


Image 5.66: Pile Driving Technique



Image 5.67: Typical Steel Piles with Reinforced End (Left) and Typical Steel Cage Fitted Inside Steel Pipe (Right)

673. These are cut, stripped, and tied into pipe collar supports to carry the weight of the pipeline. Other types of driven piles can also be used, including steel H-piles and steel pipe piles (as shown in Image 5.68 and 5.69).



Image 5.68: Steel H



Image 5.69: Steel Pipe Pile (Right)

674. Precast reinforced concrete piles, as shown in Image 5.70, can also be used. These are moulded in circular, square, rectangular or octagonal form; cast and cured in a casting yard; and then transported to the site for driving.



Image 5.70: Precast Square Pile

5.24.2.10 Pipe Installation – Open Excavation

675. Pipe installation would commence once the trench has been excavated and the pipe bedding layer has been prepared. Typically, three or four lengths of pipe would be welded together outside of the trench and then lifted and lowered into the trench with side booms/excavators. Once the pipe is in the trench, the ends of these longer lengths of pipe would be welded together to form a continuous string as shown in Image 5.71.



Image 5.71: Typical Pipe Installation

5.24.2.11 Pipe Installation – Trenchless Construction

676. Trenchless construction involves tunnelling beneath a feature rather than using a conventional open-cut method which causes a greater environmental impact or disruption. Typically, trenchless crossings are proposed underneath major crossings, for example major roads, railways, canals or watercourses.

677. Prior to commencing a trenchless construction a pre-construction assessment will be made regarding the potential for either ground borne noise / vibration, settlement and ground water effects. Mitigation will be adopted as set out in Chapter 6 (Noise and Vibration) for trenchless crossings in close proximity to residential properties and this will include consideration of the alignment of the crossing (given the Construction Flexibility defined in Section 5.3.3) and the design/selection of the cutting face for the tunnelling machine. Chapter 10 (Soils, Geology and Hydrogeology) sets out mitigation for managing groundwater risks during trenchless crossing construction including for example:

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e. Clear Bore Drilling Fluid or similar will be used)
- The area around the bentonite batching, pumping and recycling plant will be bunded using Terram geotextile (as it will clog) and sandbags in order to contain any spillages
- Drilling fluid returns will be contained within a sealed tank/sump to prevent migration from the works area
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped
- Any drilling fluid material will be contained and removed off-site
- The drilling location will be reviewed before recommencing with a higher viscosity drilling fluid mix.

678. A pre-construction assessment of the risk of settlement will be undertaken based on the final alignment of the trenchless crossing (given the Construction Flexibility defined in Section 5.3.3), monitoring and control of the drilling pressure and use of fast setting grout will help to reduce the risk of settlement.

679. Engagement will be undertaken with the relevant asset owners prior to construction.

680. Trenchless crossings take longer to construct (typically 6–8 weeks to construct) than open-cut methods and also require a wider Construction Working Width to facilitate the temporary works. In general, a minimum Construction Working Width increase from 50m to 80m, over a length of 80m, would be required. This ‘additional required area’ is referred to as a ‘box out’. Trenchless crossings can also have additional environmental effects, such as noise associated with the drilling and the method can also impact groundwater pathways and quality. Therefore, careful consideration is required when determining whether to use an open-cut or trenchless crossing, taking into account the sensitivity of a receptor and the disruption that may result.

681. Tunnelling would be used at major crossings and is an excavation method that installs the pipe behind the tunnel face shield by pushing, or ‘jacking’, pipes from a drive shaft or jacking platform. In some locations the shafts and tunnel drive would be below the natural water level, so a system of water management (using a settlement pond and discharge to land drain) would be installed to provide a suitably safe and relatively dry working environment within the excavation. The shafts would be up to 8m in diameter and would have suitable fencing installed around them (shown in Image 5.72).



Image 5.72: Typical Shaft Construction (Caisson Method – Left) and a Typical Tunnelling Shaft (Right)

682. The tunnelling machine is a steerable boring machine (shown in Image 5.73 left) which is used to ensure the reinforced concrete tunnel lining follows the intended alignment. It would tunnel under the crossing and leaves the tunnel lining as an in situ ‘sleeve’ (shown in Image 5.74 right). The proposed pipeline, complete with casing spacers, is then threaded through the sleeve and anchored at each end before applying the casing end seals.



Image 5.73 and Image 5.74: A Typical Tunnelling Boring Head Attachment (Left) and Pipe being Pulled into Tunnel/Sleeve (Right)

683. The trenchless construction described is represented schematically in Image 5.75. The plant is operated from ground level (1). The pipe 'sleeves', which are specialist pipes (3) that can withstand the jacking forces of the plant, are lowered into the shaft by crane (2) and placed into the jacking station (9). As the tunnelling machine drives forward (7) the jacking pipe is pushed behind it. As each jacking pipe is pushed forward another jacking pipe is lowered into the jacking station, and the process continues until the required tunnel distance is achieved. The tunnelling machine is recovered via another shaft at the end of the tunnel drive. An abutment (10) resists the thrusting of the tunnelling machine whilst a continuous system of spoil extraction is maintained (4, 5 and 6).

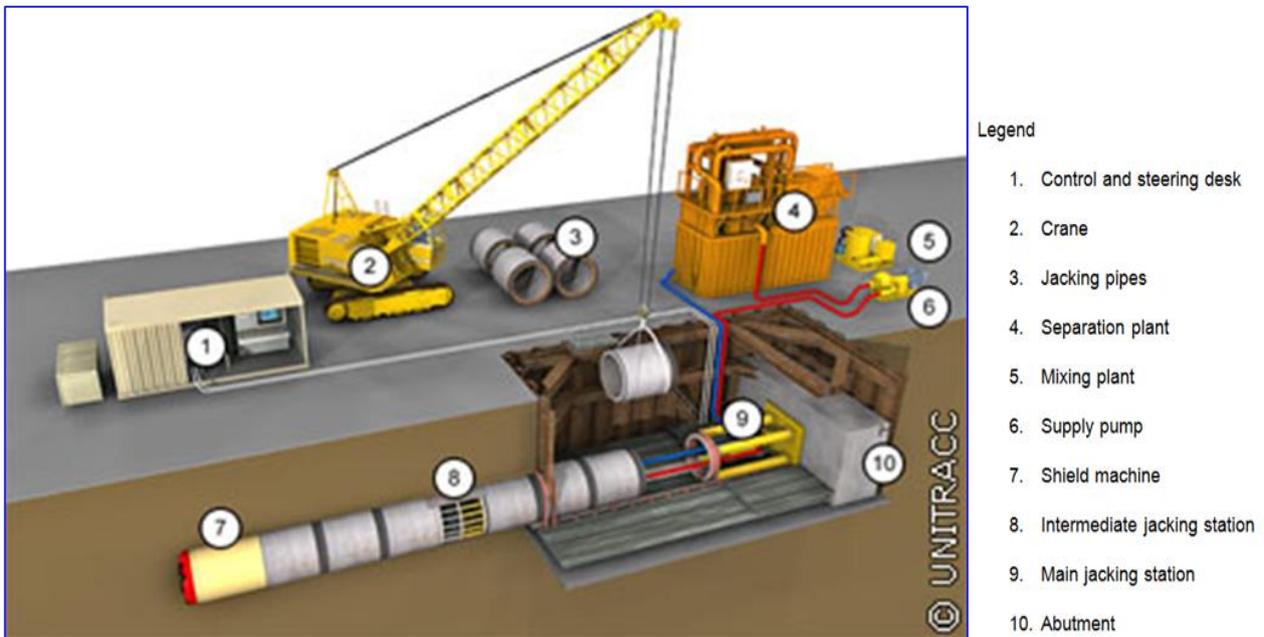


Image 5.75: Schematic Presentation of Pipe Jacking (Image: S&G GmbH)

