CHAPTER 12 LAND AND SOILS

12.1 INTRODUCTION

AECOM was commissioned by Boliden Tara Mines DAC (BTM) to undertake the Land and Soils Chapter of this Environmental Impact Assessment Report (EIAR) for the Proposed Development at the Randalstown Tailings Storage Facility (TSF) (the Site).

A description of the Site context and the Proposed Development are presented in Chapter 3: Description of the Proposed Development.

The proposed works intend to increase the Factor of Safety (FoS) associated with the extant Stage 1 to 5 embankment walls of the TSF, in accordance with the Global Industry Standard on Tailings Management (GISTM), to reduce the likelihood of future failure.

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the likely significant effects of the Proposed Development on Land and Soils, a collective term used to describe the land and soil setting and features, including land contamination and geology as well as considering implications surrounding the re-use of materials (that would otherwise be classified as waste) as construction materials where applicable.

This chapter is supported by information in the following chapters, figures, and appendices of this EIAR:

- Chapter 2: Screening and Consultation
- Chapter 3: Description of the Proposed Development;
- Chapter 5: Material Assets (Road and Traffic);
- Chapter 6: Biodiversity
- Chapter 7: Water: Hydrology and Hydrogeology;
- Figure 12.1: Teagasc Soil Map;
- Figure 12.2: Quaternary Sediments Map;
- Figure 12.3: Bedrock Geology Map

12.1.2 Consultation

Previous relevant consultations with key stakeholders in regard to the Proposed Development are detailed in Chapter 2: Scoping and Consultation. In relation to this Land and Soils chapter, the team have consulted with Geoff Beale of Piteau and Peter Corrigan of Golder Associates (now WSP) to further the understanding of the proposed buttressing work.

As per the advice within Meath County Council's (MCC) further information request to planning submission Ref. 22/331, dated 10 May 2022, Declan Grimes, from MCC Environment Department, has been consulted in respect of any potential waste permitting implications which may arise as a result of the proposed development in relation to the use of construction materials. The issue that proposed materials to be used as construction materials did not constitute a 'waste' was confirmed at a meeting held at MCC planning offices on July 26th, 2023 attended by MCC Environment representatives and BTM Environmental staff. In this regard, an Article 27 determination will be made by the EPA in relation to use of greenfield soil from development sites. These applications will be made by the Engineering and Construction (E&C) contractor.

BTM will seek approval from the Environmental Protection Agency (EPA) to use mine rock as a construction material in the proposed construction works under existing conditions[1] of their Industrial Emissions License (IEL) PO516-04.

12.1.3 Aim of Report

The Land and Soils EIAR chapter, reported herein, aims to provide an outline of the legislative and policy framework within which the Site sits, the assessment methodology, the baseline ground conditions, the predicted impacts of the Proposed Development during the

[1] Condition 8.15: ***Unless otherwise agreed by the Agency, rock used in surface construction works at the installation shall have a maximum sulphide content (measured es S%) of 0.1%, or a maximum sulphide content (measured as S%) of 1 % and a neutralising potential ratio, determined on the basis of a static test EN15875, of greater than 3.***

Condition 8.13.7: ***Design and construction details, including full method statements and technical specifications, for all basal and side-wall containment engineering works. proposed for any part of the TMF shall be agreed in writing by the Agency prior to construction.***

construction, operational and decommissioning phases, any proposed mitigation and enhancement measures, any residual effects and any cumulative effects.

12.2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

BTM is proposing the following engineering works at the TSF: **The construction of a rockfill 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, in order to minimise potential impacts. In order to increase the FoS of the extant embankment walls (Stages 1 to 5) of the tailings facility, a reinforcement buttress will be constructed against these extant embankment walls of the TSF.

12.2.1 Existing Tailings Storage Facility (TSF)

The TSF is constructed as a ring-dike configuration, with Stages 1 to 5 enclosed by earth fill embankment walls constructed from locally sourced Quaternary till which underlies the site and overburden material (tailings). The facility encloses an area of approximately 250 Hectares and has been enlarged in six lateral and vertical extensions over 46-years through a combination of permanent and temporary embankment dams (BTM, 2022). Stage 6, a lateral extension to Stages 1 to 5, is a composite-lined facility.

A perimeter interceptor channel (PIC) encircles the TSF embankments (see Plate 12.1). The interceptor channel, located at the toe of the starter embankment/dam wall, is an integral component of the internal drainage system of the facility.

