SECTION 4: Construction Strategy

4.1 Introduction

This Section describes the strategy to construct the Proposed Development. It has been prepared in accordance with Part 1 of Annex IV of the EIA Directive and has therefore been structured to describe the following:

- Indicative duration and phasing during the construction period;
- Land use requirements to support the construction of the Proposed Development;
- Likely activities required to prepare the site and undertake the enabling works to support the construction of the Proposed Development;
- Methodologies to undertake demolition and construction activities;
- An overview of anticipated construction traffic, access points and haulage routes that are likely to be used during construction;
- An overview of employment and typical site management measures associated with the construction of the Proposed Development; and
- An overview of the Outline Construction Environmental Management Plan to provide minimum requirements that the Contractor(s) will be required to implement (Refer to **Appendix 4A** for the Outline CEMP).

4.2 Approach

The approach to construction which has been assumed for the purpose of this EIAR is illustrated in **Sections 4.3 to 4.9** herein. This information describes the main construction activities that are relevant for the assessment of likely significant environmental effects.

It should be noted that Uisce Éireann proposes to procure the construction works by means of a design and build type contract. This type of contract has the benefit of encouraging innovation and value engineering, particularly for a project of this nature and scale, by giving the contractor ownership of the detailed design and construction. Under this type of contract, the successful contractor will ultimately be responsible for the final detailed design and determination of appropriate construction activities required for the Proposed Development.

Notwithstanding this, the approach to construction outlined in **Sections 4.3 to 4.9** herein is considered to be the reasonable worst case scenario, given the existing site constraints, the adjacent land uses and the various construction methodologies which could be considered by the contractor. The construction of the Proposed Development will consist of land-based works only.

It will be the responsibility of the contractor (under the obligations of the design and build type contract) to ensure compliance with those measures that have been outlined in this EIAR to avoid and/or reduce significant adverse effects that have been identified. Where the contractor proposes from the methodologies and working areas outlined herein and defined in the granted planning consent, it will be the responsibility of the contractor to ensure compliance with or obtain the relevant licenses, permits and consents for such changes.

4.3 Indicative Duration and Phasing

4.3.1 Overview

The construction of the Proposed Development is estimated at between 24 and 36-months, based on the reasonable worst case assessed herein. The estimated construction programme for the Proposed Development is outlined below to include the following tasks:

- Detailed design of the Contractor would take approximately 3-months;
- Establishment of the compound and site clearance works would take approximately 2-months;
- Carrying out of a pre-construction badger survey would take approximately 1-month ;
- Implementation of an invasive species management strategy following a survey would take approximately 1-month;
- Civil works to construct the subsurface and above ground structures would take approximately 18-months;
- Open cut construction of interconnecting pipework would take approximately 2-months;
- Upgrade of the secondary treatment process with an IFAS technology would take approximately 2-months;
- Installation of process, mechanical and electrical equipment would take approximately 8-months;
- Site finishes and landscaping would take approximately 2-months;
- Testing and commissioning would take approximately 3-months
- Trial operation of the upgraded processes would take approximately 3-months; and
- Decommissioning of process, pipework, mechanical and electrical equipment would take approximately 2-months.

Some of the above activities will overlap and be undertaken in parallel. It should be noted that some of the construction activities could be subject to seasonality restrictions e.g. during the badger breeding season (December to June inclusive) and no pile driving for the storm tank or forward feed pumping station cofferdams would be permitted as all or part of these cofferdams would be located within 150m of an active sett. Another potential restriction would be undertaking the upgrade of the secondary treatment process which could have to be undertake during a period of low incoming flows into the plant such as the summer period.

4.3.2 Sequencing

Overview

Whilst the final sequencing and phasing of the works will be for the contractor to determine, we have considered the various likely options in this regard and have set out below, a likely sequence of works that will enable the assessment of the reasonable worst case to be considered herein.

It is envisaged that the contractor will mobilise on the site and set up a compound immediately following contract award. An initial approximate 3-month period will be required to undertake site investigations and detailed design.

A pre-construction badger survey is required to be carried out no more than 10-12 months in advance of construction in order to ascertain if there are any additional sett entrances. This survey will likely be undertaken following mobilisation of the Contractor to site and within the 3-month design period. During the breeding season (December to June inclusive), no blasting or pile driving should be undertaken within 150m of active setts. It is envisaged that the storm tank, forward feed and flood event pumping stations will be constructed using rectangular sheet pile cofferdams. Therefore, programming of these works will be

dependent on the commencement date of the project and the breeding season. Further detail on the specific methodologies and activities during construction is available in **Section 4.6**.

An invasive species management strategy will be adopted to prevent the continued spread of invasive plant species from the site. Preparation of the invasive species management plan will be carried out following commencement of the Contract.

Following completion of mobilisation, surveys and site investigations, the following sequential activities will be undertaken:

- Implementation of an invasive species management strategy;
- Erection of solid fencing at the south-eastern section of the site to minimise potential of disturbance to badger sett;
- Site clearance and topsoil stripping;
- Location and diversions of existing underground services;
- Installation of a dewatering system where appropriate;
- Installation of sheet piles and excavation of the cofferdam for the storm tank;
- Construction of the storm tank;.
- Construction and piling of surface structure foundations;
- Construction of surface structures;
- Installation of sheet piles and excavation of the cofferdam for the forward feed pumping station;
- Construction of the forward feed pumping station;
- Construction of primary treatment mechanical filter building and splitter chamber;
- Construction of other subsurface structures;
- Modification and upgrade works to the sludge dewatering building;
- Upgrade of the secondary treatment process;
- Construction of interconnecting pipework;
- Finishing and fitout of buildings and site-wide landscaping;
- Testing and commissioning of buildings;
- Commissioning of the proposed upgraded treatment plant; and
- Decommissioning of pipework.

