CHAPTER 7 WATER: HYDROLOGY and HYDROGEOLOGY

7.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of the impacts of the proposed buttressing works to be undertaken on a selection of the dam walls of the Randalstown Tailings Storage Facility (TSF) at Boliden Tara Mines (BTM), Co. Meath, upon the water environment. These works are proposed to be undertaken with a view to increasing the Factor of Safety (FoS) associated with the dam walls.

This chapter defines the study area, the methodology used for developing the baseline and impact assessment, provides a description of the baseline environment in relation to water, and presents the findings of the impact assessment on water quality, hydrology, hydrogeology, hydromorphology, flood risk and water resources, as well as how these changes could impact on any water dependent ecosystems, such as wetlands.

The assessment considers the potential for non-conformance with the European Union (EU) Water Framework Directive (WFD), Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy objectives and checks that:

- the need for the avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation; and
- the selection of appropriate means of preventing significant predicted impact is made through modification of the drainage design, choice of discharge location(s) and/or adoption of run-off treatment methods, with the objective of designing-out potential adverse environmental impacts (Appendix 7A – Preliminary WFD assessment).

The application Site boundary lies within the boundary of the existing Randalstown TSF under the ownership of the Applicant (BTM) (see Figure 1).

Full details on the background, site history and the Proposed Development is provided in Chapter 3 (Description of the Proposed Development).

This chapter should also be read in conjunction with Chapter 6 (Biodiversity) and Chapter 12 (Land and Soils) and Appendix 7B (Flood Risk Assessment) of this EIAR, which pay particular attention to the potential for impacts upon the aquatic / riparian environment and the hydrogeological environment respectively.

The team at AECOM (including Jane Sladen and Jenny Rush) have provided support to BTM for almost 30 years, in the assessment of potential water impacts associated with the TSF. This report is based on the findings of a substantial background of data.

7.2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

7.2.1 Overview

BTM is proposing the following engineering works at the Randalstown TSF:

- the construction of a reinforcement buttress to the extant embankment walls of the TSF.

BTM has recently become a member of the International Council for Mining and Metals (ICMM) and is in the process of adopting the Global Industry Standard on Tailings Management (GISTM).

A key objective of GISTM is to address the risk of tailings embankment failure through conservative design criteria, independent of trigger mechanisms, to minimise potential impacts.

7.2.2 Tailings Storage Facility (TSF)

The TSF is constructed as a ring-dike configuration, Stages 1 to 5 are enclosed by earth fill embankment walls constructed from locally sourced Quaternary glacial till which underlies the site to reduce the potential amount of seepage from the overburden material (tailings) into groundwater and adjacent surface watercourses, while Stage 6 is composite lined. The facility encloses an area of approximately 250 Hectares and has been enlarged in six extensions over its 46-year existence using combinations of permanent and temporary embankment dams (Ref. 1).

A perimeter interceptor channel encircles Stages 1 to 5 of the TSF embankments (refer to Plate 7-1: Extant embankment wall, internal drainage system and interceptor channel (Ref.1)

and Plate 7-2). The interceptor channel, located at the toe of the embankment/ dam walls, is an integral component of the internal drainage system. The interceptor channel details are as follows:

- Buttress Chainage 0 to 2180 – Open channel.
- Buttress Chainage 2180 to 2625 – Piped and backfilled interceptor channel, work completed in the 1990s. A nominal 900 mm diameter concrete pipe was placed within the interceptor channel and backfilled with drainage stone.

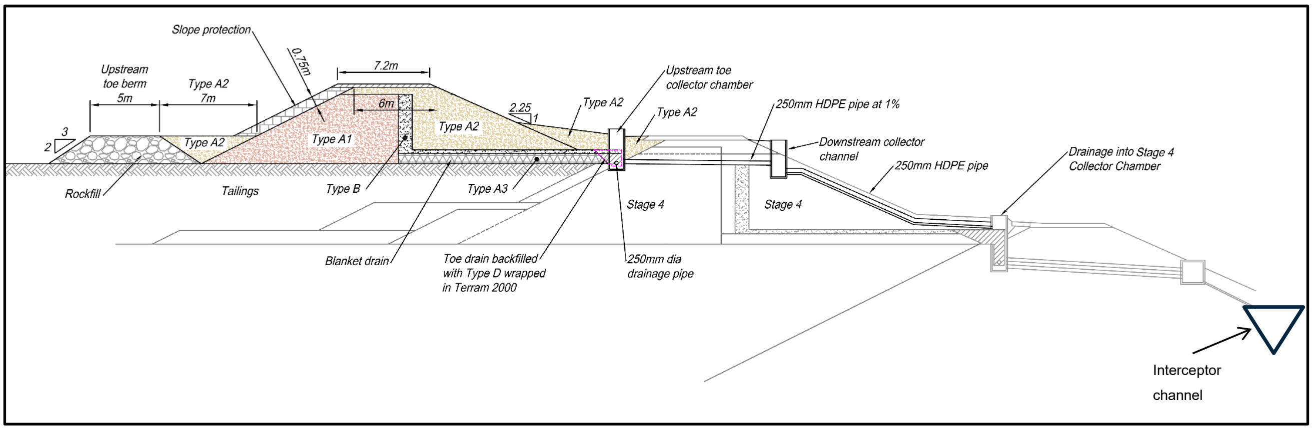
- Buttress Chainage 2625 to 3850 – Piped and backfilled, work completed in 2023. A nominal 600 mm diameter twin-wall HDPE filter pipe was placed at the base of the interceptor channel and backfilled with drainage stone.

The embankment/ dam wall is constructed using glacial clay/ silt till with a granular internal drainage system consisting of a chimney and blanket drain. The embankment/ dam wall is constructed in zones where:

- the upstream section comprises low permeability glacial till (Type A1).
- the downstream section comprises a less clayey material (Type A2).

A granular chimney drain lies between the upstream and downstream sections. The chimney drain reports to a rock fill drainage blanket. The drainage blanket drains the water to a collection chamber and then down gradient to the lower dam walls and eventually reports to the interceptor channel.

Plate 7-1: Extant embankment wall, internal drainage system and interceptor channel (Ref.1)



7.2.3 Water Management System

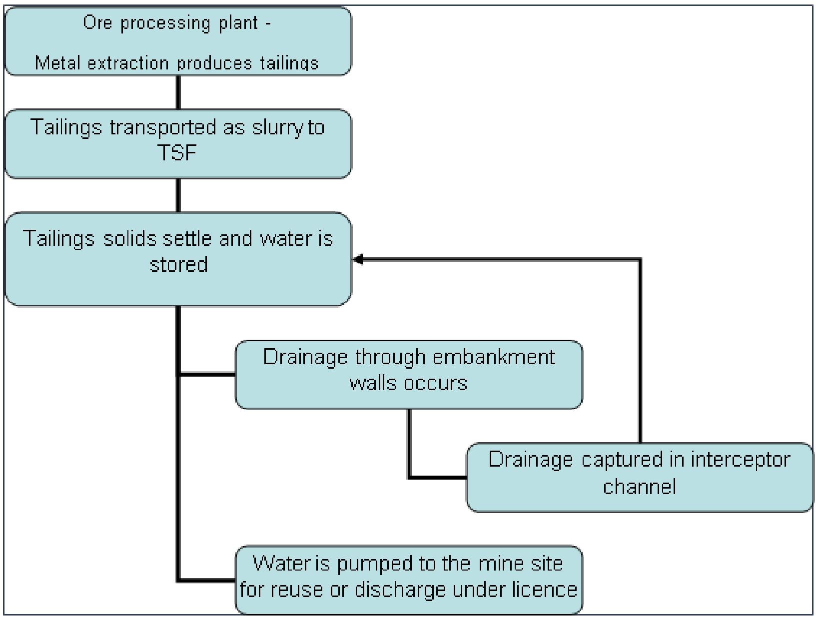
The tailings resulting from the comminution and metal recovery process at the mine site are pumped as an aqueous slurry to the TSF. The TSF is designed to operate as a large sedimentation/ aeration pond where solids settle and clear water at the surface is drawn off for recirculation (referred to as 'reclaim water') to the Reclaim Water Pond at the mine site (refer to Figure 2). The limestone in the tailings maintains the water at an alkaline pH, which precipitates all but traces of the metals remaining in solution from the milling process. The large surface area of the facility provides adequate aeration for aerobic degradation of the organic reagents, to assure a low B.O.D. concentrations in the water (Ref. 1).

The tailings storage area is also used for temporary water storage and designed such that there is always an excess storage volume over and above that required for the storage of plant tailings, which can be used for the retention of water during low flow periods in the River Boyne. The excess water accumulates in the tailings area during summer months when the flows in the River Boyne are low and discharge into the River Boyne is restricted (minimum dilution ratio of 100:1) and is released by way of the Reclaim Water and Clear Water Ponds in the winter months. When the river flow is high water is pump returned to the mine site for reuse in the processing plant and / or is discharged under conditions of the company's Industrial Emissions (IE) licence P0516-04.

The water to be discharged to the River Boyne overflows from the Reclaim Water Pond into a Clear Water Pond. A weir structure at the pond outlet measures the discharge to the River Boyne. The discharge is recorded and controlled from the Mill Central Control room, which is manned 24 hours per day, 7 days per week.

An automatic gauging station installed on the River Boyne provides a continuous record of the water level and therefore the flow in the River Boyne. The discharge to the River Boyne is measured at a measuring weir at the discharge of the Clear Water Pond. Excess water is discharged to the river Boyne at a minimum dilution ration of 100:1.

Plate 7-2 TSF water management system schematic (Ref. 1)



7.2.4 Proposed Works

In order to adopt the GISTM at Randalstown, the construction of a rockfill and earthen reinforcement buttress to the extant embankment walls of the TSF has been proposed. The purpose of these works is to increase the Factor of Safety (FoS) at the downstream toe of the Stage 4 embankment to what is now required under the GISTM. The proposed works are as follows (Ref. 1):

- *Preparatory works.*
- *The construction of a buttress to the Stage 4 dam raise and Stage 1, 2 and 3 starter dams.*
- *Extensions to existing monitoring instrumentation to facilitate continued reading post construction of the buttress.*
- *Extension to some of the existing manholes which form part of the Stage 4 toe drain and weir monitoring system so that continued access can be guaranteed post construction of the buttress.*
- *Other ancillary works as may be required by Industrial Emissions Licence (IEL) Register Number P0516-04.*

Construction Phase

The proposed buttress is to be constructed on the downstream slope of and at the crest of the Stage 1, 2 and 3 starter embankments, as detailed in Plate 7-3. The proposed buttress will be approximately 6-9m wide at the top of the starter dam and approximately 10-12m wide at the base or toe of the Stage 4 embankment. The proposed buttress will be constructed with glacial till and mine rock.

The preparatory works will include the removal of topsoil and vegetation from the crest and the side-slopes over the footprint of the proposed buttress i.e., the starter embankments and part of the Stage 4 embankment. The surface materials from a road along the crest of the starter embankments will also be removed. The topsoil and road surface materials will be stockpiled for re-use, where possible.

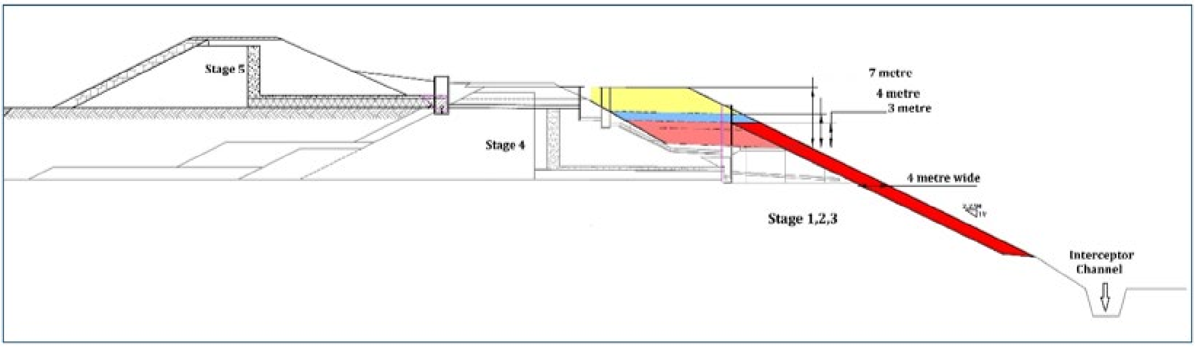
The footprint of the proposed buttress will then be graded and compacted prior to the placement of the fill. Any areas of soft or otherwise unsuitable ground will be excavated and replaced with suitable material and compacted or replaced with appropriate geosynthetics as approved by the Engineer.