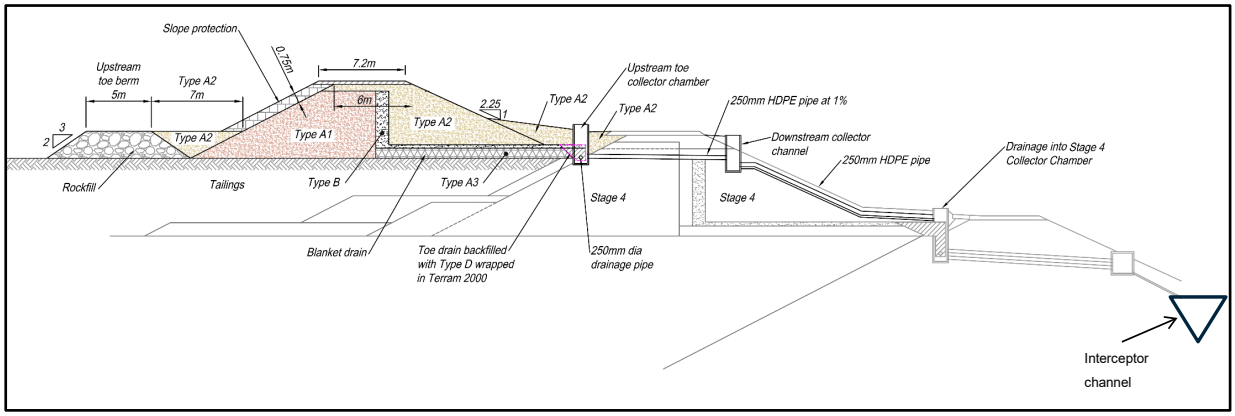
The starter embankment/dam wall is constructed using glacial clay/silt till with a granular internal drainage system consisting of a chimney and blanket drain. The embankment/ dam wall is constructed in zones where:

- 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 connects 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 connects to the interceptor channel.

Plate 12.1: Cross section: Extant embankment wall, internal drainage system and interceptor channel (BTM, 2022)



12.2.3 Proposed Works

In order to adopt the GISTM at Randalstown, the construction of a reinforcement buttress to sections of the extant 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[2]:

- 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.

[2] btw_sew_tailings facility embankments.pdf (BTM, 2022)

- Extension to the existing manholes which form part of the Stage 4 toe drain and weir monitoring system, so continued access is guaranteed post construction of buttress.
- Other ancillary works as may be required by Industrial Emissions Licence (IEL) Register Number P0516-04 issued by the Environmental Protection agency (EPA).

12.2.4 Construction Phase

The Construction Phase of the proposed works will involve the sourcing, placement, compaction and performance monitoring of suitable fills with the design quantities totalling 265,700 m^3 of 'Rock Fill' and 295,650 m^3 of 'Greenfield Soil' to form the buttress.

Source of Construction Material

The 'Rock Fill' component will be sourced from Mine Rock produced from development mining operations at the BTM main mine, located at Knockumber, Navan, which is associated with the TSF through IEL P0516-04. BTM will seek approval from the EPA to use mine rock as a construction material in the proposed construction works under existing IEL conditions. Approval for the use of mine rock as a construction material was approved by the EPA for Stage 6 lateral extension of the TSF with specific conditions to include testing of its suitability at a frequency of 1 sample per 10,000 tonnes. If there is a shortfall of suitable materials, or if operationally required, suitable products will be imported from nearby quarries.

Suitable 'Soil' fill will be sourced from independent suitable third-party greenfield development sites. These soils will be provided under Article 27 of the European Communities (Waste Directive) Regulations 2011 and will require a review of the waste material to determine if it is fit to be classed as a by-product. These applications to the EPA (visible on EPA By-Product Register) will be conducted by the Engineering and Construction (E&C) contractor. In addition, BTM have robust procedures in places for the acceptance of greenfield soil at the facility that fulfil the requirements of Conditions 8.13.23 to 8.13.28 and Schedule A of Industrial Emissions (IE) licence Reg. No. P0516-04.

No waste from the processing of the ore will be used in the construction of the Proposed Development.

Sequence of Construction

The construction works will be sequenced in two phases which may run concurrently. It is anticipated the works will commence at the eastern extremity and proceed westward:

- Phase I will proceed on a horizontal basis along Stage 4 of the tailings dam. Works will begin at the level of the toe of the Stage 4 upstream raise against the embankment wall and will vary between 3, 4 and 7 metres in height. The material will be placed in layers along 500 m sections, with each 500 m section taking approximately one month to complete. It is envisaged that the Phase I works will take approximately 30 weeks;

- Phase 2 will proceed on a horizontal basis at ground level against the embankment wall of stages 1, 2 and 3 (starter dams). The material will be placed in layers along 500 m sections, with each 500 m section taking approximately one month to complete. It is envisaged that the Phase 2 works will take approximately 80 weeks.

Sequence of works

1. Preparatory Works including cleaning the crest of the starter dams, removal of any topsoil, shrubs / scrub from the side-slopes over the footprint of the proposed buttress and to facilitate plant access;
2. Installation of the Phase 1 Buttress (toe of Stage 4); and
3. Installation of the Phase 2 Buttress (at ground level starter embankments).

Preparatory Works

The construction of the buttress will require the extension or otherwise accommodation of a number of geotechnical instruments which will be impacted by the works. These include Casagrande standpipes, environmental monitoring wells, vibrating wire piezometers and flow measurement weirs.