Removal and/or Treatment of Invasive Species

It is expected that treatment works and control measures will be required for the management of invasive species, which may involve the removal of contaminated soil from the site. A treatment regime for invasive species commenced in 2022 and will continue up to and including the construction phase. Alternatively stockpiling of the material in a controlled measure on-site may be implemented. Buffer zones around Himalayan Balsam around Giant Hogweed will be applied to prevent spread. Further details on invasive species management are included in **Part B, Section 11**.

Topsoil stripping will be undertaken in the greenfield area of the site with suitable material retained on site for landscaping at the end of the works.

Deep Excavation Works

Deep excavation works will be required to accommodate tanks, pumping stations, and interconnecting pipework. It is envisaged that three cofferdams are required, for the storm tank and storm return pumping station, forward feed pumping station, and flood event pumping station.

Deep excavations would range from approximately 4m to 5.3m below ground level. Due to the nature of the ground conditions, groundwater and proximity to existing infrastructure, unsupported excavations are not considered viable for a number of structures. Information on land and soils is available in **Section 13**. The

proposed excavation will therefore require temporary lateral support to maintain stability during the construction.

The excavations will require robust temporary support systems including sheet or secant piles with appropriate bracing. A combination of steel sheet piles with temporary propping/anchors is commonly used for this type of excavation, however there is a risk that sheet piles may not penetrate the dense granular glacial till, potentially refusing on cobbles and boulders, resulting in insufficient toe capacity for stability and limited to no impact on groundwater control. Considering the above, the adoption of a secant pile wall may be a more robust solution in providing the necessary lateral support whilst also reducing groundwater inflows. For the purpose of this assessment, a construction methodology using sheet piles will be considered as a reasonable worst-case scenario due to higher noise and vibration impacts.

Excavation is expected to result in the removal of mostly made ground, soft silt and clay deposits beneath the storm tank footprint, with the base slab likely founding on granular glacial till. While the granular glacial till represents a more competent founding material, the upper 2m of this layer is reported as loose and as such will likely require compaction prior to placement of a blinding layer and initiating of base slab construction. Excavations for pumping stations will also be considered deep excavations.

Dewatering systems will also be employed to facilitate dry excavation areas (further described in **Part B, Section 13).**

Construction of Subsurface Structures

Once the deep excavations have been completed to the required depths, the subsurface elements of the works will be constructed. As described in **Section 4.6**, this will involve construction of reinforced concrete structures for the storm tank, storm return pumping station, forward feed pumping station, and flood event pumping station.

Pipework through the walls of the reinforced concrete structures will also be completed at this stage. Interconnecting pipework to be constructed between structures will be completed following completion of the subsurface and surface structures. Piling may be required for interconnecting pipework which will be confirmed during the detailed design stage of the contract.

Construction of Above-Ground Structures

On completion of below ground structures, the above ground construction works for the Wastewater treatment plant will be commence. These structures will likely be primarily constructed of steel, blockwork and reinforced concrete.

External Finishing and Internal Fitout

On completion of all structures, the external hard standing (roads, skip plinths, crane set-up pad) as well as the soft landscaping (planting, landscaping etc.) will be installed. This will be followed by finishing works including site and task lighting etc.

The secondary treatment process will be upgraded with an Integrated Fixed-Film Activated Sludge (IFAS) system. The existing secondary treatment process operates as a conventional aeration activated sludge plant with a twin stream. Each stream will be upgraded sequentially to allow the process to remain operational during the upgrade.

Modification and upgrade works to the sludge dewatering building will be undertaken (refer to **Section 4.6.6 for** further detail).

In parallel, the installation of all process, mechanical, and electrical equipment will take place in the buildings.

Commissioning and Connection of Existing Outfall

Once construction works are complete, the testing and commissioning phase will commence (refer to **Section 4.6.9** for further detail).

Once the new Wastewater treatment plant upgrades are commissioned flows will be diverted to the new infrastructure. Some sectional upgrades may be commissioned at an earlier stage to allow the plant to return to its current operation (secondary treatment and sludge dewatering).

4.4 Land Use Requirement

4.4.1 Overview

No temporary working areas or land acquisition will be required to accommodate construction activities. All works will be undertaken within land owned by Uisce Éireann or Limerick City and County Council.

Construction traffic will be required to route through the University of Limerick for the duration of the works. Further details are outlined in **Part B, Section 6**.

4.4.2 Construction Compound and Working Areas

The construction compound will be located within the planning site boundary of Castletroy WwTP and will provide site offices and welfare facilities for construction employees, as well as providing an area for material storage. Ground levels for the compound will be raised temporarily above the design flood level for the duration of the construction contract to prevent materials and equipment being carried away by flood water in the event of a flood.