684. Material is extracted from the tunnel as the tunnel is constructed; the method of spoil extraction would be chosen based on operational and environmental constraints. There are two main methods:

- Conveyor or skip system – a conveyor or cable-pulled skip transports the spoil to the launch pit, which is then hoisted to the surface periodically to be emptied
- Slurry system – the slurry, a mix of bentonite and water, is used to suspend the excavated spoil. It is then pumped out of the excavation, via a system of pipes, to a solids separation system on the surface, at which point the spoil is filtered and separated from the slurry. The filtered slurry is subsequently recirculated and reused within the slurry system. The liquid sludge remaining in the tanks is placed under a soil separator and dewatered with a centrifuge or a filter press.

685. The excavated material and residual slurry would be disposed of in accordance with the final Construction Waste and By-Product Management Plan, Annex C of the CEMP (Appendix A5.1) prepared by the appointed Contractor.

686. Once started, some aspects of the trenchless crossing techniques cannot be safely stopped. Therefore, task lighting would be provided at the drill locations to illuminate the area around the drive shaft during night-time construction works.

687. A total list of trenchless crossing locations is presented in Table 5.28, including crossings of physical, natural and manmade obstructions, such as significant watercourses, roads, railways, canals, services and complex terrain. A provisional allowance for trenchless crossings of the ESB network has been made, although the option to use open-cut trenching is preferred if clearances allow, depending on the plant and equipment required.

688. If the ducting for the ESB network cannot be completed by open-cut trenching, directional drilling, another type of trenchless construction technique, would be utilised. All ducting for directional drilling will be completed in less than 10 consecutive days of night-time working.

Table 5.28: Location of Construction by Trenchless Construction Techniques

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Symbol
Road	RDX001	R494 and steep terrain	RW – 800	Figure 4.7	
Road	RDX003	R445 – Boher	TW – 1900	Figure 4.8	
Terrain	N/A	Steep side slope	TW – 3600	Figure 4.8	-
Road	RDX007	M7 – Kilnacranra	TW – 5500	Figure 4.9	
Power	OHX001	220 kV Network	TW – 7400	Figure 4.9	
Power	OHX002	400 kV Network	TW – 10500	Figure 4.10	
Road	RDX013	R445	TW – 12700	Figure 4.11	
Road	RDX015	M7 – Carrigatogher	TW – 13100	Figure 4.11	
Water	WCX016	Nenagh_070	TW – 19450	Figure 4.13	
Power	OHX003	220 kV Network	TW – 24780	Figure 4.15	
Power	OHX004	220 kV Network	TW – 26170	Figure 4.15	
Road	RDX026 and RDX128	N52 – Ardcroney, County Tipperary	TW – 28900	Figure 4.16	
Terrain	N/A	BPT	TWA – 0	Figure 4.18	-
Water	WCX026	Little Brosna	TWA – 13000	Figure 4.22	
Road	RDX044	N62	TWA – 14100	Figure 4.22	
Power	OHX005	38 kV Network	TWA – 21700	Figure 4.25	
Water	WCX031	Breaghmore	TWA – 26000	Figure 4.26	
Water	WCX032	Camcor	TWA – 27600	Figure 4.27	
Road	RDX053	R440	TWA - 27900	Figure 4.27	
Power	OHX006	110 kV Network	TWB – 1700	Figure 4.27	
Power	OHX007	110 kV Network	TWB – 11700	Figure 4.33	
Water	WCX036	Silver	TWB – 12600	Figure 4.33	
Water	WCX039	Clodiagh (Tullamore)	TWB – 24900	Figure 4.37	
Power	OHX008	38 kV Network	TWB – 27800	Figure 4.38	
Road	RDX071	N80	TWC – 100	Figure 4.38	
Rail	RYX005	Railway – Galway Service	TWC – 4800	Figure 4.39	

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Symbol
Road	RDX077	L1020	TWC – 9000	Figure 4.40	
Power	OHX024	38 kV Network	TWC – 11800	Figure 4.41	
Water	WCX056	Figile	TWD – 4100	Figure 4.46	
Water	WCX057	Figile	TWD – 6400	Figure 4.47	
Water	WBX078	Grand Canal	TWD – 15100	Figure 4.49	
Power	OHX009	110 kV Network	TWD – 15500	Figure 4.50	
Power	OHX010	38 kV Network	TWD – 15700	Figure 4.50	
Power	OHX011	38 kV Network	TWD – 22300	Figure 4.51	
Power	OHX012	110 kV Network	TWD – 25800	Figure 4.53	
Power	OHX013	110 kV Network	TWD – 29500	Figure 4.54	
Power	OHX014	110 kV Network	TWE – 2800	Figure 4.56	
Power	OHX015	220 kV Network	TWE – 2800	Figure 4.56	
Power	OHX016	220 kV Network	TWE – 5200	Figure 4.57	
Power	OHX017	220 kV Network	TWE – 6300	Figure 4.57	
Road	RDX107	R403	TWE – 8500	Figure 4.57	
Road	RDX108	Ardross Road	TWE – 9600	Figure 4.58	
Water & Power	WCX076 and OHX018	Unnamed Watercourse and 110 kV Network	TWE - 9700	Figure 4.58	
Water	WCX073	Liffey River	TWE - 9800	Figure 4.58	
Power	OHX019	38 kV Network	TWE – 10200	Figure 4.58	
Rail	RYX006	Dublin – Newbridge railway line	TWE – 12400	Figure 4.59	
Water	WBX088	Grand Canal	TWE – 14200	Figure 4.59	
Terrain	N/A	Yard	TWE – 15300	Figure 4.59	-
Directional Drilling for 38 kV Uprate Works (Power Connection)					
Rail	RYX003	Railway – Limerick via Nenagh Service	Power connection along R494	Figure 4.6	
Rail	RYX004	Railway – Limerick via Nenagh Service	Power connection along R445	Figure 4.7	
Water	WCX001	Kilmastulla	Power connection along R445	Figure 4.7	
Water	WCX077	Kilmastulla	Power connection along R494	Figure 4.7	