Clearance of Work Areas

The proposed Phase 1 buttress overlies the crest of the Starter Dams, (Stages 1, 2 and 3). The crest of this road includes a layer of rockfill material as capping and surface dressing. It

is proposed that this material be salvaged where possible and where the quality of the material permits. This shall be done by either stockpiling the material temporarily for re-use or preferably, through the re-use of the material as a capping layer on a section where the buttress works have already been completed.

Removal of topsoil from the footprint of the area adjacent to the crest road, i.e. the area above the Stage 4 toe drain and the Stage 4 slope shall be completed prior to commencement of the buttressing works.

For the Phase 2 buttress, it will be necessary to remove the topsoil from the entirety of the starter dam perimeter slope as well as the footprint of the buttress at the toe.

Topsoil shall be either stockpiled temporarily for re-use or preferably, through the direct re-use of the topsoil on sections where the buttressing works have already been completed. Following excavation to the Formation Level, the footprint will require trimming, grading and compaction prior to the placement of the compacted fill. The final excavated surfaces shall be trimmed and rolled to provide a clean, even and firm foundation to permit the movement of construction vehicles without causing rutting or other deleterious effects. Benching will be employed where buttress materials are being placed onto slopes to ensure that a sufficient key-in is achieved between the buttress and the dam walls.

A specified number of passes of a suitable vibratory roller will be required for the underlying soils. Soft spots and areas of unsuitable materials identified shall be excavated and replaced with suitable material placed and compacted and / or shall be improved *in-situ* via compaction or the installation of 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 shall 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 enter the Perimeter Interceptor Channel (PIC) and from there will be returned back to the tailings facility.

Measures to include the management of fine sediments in surface water runoff as a result of construction activities will be included in the Construction Environmental Management Plan (CEMP).

A series of plans and cross sections produced by WSP and provided by BTM, providing detail on the proposed construction, are included in Attachment 3.A.

12.2.5 Operational Phase

The proposed buttress itself is not considered to have an operational phase as, once constructed, it is intended that it will not be altered, amended or interacted with any part of the operations of the TSF, instead acting as a permanent earthen structure.

Elements of the Proposed Development that will have an operational phase include the continued use of the TSF, the continued reliance on the TSF perimeter interceptor drain and the required use of the 'New Lower Road' between Ch2175 and Ch2300.

12.3 ASSESSMENT METHODOLOGY

The following guidance has been used to inform the scope and content of this assessment and to assist the identification and mitigation of likely significant effects:

- Environmental Protection Agency (EPA) guidance document 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports', (EPA, 2022);
- European Commission guidance document 'Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report' (European Commission, 2017);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, (EPA, 2003); and
- The Institute of Geologists of Ireland (IGI) guidance document 'Guidelines for Preparation of Soils, Geology, Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013).

Sensitivity of Receptors

The sensitivity of a land or soil receptor has been established through the identification and evaluation of the susceptibility of the receptors' to changes arising from the Proposed Development, and the value attached to these. Susceptibility relates to the ability of a land or soil receptor to accommodate change without undue consequences.

Examples of sensitive land or soil receptors include:

- Soil and geological resources (e.g., international, national, or regionally designated sites, soils of high nature conservation or landscape importance, mineral reserves, demand on waste management infrastructure through disposal of soils); and
- Receptors susceptible to land contamination and ground hazard impacts (e.g., human, vegetation, protected habitats and species, surface water and groundwater receptors).

The overall importance/ sensitivity of these receptors is ranked as Very High, High, Medium, or Low based on such variables as the quality of the receptor or its value as a resource and in accordance with Table C2 (Criteria for Rating Site Importance of Geological Features - NRA, 2008) in "Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements" by the IGI (2013). The descriptive scale for the importance/ sensitivity of receptors is presented in Table 12.1.

Magnitude of impact criteria

The magnitude of potential impacts or changes to identified receptors, as associated with the Proposed Development, has been determined using Table C4 in the IGI guidance (Large Adverse, Moderate Adverse, Small Adverse, Negligible, Minor Beneficial, Moderate Beneficial, Major Beneficial), taking into account the potential Table 12.2).

Significance of effects

For each of the potential impacts identified, an assessment has been made of the likely level of significance of the resulting effects. The definition of effect significance has been made by considering both the importance/ sensitivity of the receptor and the magnitude of the predicted impact, and is described as Large Adverse, Moderate Adverse, Small Adverse or Negligible from Table C5 of the IGI guidance, using the matrix presented in Table 12.3.