4.5 Enabling Works

Enabling works are required for various aspects of the Proposed Development, in order to prepare the site for construction activities. A description of the enabling works required is provided in **Sections 4.5.2 to 4.5.5.**

4.5.1 Overview

The following will be required at the development site:

- Establish and get appropriate approvals for construction traffic management requirements for delivery and haulage routes through the University of Limerick (refer to **Section 4.7** for further details);
- Undertake any cutting of vegetation along the Limerick City and County Council / Uisce Éireann dedicated access road from Plassey Park Road which will facilitate some construction traffic;
- Establish and implement appropriate surface water management procedures in accordance with the requirements set out in the Outline CEMP in **Appendix 4A**;
- Erection of solid fencing will be erected at the south-eastern section of the site to minimise potential of disturbance to badger sett;
- Install secure hoarding and fencing (2.4m in height as a minimum) within the site to segregate construction works areas from plant operations that will remain in-situ for the duration of the construction works;

- Install vehicle set down and material storage areas (typically by laying down hardcore to a depth of approximately 300mm) in relevant working areas;
- Undertaking of treatment works and control measures will be required for the management of invasive species, which may involve the removal of contaminated soil from the site, or alternatively stockpiling;
- Undertake vegetation removal and stripping of topsoil as required in relevant working areas;
- Install the main construction compound to accommodate site offices and welfare facilities;
- Undertake all required utility and services diversions required; and
- Investigation and removal of any asbestos containing materials from the sludge dewatering building in advance of carrying out modification works to the first floor structure.

4.5.2 Utilities and Services

Underground services and utilities including telemetry, power, watermains and process pipework will need to be located and relocated in areas of the site to be developed.

No diversion of ESB underground or overhead power lines will be required.

4.5.3 Site Investigation

It is anticipated that the contractor may undertake further site investigation works within the planning boundary to confirm the existing information on the land and soils (as described in detail in **Part B**, **Section 13**). The specification of such works will be developed by the contractor during the detailed design.

4.5.4 Modification to Sludge Dewatering Building

To accommodate the new sludge dewatering centrifuge equipment, the first floor of the Sludge Dewatering Building will be removed. This will involve the removal of structural beams which support the steel grating floor.

All removed materials deemed to be waste will be removed from the site and transferred to an appropriately authorised facility.

An asbestos survey of Castletroy WwTP was previously undertaken for the purposes of identifying asbestos containing materials in the premises prior to the refurbishment or upgrading of the plant. All buildings and above ground structures were investigated and no asbestos containing materials were identified. Further investigation into any asbestos containing materials will be caried out prior to the building modifications.

4.5.5 Excavation, Remediation and Dewatering

Excavation

As per **Part B, Section 13** Lands & Soils, while no observations relating to contamination were made during the ground investigations contract, construction and demolition materials (e.g. concrete, plastic, timber, and reinforcement) were identified, it is recommended that further environmental sampling and testing of the made ground is undertaken.

All excavated material will be disposed of at a suitable licensed facility in respect of which a waste permit or a waste licence is granted, if there is no opportunity for reuse on site. The majority of the overburden material within the storm tank footprint is unlikely to be suitable for re-use as an engineered fill.

Excavations in made ground will be monitored by an appropriately qualified person to ensure that any evidence of contamination (e.g. asbestos, hydrocarbons, etc.) encountered are identified, segregated and appropriately contained.

Remediation

Any contaminated or construction waste material encountered will be removed off site to a licensed facility. In areas of landscaping, some depth of made ground will be removed to allow clean topsoil to be placed on the areas of landscaping. It is anticipated that all of the excavated topsoil may be reused in landscaping throughout the site.

Should the Contractor seek to reuse excavated material, acceptability of the material will need to be confirmed. Refer to **Part B, Section 13** for the control and management of material to be stockpiled should the material be shown to be suitable.

Dewatering

During the construction of the subsurface structures (i.e. the inlet sump, storm tanks, the service corridor and the outfalls), the depth of excavation will be below the water table. Construction of cofferdams using sheet or secant piling systems will assist in reducing groundwater inflows and as such, limit the amount of groundwater pumping required.

As outlined in **Part B, Section 13**, dewatering volumes are anticipated to be relatively small/moderate due to the permeability of the underlying bedrock. Discharge from the dewatering process would be passed to a suitably sized settlement pond or a proprietary silt removal system located within the working area, before discharge to the River. Any discharge to the watercourse would be subject to a discharge licence.

4.6 Indicative Construction Methods

The main construction activities are listed below:

- Construction of the stormwater storage tank;
- Construction of the primary treatment building;
- Construction of sub-surface pumping stations including forward feed and flood event pumping stations;
- Construction of above ground tanks including picket fence thickener and primary sludge holding tank;
- Modification to the sludge dewatering building;
- Upgrade of the secondary treatment process with an IFAS system;
- Construction of interconnecting pipework using open cut techniques and connection to existing infrastructure;
- Testing and commissioning of the upgraded Castletroy WwTP treatment processes.

These construction activities will occur in sequence as described previously in **Section 4.3.2**.

4.6.1 Stormwater Storage Tank

Overview

The storm tank is located near the centre of the site and the structure will extend up to approximately 2.3m above ground level and up to approximately 5.3m below ground. The structure will be unroofed and partially buried, with the walls of the tank extending above ground level and the design flood level.

Footpaths will be constructed around the perimeter of the tank and to connect with other operational and hardstanding areas. Handrailing and walkway platforms will be located above the structure to a height of approximately 1.2m.

Construction Process

As outlined in **Part B, Section 13**, excavated material will generally comprise of made ground overlying soft silt and clay. Soft soil located at the base of the excavation will also require excavation. No rock breaking or rock stripping are envisaged for the construction works.

Given the depth below ground level of the excavation, sheet piling will be required to provide support to the temporary excavations. Sheet piles will also provide protection during construction to existing infrastructure located near the works area e.g. clarifier, pipework.

The excavated area will also allow for the construction of the stormwater return pumping station will be incorporated into the storm tank structure.