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Symbol
Road	RDX117	Birdhill Roundabout (R445)	Power connection off the roundabout on the R445	Figure 4.6	
Road	RDX118	Birdhill Roundabout	Power connection at roundabout	Figure 4.6	
Road	RDX119	Birdhill Roundabout (R494)	Power connection off the roundabout on the R494	Figure 4.6	
Road	RDX120	R494	Power connection at interface of R494 and access road to RWI&PS	Figure 4.7	
Road	RDX121	R445	Power connection at interface of R445 and access road to WTP	Figure 4.7	
Road	RDX134	R440	BPS power connection	Figure 4.30	

5.24.2.12 Pipe Installation – Watercourses (General)

689. Major watercourses that would be crossed using trenchless methods are described in Section 5.24.2.11.

A list of the remaining watercourse crossings along the RWRMs and the two Treated Water Pipelines are detailed in Appendix A5.4 (Schedule of Crossings) and would be constructed using open-cut methods, namely ‘damming and fluming’ or ‘damming and pumping’. Typically, the minimum clearance between the soffit of the pipeline and the watercourse bed level would be 1.6m wherever possible, but this would be site specific. At all times the future integrity of the watercourse would be maintained.

5.24.2.12.1 Open Trench (Damming and Fluming)

690. Damming and fluming can be used to cross a watercourse, as illustrated on Figure 5.31. This involves channelling the existing water through a conduit (flume), which can comprise one or more pipes depending on the size of the flows in the watercourse. Typically, conduits would traverse the length of the works area with diameters suitably sized to accommodate existing flows.

691. The conduit is used to carry the watercourse over the excavated trench and a dam of sandbags and suitable clay material is constructed across the existing stream/riverbed to ensure all flow is diverted through the conduit. Whilst the purpose of the flume is to create a dry bed for the open excavation, it may be necessary to employ a temporary pump sump to remove any additional water. Pumped discharge would be via a settlement tank to remove any solids from the water.

5.24.2.12.2 Open Trench (Damming and Pumping)

692. Damming and pumping can also be used cross a watercourse, as illustrated on Figure 5.32. This involves constructing a dam (sandbags and suitable clay material) across the existing watercourse upstream of the proposed crossing point. A suitably sized pump sump(s) is then used to extract the water and convey it around the excavation to a point downstream of the crossing point.

5.24.2.13 Toe-Drains

693. During construction of the pipeline, shallow toe-drains will be installed along the edges of the Construction Working Width to intercept overland flows from adjoining lands; they will also catch runoff from the stockpiles of topsoil and subsoils resulting from the excavation of the trenches.

694. During pipeline construction, trenches will not be left open for extended periods of time (more than 2-3 days). Trenches will only be dug to lengths which can be constructed each day. All trenches will be backfilled once the section of pipe is installed. This will prevent pooling of surface waters within open trenches.

695. These toe-drains, which are 500mm to 750mm deep comprising perforated pipe surrounded in 150mm of stone and would drain into temporary attenuation lagoons. These would be located along the pipeline route at regular intervals, as required, as construction progresses.

5.24.2.13.1 Attenuation Ponds

696. Attenuation/settlement lagoons will be located at low points along the Construction Working Width, making use of the natural topography. The attenuation lagoons represent locations which, through their topography, have the potential to retain large areas of run-off from the surrounding land, or from along the Construction Working Width.

697. A typical example of an attenuation pond is shown in Image 5.76.



Image 5.76: Series of Attenuation Lagoons

698. Details of attenuation lagoons will be particular to the Contractor's method of working but will require detailed Pollution Control Plans, Emergency Response Plans and Method Statements, drafted in agreement with IFI and other relevant authorities, and having regard to relevant pollution prevention guidelines, in particular the IFI document 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' (IFI 2016).

699. To ensure the drainage pattern of either surface water or groundwater is not altered by the Proposed Project, native excavated material will be used as backfill and the use of imported granular bedding or surround materials will be avoided where possible. It will also be achieved by the use of clay 'stanks, to prevent unintended longitudinal drainage along the trench.

700. The depths of the ponds will be relatively shallow, about 1m, formed directly on the subsoil. The formation layer will be cleared of roots, woody vegetation, oversized stones, rocks or other unsuitable material, and the side slopes will be maintained at a 1:3 gradient. If necessary, and to prevent over topping, an earthen embankment will be provided. Alternatively, a silt curtain (fence) will be provided to capture sediment.

701. The silt curtain filter fabric will be in a continuous roll, cut to the length of the barrier to avoid the use of joints. When joints are necessary, the fabric will be spliced together only at a support post with a minimum 100mm overlap and securely sealed.
702. The likely volume of temporary storage required has been calculated along the length of the proposed pipeline, taking short sections in turn, depending on topography.
703. Where reasonably practicable, the settled surface water will be allowed to soakaway as illustrated in Image 5.77. If this is not possible, a discharge to local watercourses, ditches or road drainage will be considered, as deemed suitable at locations along the pipeline route, and in discussion with the relevant regulatory authorities. There will be no direct discharge of surface waters from within the Construction Working Width without prior attenuation and settlement.

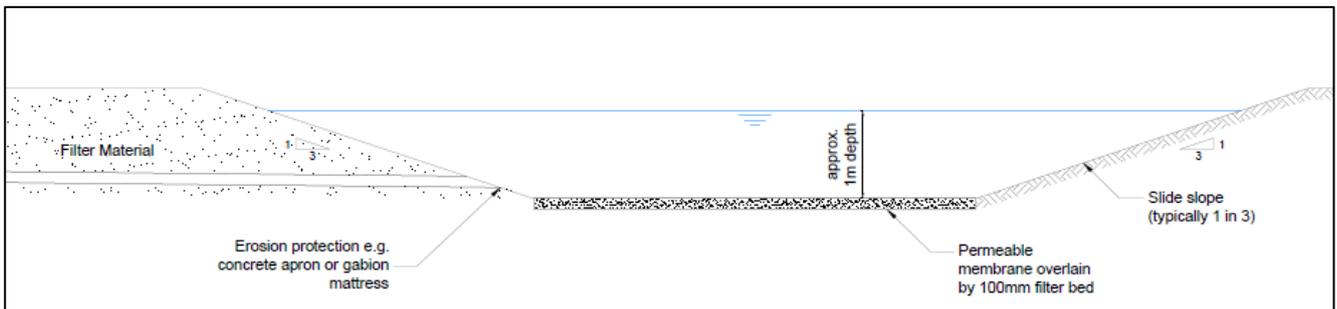


Image 5.77: Typical Section Through Attenuation Lagoon

704. The attenuation lagoons will be sized to ensure final discharge is within the prescribed limit (i.e. $\leq 25\text{mg/L}$ Total Suspended Solids [TSS] in accordance with the Freshwater Fish Directive [2006/44/EC] and Quality of Salmonid Waters Regulations [1988]).
705. They will also cater for spill containment. The treated surface water will be discharged to local watercourses, ditches or road drainage as deemed suitable at locations along the pipeline route. There will be no direct discharge of surface waters from the site without prior attenuation and treatment. Siltbuster tanks will be available for use where TSS exceeds 25mg/l from construction works to fisheries waters or 35mg/l suspended solids from construction works to water bodies in peatland.
706. In addition to the volumes required, locations for the attenuation lagoons have also been identified, which enable surface waters to be managed in short sections.
707. Where the attenuation ponds are located on a slope or for those located within a Wet Grassland or flood plain, generic mitigation may not be enough to sufficiently reduce likely significant effects, therefore additional mitigation measures may be required such as additional silt fencing or sandbags.