Table 12.1: **Sensitivity Criteria of Geological Features**

SENSITIVITY	CRITERIA	GEOLOGY	SOIL RESOURCES	CONTAMINATION
Very high	Attribute has a very high quality and rarity on international or national scale or high sensitivity.	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource	Volume of peat and/ or soft organic soil underlying route is significant on a national or regional scale	Degree or extent of soil contamination is significant on a national or regional scale
High	Attribute has a high quality, significance or value on a local scale	Geological feature of high value on a local scale (County Geological Site) Moderately sized existing quarry or pit Marginally economic extractable mineral resource	Volume of peat and/ or soft organic soil underlying route is significant on a local scale Well drained and/ or high fertility soils	Degree or extent of soil contamination is significant on a local scale Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes
Medium	Attribute has a medium quality, significance, or value on a local scale	Sub-economic extractable mineral resource	Moderately drained and/ or moderate fertility soils Volume of peat and/ or soft organic soil underlying route is moderate on a local scale	Degree or extent of soil contamination is moderate on a local scale Contaminated soil on site with previous light industrial usage

SENSITIVITY	CRITERIA	GEOLOGY	SOIL RESOURCES	CONTAMINATION
				Small recent landfill site for mixed wastes
Low	Attribute has a low quality, significance, or value on a local scale	Volume of peat and/ or soft organic soil underlying route is small on a local scale	Volume of peat and/ or soft organic soil underlying route is small on a local scale	Degree or extent of soil contamination is minor on a local scale Large historical and/ or recent site for construction and demolition wastes Small historical and/ or recent landfill site for construction and demolition wastes

Source: (from IGI, 2013, Table C2)

Table 12.2: Magnitude of Impact on Geology Attribute

SENSITIVITY	CRITERIA	GEOLOGY	SOIL RESOURCES	CONTAMINATION
Large adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves Removal of entirety of geological heritage feature	Irreversible loss of high proportion of local high fertility soils Requirement to excavate and replace high proportion of peat, organic soils and/ or soft mineral soils beneath alignment	Requirement to excavate/ remediate entire waste site
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Loss of moderate proportion of future quarry or pit reserves Removal of part of geological heritage feature	Irreversible loss of moderate proportion of local high fertility soils Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.	Requirement to excavate/ remediate significant proportion of waste site
Small adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature	Irreversible loss of small proportion of local high fertility soils and/ or high proportion of local low fertility soils Requirement to excavate and replace small	Requirement to excavate/ remediate small proportion of waste site

SENSITIVITY	CRITERIA	GEOLOGY	SOIL RESOURCES	CONTAMINATION
			proportion of peat, organic soils and/or soft mineral soils beneath alignment.	
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	No measurable changes in attributes	No measurable changes in attributes	No measurable changes in attributes
Minor beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature		
Moderate beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature		
Major beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature		

Source: (from IGI, 2013, Table C4)

Table 12.3: Rating of Significant Environmental Impacts at EIS Stage

	MAGNITUDE OF IMPACT				
Importance of Attribute		**Negligible**	**Small adverse**	**Moderate adverse**	**Large adverse**
	Extremely high	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ moderate	Profound/ significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ moderate	Profound/ significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Moderate/ Slight

Source: (from IGI, 2013, Table C6)

Assessment Assumptions and Limitations

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

The assessment undertaken in this chapter has been based on and is limited to the baseline conditions recorded at the time of undertaking field surveys (05 December 2023) and ground investigations undertaken between 1973 and 2022.

No agricultural land classification assessment survey or agricultural soil sampling has been undertaken for the Proposed Development as they are not required due to the nature of the Site (i.e. no agricultural land). The assessment relating to agricultural land classification has been based on publicly available GSI data.

Construction Method Statements and CEMP will be prepared by the Engineering and Construction (E&C) Contractor once appointed.

Study Area

The study area for the land and soils assessment is focused on land within the boundary of the Site and 2km outward from the Proposed Development. This area is considered appropriate for the consideration of geological features and historic and current potentially contaminative land uses, though, given the linked nature of the sites, some consideration is also given to the areas of historic mining, including underground mineral workings, located approximately 2.8km south of the TSF. This aligns with established industry practice and professional judgment for defining land contamination study areas for the assessment.

12.3.1 Sources of Information

Establishment of the baseline environment has involved reference to existing data sources, consultation with statutory bodies and other organisations, and fieldwork surveys. The following sources of information have been reviewed:

- Ordnance Survey of Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale and aerial photographs;
- Satellite imagery;
- Geological Survey Ireland (GSI) website for Public Viewer Geoheritage, Geotechnical, Geochemistry, Geohazards Natural Resources (Minerals/Aggregates) and borehole data;
- EPA online map viewer for surface water groundwater and catchment information;
- Previous site investigation reports;
- Previous environmental impact statements for the site; and
- Previous relevant consultation with key stakeholders (details in Chapter 2: Scoping and Consultation)

Information has also been obtained from a site walkover undertaken by AECOM on 09 December 2023.

12.4 BASELINE ENVIRONMENTAL CONDITIONS AND CONSTRAINTS

The description of baseline environmental conditions covers the following aspects of the land, soil, geological and waste setting and features:

- Soil geology;
- Subsoil geology;
- Bedrock geology;
- Ground Investigation Findings;
- Ground stability i.e. potential for subsidence;
- Mining activity and history;
- Agricultural land classification;
- Designated sites;
- Soil chemistry;
- Potential sources of contamination (including historic land use, waste sites, pollution incidents and permitted installations);
- Waste assessment of proposed fill materials;
- Identified receptors; and
- Conceptual site model.
- Soil Geology

According to the Teagasc soils map (available on the GSI map viewer (accessed 5 January 2024) (see Figure 12.1)), the Site is underlain by Made Ground, while the Study Area is underlain by Till derived chiefly from limestone from Lower Palaeozoic rocks, with occurrences of Alluvium, and Glaciofluvial sand and gravels to the south.