Construction will likely progress as per the following sequence:

1. Excavation will commence with ground excavated to approximately 2.5m below for the existing ground level. Excavated material will be removed off-site. If deemed necessary, material will be temporarily stockpiled to assist with loading. Some material will be retained to form a temporary bund around the perimeter of the excavation to provide edge protection and a wheel stop for trucks.
2. Sheet piles will be installed around the perimeter of the area to be excavated.
3. The top level frame of the shoring system will be installed following first phase excavation. Individual waler beams will be lifted into place and the shoring system assembled within the cofferdam.
4. Excavation will recommence and will result in a further dig depth of 2m. Excavated material will be hauled off site. Dewatering will be undertaken as required or as per a pre-installed dewatering system.
5. The bottom level frame of the shoring system will be installed following second phase excavation. Again, individual waler beams will be lifted into the cofferdam and assembled. Additional supports using knee bracing will likely be installed.
6. Once the frame system is complete, third phase excavation works will then commence removing an additional 1m of overburden. Limited soft soils may require excavation and replacement at the base of the excavation.
7. Upon completion and excavation to formation level, a layer of concrete blinding will be installed and construction of the tank itself will commence. The reinforced concrete base slab will be constructed and will include for sumps and the storm return pumping station which will be a lower level.
8. The tank walls will likely be reinforced concrete cast in-situ. Alternatively, pre-cast concrete wall units may be used. The walls will be poured in sections until all external and internal walls of the tank are constructed.
9. Pipework will be installed through the walls of the tank and sealed to ensure water tightness.
10. Testing will be undertaken for water-tightness in accordance with the CEWSI (2011) Civil Engineering Specification for the Water Industry, 7th Edition. This will involve the tank being filled to its full capacity and water levels measured to ascertain if they drop (i.e. confirm that there if no loss of water from the tank) over a period of time. It will be the responsibility of the contractor to source the required water, however it is anticipated that it is likely that it would be sourced either through a connection to the local groundwater supply or via tankering to site. Upon completion of the testing, the contractor will empty the structure. Any water used during the testing will be treated accordingly (to remove silt or other contaminants) and discharged (in accordance with an approved discharge licence) to a local water course or to the drainage network.
11. Backfilling will commence following completion of the tank walls. The first stage of backfilling will be completed to the underside of the bottom level frame of the shoring system. Waler beams and any additional bracing installed will be removed. All backfilling will be compacted accordingly with the selected engineering fill requirements.

12. Following removal of the lower level of the shoring system, backfilling will recommence to the underside of the top level frame where waler beams will be removed. Sheet piles will then be abstracted around the perimeter of the cofferdam.
13. The final phase of backfilling can then be completed. SR21 material will be placed beneath areas to be finished in footpaths.
14. Once constructed, mechanical and electrical installation will commence including the storm tank cleaning system, stormwater return pumps, and a mechanical stormwater overflow screen. Lockable access covers will be installed over the storm water return pumping station.
15. Access platforms, walkways, and handrailing will then be installed. Hose reel connections will be installed at various locations along the storm water to facilitate wash down points using final effluent wash water.

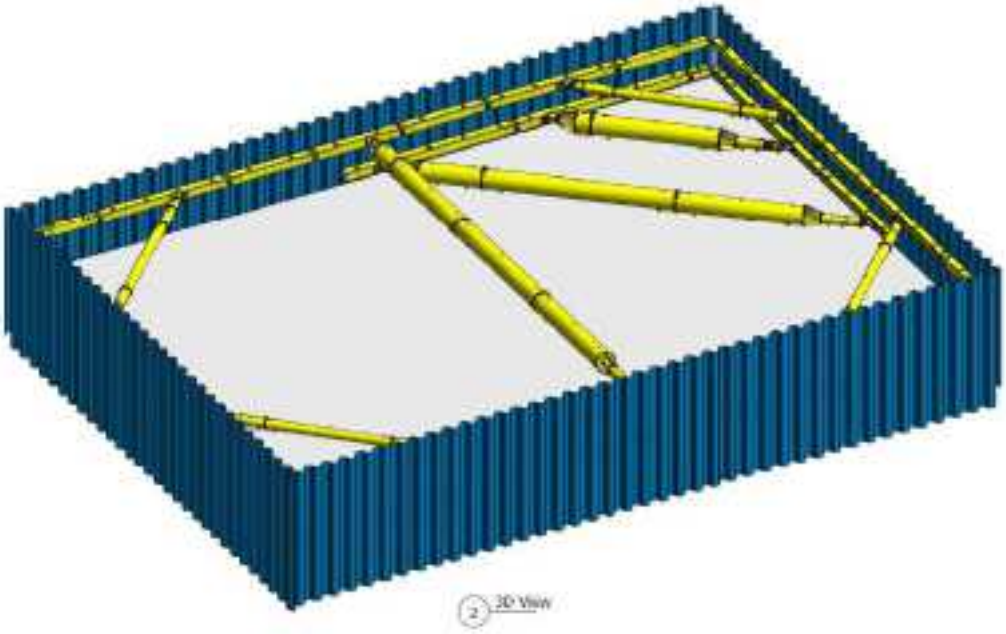

Figure 4.1: Cofferdam Shoring System

4.6.2 Primary Treatment Building

Overview

The primary treatment building will be located to the south of the storm tank. The height of the building will be approximately 9m above ground level. The floor level will be raised higher than the current ground level to above the design flood level. Construction of the building will likely comprise of a steel frame structure with blockwork and insulated composite panels on a reinforced concrete base.

The splitter chamber, which will be located between the storm tank and filter building will also be constructed at this stage. The height of the splitter chamber will be approximately 4.2m above ground. This surface structure will likely be constructed of reinforced concrete cast in-situ. An open bar grating flooring grid and access covers will be installed over the splitter chamber. External stairs will provide access to the top of the structure. Handrailing will be installed around the perimeter to provide edge protection to operatives.