5.24.2.14 Spawning Gravels and Silt Runoff Control Measures

708. There would be seasonal constraints on working through and adjacent to watercourses which are salmonid waters. Works would take place during the July to September months inclusive, depending on the watercourse crossing, and would not be undertaken outside of this period.
709. If spawning gravels are encountered, they would be removed at the stream crossing points prior to construction works taking place under the supervision of an aquatic ecologist. This would be subject to the prior agreement, at all stages, of IFI. The spawning gravels would be stockpiled on geotextile filter fabric, clearly marked and taped off adjacent to the watercourse crossing. The gravels would be used to reinstate the stream bed after the pipe has been installed, and the damming/fluming materials have been removed.

710. Silt traps, cages and sedimats, would be placed downstream of in-channel works prior to construction to minimise any potential silt loss. Following construction, a silt fence, a form of perimeter control, would be placed along the riverbank where the works were undertaken to prevent solids entering the stream while the disturbed bank re-vegetates. This measure would be particularly important at sites that slope to the edge of a watercourse. Typically, a silt fence would incorporate a geotextile filter fabric stretched between a series of wooden or metal fence stakes and would be installed in such a way to create pooling of runoff and thereby allowing sedimentation to take place.

5.24.2.15 Testing

711. A detailed explanation on the mechanics of pipeline testing is described in Appendix A5.2 (Commissioning Strategy).

5.24.2.16 Backfill

712. Trench backfilling would commence as soon as possible after pipe installation, typically the same or following day. Where buried structures are required, e.g. for Air and Washout Valves, these would be installed before backfilling is completed for that location.

713. Wherever possible, the subsoil and topsoil excavated from the trench would be replaced to avoid the need to import material and the consequences of removing surplus excavated material. This has significant environmental benefits including fewer vehicle movements along the corridor and on public roads. Construction Working Width preparation and maintenance issues are also significantly reduced when the need for separate stockpiling of imported materials is avoided. Depending on the quality of excavated material, it may be screened to remove stones and debris which could damage the pipeline.

714. There may be some locations where the excavated material is not suitable or sufficient for reusing. In such cases, suitable material would be imported for the bedding and backfill around the pipeline to the required level. In addition, in some locations the trench may have to be partially or fully lined with a suitable geotextile membrane to prevent undue settlement/migration of stone surround to the surrounding ground. The trench may also need to be sealed longitudinally with a stank (Image 5.60) such as puddle clay (or a similar watertight barrier) to prevent the creation of a drainage path through the granular stone surround.

715. With regard to peat, the peat would be reinstated over the pipe to a thickness agreed in advance, so the pipeline profile can, if necessary, be adjusted to ensure there is a sufficient specified depth of structural backfill between the surface peat layer and buried pipe. This would be undertaken in accordance with Appendix A5.3 (Methods of Working in Peat).

716. An example of a backfilled chamber is shown in Image 5.78.



Image 5.78: Typical Reinstatement to Chamber (Prior to Reestablishment of Vegetation)

717. The reconnection of land drains temporarily altered during construction would be carried out as part of the backfill operation. After the installation of the pipeline, the backfill would be compacted in layers up to the underside of the severed drains which are to be permanently reinstated. The replacement drain would extend into the undisturbed ground on each side of the trench for a suitable distance to ensure a properly supported reconnection can be made (typically 1m or more).
718. Excavated material would be used within the Construction Working Width, wherever practicable, to reinstate to the pre-existing levels allowing for settlement of disturbed material; surplus excavated material, which would be the much greater part, would be removed off site. In accordance with Uisce Éireann's circular economy objectives a suitable re-use of this material will be sought in preference to disposal.
719. Settlement under structures such as road crossings, after open excavation construction would be managed through the selection of the material used to back fill over the top of the pipe.

5.24.2.17 Reinstatement

720. The general principles of the reinstatement of the Construction Working Width and the outcomes to be achieved are defined in Section 5.9.3. This sections described the reinstatement process.
721. Reinstatement of the soil profile would be undertaken during favourable weather conditions when the soil is drier and more friable. Soil handling would be avoided during periods of prolonged rainfall. The machines used for the reinstatement of topsoil and subsoil would be of a suitable ground bearing pressure to minimise compaction as much as is practicable.
722. After the 'Backfilling' described in Section 5.24.2.16 has been undertaken and the good subsoil that was excavated replaced, the reinstatement operations would, generally, start with the remediation of the subsoil by scarifying/ripping it with tractor mounted flat lift rippers. This would be done to a minimum uniform depth of 600mm, taking care not to damage the field drainage and other services. The depth of ripping would be selected to scarify/loosen any material compacted during construction. In all cases, the depth of ripping shall exceed the depth of subsoil compaction. All surface stones and roots over 150mm in diameter would be picked up and removed from the subsoil before re-grading it using excavators and graders.

723. An excavator would be used for the reinstatement of ditch banks, boundary fences/walls and the replacement of any 'hedge mounds' (or raised soil areas to receive rooting of hedges). All stones/roots more than 50mm in diameter would be removed from the topsoil and surface. The stockpiled subsoil would then be pulled back from the fence line using excavators to allow tractor mounted scrapers to push it evenly back across the corridor and leaving it generally level. This would be followed by the same process during the reinstatement of the topsoil which would then be given a final inspection, and corrected accordingly, to ensure it is neat and level in appearance. Generally, all areas would be levelled to pre-existing ground conditions allowing for some settlement. In peat areas, the uppermost layer of peat, including the root zone, seeds and flora, would be spread over the backfilled underlayers of excavated peat.
724. In all situations, the topsoil from that parcel of land which was cleared, stockpiled and protected during construction would be the priority for use during reinstatement. If it is necessary to import topsoil onto the site, the topsoil would be screened for invasive species, weeds and roots, and checked for quality, consistency and soil structure, ensuring that no stones more than 50mm in diameter, or debris, are contained within the topsoil. The source and supplier of the topsoil would be inspected and approved by the Agronomist engaged by Uisce Éireann for the suitability of the proposed location.
725. Reseeding would be carried out on completion of the topsoil spreading (shown in Image 5.79), if required. The rate of seeding, time and method of sowing, including application of fertiliser, shall be in accordance with good agricultural practice. Driving over land where topsoil has been put back would be kept to a minimum and would be monitored by the Agronomist engaged by Uisce Éireann. Mechanical equipment heavier than standard tractors and trailers would not be allowed to travel back over the topsoil.
726. Where areas of specific specialist reinstatement are required, e.g. species rich grasslands, the methods employed would be in accordance with the final CEMP prepared by the appointed Contractor. As described in Section 5.4 this will be based on the CEMP contained within Appendix A5.1 and any updates or changes will not be permitted to reduce the level of environmental protection or environmental mitigation as defined in the CEMP in Appendix A5.1.