The National Soils map (available on the EPA map viewer (accessed 5 January 2024)) shows the TSF and surrounding areas to comprise a combination of Made Ground, acidic, deep, poorly drained to well drained mineral soils derived mainly from non-calcareous rocks and alluviums. Shallow well drained soils derived from calcareous rocks are mapped adjacent to the southern boundary of the TSF (see Figure 12.1).

Subsoil Geology

According to the Quaternary Sediments map (available on the GSI map viewer), the Site is underlain by Tailings pond and the broader Study Area is underlain by *Till derived from Lower Palaeozoic sandstones and shales*, small, localised occurrences of Alluvium around the site and Gravels derived from limestones to the south. Smaller localised areas of Gravels derived from Lower Palaeozoic sandstones and shales can be found further to the west and south-east of the site.

A continuous band of more permeable superficial deposits was encountered during the 1996 Environmental Impact Statement (EIS) in boreholes OB1 to OB6. It consists of sand, sand and gravel, or silty sand and gravels.

There are no bedrock outcrops mapped within the Proposed Development Site. Bedrock outcrops and Karstified bedrock outcrops are mapped by GSI and located to the north-west, north-east and east of the Site (>400m from the Proposed Development).

The southern extent of the Proposed Development consists of tailings pond which is relatively flat and slops south-westwards from ~60m AOD in the north-east to ~50m AOD in the south-west.

The northern extent of the Proposed Development is relatively flat and slopes westward from ~54m AOD to the east to ~48m AOD to the west.

The mapped subsoil geology is shown on Figure 12.2.

Bedrock Geology

According to the GSI's online map viewer (see Figure 12.3), the Site is underlain by Carboniferous strata including limestone and calcareous sandstone of the Meath Formation, Old Red Sandstone and laminated beds and muddy limestones from the Liscarton Formation. These strata are underlain unconformably by Lower Palaeozoic black mudstone, siltstone and greywackes of the Rathkenny Formation which also extends to the north and east of the TSF.

The TSF is located in an area of major faults, mainly trending north-east to south-west.

Ground Investigation Findings

There are three verified borehole records available on the GSI map viewer for the Site. GSI well name 2627SEW061 was reportedly drilled to a depth of 61.0m BGL in November 1987 and no other details are provided. GSI well name 2627SEW061 is a shallow well drilled to 2.7m BGL in November 1987 and no other details are provided. GSI well name 2627SEW063 was also reportedly drilled in November 1987 to a depth of 11.0m BGL. No other details are provided.

Ground investigation data held by Tara Mines and provided to AECOM for use within this assessment included:

- Hand written trial pit and boreholes logs from Golder Associates 1973 ground investigation of Stage 1 of the TSF. Records include 5 boreholes taken to the bedrock, up to 17.08m deep, and nine trial pits up to 4.6m deep. These records were included within the WSP Golder report reference 41000068-003, dated September 2022, titles Re-Grading of Perimeter Interceptor Channel. The records are pertinent to the Proposed Development and generally confirmed the stratigraphy outlined from the geological mapping. The Till is typically described as firm to stiff though N390 intersected loose silty sand from 0.3m to 1.2m and T144 identified loose silty sand from 1.4m to 3.1m.
- A site investigation was completed by JS Drilling in December 2013 consisting of eighteen rotary drilled boreholes to depth ranging between 7.5m BGL to 40m BGL, nine located within the Tara Mines site and the remaining nine located within the TSF. The borehole records indicate that a typical stratigraphy would comprise topsoil described as a soft, sandy gravelly clay, underlain by a gravelly clay, then underlain by limestone interpreted to be of the Meath Formation.
- A trial pit investigation undertaken by Golder in 2020 along the toe of the Stage 5B embankment comprising 8 trial pits to a maximum depth of 1.1m. The investigation identified topsoil overlying a mixture of clay with variable gravel, cobble and boulder contents, sand and gravels, organic silts and suspected bedrock (though this is not corroborated by the 1973 investigation and may be boulders).

Ground Stability

A major bedrock fault (fracture zone) runs approximately east-west, extending through the tailings pond site. This fault is intersected by another fault, running northeast-southwest creating an anticlinal unconformity to the west of the fault.

The tailings contained within the TSF have the potential to liquefy through dynamic and/or static liquefaction processes.

Dynamic liquefaction can occur as a result of seismic activity. Though the risk of a significant seismic event is very low in Ireland the position of the TSF overlying a major bedrock fault would indicate that a dynamic liquefaction event is possible, particularly if the Proposed Development is not constructed.

Static liquefaction could occur following a failure of the TSF dam walls due to the strain that would be caused by the loss of containment.