As part of the Phase 1 buttress construction works, the material which overlies the Stage 1,2 and 3 chimney drains will be removed intermittently. This will allow sub-surface water drainage in the section to drain into the Stage 1,2 and 3 chimney drain. This water will then report into the interceptor channel and from there will be returned back to the tailings facility.

The base of the proposed buttress raise side slopes is formed on a drainage blanket that will extend over the piped section of the interceptor channel, between Ch2300 and Ch3700 (see Plate 7-4). This section of the interceptor channel was re-graded and installed with perforated pipe set in a channel of drainage stone, in 2023 (see Section 7.4.2). The drainage blanket is to consist of Type D1 material (100mm), consistent with the material used in the re-grading works.

No significant impacts to water levels or water quality at the TSF and in the surrounding environment are anticipated as a result of these works; however, this assessment will examine this in more detail.

Plate 7-3 Cross section of existing embankment walls and proposed buttress (Ref. 1)



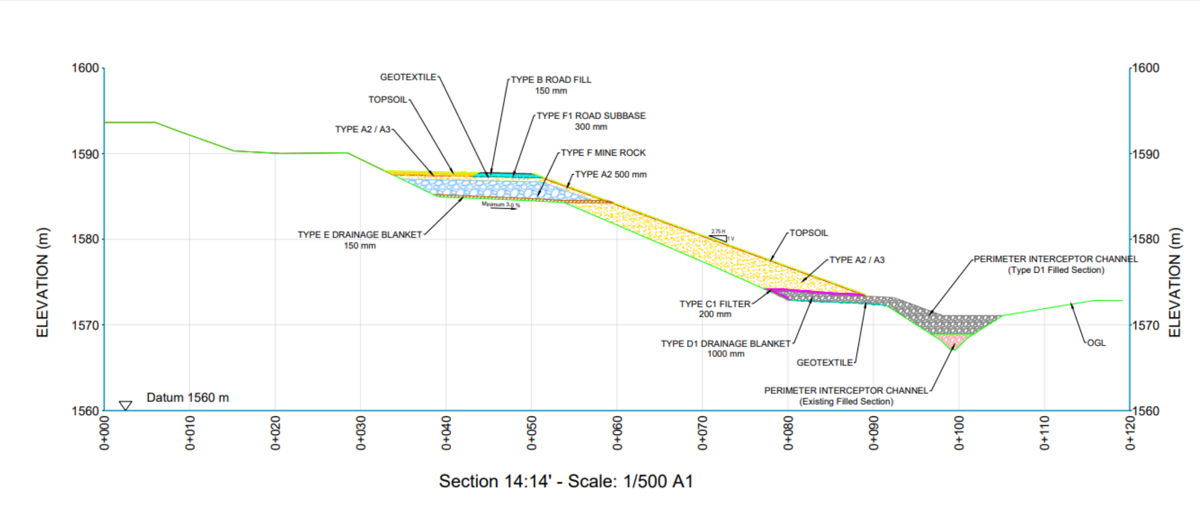
Operational Phase

As part of the design works for the Proposed Development, the following assessments and analyses were undertaken (Ref. 27):

- A mine rock geochemical assessment was undertaken to review the construction materials. The results of static testing indicated that the material is not expected to generate acidic drainage, that metal concentrations from short-term leach tests were low and that the material is considered suitable for use in the Proposed Development construction works, subject to regulatory approval (Ref. 25).
- A seepage assessment was undertaken to review the potential for long-term seepage entering the buttress.

- A hydrological assessment to review the operational, post-closure and long-term seepage rates from the interceptor channel.
- Stability analyses were undertaken which examined the stability of the proposed buttress raise slopes.

Plate 7-4 Cross section of proposed buttress and interceptor channel at Ch2700 (Ref. 2)



7.3 ASSESSMENT METHODOLOGY

7.3.1 Regulatory and Policy Framework

Legislation

The following European legislation and transposing Irish regulations are of relevant to this water environment assessment and Proposed Development:

- European Union Water Framework Directive (WFD) (2000/60/EC). The following legislation in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programmes in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments: The Board is respectfully asked to discharge its obligations under the Water Framework Directive and assess whether the Proposed Development will compromise the objectives of that Directive, in light of the pending CJEU reference by the High Court in Sweetman v An Bord Pleanála [2021] IEHC 16; [2021] IEHC 777.
- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003).
- European Union (Water Policy) Regulations, 2014 (S.I. No. 350 of 2014).
- European Union (Water Policy) (Abstractions Registration) Regulations, 2018 (S.I. No. 261 of 2018).
- European Communities (Drinking Water) Regulations 2014 (S.I. 122 of 2014).
- European Communities Environmental Objectives (Surface Water) Regulations, 2009 (‘S.I. No. 272 of 2009 as amended’), as amended in 2012 (by S.I. No. 327/2012), 2015 (by S.I. No. 386/2015) and 2019 (by S.I. No. 77/2019).
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010 as amended), as amended in 2016 (S.I. No. 366 of 2016).
- European Union Environmental Impact Assessment (EIA) Directive 2011/92/EU as amended by 2014/52/EU.
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations S.I. No. 419 of 2012, as amended by S.I. No. 543 of 2014, 2018 (S.I. No. 296 of 2018), as amended by S.I. No. 404 of 2018 and S.I. No. 646 of 2018.
- The EU Floods Directive 2007/60/EC.

- European Communities (Assessment and Management of Flood Risks) Regulations, 2010 (S.I. No. 122 of 2010); and
- European Union (Environmental Impact Assessment) (Flood Risk) Regulations 2012 (S.I. No. 470 of 2012).

Policy

The Meath County Development Plan 2021-2027, prepared in accordance with the provisions of the Planning and Development Act 2000 (as amended), sets out a range of proposed policy objectives for development up to 2027 (Ref. 3). The plan incorporates the mandatory objectives listed in the Act, including conservation and protection of the environment and promotion of compliance with environmental standard.

Guidance

The following guidance documents are of relevant to this water environment assessment and Proposed Development:

- Department of Housing, Local Government and Heritage, 2018. River Basin Management Plan 2018-2021 (Ref. 4).
- Environmental Protection Agency (EPA), 2022. Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Ref. 5).
- EPA, 2003. Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (Ref. 6.)
- EPA, 2013. Management of Contaminated Land and Groundwater at EPA Licensed Sites (Ref. 7).
- National Road Authority (NRA), 2008. Guidelines on Procedures for Assessment Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (Ref. 8).
- Institute of Geologists of Ireland (IGI), 2013. Guidelines for Preparation of Soils, Geology, Hydrogeology Chapters of Environmental Impact Statements (Ref. 9).
- Transport Infrastructure Ireland (TII), 2015, Road Drainage and the Water Environment (DN-DNG-03065) (Ref. 10).
- Department of housing, Local Government and Heritage (DHLGH) 2009, The Planning System and Flood Risk Management – Guidelines for Planning Authorities (Ref. 11).

- Inland Fisheries Ireland, 2016. Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Ref. 12).
- CIRIA (Construction Industry Research and Information Association), 2006. Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648) (Ref. 13).
- Joint Assistance to Support Projects in European Regions (JASPERS), 2018. Water Framework Directive Project assessment checklist tool (Ref. 14).
- Planning Inspectorate Note (PINS), 2017. Advice Note 18: The Water Framework Directive (Ref. 15).

7.3.2 Determination of the Baseline Environment

Study Area

For the purposes of this assessment, a **Study Area** of 1km radius around the Proposed Development has been considered. This Study Area takes account of waterbodies (both surface and groundwater) within and adjacent to the Proposed Development, their immediate catchments, and any water dependent habitats which could be hydraulically connected to these waterbodies in which potentially significant impacts could arise.

Desk Study

A desk study has been undertaken as part of this assessment to identify the key waterbodies within and adjacent to the Site, and to gather and critically evaluate relevant data and information on their condition and attributes. The following sources of information have been reviewed in the preparation of this chapter:

- Ordnance Survey Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale and aerial photographs [Accessed December 2023].
- OSI Discovery series of 1:50,000 scale [Accessed December 2023].
- Geological Survey of Ireland (GSI) online map viewer www.gsi.ie/mapping [Accessed December 2023].
- EPA online map viewer, https://gis.epa.ie/EPAMaps/ [Accessed December 2023].
- EPA Catchments online map viewer, www.catchments.ie [Accessed December 2023].

- EPA Hydronet online map viewer, https://epawebapp.epa.ie/hydronet/ [Accessed December 2023].
- National Parks and Wildlife Service (NPWS) designated sites and protected areas online map viewer, www.npws.ie/mapping [Accessed December 2023].
- Wetland Surveys Ireland wetland inventory online map viewer, www.wetlandsurveys.ie [Accessed December 2023].
- GeoHive historic maps online map viewer, https://webapps.geohive.ie/mapviewer/index.html [Accessed December 2023].
- Office of Public Works (OPW), Fluvial and Coastal Flood information mapping from the Catchment Flood Risk Assessment and Management Program (CFRAM), https://www.floodinfo.ie [Accessed December 2023].
- GSI, 2004. Athboy and Wilkinstown groundwater body descriptions (Ref. 16 and 17).

Site Walkover

A site walkover was undertaken by AECOM on 5th December 2023, as part of this assessment. The walkover included an overview of the TSF and interceptor channel, and inspections of surface waterbodies in the Study Area, observing their current character, condition and proximity to the Proposed Development, the presence of existing risks and any potential pathways for construction and operational impacts from the Proposed Development to these waterbodies.

Monitoring

The Randalstown TSF monitoring system has been operating since 1996 to collect relevant water quality data at strategic locations in the immediate area. The system aims to act as an advance warning system for any potential pollution incidents to local landowners or water users, and to ensure compliance with the EPA IE Licence and the WFD.

Groundwater chemistry is determined from the collection and analysis of samples taken from domestic wells and piezometers at up to 52 locations; while surface water chemistry is determined from the collection and analysis of samples taken from rivers, streams, and water from the interceptor channel at up to 17 locations (refer to Figure 2). The sampling frequency, as required by IEL P0516-04, and is quarterly, with monthly in-situ field parameter readings.

This assessment relies on this water quality and water level data and on the robust conceptual model of the TSF and the surrounding water environment generated from this dataset. No monitoring has been undertaken specific to this assessment.

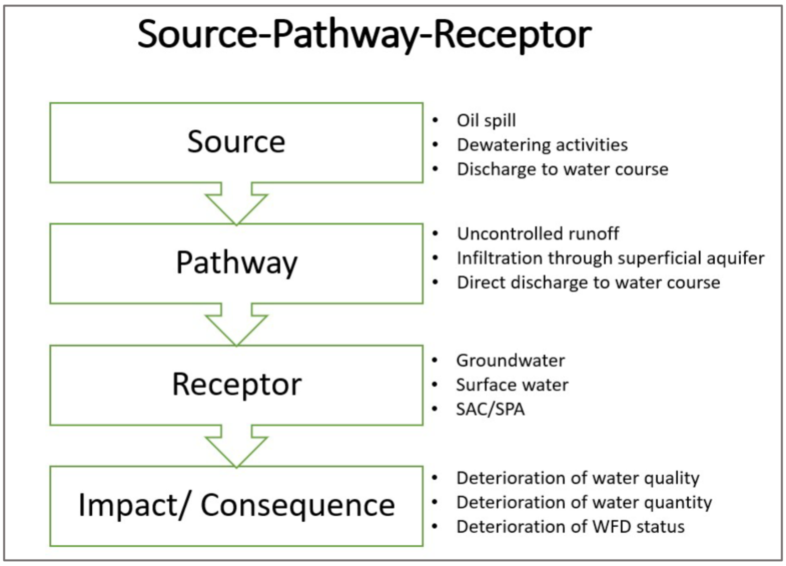
7.3.3 Impact Assessment Methodology

Overview

A qualitative assessment of the likely significant effects on the Water Environment has been undertaken, using the source-pathway-receptor approach (Plate 7-5). For an impact on the Water Environment to exist, the following is required:

- An impact source (such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water body).
- A receptor that is sensitive to that impact (i.e., water bodies and the services they support).
- A pathway by which the two are linked.

Plate 7-5 Source-Pathway-Receptor model



The first stage in applying the Source-Pathway-Receptor model is to identify the causes or ‘sources’ of potential impact from a development. The sources have been identified through a review of the details of the proposed development, including the size and nature of the development, proposed construction methodologies and timescales. The next step in the model is to undertake a review of the potential receptors that have the potential to be affected.