Construction Process

As per the previous section, excavated material will generally comprise of made ground overlying soft silt and clay. Construction of the primary treatment building will commence following completion of the storm

tank. Working space will be required around the perimeter of the storm tank to facilitate the installation and removal of sheet piles.

Surface structures will likely need to be piled to transmit loads to more competent layers at depth to avoid potential bearing failure and/or excessive total and differential settlement. It is envisaged that reinforced concrete piled foundation system is required. For the purpose of this assessment, it is assumed that Continuous Flight Augured (CFA) piles will be installed to support the process building and splitter chamber.

Following the enabling works described in **Section 4.5**, construction of the building will likely progress as per the following sequence of works:

1. The first phase will be to auger and install the CFA piles required to support the buildings structure. Clearance of the work area will be undertaken and a hard standing provided to allow for the set-up of piling plant and equipment.
2. The piling rig will auger to the required depth for each pile. Once the required depth is achieved, concrete will be pumped into the bottom of the shaft as the auger is lifted.
3. The extraction rate of the auger will be matched with the concrete pressure being supplied until the auger reaches ground level.
4. Concrete will be installed to piling platform level and will later be cut to the required depth.

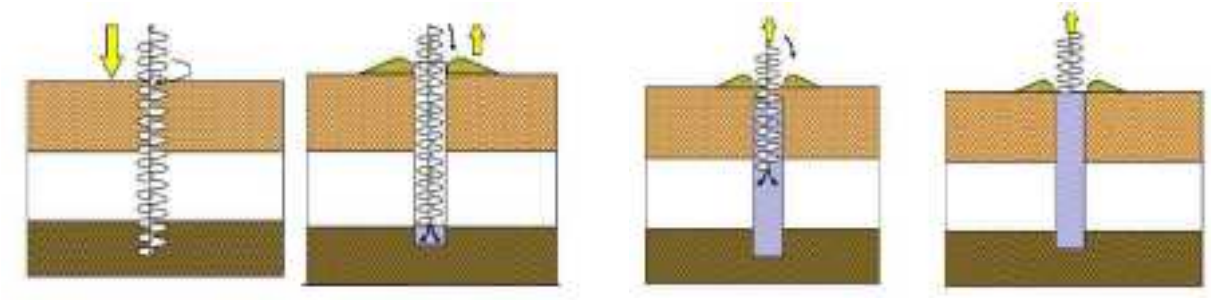

Figure 4.2: CFA Piling Sequence Illustration

5. The next phase of construction will involve the construction of the splitter chamber. The footprint of the primary treatment building and splitter chamber will be excavated to formation level and a layer of concrete blinding will be installed.
6. Pile caps will be constructed and incorporated into the splitter chamber reinforced concrete base.
7. The tank walls will likely be reinforced concrete cast in-situ. Alternatively, pre-cast concrete wall units may be used. The walls will be poured in sections until all external and internal walls of the tank are constructed.
8. Pipework will be installed through the walls of the tank and sealed to ensure water tightness.
9. Testing will be undertaken for watertightness in accordance with the CEWSI (2011) Civil Engineering Specification for the Water Industry, 7th Edition. Please refer to **Section 4.6** Construction Process for the Storm Water Storage Tank for further detail.
10. Construction will commence on the pile caps and ground beams which will support the structural steel frame for the primary treatment building.
11. Pile caps will be constructed over each pile, followed by the construction of ground beams. The ground bearing slab will also likely be constructed at this stage.
12. The next phase will be to erect the structural frame and secondary support steel for the primary treatment building. Roof purlins will also be installed.
13. Masonry walls will be constructed to an intermediate level around the perimeter of the building.

14. Wall cladding will then be installed to the remaining height of the building. The roof system will also be installed at this stage.
15. Once constructed, the final phase of mechanical and electrical installation will commence including installation of the primary treatment filtration system, control panels, and ancillary equipment. The contractor may install larger equipment at an earlier stage of the sequence to avail of easier lifting arrangements.
16. Building fit-out and finishes will also be completed at this phase. Access platforms, walkways, and handrailing will then be installed for both structures.
17. Footpaths and vehicle access will be constructed at a later stage in parallel with overall site finishes.

4.6.3 Forward Feed Pumping Station

Overview

The pumping station will be partially constructed below ground level to a depth of 4.5m and will be constructed adjacent to the primary treatment building. The top of the structure and access covers will be located above the design flood level. Reinforced concrete cast in-situ will likely be used for construction of the pumping station.

The pumping station will consist of two sections at split levels for the wet well sump and valve chamber. A galvanised steel gantry beam supported on a frame will be installed above the pumping station to facilitate removal of the pumps. A staircase will be installed to allow access to the structure with handrailing installed around the perimeter.

Construction Process

It is not envisaged that any reinforced concrete piled foundation is required. It is expected due to the depth of the excavation and the surrounding ground conditions, a sheet pile cofferdam will be installed for the forward feed pumping station.

The pumping station will likely be constructed following completion of the primary treatment building, particularly the external cladding and roofing. Working space will be required around the perimeter of the building for these tasks.

Construction will likely progress as per the following sequence:

1. The first phase will consist of installing sheet piles to the required depth around the perimeter of the area to be excavated.
2. Excavation of ground will be undertaken to approximately 3m below the existing ground level. Excavated material will be removed off-site. If deemed necessary, material will be temporarily stockpiled to assist with loading.
3. The shoring system will be installed following the first phase of excavation. Individual waler beams will be lifted into place and the shoring system assembled within the cofferdam.
4. Excavation will continue and result in a further dig depth of 2m. Excavated material will be hauled off site. Limited soft soils may require excavation and replacement at the base of the excavation. Dewatering will be undertaken as required or as per a pre-installed dewatering system.
5. Upon completion and excavation to formation level, a layer of concrete blinding will be installed for the sump and construction of the tank itself will commence.
6. The base slab for the sump will be constructed followed by the walls which will likely be reinforced concrete cast in-situ. The walls will be partially poured to a height above the base of the valve chamber.