The extant embankment walls have been designed and assessed to meet a target design criterion, for long-term static slope stability, with a Factor of safety (FoS) of >/= 1.5 using effective strength parameters. A detailed geotechnical assessment of the slope gradients and construction materials are beyond the scope of this chapter however it is assumed that the earthen structures that form the TSF were built, under supervision, to appropriate engineering standards at the time of construction. This assumption is supported by and the absence of any sign of instability observed during the site walkover. The risk of a failure of the dam wall is therefore considered to be low and would become more unlikely on completion of the proposed buttress. The buttressing works will increase the Factor of Safety to:

- >/=1.5 for the peak strength undrained scenario and to
- >/= 1.1 for the residual strength undrained scenario which is now required.

The proposed buttress will increase the loading on the ground surrounding the TSF. This may result in settlement of the underlying ground through consolidation or creep processes. Though it is unlikely that the possible settlement will have any significant impact on ground stability this could impact underground services, such as the perimeter drainage channel pipework, which is overlain by the proposed buttress between Ch2300 and Ch3700.

Mining History and Activity

The area occupied by the current Tara Mines processing facility and the TSF were greenfield until the lead-zinc orebody was discovered in 1970 by Northgate Exploration. Development on the sites started in 1973 and the site entered production in 1977. The site has operated continuously since 1977, with the exception of between 2001 and 2002 and July 2023 to present, where production stopped due to a decrease in metal prices.

The equipment and methods used on site have modernised over time, including the changing from thermal drying of concentrate to the use of a filter press system, installation of a new autogenous grinding mill in 2009, changes in processes and improvements to bulk fuel storage facilities.

The TSF is used as a settlement area for the fines fraction of tailings following the extraction of lead and zinc concentrate. The tailings are allowed to settle and the water is then pumped back to the processing site either for re-use in the processing plant or discharged to the River Boyne under strict IEL conditions.

A detailed waste classification for the Stage 5 tailings conducted in 2015 by SLR (ref:416-03390-00004-Hazwaste), including analysis by x-ray diffraction and Chemometric Identification of Substrates and Element Distribution, concluded that more than 99 % of the tailings were comprised of naturally occurring species derived from limestone and contained less than 0.5 % lead and zinc ore. The tailings stored at the TSF were classified as non-hazardous.

There are no extractive workings within the Study Area, with mining of the ore occurring approximately 2.5km south of the Proposed Development.

Agricultural Land Classification

Land within the Site is predominantly Made Ground derived from the former and current industrial land use and is not used for agricultural purposes.

Lands within 2km of the Site are predominately pastureland agricultural lands, with individual or clustered rural residential properties, the closest of which is approximately 300m from the Proposed Development. The main Tara Mines site is located approximately 2.8km to the south

of the Site. Clonmagaddan Lane is the closest residential settlement (>1km) and sits between the Site and Navan town.

Soil Chemistry

Golder-WSP carried out a geochemical classification programme on 10 waste rock samples and 1 duplicate collected from stockpiled waste rock at the Tara Mines site with their assessment included in their Buttress Construction Works Engineering Design Report (November 2022).

Chemical analysis undertaken by SGS on the samples identified a number of elevated concentrations of heavy metals, including lead concentrations ranging from 370 mg/kg to 13,000 mg/kg, arsenic concentrations ranging from 49 mg/kg to 400 mg/kg, cadmium concentrations ranging from 1.8 mg/kg to 650 mg/kg and zinc concentrations ranging from 1,300 mg/kg to 99,000 mg/kg.

Though the metal concentrations are high in absolute terms the report provides detail on the mineralogy, clarifying that the majority of metal elements present are contained within natural mineral (e.g. galena and sphalerite), and the potential leachability which was found to be low due to the alkaline nature of the parent rock and low potential for acidification due to low sulphur contents. This is supported by short term leachability testing plotted on a Ficklin Diagram on which all samples tested are grouped in the Alkaline, Low Metal category. The report concludes that there does not appear to be a potential environmental concern based on the short-term leachability assessment.

Analytical results were also provided within the Golder-WSP report from testing completed by ALS on two soil samples. The samples labelled 19249391 and 19249392 were described by ALS as dark brown, loamy, sand with stones and vegetation. It is understood this testing was commissioned by Boliden Tara Mines. A broad suite of analysis was tested, typical of a RILTA suite. Mineral oil (C10 – C40) was identified at concentrations between 91.2 and 103 mg/kg and 10:1 leachate testing of the samples identified exceedances of the limit values for inert waste landfill criteria for sulphate and exceedances of the limit values for stable non reaction hazardous waste in non-hazardous landfills for antimony.

Designated Sites

The Site is located 750m east of the River Blackwater at its nearest point (IE0004232) which has been designated a Special Protected Area (SPA), along with the River Boyne, under the E.U. Birds Directive of special conservation interest for the kingfisher species. The River Boyne and River Blackwater (IE0002299) have also been designated a Special Area of Conservation (SAC) for habitats, including alluvial forests.

There are no Proposed Natural Heritage Areas (pNHA) or Natural Heritage Areas (NHA), and no other SPA or SAC within 5km of the Site.