The last stage of the model is, therefore, to determine if there is a viable exposure pathway or a ‘mechanism’ linking the source to the receptor. This has been undertaken in the context of local conditions relative to the water receptors within the study area, such as topography, geology, climatic conditions, and the nature of the impact (e.g., the mobility of a liquid pollutant or the proximity to works that may physically impact a water body).

The assessment of the likely significant effects is qualitative, and considers both construction and operational phases, as well as cumulative effects with other developments. This assessment has considered the risk of pollution to surface water bodies and groundwater directly and indirectly from construction activities, particularly in relation to those water features which are within or close to the Proposed Development. The risk of pollution from runoff from the built environment has also been considered so that appropriate measures can be incorporated into the design of the Proposed Development.

Determination of Sensitive Receptors

The EPA 2022 Guidelines provide high-level guidance across multiple disciplines on the assessment of effects and recognises that “when more specific definitions exist within a specialised factor or topic, e.g., biodiversity, these should be used in preference to these generalised definitions”. In the absence of specific criteria for rating sensitivity in the EPA’s 2022 EIAR guidance, the criteria from the NRA’s Guidelines on Procedures for Assessment Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (Ref. 8) have been used and are presented in the table below. The sensitivity rating ranges from low to extremely high, and considers their likely adaptability, tolerance, and recoverability, as well as their designation, see Table 7-1.

Table 7-1 Receptor sensitivity/ importance (Ref. 8)

Sensitivity/ importance	Description	Example
Extremely High	Attribute has a high quality or value on international scale or protected by EU legislation	River, groundwater body, surface water dependent ecosystems (SWDE) or groundwater dependent terrestrial ecosystems (GWDTE) of Special Area of Conservation (SAC) or Special Protected Area (SPA) status
Very High	Attribute has a high quality or value on regional or national scale	River, groundwater body, SWDE or GWDTE of Natural Heritage Area (NHA) status, regionally important public water supply, active continuous hydrometric station, Quality Class A (Biotic Index Q4, Q5)
High	Attribute has a high quality or value on local scale	SWDE or GWDTE of county importance, locally important potable water supply, Quality Class B (Biotic Index Q3-4)

Sensitivity/ importance	Description	Example
Medium	Attribute has a medium quality or value on local scale	SWDE or GWDTE of local importance, local potable water supply, Quality Class C (Biotic Index Q3, Q2-3)
Low	Attribute has a low quality or value on a local scale	Local water supply used for domestic/ agricultural purposes, Quality Class D (Biotic Index Q2, Q1)

Magnitude of Impact

The EPA 2022 Guidelines focus on likely, significant effects. In the absence of specific criteria for rating of potential impacts and determining their significance, the criteria listed in Annex III of the amended Directive and in the NRA's Guidelines on Procedures for Assessment Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (Ref. 8) have been used (see Table 7-2). These focus primarily on the type and characteristics of potential impacts in terms of magnitude, direct/ indirect [1], probability [2], nature/ quality [3], and duration [4].

Table 7-2 Magnitude of impact (Ref. 8)

IMPACT LEVEL	DESCRIPTION	TYPICAL EXAMPLE
Large adverse	Results in loss of attribute and/ or quality and integrity of attribute	Hydrogeology: – Removal of large proportion of aquifer – Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. – Potential high risk of pollution to groundwater from routine runoff – Calculated risk of serious pollution incident >2% annually Hydrology: – Loss or extensive change to a waterbody or water dependent habitat – Increase in predicted peak flood level >100mm. – Extensive loss of fishery – Calculated risk of serious pollution incident >2% annually – Extensive reduction in amenity value
Moderate adverse	Results in impact on integrity of attribute	Hydrogeology: – Removal of moderate proportion of aquifer

[1] Direct – a change or alteration as a consequence of the site activity; indirect – a change or alternation as a consequence of activities related to the site activity.
[2] Certain and likely; no consideration is given to impacts which may be rated as possible or unlikely
[3] Positive – a change which improves the quality of the environment; neutral – no change or change that is imperceptible; and negative/ adverse – a change which reduces the quality of the environment.
[4] Temporary – lasting less than a year; short-term - lasting one to seven years; medium-term – lasting seven to fifteen years; long-term – lasting fifteen to sixty years; and permanent – lasting over sixty years.

IMPACT LEVEL	DESCRIPTION	TYPICAL EXAMPLE
	or loss of part of attribute	– Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. – Potential medium risk of pollution to groundwater from routine runoff – Calculated risk of serious pollution incident >1% annually Hydrology: – Increase in predicted peak flood level >50 mm. – Partial loss of fishery – Calculated risk of serious pollution incident >1% annually – Partial reduction in amenity value
Small adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Hydrogeology: – Removal of small proportion of aquifer – Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. – Potential low risk of pollution to groundwater from routine runoff – Calculated risk of serious pollution incident >0.5% annually Hydrology: – Increase in predicted peak flood level >10 mm. – Minor loss of fishery – Calculated risk of serious pollution incident >0.5% annually – Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Hydrogeology: – Calculated risk of serious pollution incident <0.5% annually Hydrology: – Negligible change in predicted peak flood level. – Calculated risk of serious pollution incident <0.5% annually

Significance of Effect

The methodology used for describing the potential impacts considers the “quality” of the impacts (i.e., whether it is adverse or beneficial), the “probability” of the event occurring and the “duration” of the impacts (i.e., whether it is short or long term), and a rating of impacts “magnitude” of negligible to large, as per the NRA 2008 Guidelines (Ref. 8). The impact rating is then combined with the sensitivity rating of the impacted receptor to determine the significance of the potential effect (see Table 7-3).

Table 7-3 Effect significance ratings (Ref. 8)

SENSITIVITY/ IMPORTANCE OF ATTRIBUTE	**MAGNITUDE OF IMPACT**				
		Negligible	**Small**	**Moderate**	**Large**
	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
	High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe (Very significant) / Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Limitations and General Assumptions

The assessment has been based on the description of the Proposed Development detailed within Chapter 3: The Proposed Development of this EIAR.

Assumptions and limitations relating to flood risk are outlined in the Site-Specific Flood Risk and Drainage Assessment (Appendix 7B).

While Construction Method Statements will be prepared by the Engineering and Construction (E&C) Contractor when appointed, all works will take place using best practice, as set out in an Outline Construction Environmental Management Plan (CEMP).

7.4 RECEIVING ENVIRONMENT

7.4.1 Land use, Topography and Rainfall

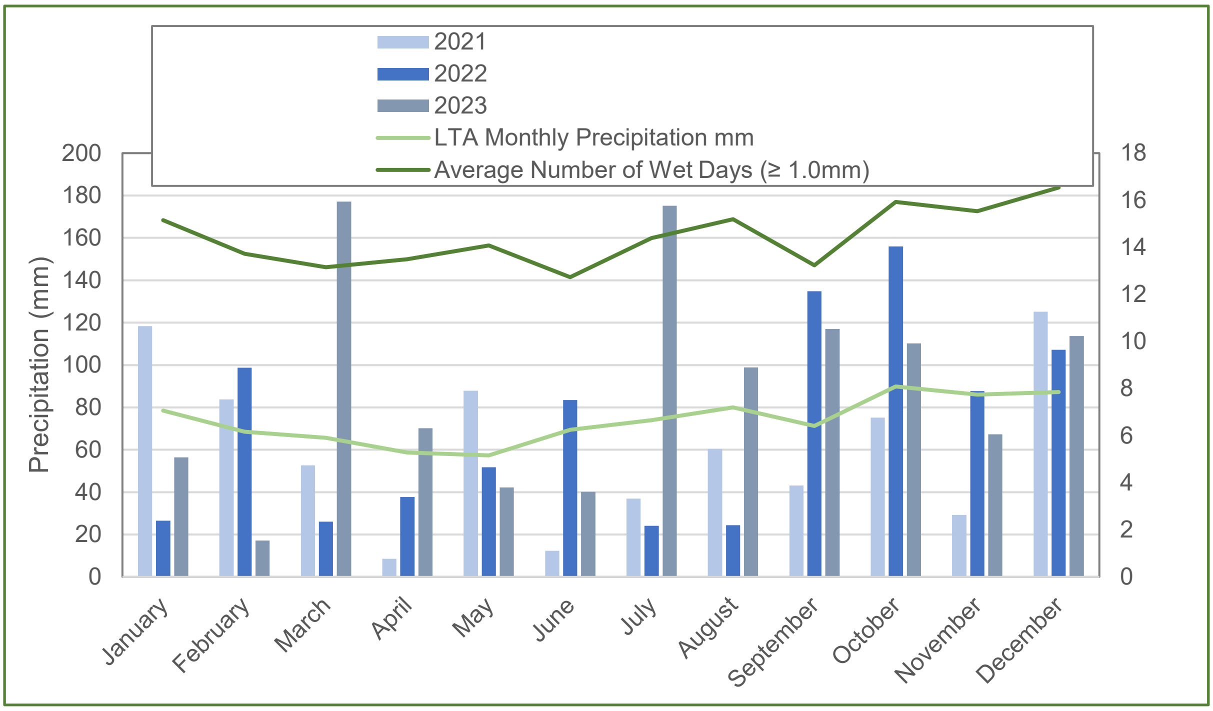
The Randalstown TSF is located approximately 3km northwest of Navan town, Co. Meath, and approximately 2.5km north of the BTM mine site.

The topography of the Site lies at approximately 60m above Ordnance Datum (AOD) with the lowest areas being along the watercourses which skirt the existing Randalstown TSF, and towards the Blackwater River to the south and southwest.

The Site is industrial in character, with the surrounding area characterised primarily of agricultural land use, with the majority as pasture.

Rainfall records are available from the rain gauge at the Tara Mines. Based on the average climate data (for the period 1987 to 2023) for this rain gauge. Refer to Plate 7-6 for more detail.

Plate 7-6 Summary of rainfall and days of rainfall (1987-2023)



7.4.2 Hydrology

Surface waterbodies

Watercourses

The TSF is bounded by the Yellow River to the west, the Blake's Stream to the northeast and the Simonstown Stream to the east and southeast (refer to Figure 2 – referred to as Tatestown Stream and Proudstown Stream respectively in EPA River Network mapping).

The Yellow River flows southwards towards the Blackwater River draining an area of 38.1 km^2 north and north-west of the existing embankment walls. Blake's Stream, to the north of the TSF, is a tributary of the Yellow River, but in 2019, was diverted and flows into the Simonstown Stream (refer to Figure 2).

The Simonstown stream, to the east, has a smaller catchment area of 9.7 km^2 and used to flow beneath what is now the Stage 1 and 2 starter embankments. In 1977, the stream was diverted into a trapezoidal channel which runs parallel to the interceptor channel around the southeastern corner of the TSF. The Simonstown Stream returns to its original course near the TSF access road to the south before combining with the Duog Stream (referred to as

Rathaldron stream in EPA River Network mapping) and continuing westward toward the confluence with the Blackwater River.

The Blackwater River at Liscartan, downstream of inflow from the Yellow River and Randalstown stream, drains a total catchment area of 717 km^2 and follows a meandering south easterly course towards the confluence with the River Boyne east of Navan, at approximately 6km downstream of the TSF.

These surface watercourses are located within the Boyne catchment, which lies within Ireland's Eastern River Basin District (ERBD), as designated under the WFD.

Interceptor channel

The interceptor channel, close to the base of the existing embankment walls or tailings dam captures runoff, underdrainage from the dam and groundwater. Tailings water collected in the interceptor channel is then pumped back up to the tailings pond from one sump pump with automated level controls, located at the south of the interceptor channel/ dam. By returning tailings water back to the tailings pond, a closed water cycle system operates which helps to protect the local water environment. No surface drainage or runoff makes it way off site to the external surface water network.