Image 5.79: Land Reinstatement (Left: Pipeline Installation; Right: Following Reinstatement)

5.24.2.18 Land – Pre-Handover Inspection

727. The handover of the Construction Working Width would be discussed with the landowner through the LLO following reinstatement. This would include an inspection and photo survey of the works section to ensure that all works have been completed in accordance with the landowner agreement. If this inspection identifies any outstanding works, these would be completed by the appointed Contractor prior to handover.

5.24.3 Construction of the Pipeline – Specific Measures for the RWRMs

728. The methodology for the construction of the pipeline is generally as described in Section 5.24.2. This is augmented by inclusion in this section of details pertinent to the RWRMs only.

5.24.3.1 Earthworks on the RWRM Construction Working Width

729. The Construction Working Width in the section of the RWRMs which extends between the RWI&PS site and the R494 Regional Road would have its topsoil and upper level of subsoil stripped and stockpiled over the full 50m Construction Working Width, as generally described in Section 5.24.2.7. As work progresses on the lowermost section, the upper section of the RWRMs (from the R494 Regional Road to the WTP site) would be prepared in the same way, such that there would be access along the RWRM Construction Working Width between the RWI&PS site and the WTP site. When the Temporary Construction Road within the RWRM Construction Working Width is complete, the surplus excavated material from the installation of the RWRMs would be moved into the WTP site for use as fill.

730. The deep section of pipe between Chainage RW – 450 and Chainage RW – 550 would use open-cut trenching. This section of excavation would be constructed as a sheet piled trench as described in Section 5.17.2.7. The section from Chainage RW – 810 to approximately Chainage RW – 1040, under the R494 Regional Road and through the deep section to the east of the R494 Regional Road, would be constructed using tunnelling techniques, as described in Section 5.24.2.11.

5.24.3.2 Drainage on the RWRM Construction Working Width

731. The RWRMs would generally follow a rising gradient from the RWI&PS site, through the R494 Regional Road crossing to the Air Valve located approximately 1,590m from the RWI&PS. Consequently, the RWRMs would be laid working uphill and any water encountered in the trench would be drained downhill through one of the RWRMs to the RWI&PS site. The water would then be discharged into the settlement lagoons as described in Section 5.18.2.7, before joining the surface water discharge from the RWI&PS site back to Parteen Basin (Figure 5.1).

732. From the Air Valve position at Chainage RW – 1590, the gradient of the RWRMs would fall toward the WTP, and runoff water accumulating in this section of the trench would be drained to the WTP site, to be managed with surface water there, as described in Section 5.18.2.7.

5.24.3.3 RWRM Construction Working Width

733. A typical Construction Working Width for the RWRMs is shown in Image 5.80.

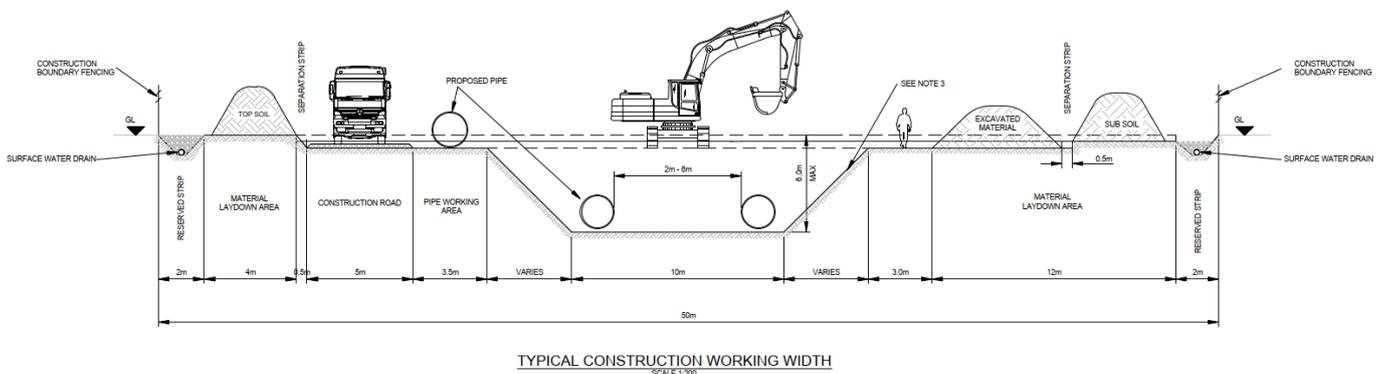


Image 5.80: Indicative RWRMs Construction Working Width

5.24.3.4 Traffic Management on the RWRM Construction Working Width

734. The lowermost section of the Construction Working Width would be accessed from both the RWI&PS site via its access road and later from the point of crossing of the R494 Regional Road. Disruption of traffic on the R494 Regional Road would be minimised, moving pipe sections into the lowermost Construction Working Width and retaining construction plant there, so as to make that work section as self-contained as possible. In the same way, access for earthworks and pipe section importation on the upper side would take place from the WTP site, working via its access road.

735. As pipe laying works approach the R494, the Construction Working Width traffic crossing would be made active. This would consist of earthworks moving the surplus excavated material from the lower section, across the R494 Regional Road to the upper section and into the WTP site. This is generally not programme-critical, and it would be planned and managed to coordinate with other works requiring traffic light or flagman controls on the R494 Regional Road, so that red-light time on this road is optimally and efficiently used and disruption to road users is minimised.

5.24.4 Commissioning of the RWRMs

736. The procedure for pipeline testing and commissioning the RWRMs is detailed in Appendix A5.2 (Commissioning Strategy) and would be carried out in the following sequence:

- Step 1 – Initial clean and internal inspection
- Step 2 – Low pressure 'air test' using compressed air
- Step 3 – Hydrostatic pressure testing with filtered raw water
- Step 4 – Final swabbing and cleaning
- Step 5 – Disinfection
- Step 6 – Filling with raw water.

737. The RWI&PS and the RWRMs would need to be the first elements of the Proposed Project to be tested and commissioned. Water required for testing and commissioning the RWRMs would be taken from Parteen Basin via the Intake and Inlet Chambers structures.

5.24.4.1 Pre-Cleaning and Preparation for Testing

738. Any equipment, tools, rags, welding rods, bolts, washers, wood, packaging, and other debris in the pipeline left from construction would be removed prior to cleaning.

739. Each RWRM would be partitioned using the Line Valves as break points, which would be temporarily replaced with specialist test ends. The first RWRM would be filled at acceptable flow rates and hydrostatically tested in sections. Test water from one main would be drained back and used to fill and test the second main.

5.24.4.2 Water Filling and Hydrostatic Testing

740. The RWI&PS would provide a source of suitable and adequate clean water supply. The first RWRM would be filled once acceptable flow rates are established.