The nearest Water Framework Directive (WFD) designated feature is the YELLOW (Blackwater Kells)_20 river water body (IE_EA_07Y011100), which flows through the TSF.

A review of the GSI map viewer has identified that the Site lies approximately 1.6 km to the south-east of Gibstown Castle, which is a County Geological Site (CGS) (Site Code: MH001) described as a '*natural rock outcrop and spring*'.

Potential sources of contamination

The historical land use of the Study Area has been determined by examining the historical mapping for the Tara area available on the OSi map viewer (GeoHive) and Google Earth aerial photography.

The historic land use is primarily agricultural and scrub land within the Site and wider Study Area. The satellite image from 1995 shows evidence of the mining in the area with the tailings ponds visible at Randalstown. The mining production is known to have begun in 1977 with Stage 1 TSF completed in 1978. A summary of construction history for the various extensions of the TSF is provided in Chapter 3.

There is potential for historical pollution incidents and ground contamination at the TSF related to the former mining operations including spills of hydrocarbons from plant and areas of made ground with elevated concentrations of metals however no records of such possible pollution incidents have been provided.

The TSF is operated by BTM and is managed and under EPA IEL P0516-04, which have enforced control measures to mitigate against potential environmental risk since 26 July 2000.

Unilin Insulation Ireland Limited (IEL reg P0583-01) is located 1.8km to the south-west of the site. There are no other permitted installations recorded.

Waste Sites

The TSF is licensed by the EPA to perform limited waste disposal and recovery activities as defined in IEL conditions.

The Proposed Development intends to use waste excavated mine rock from the mineral metalliferous excavation (List of Waste catalogue waste code LoW 01 01.01 01 (mine rock – waste from mineral metalliferous excavation)) and greenfield soil (LoW 17 05 04 (soil and stone form greenfield development sites)) to form the proposed buttress. Waste from such activity are classified as absolute non-hazardous in the European Waste Codes and as such no further hazardous assessment is required. Waste from the chemical processing of the ore will not be used in the construction of the buttress.

The closest recorded waste boundary to the Site is the Clonmagaddan waste transfer station (W0121-02) located 1.5km south-east of the Site.

Conceptual Site Model

A Conceptual Site Model (CSM) defines the plausible contaminant source, pathway, and receptor linkages, which are integral to identifying potential impacts to human health at the Site. Potential environmental impacts to the groundwater or surface waters on the Site and within the Study Area are assessed within Chapter 7.

The CSM presents details of potential sources of contamination, potential receptors and potential contaminant migration pathways that have been identified for human health. Table 12.4 lists the potential contaminant linkages and associated potential risks for the Site and Proposed Development. Any risk identified to be higher than Low will require further assessment or mitigation.

Table 12.4: Conceptual Site Model (Human Health

POTENTIAL SOURCE	SOURCE	PATHWAY	RECEPTOR	POTENTIAL RISK
Existing soil contamination	Existing contamination in the made ground and superficial deposits, as a result of deposition of mining spoil and demolition of previous mine buildings and structures and of potential historic pollution incidents could be exposed and disturbed during construction across the Site, depending on the depth of excavations.	Dermal contact - Direct contact with contaminated ground soils, soil derived dust, soil leachate and perched water in the made ground/ subsoil.	- Construction workers	Low - It is expected that any potential impacts can be adequately mitigated through the use of appropriate gloves, respiratory protective equipment (RPE) and good hygiene.
		Inhalation - Inhalation of made ground derived dust, organic vapours or ground generated gas.	- Construction workers - Off-site residential land users (>300m distant)	Low - Any contamination present is unlikely to be mobilised in significant quantities/concentrations, particularly given the controls that would be adopted in the CEMP and dispersion that would occur between the Proposed Development and the nearest offsite receptor (300m distant). - There is no requirement for confined space entry - It is expected that any potential impacts to construction workers can be adequately mitigated through the use of appropriate RPE.
		Leaching and infiltration into water environment - Rainfall infiltration can generate and mobilise made ground soil/ mining spoil-derived leachate into groundwater within underlying aquifers.	- Pottable water supplies	Low - The nearest abstraction for potable purposes from surface watercourses is approximately 2.4km south of the TSF. Given the distance and dilution that would apply over this distance it is not feasible that leaching from the TSF, given its construction, could have a significant impact on the water quality, causing it to exceed the drinking water standards (DWS) at the point of abstraction without a structural failure of the TSF which is very unlikely.
	Existing contamination in the shallow groundwater (in the	Dermal contact - Direct contact with contaminated groundwater.	- Construction workers	Low