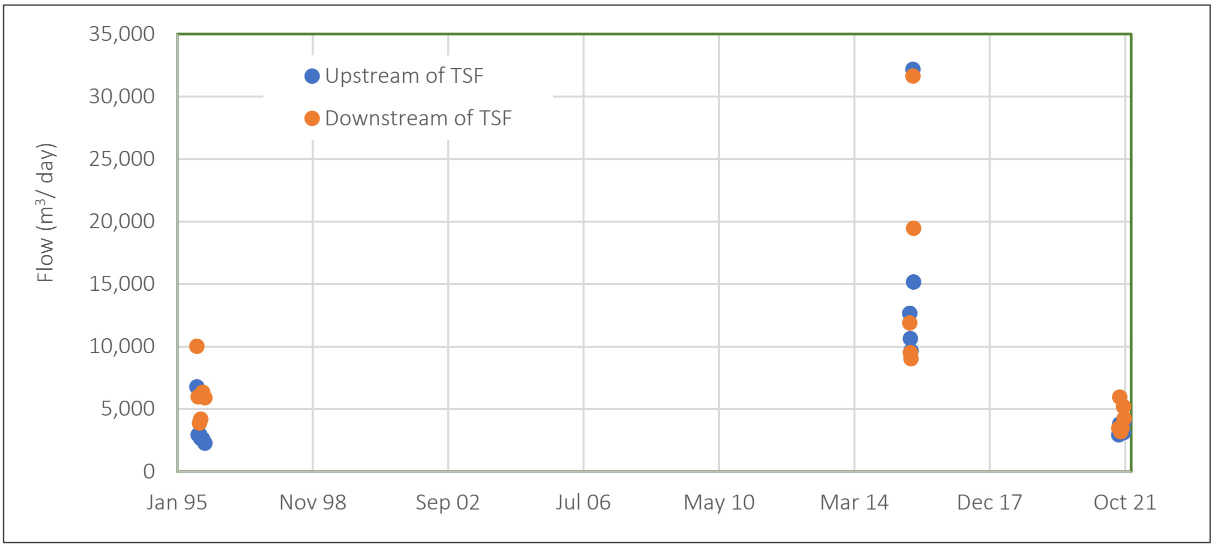
The interceptor channel was designed to be at a deeper level than the Yellow River. However, reaching the design depth in a small section along the southwestern corner of the interceptor channel was historically thwarted by bedrock close to the surface and a high-water table in the superficial deposits. In 2023, a 900m section of the channel (Ch3700 to Ch2625) was re-graded and installed with a perforated pipe set in a channel of drainage stone (Figure 2). The invert level was lowered, and the gradient 'corrected', so that all interceptor water can drain by gravity to the collection point and be pumped back into the tailings pond.

Surface water flows/ levels

Watercourses

There are no active EPA, or OPW hydrometric stations located on the Yellow River, Simonstown Stream, Duog Stream or Blake's Stream, and therefore there are no continuous records of river flow. However, in 2021, Boliden commissioned NVM Limited to carry out gauging of the Yellow River with the aim of establishing a relationship between the water level and the flow. This work was carried out as part of AECOM's *Yellow River Mass Balance* report, prepared to meet IE Licence P0516-04 Condition 6.13.7 "*prepare and report a mass balance* *of seepage from the TMF once every three years to determine inputs into the Yellow River"* and had been previously carried out in 1995 and 2015 (Ref. 18). The following graph summarises the results of the spot flow gauging carried out for these studies.

Plate 7-7 Results of spot flow monitoring in Yellow River (Ref. 18)



The results of spot flow monitoring in 2015 show a decrease in flow from the upstream to the downstream locations indicating a loss of stream flow where the TSF is located. This occurs throughout the 6-week monitoring period in 2015, except for one date in November, which shows the effect of rainfall during the day. This suggests that the Yellow River is an influent stream, at least in places and at least some of the time, with water infiltrating into the alluvial superficial deposits, which are mapped as underlying the stream channel (see Chapter 12: Land and Soils for more detail on geology), as a result of the water table being below the bottom of the stream channel.

There is an active OPW hydrometric station located on the Blackwater River, at Liscartan (Station 07010), at approximately 2km to the south of the Site (Figure 2). The flows equalled or exceeded 95% of the time (Q95) are 1.22m^3/ s or 105,000m^2/ day, based on data derived for the period 1986 to 2024 (www.waterlevel.ie).

Interceptor channel

Interceptor channel water levels are monitored at 6 locations by BTM on a weekly basis (refer to Figure 2). The channel water levels remain constant, due to water levels being controlled by pumping from the channel, apart from some response to rainfall events. The water levels in the interceptor channel range between 1565 and 1574 m above mine datum (AMD), which equates to approximately between 38 and 47maOD. Plate 7-8 summarises the these monitored levels. In 2023, as part of the regrading works at the interceptor channel, these VNW locations were replaced, with the new locations (VNW1-8) shown in Plate 7-9 below.

Plate 7-8 Interceptor channel water levels (2019-2022)

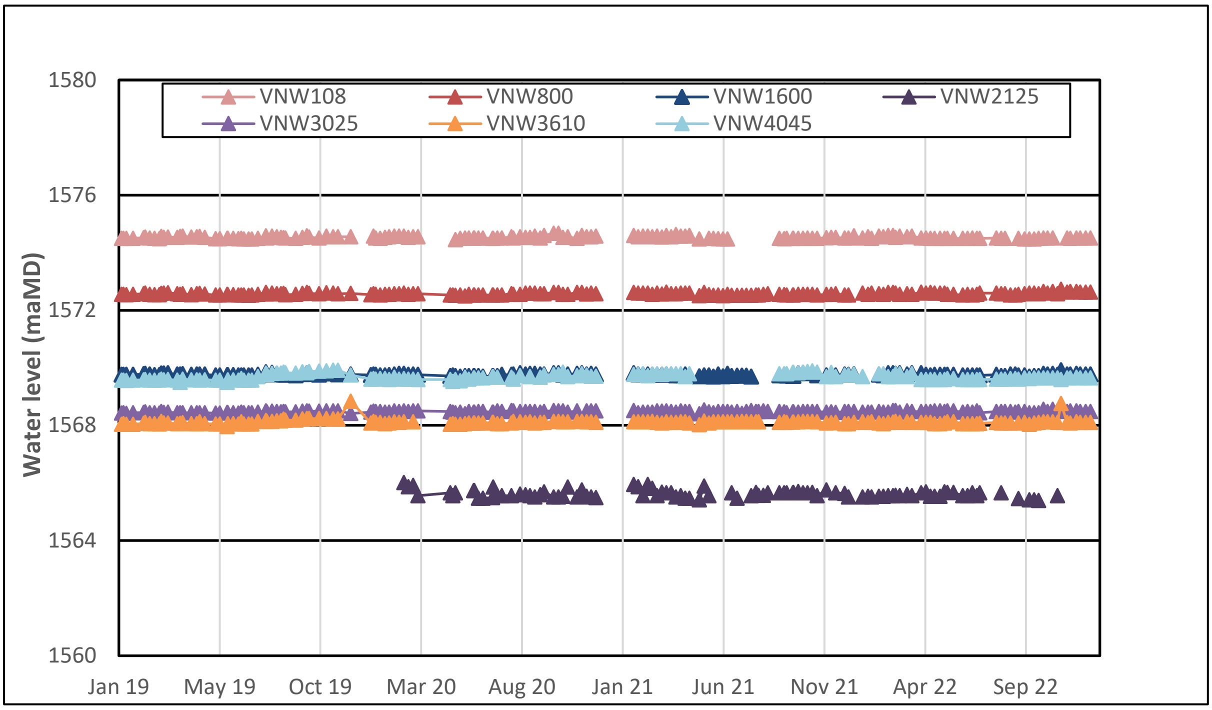
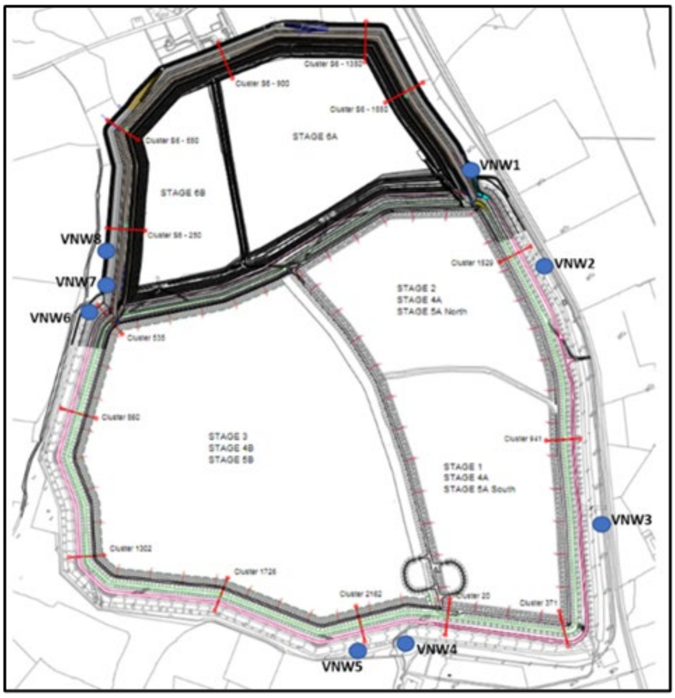


Plate 7-9 New interceptor channel monitoring locations

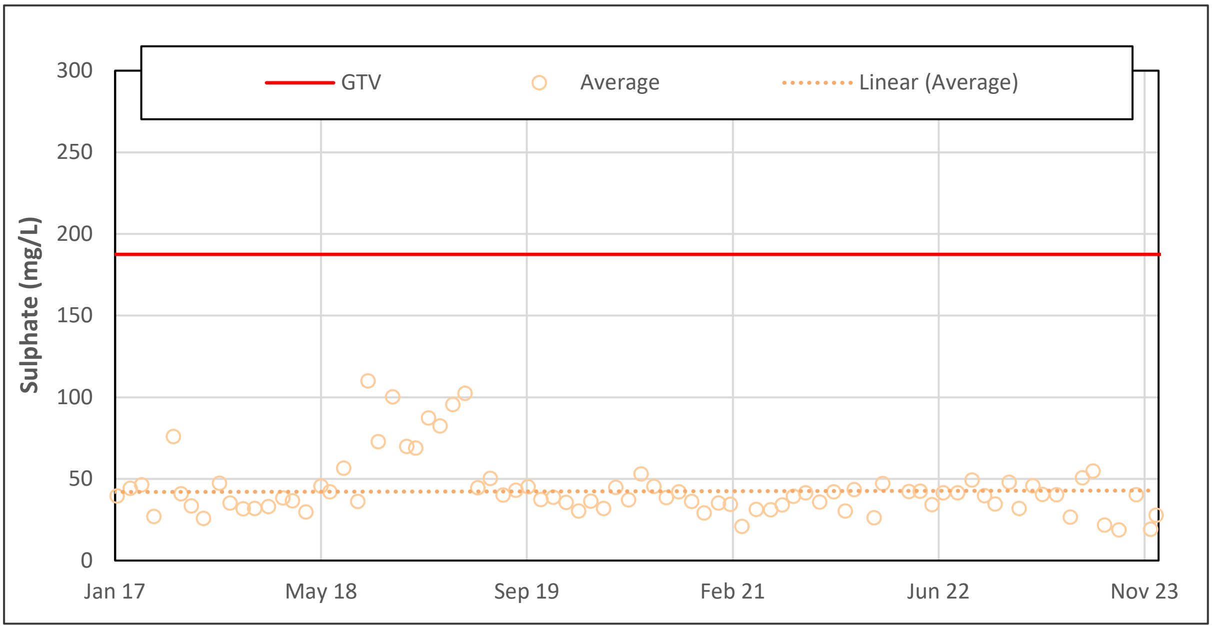


Surface water quality

Watercourses

As part of the Randalstown TSF monitoring network, surface water quality is monitored at up to 17 locations on the Yellow River, Duog Stream, Simonstown Stream and the Blackwater River (Figure 2). Sulphate is used as the key parameter for assessing the influence of the TSF on the surrounding water environment. There are no exceedances of the Groundwater Threshold Value (GTV)[5] for sulphate, except for some construction related events in 2018-2019 (refer to Plate 7-10). There is a stable trend in the dataset (2017-2023), which includes locations both up and downstream of the TSF.

Plate 7-10 Sulphate surface water concentrations (2017-2023)



Other parameters are analysed in surface water in accordance with IE Licence P0516-04, namely manganese, ammoniacal nitrogen, magnesium, zinc, total hardness, nitrate, phosphate, and other heavy metals. Concentrations remain below the respective GTVs, except for isolated and occasional exceedances. There is historical data that manganese occurs naturally in surface water in this area.

[5] EC Environmental Objectives (Groundwater) (Amendment) Regulations S.I. No. 287 of 2022, which came into force on 17th June 2022 to amend EC Environmental Objectives (Groundwater) Amendment Regulations S.I. No. 366 of 2016, S.I. No. 389 of 2011 and S.I. No. 9 of 2010.