7. Engineering fill will be placed beneath the valve chamber followed by a layer of blinding. The base slab for the valve chamber will be incorporated into the sump walls partially constructed.
8. The walls for the pumping station will be completed to above ground level with a roof slab constructed over the structure.
9. Testing will be undertaken for watertightness in accordance with the CEWSI (2011) Civil Engineering Specification for the Water Industry, 7th Edition. Refer to **Section 5.6.1.2** Construction Process for the Storm Water Storage Tank for further detail.
10. Backfilling will commence following completion of the tank walls. The first stage of backfilling will be completed to the underside of the shoring system. Waler beams and any additional bracing installed will be removed. All backfilling will be compacted accordingly depending on the selected engineering fill used.
11. Once constructed, mechanical and electrical installation will commence including pumps and valves. Lockable access covers will be installed over the pumping station.
12. Access platforms, walkways, handrailing, and the steel lifting gantry beam will then be installed.

4.6.4 Other Subsurface Structures

Overview

Three other sub-surface structures will be constructed and are listed as follows:

- Flood Event Pumping Station;
- Scum Pumping Station; and
- Wash Water Storage Tank.

These structures will be constructed to a maximum depth of approximately 4m below ground.

Construction Process

It is envisaged that construction of these structures will follow the same sequence as outlined in **Section 4.3.2.** It is not envisaged that a cofferdam is required for the construction of the scum pumping station and wash water storage tank.

4.6.5 Picket Fence Thickener and Primary Sludge Holding Tank

Overview

A picket fence thickener (PFT) will be constructed in the north eastern corner of the site with a height of approximately 4.6m above ground level. The primary sludge holding tank will be located to the west of the stormwater storage tank and will be constructed to a height of approximately 3.2m above ground level.

Both tanks will contain a central sump within the tank which will be located below ground level. The tanks will likely be constructed using pre-cast concrete units on a reinforced concrete base cast in-situ. External staircases will provide access to a platform and walkover installed over each tank. Handrailing will be installed along the access platforms.

Construction Sequence

Construction of the picket fence thickener tank will not be impacted by the construction of other infrastructure or project constraints. The primary sludge holding tank will likely be constructed after completion of the structures for the storm tank, primary, treatment building, and forward feed pumping station. As the structure will be above ground and using pre-cast concrete units, less working space is required for construction of the tank.

Piled foundations are likely due to ground conditions as described in **Part B, Section 13**. For the purpose of this assessment, it is assumed that Continuous Flight Augured (CFA) piles will be installed to support both the picket fence thickener and primary sludge holding tank.

Piling foundation works will likely be undertaken during the same stage for the primary treatment building. The pile columns can be buried and protected by a suitable fill material if required until such time construction of the tanks is programmed.

Following the enabling works, as described in **Section 4.5**, construction of the building is likely to progress under the following sequence of works:

1. The first phase will be to auger and install the CFA piles required to support the tank structures. Clearance of the work area will be undertaken and a hard standing provided to allow for the set-up of piling plant and equipment.
2. The piling rig will auger to the required depth for each pile. Once the required depth is achieved, concrete will be pumped into the bottom of the shaft as the auger is lifted.
3. The extraction rate of the auger will be matched with the concrete pressure being supplied until the auger reaches ground level.
4. Concrete will be installed to piling platform level and will later be cut to the required depth.
5. The footprint of the tanks will be excavated to formation level and a layer of concrete blinding will be installed.
6. Pile caps will be constructed and incorporated into the reinforced concrete bases. Each base will likely consist of two individual pours with the central sump constructed first.
7. The tank walls will likely use pre-cast concrete units and will be erected in sequence. Joints will be sealed according with supplier specifications.
8. Pipework will be installed through the walls of the tank and sealed to ensure water tightness.
9. Testing will be undertaken for water-tightness in accordance with the CEWSI (2011) Civil Engineering Specification for the Water Industry, 7th Edition. Please refer to **Section 4.6** Construction Process for the Storm Water Storage Tank for further detail.
10. Once constructed, the final phase of mechanical and electrical installation will commence. Access platforms, walkways, and handrailing will then be installed for both structures.
11. Footpaths and vehicle access will be constructed at a later stage in parallel with overall site finishes.

4.6.6 Sludge Dewatering Building Modification

Overview

The first floor of the building will be removed to accommodate the installation of new dewatering units. As discussed under **Section 4.5.4**, an asbestos survey of Castletroy WwTP was previously undertaken which identified no asbestos containing materials (**Appendix 15A**). A further survey of the building will be undertaken in advance of the demolition works.

Construction Sequence

The works will likely progress as per the following sequence:

1. Materials from the first floor will be removed. Any asbestos containing materials identified during an additional survey to be undertaken will be removed and disposed of appropriately.
2. The existing sludge dewatering equipment and associated pipework will be decommissioned. It is envisaged that temporary dewatering units will be used during the work to maintain plant operations.