741. For each section of RWRM to be tested, all cross-connections would be fitted with blank flanges to ensure complete isolation of the test section. Air Valves would be removed, and the outlets would be fitted with blank flanges.

742. An initial low-pressure air test would be completed to ensure the RWRM test section is sealed and that there would be no significant leakage. Once this is confirmed, the length of the RWRM to be tested would be charged with clean water. The section would be pressure tested in accordance with Water UK's, Water Industry Information and Guidance Note IGN 4-01-03 (Guide to Pressure Testing of Pressure Pipes and Fittings for use by Public Water Suppliers) (Water UK 2015) and compliance with leakage standards would be confirmed.

5.24.4.3 Cleaning of the RWRM

743. The RWRMs would be cleaned of silts and deposits arising from construction and trench drainage. The cleaning would be carried out by propelling foam swab 'pigs' (shown in Image 5.81 and Image 5.82) separated by water slugs through each RWRM with oil-free compressed air.



Image 5.81: Pipeline Cleaning – Swabbing



Image 5.82: Typical Pipeline Swab

5.24.5 Commissioning of the Treated Water Pipeline

744. The construction of the entire pipeline may take up to five years. Therefore, to enable reinstatement to take place in a timely fashion, it would be necessary to test sub-sections as they are completed so any remedial works can be completed whilst the appointed Contractor is still mobilised and reinstatement can begin.

745. Generally, sub-sections would be bounded by two Line Valves as they form a logical and suitable length of pipeline for hydrostatic pressure testing to prove the leak tightness of the pipeline. Other logical places are at intermediate road crossings or at tunnels. The precise division into sub-sections would be determined during detailed design and in conjunction with the construction schedule of each appointed Contractor.

746. The procedure for pipeline testing and commissioning the Treated Water Pipelines is detailed in Appendix A5.2 (Commissioning Strategy) and would be carried out in the following sequence:

- Step 1 – Initial clean and internal inspection
- Step 2 – Low pressure 'air test' using compressed air
- Step 3 – Hydrostatic pressure testing with filtered raw water
- Step 4 – Final swabbing and cleaning
- Step 5 – Disinfection
- Step 6 – Filling with potable water

- Step 7 – Water quality sampling.

5.24.6 Overall Control System Commissioning

747. The final element of commissioning brings together all the various elements of the raw and treated water systems once all individual elements have been successfully commissioned. The procedure for overall control system commissioning is detailed in Appendix A5.2 (Commissioning Strategy).

5.25 Pipeline Features

748. Along the route of the pipeline, a series of valves would be provided to facilitate the operation of the pipeline. These valves would include:

- Line Valves (Section 5.25.1)
- Washout Valves (Section 5.25.2)
- Air Valves (Section 5.25.3)
- Valves at Potential Future Connection Points (Section 5.25.4).

749. Wherever possible, valves would be located adjacent to field boundaries. A preliminary layout of the valve locations along the RWRMs, Treated Water Pipeline from the WTP to the BPT and Treated Water Pipeline from the BPT to the TPR is presented in Figure 4.2 to Figure 4.60 inclusive; however, the location of Air Valves, Washout Valves, Line Valves and Potential Future Connection Points may be subject to minor adjustment to meet construction, engineering, planning, archaeological and other requirements.

5.25.1 Line Valves

750. Actuated Line Valves would be installed on average every 3.5km along the pipeline to enable sections to be isolated, drained and recharged post maintenance. These Line Valves would be installed below ground in a concrete chamber and would be operated by an electric actuator within the chamber which would require a power supply. A mobile crane would be used to lift the valves into place during the installation of the pipeline.

751. A permanent electricity connection is required at each Line Valve location to provide power to the valve actuators, SCADA, sensors, telemetry equipment, and site infrastructure.

752. Power is to be supplied to the Line Valve sites via a connection to an existing electricity supply using a mix of overhead lines and underground cables as appropriate. New polesets and overhead lines would deliver power from the connection point on the existing electricity network to the Line Valve sites. These polesets, which include the cable stays, would be installed by ESNB. The hole for the pole would be dug by an excavator to depth of at least 2m and a footprint of 0.5m². The pole would be installed vertically to the correct height by a pole erection vehicle or an excavator with pole erection equipment, and the pole backfilled in quick-set concrete. If a steel cable stay is required, it would be set at an angle of 45 degrees and anchored 1.2m into the ground. A cattle guard would be provided to the cable stay for protection. Once inside the Line Valve site boundary, the overhead line would be dropped, entering the control kiosk via underground cabling. These overhead line works would be undertaken as described in Section 5.23.4.3 the ducting would be undertaken as described in Section 5.23.4.4.

5.25.2 Washout Valves

753. Once the pipeline is fully operational, Washout Valves would be used very infrequently during planned maintenance to release the pressure from the pipeline or, even more rarely, to drain (for cleaning) an entire section of pipeline. These would be provided at low points along the pipeline and would be buried within concrete chambers with locked manhole covers. All that would be visible at the surface would be concrete plinths raised approximately 150mm above the surrounding ground.
754. In certain locations, Washouts would have additional permanent infrastructure to convey water to the discharge location. This would consist of valving to control discharge of drain water, a washout chamber, a suitable length of pipeline and outfall structure. The valving would be lifted into position by a crane and directly buried; extension spindles to operate the valves would be placed inside plastic tubing and the whole valve arrangement would be directly buried. Covers to spindles would be cast in a plinth at ground level. The plinth would be formed with precast concrete. The washout chamber would be formed in precast concrete on a stone hardcore base and capped with a precast lid; openings would be provided in the top of this lid for securing with metal covers. The outfall structure would have three sides and be formed of precast concrete or cast in situ. All materials would be brought to site along the Construction Working Width and manoeuvred into position, or placed, with cranes and excavators.
755. The construction of the permanent pipework would be as described in Section 5.25 and would undergo a hydraulic test as described for pipework in Appendix A5.2 (Commissioning Strategy), which also sets out how Washout Valves would be used during commissioning.

5.25.3 Air Valves

756. Air Valves are critical for initial filling and priming, efficient operation and for draindown and recharge of the pipeline. These are required at every local high point and all significant changes of gradient of the pipeline and would be typically 500m to 800m apart. The Air Valves would be located on top of the pipe in concrete chambers with lockable access covers and the chamber would sit approximately 750mm to 1,000mm above ground level and mounded at a gradient of 1 in 2.

5.25.4 Potential Future Connection Points

757. 'Tee' pieces would be inserted on the Treated Water Pipeline at three Potential Future Connection Points. These would be located at road crossings and would comprise an 800mm tee off the Treated Water Pipeline from the BPT to the TPR and include two isolation valves in series and a blank flange.
758. The valving would be lifted into position and directly buried using cranes and excavators. As the Connection Points are short lengths of pipe, i.e. less than 5m, they would be constructed and completed with the Treated Water Pipeline from the BPT to the TPR.
759. The Potential Future Connection Points would be tested and commissioned in conjunction with the Treated Water Pipeline from the WTP to the BPT and Treated Water Pipeline from the BPT to the TPR; see Appendix A5.2 (Commissioning Strategy).
760. There would be an additional Potential Future Connection Point directly from the WTP where a pipeline would be routed along the access road to the WTP, terminating with a blank flange at the junction of the access road and the R445.