The EPA also monitors surface water quality at two river monitoring stations on the Yellow River, and two river monitoring stations on the Blackwater River (Figure 2). Further detail is provided in Table 7-4.

The biological assessment used by the EPA is known as the Q-Rating system. The Q-Rating system refers to a biological rating system for freshwaters and measures the effects of pollution by condensing biological information into a readily understandable form by means of a 5-point biotic index (Q-Values) – where Q5, Q4-5 and Q4 is unpolluted; Q3-4 is slightly polluted; Q3 and Q2-3 is moderately polluted; and Q2, Q1-2 and Q1 is seriously polluted.

Table 7-4 Summary of River Q Values

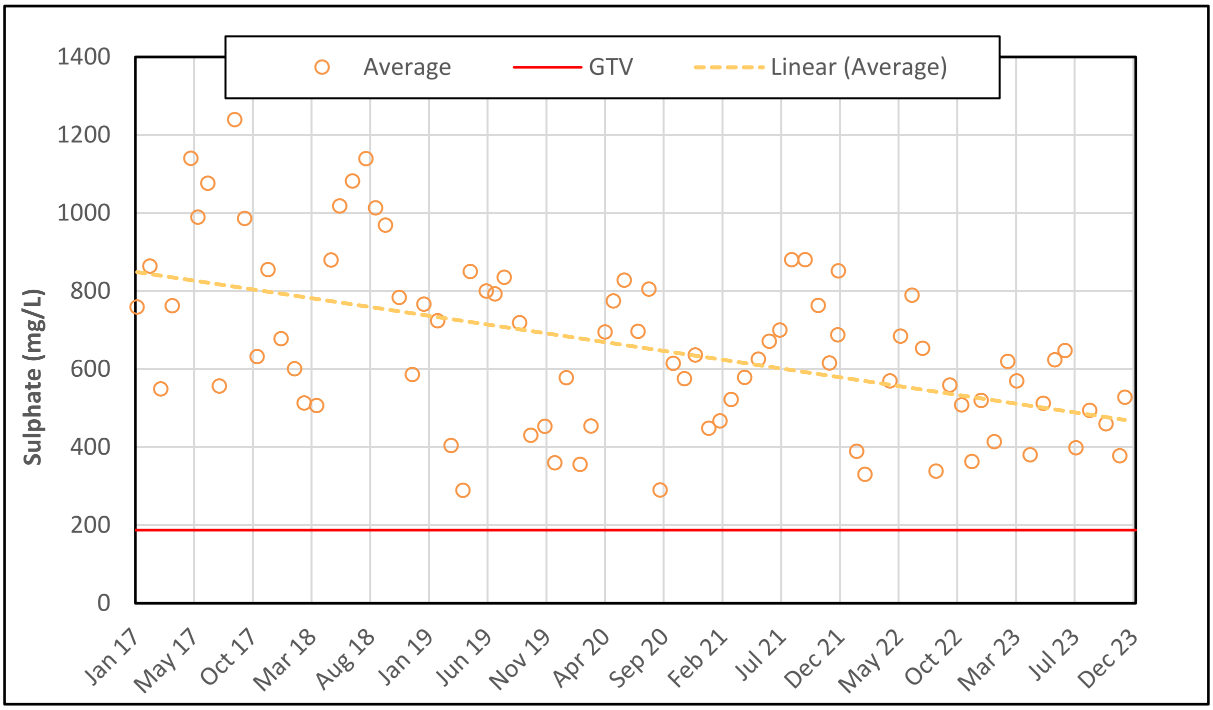
Watercourse	Station ID	Approximate location relative to TSF	Latest River Q Values[6]	Year
Yellow River	RS07Y010900	700m upstream	4 (Good)	1990
	RS07Y01100	600m downstream	3 (Poor)	2020
Blackwater River	RS07B011500	2.2km upstream	4 (Good)	2020
	RS07B011790	2.8km downstream	3-4 (Moderate)	2020

Interceptor channel

As part of the Randalstown TSF monitoring network, water quality is monitored at four locations within the interceptor channel monthly. These locations are ICP3, ICP6, ICP1E and ICP1W (Figure 2). ICP6 was removed in 2023 as part of the regarding works at the interceptor channel. The results of monitoring here reflect water quality in the TSF, and the water is pumped back into the active stage of the tailings dam. All the monitored concentrations exceed of the Groundwater Threshold Value (GTV)[7] for sulphate, as would be expected in the interceptor channel. However, this is a downward trend in the dataset (2017-2023).

[6] EPA www.catchments.ie
[7] EC Environmental Objectives (Groundwater) (Amendment) Regulations S.I. No. 287 of 2022, which came into force on 17th June 2022 to amend EC Environmental Objectives (Groundwater) Amendment Regulations S.I. No. 366 of 2016, S.I. No. 389 of 2011 and S.I. No. 9 of 2010.

Plate 7-11 Sulphate interceptor channel concentrations (2017-2023)



WFD river sub basins

The European WFD (2000/60/EC) (WFD) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. The WFD requires that all inland and coastal waters must reach 'Good' ecological status. 'Good ecological status' means achieving satisfactory quality water, maintaining ecosystems that can support all the species of plants, birds, fish, and animals that live in these aquatic habitats. The Directive runs in 6-year cycles; the first cycle ran from 2009-2015, the 2nd cycle from 2016-2021, and the 3rd currently runs from 2022-2027.

The Yellow River and the Blake's Stream are classified as a WFD surface waterbody (waterbody code: IE_EA_07Y011100). The EPA mapping of 3rd cycle (2013-2018) WFD status indicates that this surface waterbody has been classified as having 'Poor' ecological status or potential and is 'At Risk' of failing to meet its WFD objectives. The mapping indicates that the significant pressure resulting in the 'At Risk' status is the influence of agriculture on water quality. There is no high-status objective listed for this waterbody and no listed hydromorphological issues. No other information on the hydromorphology of the Yellow River adjacent to the TSF is available to this study.

The Blackwater River, the Simonstown and Duog streams are classified as one WFD surface waterbody (waterbody code: IE_EA_07B011800). This surface waterbody has been classified as having 'Poor' ecological status or potential and is 'At Risk' of failing to meet its WFD objectives. The mapping indicates that the significant pressure resulting in the 'At Risk' status is the influence of agriculture and urban runoff on water quality and pressures on hydromorphology. There is no high-status objective listed for this waterbody. Table 7-5 summarises this information.

Table 7-5 WFD surface waterbody condition and At-Risk status

Waterbody name	Watercourse name/s	Waterbody code	Latest WFD Status (2016 – 2021)	WFD risk Cycle (3rd cycle)	Significant pressures
Yellow (Blackwater Kells) 020	Yellow River	IE_EA_07Y01 1100	Poor	At Risk	Agriculture
	Blake's Stream				
Blackwater (Kells)_120	Simonstown Stream	IE_EA_07B01 1800	Poor	At Risk	Agriculture, urban runoff, hydromorphology
	Duog Stream				
	Blackwater River (between Donaghpatrick Bridge and the Boyne)				

Designated sites

The River Boyne and the River Blackwater are designated as a Special Area of Conservation (SAC) (Figure 4). These rivers are designated for the following qualifying interests[8]: alkaline fens, alluvial forests, river Lamprey, salmon, and otter.

The River Boyne and the River Blackwater are also designated as a Special Protection Area (SPA). These rivers are designated to provide protection for kingfisher (*alcedo atthis*) habitats. It prevents alterations to the local vegetation, works affecting the watercourse, and abstractions of ground or surface water without ministerial permission[9].

The conservation objectives of the qualifying interests of these protected areas are directly or indirectly dependent on water quality and flows. Further detail is provided in Chapter 6 Biodiversity.

The River Blackwater is designated as a Drinking Water River, along with a short section (circa 175m) of the Yellow River from its confluence with the Blackwater upstream to the bridge on Windtown Road, the Duog stream and the Simonstown stream (Figure 4). The abstraction

[8] River Boyne and River Blackwater SAC | National Parks & Wildlife Service (npws.ie)
[9] River Boyne and River Blackwater SPA | National Parks & Wildlife Service (npws.ie)

point on the River Blackwater is located at Liscartan, approximately 2.4km to the south of the TSF.

The Boyne is a designated Salmonid River, capable of supporting salmon and subject to Salmonid Regulations S.I. No. 293, and a designated nutrient sensitive river.

Based on Wetlands Survey Ireland mapping, there are no other wetland sites within 1km of the Proposed Development and of significance to this assessment[10].

Surface flood risk and drainage

A Site-Specific Flood Risk Assessment has been undertaken as part of this impact assessment and planning application – see Appendix 7B.

The GSI's National Indicative Fluvial Mapping (NIFM) dataset shows the modelled extent of land that might be flooded by rivers during a theoretical flood event with an estimated probability of occurrence, rather than information for actual floods that have occurred. The mapping shows an area of medium flood event probability (1% or 1 in 100-year event) along the channel and banks of the Yellow River. This is due to man-made features as this area is currently being used for mining associated activities with some local low points. This modelled extent remains outside of the TSF site boundary, except for a very small patch along the western edge (www.floodinfo.ie).

The GSI's Historic Flood Mapping dataset shows fluvial and pluvial floods, during the winter 2015/2016 event. The mapping shows an area of flooding extending from the River Blackwater upstream on the Yellow River as far as the EPA's monitoring station (RS07Y011100), and two smaller areas of flooding along the Duog Stream (see Figure 2).

According to the FRA, there is no evidence of coastal, pluvial and groundwater derived flooding. The Proposed Development is located within Flood Zone B and is defined as Appropriate Development as per the DHLGH's *The Planning System and Flood Risk Management* (Ref. 11).

7.4.3 Hydrogeology

Geology and aquifers

According to GSI mapping, the Study Area is underlain by Carboniferous strata incorporating the Pale Beds (Meath Formation), Mixed Beds (Liscarton Formation) and Red Beds (Old Red Sandstone) underlain unconformably by the Lower Palaeozoic sequence (Rathkenny

[10] MIW Intro — Wetland Surveys

Formation) (see Figure 3). The TSF and the surrounding areas to the north and east are dominated by the Pale Beds and Lower Palaeozoic sequence. To the south and east the Shaley Pales (Moathill Formation) appear along with the Upper Dark Limestone (Ballysteen Formation). The TSF is in an area of major faults, mainly trending north-east to south-west.

According to GSI mapping, the TSF is underlain by sandstone and shale till on the western half, and alluvium on the eastern half (see Figure 3). The alluvium is associated with the channels of Blake's Stream to the northeast of the TSF and Simonstown Stream to the east and south. There is also a thin strip of alluvium mapped along the Yellow River channel to the immediate west of the TSF. Along the southern boundary of the site, there is mapped pocket of limestone sands and gravels. The thickness of these deposits can vary from 5m to more than 10m (Ref. 19).

The Meath, Liscarton and Old Red Sandstone formations are classified as a locally important bedrock aquifer, described by the GSI as "bedrock which is moderately productive only in local zones", while the Rathkenny Formation is classified as a poor aquifer, described as "bedrock which is generally unproductive except for local zones" (see Figure 3). The permeability of the Meath Formation (Pale Beds) can be highly variable and in the range of 10^{-2} to 10^{-9} m/s, depending on the extent of fracturing.

There are no superficial deposit aquifers defined at or within the immediate area of the TSF. However, areas of sands and gravels within the superficial deposits are also water-bearing and may constitute aquifers of local importance. The permeability of the superficial deposits is also variable and in the range of 10^{-4} to 10^{-6} m/s in areas of sandy deposits, and 10^{-8} to 10^{-10} m/s in areas of clayey deposits.

Groundwater level and flow

As part of the Randalstown TSF monitoring network, groundwater levels are monitored in the superficial deposits and in bedrock monthly at up to 25 locations surrounding the TSF (Figure 3). The following are the key points relating to groundwater levels:

- Groundwater levels in the superficial deposits are generally between 1 and 9 m below ground level, are generally unconfined and in hydraulic continuity with the underlying bedrock aquifer.
- The dominant flow direction in the superficial deposits is towards the southwest, the Yellow River and the River Blackwater, and overall, groundwater levels in the superficial deposits have remained relatively stable since 2015.

- Groundwater levels in the bedrock aquifer are generally between 1 and 9 m below ground level.
- The dominant flow direction in the bedrock is towards the south and appears to be influenced by dewatering of the Tara Mines, and overall, groundwater levels in the bedrock aquifer have remained relatively stable since 2015.
- Groundwater levels in the bedrock vary from being similar, higher to lower than groundwater levels in the overlying superficial deposits across the TSF site and across the year. The vertical hydraulic gradient and the potential for vertical seepage downwards therefore varies across the year.