3. Sections of the steel floor grating will be removed to allow equipment to be lowered from the first floor to ground level. Lifting gantry beams will be used to relocate or support equipment during this stage.
4. Additional sections will be lifted as required to remove all equipment from the first floor. Once removed, the remaining floor grating will be removed.
5. Structural columns supporting the first floor beams will be removed. Beams will be retained in place.
6. New sludge dewatering units including both feed and discharge pump arrangement will be installed at ground level on elevated platforms.
7. Installation of sludge storage skips outside.
8. New odour control equipment and ventilation.
9. New mechanical and electrical upgrade including new motor control panels to replace existing.

4.6.7 Landscaping and Site Infrastructure

It is anticipated that drainage, utilities and services infrastructure will be installed as required during the construction of the various structures. Any ancillary civil infrastructure works will be completed once the structures have been constructed.

The landscaping works associated with the site will be implemented upon completion of construction activities at this location. Hard landscaping will be installed between the buildings in the form of kerbs, roads and pathways with concrete and gravel finishes and appropriate marking and parking added. Soft landscaping in the form of the placing of soil, levelling and planting of vegetation will also be undertaken.

4.6.8 Process, Mechanical and Electrical Installation

The process, mechanical and electrical equipment will be brought to site and installed upon completion of the construction of the buildings. It is likely that major installations such as the process equipment and new transformer will be installed in the first instance followed by smaller equipment (such as secondary treatment air blowers and odour control unit [OCU]) and then services in the buildings.

The contractor will be responsible for determining the specific methods and sequence of works for the process, mechanical and electrical installation in each of the buildings.

4.6.9 Testing and Commissioning

Upon completion of construction of the Proposed Development, a period of testing and commissioning will be undertaken. Testing and commissioning will comprise the following activities occurring in sequence:

- Level 1 testing - Pre-commissioning;
- Level 2 testing – Site acceptance tests; and
- Level 3 testing – Performance tests.

Level 1 Testing - Pre-commissioning

Level 1 testing will encompass all offline testing associated with pre-commissioning and start-up activities including the completion of all tests that can be conducted without the connection of any services (electrical power, chemicals, compressed air, fuel, or pressurisation), other than for the purpose of hydrostatic testing, any part of the equipment. Pre-commissioning will include commissioning checks including mechanical, electrical and instrumentation, control and automation elements as a minimum.

Level 2 Testing - Site Acceptance Tests

Level 2 testing will comprise any online dry and wet functionality testing required following connection of services. Site acceptance testing will incorporate:

- Testing of each piece of plant and equipment individually;
- Testing of each system within the works both manually and automatically; and
- The interactions of the various systems and the setting to work of the plant as a whole.

Once each of the principal systems has been tested and accepted, the works will be process commissioned and optimised to achieve a status of process established. Site acceptance testing will include general testing (including domestic electrical installation, emergency lighting, fire and intruder alarms) in addition to functional testing of preliminary, secondary processes, sludge processes and associated pumping systems, generator changeover and a full (clean water) operational test of the Wastewater treatment plant.

Level 3 Testing - Performance Tests

Level 3 testing will comprise performance testing during which the contractor must ensure that the wastewater treatment plant complies with the performance requirements as outlined in the tender documents. Performance tests will be undertaken following completion of the entire wastewater treatment plant and will not accommodate testing of individual items or sections within the Wastewater treatment plant Performance tests will include:

- Process commissioning including flow diversion and initial wastewater reception; and
- Final test on completion including continuous plant operation for a fixed period of time.

4.7 Traffic Management

4.7.1 Overview

A detailed construction traffic management plan will be prepared by the contractor in advance of any works taking place on site and submitted to Limerick City and County Council for approval. This plan is required to control the impact of construction traffic on the local transport network and ensure compliance with the relevant measures outlined in this EIAR. The traffic management plan will also be submitted to the University of Limerick for approval.

High level agreements with both Limerick City and County Council and the University of Limerick will be sought in advance of works commencing and any requirements or constraints will be incorporated into contract documents for the works.

4.7.2 Construction Traffic

During the peak construction period, it is anticipated that up to 136 additional passenger car units may be generated (refer to **Part B, Section 6** for further information). Traffic flows and scheduling will be appropriately planned to ensure construction traffic flows through the Castletroy area, and the University of Limerick campus are managed efficiently and effectively in accordance with the relevant legislative requirements.

Further detail on the assumptions made and a description of how the traffic has been quantified is provided in **Part B, Section 6**.

4.7.3 Site Access and Haulage

Current access to the WwTP is via a single lane access road from Plassey Park Road. This dedicated access road is in the ownership of Limerick City and County Council. Alternatively, as per conditions outlined in **Part B, Section 6**, the WwTP can be accessed through the University of Limerick campus.

The Limerick City and County Council access road will be used by construction staff travelling to and from site, as well as some deliveries. Due to the narrow width of a road a one-way system will be implemented,

the direction of which will change based on peak hours. It is envisaged that during peak morning hours, the direction of flow will be to the Proposed Development site from Plassey Park Road. This will reverse during peak evening hours.

Delivery of the contractor's compound (offices, welfare units, storage containers etc.) larger construction plant (cranes, piling rigs, excavators, mobile elevating work platforms etc.), and materials (pre-fabricated concrete units, sheet piles, pipework, structural steel members, cladding etc.) may not be possible through the Limerick City and County Council access. Similarly, it may not be feasible to deliver larger process equipment (centrifuges, IFAS system, primary treatment filters, control panels etc.) to be installed as part of the plant upgrade using the access road. Access for these activities will be undertaken, by agreement, through the University of Limerick campus internal road network.

During peak construction hours, both ends of the access road will be managed by contractor personnel to maintain the system. During off-peak hours it is envisaged that the one-way system will be altered to accommodate suitable delivery vehicles to and from site.