5.26 Pipeline – Ancillary Pipeline Infrastructure

5.26.1 System Control

761. Telemetry for the SCADA system would be provided to the FCV complex, Line Valve installations and the Infrastructure Sites.
762. Digital radio (point to multipoint) would be used for telemetry network communications where the location is within reach of the nearest digital radio backhaul site although due to the length and remoteness of many of the LV sites it is expected that the 4G / 5G mobile phone network will be used as the primary communications technology. Each site would have a back-up comms system which would either be 4G/5G or via satellite kiosks
763. For each actuated Line Valve and FCV installation, a control kiosk (circa 2.2m x 0.9m footprint x 2.2m high) would be required to house interfacing equipment (typically a remote Input/Output unit or Programmable Logic Controller Central Processing Unit). An additional similar sized kiosk for the electricity supply termination from the Distribution Network Operator would also be required. The satellite, 4G / 5G and digital radio options would require a dome-shaped aerial of approximate dimensions 250mm by 150mm by 100mm high attached to the top of the control kiosk.
764. Each Line Valve location would incorporate two kiosks a short distance from the chamber. The first kiosk would contain the ESB connection, meter and ESB fuse and isolator. The second would contain Uisce Éireann's isolation SCADA and telemetry for the actuator. The kiosks would be situated on precast plinths which would be founded on a compacted stone hardcore base. Electrical and instrumentation equipment would be installed within the chamber or the kiosks.

5.26.2 Lay-Bys

765. At Line Valve locations adjacent to roads, Lay-Bys would be constructed to facilitate safe working during planned periodic maintenance to the Line Valves and associated electricity supply kiosks. The Lay-Bys would be constructed using a cellular-type construction that allows grass to grow through the surface, in accordance with TII guidance for Maintenance Lay-Bys in The Location and Layout of Lay-bys and Location Markers (DN-GEO-03046) (TII 2010)⁸. On completion of construction, suitable fencing complete with entrance gate would be erected along the extent of the Lay-By. Any existing hedgerows would be reinstated.
766. The locations of Lay-Bys along the Treated Water Pipeline from the WTP to the BPT and Treated Water Pipeline from the BPT to the TPR are included in Figure 4.2 to Figure 4.60.

5.26.3 Cathodic Protection

767. A Cathodic Protection vertical ground bed would be installed at select Line Valve locations to monitor the initial and ongoing integrity of the pipeline external coating and to provide protection against corrosion of the pipeline.
768. The Cathodic Protection requires a direct current (DC) power supply, which typically requires transformer rectifiers to convert mains electricity to low voltage DC. The rectifiers would share the same kiosks and share the same power and SCADA system.

⁸ Guidance currently withdrawn and under review but still considered relevant in the absence of updated guidance.

769. A grounded bed is a group of anodes driven vertically in deep boreholes, or multiple shorter boreholes. This is dependent on the site conditions at a chosen Line Valve location. The boreholes would be driven by a combination of cable percussive and rotary core drilling rigs depending on the ground conditions encountered. The deep boreholes incorporate steel casing to prevent the collapse of the drilled hole, which would be installed as the drilling progresses. Several anodes attached together with a rope would be placed inside the casing. The remaining space is then backfilled with the coke material. Deep wells would be fitted with a vent to allow gases to escape.

770. Ducts would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with the ESB standards. The kiosks would be situated on precast plinths which would be founded on a compacted stone hardcore base.

5.27 Construction of Crossings

771. There are several crossings to be carried out for the Proposed Project, which would use either open-cut trenching or a trenchless construction method. The crossings and the methods of construction to be carried out are listed in Appendix A5.4 (Schedule of Crossings).

772. Trenchless crossings are proposed for high voltage power lines, railways, major roads and main rivers as described in Section 5.25.2.11. The remaining crossings would be open-cut, as described in Section 5.25.2.10. This may require specific measures depending on the type of crossing as follows:

- Medium and low voltage electricity crossings – where a crossing is required of an overhead power line this may require the appointed Contractor to obtain an outage from EirGrid, which is a temporary interruption to transmission/supply, to allow the works to be carried out safely. Alternatively, Hazard Zones and demarcation areas would be established, as would barriers, bunting and height-restricting goal posts, and the appointed Contractor can use specialist equipment such as short jibs to safely undertake the works
- Watercourse crossings – where a crossing is required of a watercourse which does not require a trenchless crossing, the watercourse would be crossed by open-cut techniques as outlined in Section 5.25.2.12. Temporary bridges are covered in Section 5.28.1. At the WTP a permanent road crossing is required over a tributary of the Kilmastulla River, County Tipperary. This is described in Section 5.18.2.3 and would provide a permanent access between the WTP and the R445
- Road crossings – the method of construction at each road crossing would be determined with reference to the road standard and traffic volume, road width, availability of an alternative road diversion for the duration of the crossing, and topography where a road is at a much higher elevation to the surrounding land through which the pipeline is passing. It is envisaged in the majority of cases that roads would be closed for between 24 and 48 hours. There are two types of closure:
 - Where a road can be closed with a diversion on the local road network, these diversions would be agreed in advance of works taking place at any road crossing with the Local Authority. The length of time a road needs to be closed, and a diversion put in place, would depend on the road width and standard. Sign boards would be set up in advance of any diversions taking place giving dates of the disruption. Diversion routes would cater for every type of vehicle that could be expected on the road that is to be closed
 - Where a road needs to be closed and there is no available diversion on the local road network, for example a dead-end access servicing one or more properties, an alternative route or diversion would be provided by providing a temporary road bypass (4m in width) across the Construction Working Width for the duration of the crossing. The temporary bypass would be made of a 300mm deep layer of stone hardcore compacted with stone dust to provide a clean level surface for trafficking. Prior to the temporary road bypass taking place, all property owners would be notified of the pending temporary traffic changes and signage would be put in place before the temporary road bypass is put into effect. On completion of the road

crossing, the existing road would be reinstated to its previous standard and then re-opened to through-traffic and the temporary road bypass would be reinstated.

5.27.1 Temporary Bridges

773. The Proposed Project is essentially 'linear' in extent, and off road. To maintain the unhindered flow of construction traffic from one part of the works to another, temporary bridges would be deployed to span watercourses and maintain the movement of construction traffic along the Construction Working Width. These would only be retained for the duration of the construction of the Proposed Project. Different designs and construction methods would be used depending on factors such as the watercourse being crossed (width, sensitivity) and the vehicles that would need to cross the structure. In all cases, bridging would incorporate silt control fencing to prevent loose material from construction vehicles being deposited into the watercourse being crossed.