Groundwater quality

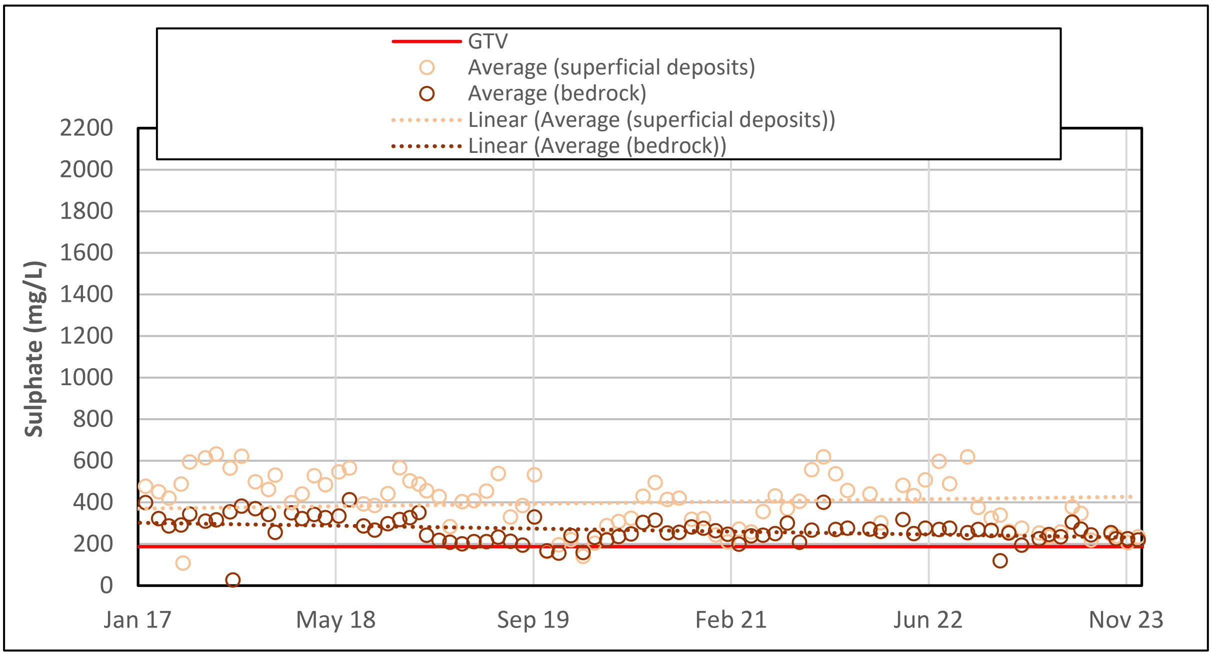
Groundwater quality is monitored in the superficial deposits and in bedrock at up to 25 locations monthly. As in the interceptor channel, sulphate is used as the key parameter for assessing the water quality of the surrounding water environment. In accordance with the IE Licence No. P0516-04, all tailings waste deposited in the TSF is monitored annually for Acid Rock Drainage, and groundwater is monitored monthly for sulphate, pH, and conductivity and quarterly for heavy metals[11]. While the presence of elevated sulphate in the water environment can be an indicator of Acid Mine Drainage (AMD), the monitoring of heavy metals in groundwater at the TSF shows that concentrations generally remain below the GTV.

The following are the key points relating to sulphate concentrations:

- The plotting of average sulphate concentrations shows a steady overall decreasing trend in the 5 years' worth of data in bedrock boreholes, and a relatively stable trend in superficial deposit boreholes.
- Generally, average sulphate concentrations continue to be higher in the superficial deposits than in the bedrock monitoring boreholes and are highest in the superficial deposits to the south and southwest of the TSF.

[11] Lead, zinc, arsenic, aluminium, iron, copper, mercury, cobalt, calcium, magnesium, manganese, cadmium, nickel, cyanide.

Plate 7-12 Sulphate concentrations in groundwater (2017-2023)



PH and heavy metal concentrations have generally remained below the laboratory Minimum Detection Limit (MDL) and below the respective GTVs. Other parameters are analysed in groundwater in accordance with IE Licence No. P0516-04, namely manganese, ammoniacal nitrogen, total hardness, nitrate, and phosphate. Concentrations of these other parameters also generally remain below the respective GTVs, except for manganese, ammoniacal nitrogen and potassium. There is historical data that manganese occurs naturally in groundwater in this area, and the spatial distribution of potassium suggests the source to be agricultural activity in the area.

WFD groundwater bodies

Groundwater bodies are the management unit for groundwater under the WFD. The Meath, Liscarton and Old Red Sandstone formations, which underlie the southern half of the TSF site and the areas to the south and west, form part of the Athboy groundwater body. The EPA's mapping of 3rd cycle (2016-2021) WFD status indicates that this groundwater body has been classified as having 'Good' WFD status and is classified as being 'Not At Risk' of failing to meet its WFD objectives by 2027[12].

The Rathkenny Formation forms part of the Wilkinstown groundwater body, which underlies the northern half of the site. The EPA's mapping of 3rd cycle (2016-2021) WFD status indicates

12 EPA Maps

that this groundwater body has been classified as having 'Poor' WFD status and is classified as being 'At Risk'. The listed significant pressure, those pressures which need to be addressed to improve water quality, is agriculture.

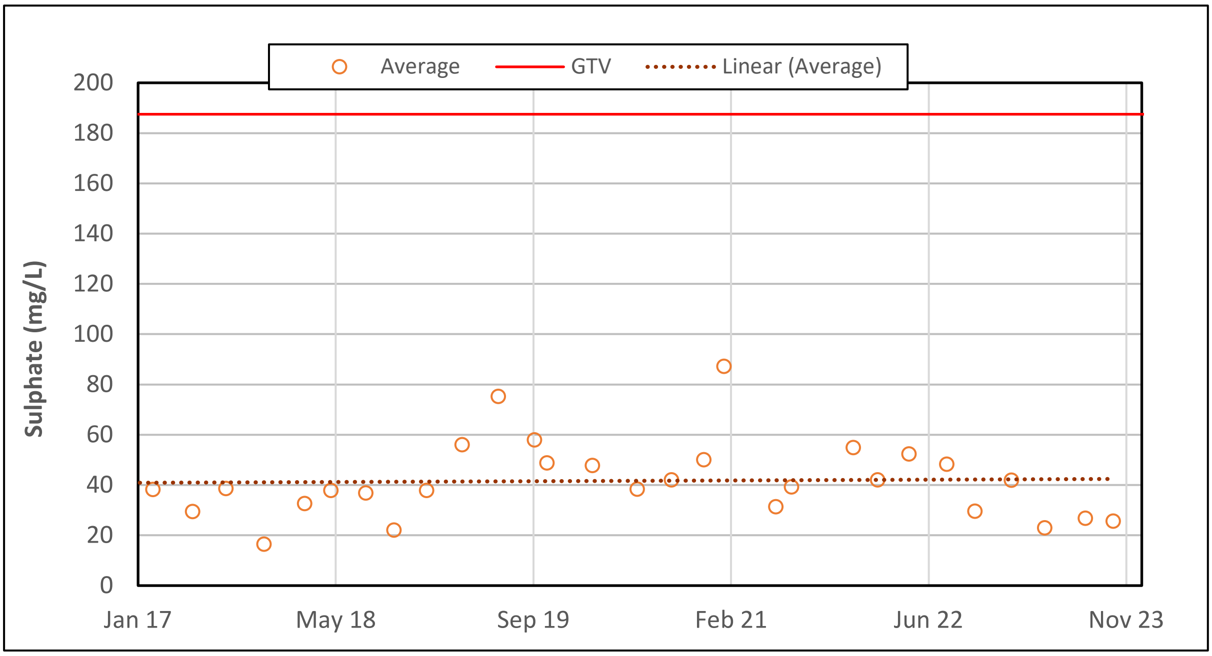
Table 7-6 WFD groundwater body condition and At-Risk status

Waterbody name	**Waterbody code**	**Latest WFD Status (2016 – 2021)**	**WFD risk Cycle (3rd cycle)**	**Significant pressures**
Athboy	IE_EA_G_001	Good	Not At Risk	None listed
Wilkinstown	IE_EA_G_010	Poor	At Risk	Agriculture

Groundwater users

As part of the Randalstown TSF monitoring system, groundwater quality is monitored at up to 13 private wells located within the Study Area monthly (see Figure 3 for locations marked as R). Only 3 of these wells are currently in use, 10R, 18R and 29R, with only 10R used for potable purposes. Groundwater levels are not monitored in these monitoring points, only water quality. Sulphate concentrations in the private wells remain below the GTV for sulphate, except for a few isolated exceedances (Plate 7-13).

Plate 7-13 Sulphate concentrations in private wells (2017-2023)



Other parameters are analysed in groundwater in accordance with IE Licence No. P0516-04, namely manganese, potassium, ammoniacal nitrogen, magnesium, zinc, total hardness, nitrate, phosphate, and other heavy metals. Concentrations remain below the respective GTVs, except for isolated and occasional exceedances. There is historical data that manganese occurs naturally in surface water in this area, and the spatial distribution of potassium suggests that the source is agricultural activity.

Designated sites

The River Boyne and the River Blackwater SAC is designated for qualifying interests with the potential to be groundwater dependent terrestrial ecosystems (GWDTEs), namely alkaline fens (EU Habitat code [7230]). These habitats have the potential to be extremely sensitive to changes in groundwater quantify and highly sensitive to changes in groundwater quality (Working Group on Groundwater, 2004). The conservation objectives of these qualifying interests are directly or indirectly dependent on water quality and flows.

There are no other designated or non-designated wetlands with the potential to be GWDTEs identified within the Study Area.

Groundwater flood risk

The GSI and Department of Environment Climate and Communications' Groundwater Flood Maps are based primarily on the winter flood event of 2015/2016. The current version of groundwater flood maps was released in July 2020. Two types of maps are available on this tool: predictive maps and historic maps. The predictive maps show the probability of an event to occur in any given year. The historic maps show maximum observed flood extents for locations of recurrent groundwater flooding in limestone regions.

The Groundwater Flood Probability Maps show no area of flooding in the Study Area; however, it is not considering climate change. An extensive area of surface water flooding occurred during the winter of 2015/2016 in the area where the Yellow River joins the Blackwater River, about 1 km southwest from the TSF. The seasonal flood maps produced by satellite images show with low confidence areas of flooding in the same specific area, with an occurrence every year since 2015.

7.4.4 Summary of receptors

Table 7-7 summarises the key water environment receptors which have been identified and their importance/ sensitivity rating.

Table 7-7 Summary of key water environment receptors

Receptor	Importance	Reason
River Blackwater SAC/ SPA	Extremely high	International EU SAC/ SPA designation
Section of Yellow River, Duog Stream and Simonstown Stream	High	WFD river waterbodies, locally important drinking water source, and quality class B (biotic index 3-4)
Athboy groundwater body (containing locally important bedrock aquifer)	Medium	WFD waterbody of 'Good' WFD status, and locally important drinking water source
Wilkinstown groundwater body (containing poor bedrock aquifer)	Low	WFD waterbody of 'Poor' WFD status, and locally important drinking water source
Groundwater users	Low	Private water supplies not used for drinking purposes
Superficial deposits	-	Not classified as an aquifer

7.5 IDENTIFICATION OF LIKELY SIGNIFICANT IMPACTS AND EFFECTS

7.5.1 Overview

The following are the potential impacts to the water environment which are likely to occur because of the Proposed Development, likely to result in effects on the identified sensitive receptors, and which are examined in this assessment:

- Temporary[13] impacts to surface water quality because of turbidity in uncontrolled construction site runoff.
- Temporary impacts to surface and groundwater quality because of construction-related accidental spillages.
- Temporary impacts to surface and groundwater quality because of increased risk of seepage to groundwater from the interceptor channel.
- Temporary impacts to surface water flows and reduction in groundwater recharge because of removal of vegetation and topsoil.
- Temporary impacts to the hydromorphology[14] of the Yellow River because of construction.
- Potential reduction in surface and groundwater quality because of leaching of sulphate-rich water from surplus mine rock used for buttressing, during operation.
- Potential increase in volume and rate of surface water runoff during construction and during operation, leading to an impact on flood risk.
- Potential reduction in surface and groundwater quality during operation as a result of damage to piped section of interceptor channel because of increased ground loading.
- These potential impacts have been assessed in the absence of mitigation, other than where embedded mitigation measures have been considered as part of the design.