Within the site, an internal construction road will be constructed adjacent the main works area. This will allow current plant operations to continue as normal, particularly the transportation of sludge. The construction road will be maintained for the duration of the works and will be retained as part of the permanent works.

4.8 Site Management

4.8.1 Employment

Construction of the Proposed Development will generate employment opportunities as there will be a range of personnel employed directly to support the construction activities. It is anticipated that there will be up to approximately 80 construction employees on site during the peak construction period.

4.8.2 Hours of Working

The timing of construction activities, core working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising nuisance and significant effects.

The core construction working hours for the Proposed Development will be:

- 7am – 7pm: Monday to Friday; and
- 8am – 2pm: Saturday.

These working hours correspond to the current construction programme, sequencing and durations as described in **Section 4.3**.

The removal of waste material off site by road and regular deliveries to site will be generally confined to daytime hours but outside of peak traffic hours (10am to 4pm). However, for large concrete pours (storm tank) and waste removal, deliveries and haulage may take place during peak hours.

It may be necessary in exceptional circumstances to undertake certain activities outside of the construction core working hours. Any construction outside of the construction core working hours will need to be agreed in advance with Limerick City and County Council and scheduling of such works will have regard to nearby sensitive receptors.

4.8.3 Hoarding

Site security fencing is currently erected around the perimeter of the site. As outlined previously, hoarding and decking will be erected within the site to segregate construction works areas from plant operations that will remain in-situ for the duration of the construction works. Hoarding will also be erected along the south-eastern section of the site to minimise potential of disturbance to badger sett.

The hoarding/fencing would be up to approximately 2.4m high to provide a secure boundary to what can be a dangerous environment for those that have not received the proper training and are unfamiliar with construction operations.

Site hoarding also performs an important function in relation to minimising nuisance and effects including:

- Noise emissions (by providing a buffer);
- Visual impact (by screening the working areas, plant and equipment); and
- Dust minimisation (by providing a buffer).

The erection of hoarding will be of a similar nature to what is carried out on most construction sites. Mounting posts will be erected by using a mini-digger and the posts would be set in concrete. Where practicable, hoarding and fencing will be retained, re-configured and re-used between working areas as the construction activities progress.

4.8.4 Services and Lighting

Site services will be installed in parallel with the rearrangement and diversion of existing utilities, where relevant. The site will be powered by mains supplies or diesel generators (for construction use only) where an electrical supply is not available.

Site lighting will typically be provided by tower mounted 1000W metal halide floodlights at the various work areas in the Proposed Development site. The floodlights will be cowled and angled downwards to minimise spillage to surrounding properties. The contractors' site will be powered by mains supplies or diesel generators.

4.8.5 Materials

Construction of the Proposed Development will require the import of materials to site for construction activities as well as the export of materials generated and surplus to requirements. Where practicable, efforts will be made to manage materials in accordance with the waste hierarchy and promote the reuse and recycling of materials on site.

A summary of the estimated material types and indicative quantities of each type of material to be managed is provided in Table 4.1 and further detail on the indicative quantities and associated construction traffic to move these materials is available in **Sections 4** and **15** respectively.

A temporary compound has been provided within the site boundary for the storage of materials. Stockpiling of materials outside of site boundary will not be permitted and management measures (as described in detail in the Outline CEMP in **Appendix 4A**) will be implemented to ensure effective containment and handling of all materials during construction.

Table 4.1: Estimated Bulk Materials Quantities and Management during Construction

Nature	Structure	Nature / Source	Quantity (m^3)
Export	Storm Tank	Non-hazardous Excavation Material	6,223
	Filter Building & Splitter Chamber		650

Nature	Structure	Nature / Source	Quantity (m^3)
	Picket Fence Thickener		540
	Forward Feed Pumping Station		508
	Flood Event Pumping Station		253
	Primary Sludge Holding Tank		245
	Wash Water Tank		114
Import	Storm Tank	Granular fill	1,260
	Forward Feed Pumping Station		217
	Flood Event Pumping Station		132

4.9 Environmental Management

An outline Construction Environmental Management Plan (CEMP) and schedule of mitigation measures has been prepared (also refer to **Part B, Section 20**). These documents define the minimum standards required of the contractor as they affect the environment, amenity and safety of local residents, businesses, the general public and the surroundings in the vicinity of the Proposed Development.

The contractor is required to integrate these measures into a Detailed CEMP(s) following appointment (prior to the commencement of any construction activities). Effective implementation of the CEMP will ensure that disruption and nuisance are kept to a minimum throughout the construction of the Proposed Development. The Detailed CEMP(s) will be required to have regard to the guidance (CIRIA (2015) Environmental Good Practice on Site Guide, 4th Edition) and industry best practice. The Detailed CEMP(s) will be implemented throughout construction and the contractor will be required to review and update them as construction progresses.

In addition to the Detailed CEMP(s), it is anticipated that the contractor will prepare a Construction Management Plan and relevant Works Method Statements in advance of any works commencing on site. Every effort will be made to ensure that any significant environmental effects as described in this EIAR will be avoided, prevented or reduced by adopting the mitigation measures outlined in this EIAR.

4.10 References

CEWSI (2011) Civil Engineering Specification for the Water Industry, 7th Edition

CIRIA (2015) Environmental Good Practice on Site Guide, 4th Edition.

CIRIA (1996) Sea outfalls - construction, inspection and repair: Report 159.

Health and Safety Authority (2013) Asbestos-containing materials (ACMs) in Workplaces: Practical Guidelines on ACM Management and Abatement.

Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and adjacent to Water.

UK Water Industry Research Limited (2011) Civil Engineering Specification for the Water Industry, 7th Edition