774. Temporary bridges would typically be modular flat-pack bridges (steel flooring panels) made specifically for this purpose. They are available in various lengths (max 12.6m including ramps and 3.5m wide) and can handle loads of up to 110 tonnes. An example is shown in Image 5.83.

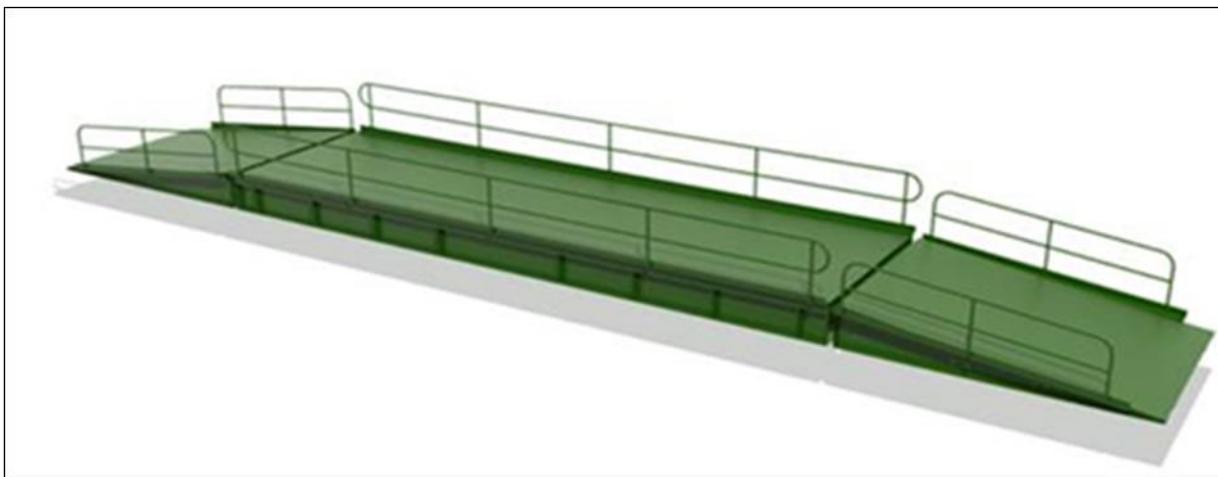


Image 5.83: Watercourse Crossing – Temporary Bridge

775. Where longer spans are required, e.g. to mitigate impact on a sensitive habitat, beam bridges can be deployed. These are modular units which can come pre-assembled and can accommodate spans up to 25m. They can be installed in a skewed format to accommodate site constraints (shown in Image 5.84).

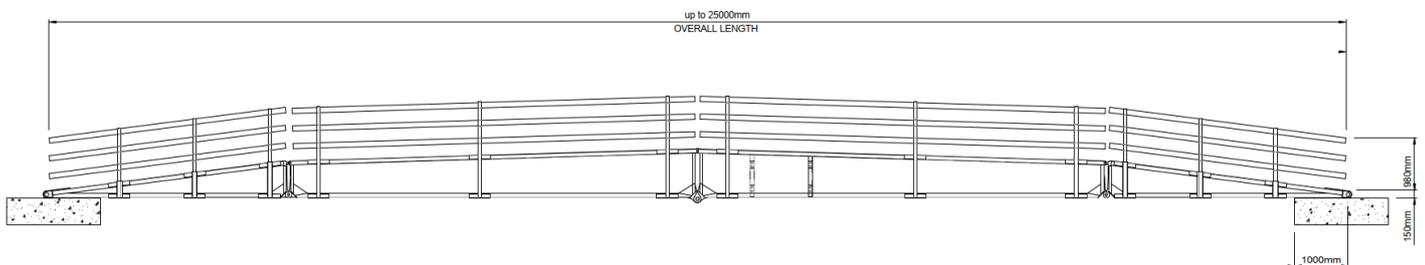


Image 5.84: Watercourse Crossing – Temporary Bridge

776. Beam bridges are supported on concrete piers. The top of the pier is set to ensure sufficient clearance is maintained over the obstacle, such as a sensitive watercourse and riparian habitat. As this bridge would be above existing ground level, the approach to the bridge would be engineered ramps formed from construction materials being used on the works, including suitable excavated material extracted from the pipeline works and coarse stone. Suitable provision for a working area to accommodate a beam type bridge has been made at Breaghmore, County Offaly (WCX031, Figure 4.26).

777. If the appointed Contractor requires spans greater than can be provided by a beam bridge, then plate girder bridges (for spans up to 45m) are available. These are similar in appearance to a beam bridge, but structurally more substantive. They can be pre-assembled as separate units, transported and assembled at the crossing location.

5.27.2 Reintroduction of Gravels at Watercourse Crossings

778. IFI have requested that works for the Proposed Project should include the reintroduction of gravels to watercourse crossings linked to the Proposed Project. Their position is that such works would represent a significant environmental gain, as most of these waters were subject to significant over-deepening and over-widening in the recent past, and as a result of the extent of the hydro-morphological damage and relatively low gradient for any habitat restoration to occur here, the replacement of gravels will be necessary.

779. Reintroducing gravels to watercourses is a method of river restoration and typically involves using gravels to either raise the riverbed or create variations in depth and flow speeds, which in turn can improve water quality and habitat in the watercourse.

780. The reintroduction of gravels would be an 'enhancement', and not essential mitigation for the Proposed Project. An enhancement is defined as a measure that is over and above what is required to mitigate the adverse effects of the Proposed Project. Unlike mitigation and compensation measures, enhancements are not factored into the determination of significance. As such, the general reintroduction of gravels is included in the EIAR as an enhancement, but not a specific measure that is relied upon in the EIAR to inform the conclusions on likely significant effects.

781. At this stage, specific rivers' locations have not been identified or agreed, as there is uncertainty regarding river conditions at the time of construction works. The principle has been agreed that this will be undertaken where reasonably practicable and as agreed with IFI. Uisce Éireann will work with IFI leading up to the Construction Phase to identify watercourse crossings where gravels could be reintroduced and to agree the works to be undertaken.

782. Gravels would be introduced within the Planning Application Boundary (which would typically mean within a length of approximately 50m of a watercourse, i.e. the typical Construction Working Width), and no permanent access would be required for maintenance purposes. The energy within the watercourse would then determine where the gravels ultimately end up. Suitably tested, surplus material generated from constructing the Proposed Project would be used for this purpose.

5.28 Handover of the Works

783. Once the Construction Phase has been completed, training would be provided for Uisce Éireann's operating and maintenance staff, or agents acting on their behalf, on every aspect of the Proposed Project, including all plant, instrumentation and controls, facilities and testing. Once the training is complete and testing and commissioning has confirmed that the Proposed Project is performing in accordance with the set objectives, specified standards and criteria, all of the relevant information for the safe operation of the Proposed Project would be handed over to Uisce Éireann. Uisce Éireann would then formally close out the construction and commissioning stages and the Proposed Project would formally enter into the Operational Phase.

5.29 References

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