[13] Temporary - construction-related and lasting less than one year (Ref. 8).

[14] A hydromorphological assessment has not been carried out at this stage. The potential impacts examined here are based on the information currently available, what is likely to occur and on an understanding that the CEMP would ensure the protection of watercourses, including the hydromorphological regime.

7.5.2 Construction Phase

Impacts to water quality

As part of the Phase 1 buttress construction works, the soil material and vegetation which overlies the Stage 1,2 and 3 chimney drains will be removed intermittently. This will allow surface runoff from the area to drain into the chimney drains, and ultimately into the interceptor channel. Exposed soil is more vulnerable to erosion during rainfall events without vegetation to bind it. Surface runoff could contain excessive quantities of fine sediment. The removal of topsoil and vegetation could lead to **an increase in turbidity** in surface runoff entering the interceptor channel water from the exposed works area.

Uncontrolled surface runoff from such areas can also contain excessive quantities of fine sediment, which may end up in adjacent watercourses and result in adverse impacts on water quality, flora, and fauna. While excessive fine sediment in runoff can be chemically inert, it can affect the water environment through smothering riverbeds and plants, temporarily changing water quality (e.g., increased turbidity and reduced photosynthesis) and causing physical and physiological adverse impacts on aquatic organisms (such as abrasion, irritation).

The interceptor channel is designed to be a closed water cycle system, therefore surface runoff captured here will be returned to the tailings pond via pumping for further settlement, minimising any potential impacts to water quality in the surrounding water environment. A negligible impact is anticipated, resulting in an **imperceptible effect** on the River Blackwater, the Yellow River, Duog Stream and Simonstown Stream.

The removal of the topsoil and exposure of the underlying superficial deposits in the footprint of the proposed buttress could lead to **an increased risk of surface and groundwater contamination** from construction activities, due to spillage of oils, fuels, or other construction chemicals. The superficial deposits are unconfined and in hydraulic continuity with the underlying bedrock aquifer across the TSF site, with groundwater levels between 1 and 9m below ground level. The Yellow River is adjacent to the interceptor channel along the western edge of the TSF and considered to be in hydraulic continuity with the superficial deposits, at least in places. In the absence of mitigation, a small adverse impact is anticipated, resulting in a **significant** effect on the River Blackwater, a **moderate/ slight effect** on the Yellow River, the Duog Stream and the Simonstown Stream, a **slight** effect on the Athboy groundwater body, and **imperceptible** effects on the Wilkinstown groundwater body and identified local groundwater users.

The removal of vegetation from the construction works area could lead to an increase in surface runoff, a temporary increase in water levels in the interceptor and an increased risk of seepage to groundwater. The interceptor channel is known to be an intermittent surface of groundwater contamination, with seepage occurring when adjacent groundwater levels are below the base of the interceptor channel. Should interceptor channel water levels rise temporarily during construction, there is **an increased risk that seepage to surface and groundwater could occur**, which could impact on water quality in the underlying Athboy and Wilkinstown groundwater bodies and the Yellow River, Duog Stream and Simonstown Stream (which join the River Blackwater) via the superficial deposits, and for local groundwater users in the vicinity of the TSF. A small adverse impact is anticipated, resulting in a **significant** effect on the River Blackwater, a **moderate/ slight effect** on the Yellow River, the Duog Stream and the Simonstown Stream, a **slight** effect on the Athboy groundwater body, and **imperceptible** effects on the Wilkinstown groundwater body and identified local groundwater users.

Impacts to flows

According to the GSI's groundwater recharge mapping, the edges of the TSF, where the existing embankment walls and the proposed buttress are located, are likely to have a recharge coefficient[15] of 20%. This corresponds with a hydrogeological setting of moderate permeability subsoil and overlain by poorly drained soil, or low permeability subsoil. Conversely, the groundwater recharge mapping suggests that runoff could be as much as 80% of effective rainfall[16] here. The removal of vegetation could lead to an increase in effective rainfall, and therefore **an increase in volume and rate of surface water runoff** from this area. The grading of the works area will allow surface runoff to drain into Stage 1, 2 and 3 chimney drain and ultimately the interceptor channel. The interceptor channel is designed to be a closed water cycle system, therefore surface runoff captured here will be returned to the tailings pond via pumping for further settlement. This will contain and manage any construction related increase in surface runoff, minimising the impacts on the volume of water entering in the interceptor channel from the construction works area, and any associated flood risk impacts to the surrounding water environment. In addition, the proposed finished floor level is above the NIFM mapped low probability exceedance event level, it is not at the risk of flooding, will not obstruct or impede important flow paths, exacerbate flooding in the immediate vicinity or wider area and will not result in residual risk to the area (see Appendix 7B: Site-Specific

[15] Recharge coefficient - the proportion of effective rainfall that becomes groundwater. (https://dcenr.maps.arcgis.com/home/item.html?id=74ebff46d706439bae702eb0a15e9014)
[16] Effective rainfall - the rainwater remaining after plants have taken up some of the rainfall. (https://dcenr.maps.arcgis.com/home/item.html?id=74ebff46d706439bae702eb0a15e9014)

Flood Risk Assessment and Ref. 28 for more information on the risk to the proposed buttress from flooding and embedded mitigation measures in the buttress design). A negligible impact is anticipated, resulting in an **imperceptible** effect on the River Blackwater, the Yellow River, the Duog Stream and the Simonstown Stream.

The removal of topsoil and vegetation in the construction works area could lead to an increase in the volume and rate of surface runoff, and conversely a reduction in effective rainfall reaching groundwater from this area, i.e., **a reduction in groundwater recharge**. The interceptor channel is designed to capture underdrainage from dam, therefore recharge from the existing embankment walls and from the proposed buttress works area is likely to end up in the channel being returned to the tailings pond via pumping. A negligible impact is anticipated, resulting in an **imperceptible** effect on the Athboy and Wilkinstown groundwater bodies and local groundwater users.

Impacts to hydromorphology

Construction works along the banks and/ or across watercourses could lead to a change in sediment dynamics and hydromorphology. The Yellow River is adjacent to the interceptor channel along the western edge of the TSF and the proposed works will take place on the upstream side of the interceptor channel within 5m of the watercourse. A construction-related sediment accident or physical damage to the riverbanks could also lead to a significant change in sediment dynamics and hydromorphology. A small adverse impact is anticipated, resulting in a **moderate/ slight** effect on the Yellow River.

7.5.3 Operational Phase

Impacts to water quality

The use of mine rock to construct the proposed buttress could lead to an increase in sulphate and magnesium concentrations, and reduction in surface and groundwater quality through **leaching by rainwater** and by underdrainage from the existing dam, during the operational period. The tailings water is a known source of elevated sulphate and magnesium (see Section 7.2). The interceptor channel is designed to capture runoff, underdrainage from the dam and groundwater; however, the groundwater monitoring data for the site indicates that some seepage to groundwater is occurring. The site conceptual model suggests that there are pathways for shallow groundwater contamination to move towards and into the Yellow River, via the superficial deposits, to move laterally within the more permeable superficial deposits in the Yellow River channel, and to move downwards into the underlying bedrock aquifer and towards local groundwater users (Ref. 24). The design of the proposed buttress includes embedded mitigation to minimise the impacts of leaching by rainwater, as follows (these measures are also considered within Chapter 12: Land and Soils):

- The ongoing testing of mine rock waste regime of 1 sample per 10,000 tonnes for total sulphur, sulphide sulphur and neutralisation potential (EN 15875) as well as EN 12457 leachate testing (Ref. 25).
- The application of a neutralising potential ratio of greater than 3 determined on the basis of status test EN15875 and a limit of 3% sulphide sulphur (Ref. 1).
- The encapsulation of mine waste rock within low permeability clay.
- The collection of any leachate from the buttress in a drainage layer and transfer via the internal and external embankment drainage systems to the TSF encompassing interceptor channel and treated in the water treatment system. Upon mine closure, the leachate from the TSF, is to be treated using a passive wetland system (Ref. 26)

Taking account of this embedded mitigation, a negligible impact is anticipated, resulting in an **imperceptible** effect on the River Blackwater, the Yellow River, Duog Stream and Simonstown Stream, the Athboy and Wilkinstown groundwater bodies, and on local groundwater users.

The base of the proposed buttress raise side slopes are to be formed on a drainage blanket and extend over the section of piped interceptor channel, between Ch3400 and Ch3800 . In addition, an access ramp to the buttress crest and an access road are to be constructed over the piped interceptor channel at Ch2900 and between Ch2210 and Ch2260 respectively (see Figure 2). This section of the interceptor channel was re-graded and installed with perforated pipe set in a channel of drainage stone, in 2023 (see Section 7.4.2). The drainage blanket is to consist of Type D1 material (100mm), consistent with the material used in the re-grading works. There is the potential for damage to the piped section of the interceptor channel because of increased ground loading along these sections. However, the piped interceptor channel includes embedded mitigation in the design, in terms of pipe specification and installation methodology, to minimise the risk of pipe failure. The piped interceptor channel can accommodate the loading with minimal deformation and loading from the buttress toe and the access ramps and road are not anticipated to impact the performance of the piped interceptor channel (Ref. 29). A negligible impact is anticipated, resulting in an **imperceptible** effect on the River Blackwater, the Yellow River, Duog Stream and Simonstown Stream and the Athboy and Wilkinstown groundwater bodies, and on local groundwater users.

No other potential operation-related impacts on water quality are anticipated because of the proposed buttress.

Impacts to flows

The proposed buttress has the potential to result in a change in material permeability at the TSF site, which would in turn result in **a long-term increase in the volume and rates of surface runoff**. The proposed buttress is to be constructed from mine rock and a cap of low permeability Quaternary glacial till, with a similar permeability to the existing embankment walls of up to 10^{-9} m/s. The buttress slopes are to be seeded and vegetated providing a similar surface to the existing TSF embankment slopes. The proposed finished floor level is above the NIFM low probability exceedance event level, it is not at the risk of flooding, will not obstruct or impede important flow paths, exacerbate flooding in the immediate vicinity or wider area and will not result in residual risk to the area. Therefore, there is no anticipated change in material permeability, resulting in an **imperceptible** effect on the surrounding water environment receptors.

Summary of effects

The potential impacts and resulting effects on the water environment because of the proposed buttress have been assessed in the absence of mitigation. Table 7-8 provides a summary of these potential impacts and resulting effects.

Table 7-8 Summary of effects

Potential impacts	**Receptor**	**Potential effects**			
Identified receptors	River Blackwater	Yellow River, Duog Stream and Simonstown Stream	Athboy and Wilkinstown groundwater body	Wilkinstown groundwater body	Local groundwater users
Receptor importance	Extremely high	High	Medium	Low	Low
Construction:					
Temporary impacts to surface water quality because of turbidity in uncontrolled construction site runoff	Imperceptible	Imperceptible	-	-	-
Temporary impacts to surface and groundwater quality because of construction-related accidental spillages	Significant	Moderate/ slight	Slight	Imperceptible	Imperceptible
Temporary impacts to surface and groundwater quality because of increased risk of seepage to groundwater from the interceptor channel	Significant	Moderate/ slight	Slight	Imperceptible	Imperceptible
Temporary impacts to surface water flows and reduction in groundwater recharge because of removal of vegetation and topsoil	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Temporary impacts to the hydromorphology of the Yellow River because of construction	-	-	Slight		
Operation:					
Potential reduction in surface and groundwater quality because of leaching of sulphate-rich water from surplus mine rock used for buttressing	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Potential increase in volume and rate of surface water runoff leading to an impact on flood risk	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Potential reduction in surface and groundwater quality as a result of damage to piped section of interceptor channel because of increased ground loading	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible

7.6 DO NOTHING SCENARIO

The ‘do nothing’ scenario would result in BTM not complying with GISTM and ICMM standards (see Section 7.2). A key objective of GISTM is to address the risk of tailings embankment failure through conservative design criteria, independent of trigger mechanisms, to minimise potential impacts. Therefore the ‘do nothing’ scenario is not considered a sustainable option.

7.7 MITIGATION MEASURES

7.7.1 Overview

The following mitigation measures will be implemented as part of the Proposed Development.

7.7.2 Construction Phase

Construction Environmental Management Plan

Prior to construction, a Construction Environmental Management Plan (CEMP) will be prepared by the Contractor in conjunction with the BTM environmental management team, to be approved by the planning authority. The CEMP will detail the measures necessary to avoid, prevent and reduce adverse effects where possible upon the local water environment, including a detailed groundwater and surface water management plan for the duration of the construction works. This will be a live document and updated as necessary as the embankment construction progressed and groundwater and/ or surface water levels change.

The CEMP will take cognisance of the following best practice guidelines:

- CIRIA, Control of Water Pollution from Construction sites – Guidance for Consultants and Contactors, C532 (2001) (Ref. 20).
- Inland Fisheries Guidelines on the protection of fisheries during construction works in and adjacent to waters (2016) (Ref. 21).
- Eastern Regional Fisheries Board Guidance Notes ‘Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites’ (Eastern Regional Fisheries Board, 2006) (Ref. 22).
- SEPA guidance developed for engineering in the water environment, including but not limited to WAT-SG-23 Good Practice Guide – Bank Protection, WAT-SG-25 Good Practice Guide – river crossings and WAT-SG-26: Good Practice Guide - Sediment Management (Ref. 23).

Measures for the management of fine sediment in surface water runoff as a result of construction activities to be included in the CEMP, but not limited to, are as follows:

- All reasonably practicable measures will be taken to prevent the deposition of fine sediment or other material in, and the pollution by sediment of, any existing waterbody, arising from construction activities. The measures will accord with the principles set out in industry guidelines including the CIRIA report *C532: Control of water pollution from construction sites*.
- Where possible, earthworks will be undertaken during the drier months of the year. When undertaking earth moving works periods of wet weather will be avoided, if possible, to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case mitigation measures will be implemented to control fine sediment laden runoff.
- Where possible and to protect waterbodies from fine sediment and other pollutant runoff, all construction works will be undertaken at 10m or one channel width, whichever is greater, as a minimum distance from any watercourses, as set out in the CIRIA report *C532: Control of water pollution from construction site*. Where construction works are at less than 10m from watercourses, additional mitigation measures will be put in place, to protect the waterbody from fine sediment and other pollutant runoff, such as installation of silt traps, minimising the time that works take, avoiding working close to the watercourse during wet conditions when the risk of runoff is likely to be much greater, and to protect the river banks directly from physical damage. These additional measures will be identified in the CEMP.
- To protect waterbodies from fine sediment runoff, topsoil/ subsoil will be stored a minimum of 20m from watercourses on flat lying land (and further if the ground is sloping, subject to on-site risk assessment and observational monitoring). Where this is not possible, and it is to be stockpiled for longer than a two-week period, the material will either be covered with geotextile mats, seeded to promote vegetation growth or bunded. In all situation, runoff from the stockpile will be prevented from draining to a watercourse without prior treatment.
- Mud deposits will be controlled at entry and exit points to the construction works area using wheel washing facilities and / or road sweepers operating during earthworks activities or other times as considered necessary.

- Equipment and plant will be washed out and cleaned in designated areas within the construction works area where runoff can be isolated for treatment before drainage to the interceptor channel.
- Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of clearly labelled waste receptacles, grid covers and the presence of site security fencing.
- A wheel-wash will be installed to minimise the transport of fine sediment offsite and uncontrolled site runoff. There will be no discharge from the wheel-wash to any drainage ditch or watercourse.

Measures for the control of spillages and leaks as a result of construction activities to be included in the CEMP, but not limited to, are as follows:

- A Pollution Prevention Plan will be prepared and included alongside the CEMP. Spill kits and oil absorbent material will be carried by mobile plant and located at high-risk locations across the construction works area and regularly topped up. All construction workers will receive spill response training and toolbox talks.
- All hydrocarbons, chemicals, oils, etc. will be stored in a dedicated bunded area at least 30m from watercourses and capable of storing 110% of the container/ tank capacity.
- All spills to be cleaned up immediately, with resultant wastes (soils, rags, and absorbent material) appropriately stored and disposed of by an appropriately licensed waste contractor as controlled waste.
- All spills reported and investigated as required.
- Safety Data Sheets (SDSs) for all chemicals stored on-site will be kept on file and made available on-site.
- Drip trays to be used on stationary equipment if not internally bunded (e.g., generators).
- All plant and equipment will be regularly serviced to reduce emissions and the chance of leaks/spillage, ideally off-site. If servicing is required to be completed on-site, then control measures must be implemented to contain potential hydrocarbon leaks during servicing (e.g., drip trays when changing oil).

- Temporary environmental screens will be erected sufficient to prevent construction debris oils, chemicals, or other construction materials from entering any watercourse/ drain for the duration of the works. The Contractor’s method statement should make specific reference to measures for the protection of river quality.
- All re-fuelling will be carried out in a designated refuelling area at least 30m from watercourses, with details to be included in the CEMP.

Monitoring

The CEMP will include details of pre- and during construction water quality, water level and hydromorphological monitoring using the existing TSF monitoring network. This will be based on a combination of visual observations, frequent in situ testing using handheld water quality probes, and periodic sampling for laboratory analysis.

While there is a large amount of historic water quality and water level data for the site, collected at the TSF monitoring system, there is little hydromorphological data for the Yellow River. Therefore, a baseline hydromorphological assessment will be carried out in advance of construction works.

The subsequent monitoring works will refer to this baseline hydromorphological data, to the typical range of baseline/ historic water quality and water level data for the site, and to trigger and intervention values set for sulphate at specific compliance points at the TSF (see Ref. 24). The monitoring works will also compare monitored interceptor channel water levels and nearby groundwater levels to evaluate the potential for seepage to occur.

The CEMP will include details of actions to be taken should these typical ranges be exceeded, such as investigating the circumstances, re-taking the sample, cessation of the offending activity and any required reporting to the EPA or local authority.

In addition, the routine ground and surface water, including the interceptor channel, monitoring programme as mandated in IE Licence No. P0516-04, will continue for the duration of the construction period.

The CEMP will include for monitoring of pumped volumes and water levels in interceptor channel to ensure that water levels are kept to a minimum, i.e., the typical range established through monitoring and remaining below groundwater levels monitored in adjacent monitoring boreholes. Reference will be made to historic interceptor channel water level and groundwater level data available for the site.

7.7.3 Operational Phase

Monitoring

The CEMP will include details of post-construction water quality, water level and hydromorphological monitoring at the existing TSF monitoring network, as detailed in Section 7.7.1.

In addition, the routine ground and surface water, including the interceptor channel, monitoring programme as mandated in IE Licence No. P0516-04, will continue for the duration of the post-construction monitoring period.

7.8 RESIDUAL EFFECTS

The residual effects on the water environment are summarised in Table 7-9.

Table 7-9 Summary of residual effects

Potential impacts	Receptor	Potential effects				Mitigation	Residual effects
Identified receptors	River Blackwater	Yellow River, Duog Stream and Simonstown Stream	Athboy and Wilkinstown groundwater body	Wilkinstown groundwater body	Local groundwater users		
Receptor importance	Extremely high	High	Medium	Low	Low		
Construction:							
Temporary impacts to surface water quality because of turbidity in uncontrolled construction site runoff	Imperceptible	Imperceptible	-	-	-	CEMP implementation and programme of monitoring	Imperceptible
Temporary impacts to surface and groundwater quality because of construction-related accidental spillages	Significant	Moderate/ slight	Slight	Imperceptible	Imperceptible		Imperceptible
Temporary impacts to surface and groundwater quality because of increased risk of seepage to groundwater from the interceptor channel	Significant	Moderate/ slight	Slight	Imperceptible	Imperceptible	Programme of monitoring	Imperceptible
Temporary impacts to surface water flows and reduction in groundwater recharge because of removal of vegetation and topsoil	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible	N/A	Imperceptible
Temporary impacts to the hydromorphology of the Yellow River because of construction	-	-	Slight			Pre-construction hydromorphology baseline assessment and programme of monitoring	Imperceptible

Potential impacts	Receptor	Potential effects				Mitigation	Residual effects
Operation:							
Potential reduction in surface and groundwater quality because of leaching of sulphate-rich water from surplus mine rock used for buttressing	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible	N/A	Imperceptible
Potential increase in volume and rate of surface water runoff leading to an impact on flood risk	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible	N/A	Imperceptible
Potential reduction in surface and groundwater quality as a result of damage to piped section of interceptor channel because of increased ground loading	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible	N/A	Imperceptible

7.9 INTERACTIONS ARISING

7.9.1 Land, Soil and Geology

The interactions arising between this assessment and the land, soil and geology relate to the potential impact of ground loading on the piped section of the interceptor channel, between Ch2300 and Ch3700, on water quality, should a pipe failure occur. This assessment relies upon the expertise and mitigation measures outlined in the Chapter 12: Land and Soils.

7.9.2 Biodiversity

The interactions arising between this assessment and biodiversity relate to the potential impacts of construction on the water quality and hydromorphological condition of the adjacent WFD watercourses. These potential impacts have been assessed in detail in this chapter and outlined in Chapter 6: Biodiversity, in addition to appropriate measures to mitigate these potential impacts.

7.10 POTENTIAL CUMULATIVE/ IN-COMBINATION EFFECTS

7.10.1 Overview

This section of the chapter assesses the likelihood of effects of the Proposed Development in combination with the potential effects of other development schemes (referred to as ‘cumulative developments’) within the surrounding area, as listed within Table 7-10. The other projects included are primarily located within the Study Area (1km) but where mining-related further is considered.

7.10.2 Construction Phase

The key other development schemes with the potential to impact on the local water environment and have cumulative/ in-combination effects on the identified receptors during construction, are Development Ref. 22924 within 1km of the TSF site, and Development Ref. 2360198 within 0.5km of the TSF site.

The development of 138 no. residential units, public open spaces and all associated site works by Glenveagh Homes on lands at approximately 1km from the TSF site has the potential to impact on surface and groundwater quality, water levels and flood risk as a result of construction works. There is no likelihood of in-combination effects with the water environment receptors addressed in this Chapter following mitigation measures outlined in the respective projects.

The development of approximately 3.9km of below ground potable water mains (450mm diameter) between Liscarton Water Treatment Plant and Proudstown Reservoir on lands at approximately 0.5km from the TSF site has the potential to impact on surface and groundwater quality, water levels and flood risk as a result of construction works. There is no likelihood of in-combination effects with the water environment receptors addressed in this Chapter following mitigation measures outlined in the respective projects.

Table 7-10 Summary of other schemes/ projects

Planning Ref.	Development	Status	Distance (km)
Mining-related			
ABP - 317390-23 (MCC Planning Ref: 23341)	Construction of water treatment plant within mine site complex.	Appealed to An bord Pleanála	2.8 (south)
	BTM Intend to apply for a 18MW solar energy development at Knockumber to generate renewable energy for use within the BTM mine site		3.0 (south, southwest)
Residential-related			
22924	Glenveagh Homes Ltd. intends to apply for planning permission for a large-scale residential development on lands (6.96 ha) of 138 no. residential units, public open spaces, and all associated site works.	-	1 (southeast)
Infrastructure-related			
2360198	The development will consist of the construction of approximately 3.9km of below ground potable water mains (450mm diameter) between Liscarton Water Treatment Plant and Proudstown Reservoir, associated below ground valves, associated swab chambers and a surge vessel, a 380kW solar array comprising 1,875m2 photovoltaic panels on ground mounted frames, and all associated ancillary development works.	Granted 07/11/2023	0.5 (south)

7.10.3 Operational Phase

The key other development schemes with the potential to impact on the local water environment and have cumulative/ in-combination effects on the identified receptors during operation, are Development Ref. 22924 within 1km of the TSF site, and Development Ref. 2360198 within 0.5km of the TSF site.

There is no likelihood of in-combination effects with the water environment receptors addressed in this Chapter following mitigation measures during operation as outlined in the other two projects.

7.11 MONITORING

The environmental monitoring commitments are outlined in Sections 7.7.1 and 7.7.2 above.

7.12 CONCLUSIONS

This assessment has examined the potential impacts of the proposed buttress and its construction on water levels and water quality at the TSF and in the surrounding local water environment. Following implementation of the mitigation measures outlined in Section 7.7, **no significant adverse impacts** are anticipated as a result of the proposed works.

7.13 REFERENCES

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28. WSP Golder, September 2022. Response to request for further information from Meath County Council in respect of planning application 22/331.

29. Correspondence from BTM Engineer of Record on 01/02/2024.

7.14 APPENDIX 7.A: WFD SCREENING ASSESSMENT…………… …. APPENDICES VOLUME 1

7.15 APPENDIX 7.B: SITE SPECIFIC FLOOD RISK ASSESSMENT……. APPENDICES VOLUME 1