POTENTIAL SOURCE	SOURCE	PATHWAY	RECEPTOR	POTENTIAL RISK
Existing groundwater contamination	superficial deposits) and deep groundwater (in the limestone bedrock aquifers) from presence of the Tara ore body, leaching from the TSF and from historical mining activities or pollution incidents.			- Given that there will be no excavation beneath the surrounding ground level it is very unlikely that construction workers would come into contact with groundwater.
		Mobilisation and migration along preferential flow paths in superficial or bedrock aquifers - Rainfall infiltration can mobilise contaminated groundwater further into the subsurface from there to other water environment receptors.	- Pottable water supplies	Low - The nearest abstraction for potable purposes from surface watercourses is approximately 2.4km south of the TSF. Given the distance and dilution that would apply over this distance it is not feasible that concentrations would be elevated above the DWS.
On-site sources	Construction activities / incidents with the potential to contaminate soils and groundwater on the Site	Dermal contact - Direct contact with contaminants, contaminated soils, soil derived dust.	- Construction workers	Low - Construction workers will be protected through adherence with H&S legislation and appropriate PPE.
		Inhalation - Inhalation of made ground derived dust, organic vapours or ground generated gas	- Construction workers	Low - Construction workers will be protected through adherence with H&S legislation and appropriate RPE.
		Leaching and infiltration into water environment - Pollution incidents on-site during construction could result in contamination reaching soil and groundwater beneath the Site or enter the surface water network through the Sites drainage.	- Pottable water supplies	- The nearest abstraction for potable purposes from surface watercourses is approximately 2.4km south of the TSF. Given the distance and dilution that would apply over this distance it is not feasible that concentrations would be elevated above the DWS as a result of a pollution incident resultant from construction given the controls that will be adopted withing the CEMP and enforced by adherence with the Sites IE Licence.

Identified receptors, impacts and significance of effects

The land, soil and geological resource receptors which have the potential to be impacted upon by the Proposed Development during construction, operation, and decommissioning include:

- Land: The proposed buttress will slightly extend the existing embankments of the TSF however will be contained within the existing TSF boundary, with no additional land take required. As such there is negligible impact and no significant effects anticipated.
- Soil resources: the soil resources within the Site are dominantly classified as made ground and of low sensitivity. Though the works will not directly interact with the natural soils, the works are considered as having negligible impact in these areas and no significant effects.

  The Till is variably drained, though mostly poorly drained, and considered to be of low sensitivity. The proposed works could have a small adverse impact on the Till through compaction though given the low sensitivity this is likely to be imperceptible with no significant effects.

  Well-drained superficial soils associated with the sand and gravel to the south of the TSF may extend into the Site and would be considered of high sensitivity however there would be no measurable changes in the attributes of these soils from the Proposed Development (as sands and gravels cannot be permanently compacted) and as such the Proposed Development would have no significant effects.

  There is likely to be some areas of moderately fertile natural topsoil present beneath the Site that are considered of medium sensitivity and the Proposed Development could have a small adverse impact on these soils leading to slight effects if left unmitigated.
- Geology: The Proposed Development does not involve extensive excavations and there are no known geological features of value or any known mineral resources of value beneath the Proposed Development. The Gibstown Castle County Geological Site is present within the Study Area however it is not feasible that the proposed development would have any impact on the land, soils and geology of this site given its distance of approximately 1.6km from the Proposed Development. As such potential impacts are considered negligible. The geological receptors that are present are determined to be of low sensitivity and as such the effect of the Proposed Development is **imperceptible.**

The receptors which could be affected by contamination which is mobilised by construction of the Proposed Development are detailed, along with an assessment of their sensitivity, in Chapter 7: Water. A summary is provided below:

- Designated sites: The River Blackwater is a designated site (SPA and SAC) within the Study Area which may be susceptible to contamination and is deemed to be of extremely high importance. The remaining area is considered of local importance and of low sensitivity, containing no other designated sites (SPA, pNHA, NHA or SAC).
- Surface Water: There is an open water body bordering the site the Site (EPA River Waterbody code IE_EA_ 07Y011100). This surface water body is classified by the EPA under the WFD and is classified as having poor WFD status and being at risk of not achieving Good status. There are no known surface water abstractions within 1km of the Site with the nearest being at Liscartan, approximately 2.4km south of the TSF. Surface water courses are discussed further in Chapter 7: Water.
- Groundwater: The groundwater receptors identified as being at potential risk from impacts to soil and geological resources are:
  - One potential private or public water supply located within the Study Area recorded in the GSI Groundwater Wells and Springs database in the Townland of Silloge, approximately 900m to the north east of the Site;
  - As highlighted in Chapter 7: Water of this EIAR there is known to be three active groundwater abstraction within the Study Area, with one none for potable water;
  - There are no known groundwater dependent terrestrial ecosystems (GWDTEs) within the 1km Study Area; and
  - The hydrogeology of the Site and wider Study Area are detailed in Chapter 7: Water of this EIAR.
- Human Health: The land use within the Site is brownfield/industrial with the associated potential contamination considered to be of medium sensitivity given the history of the Site. Construction workers are more likely to come into contact with any potentially significant contamination present during the construction phase however through the use of appropriate PPE/RPE and hygiene controls that are standard on construction sites there is not thought to be any significant risk. There are no significant human health risks

identified from the potential impacts to groundwater or surface water quality from erosion of or leaching from the TSF soils or those proposed for use in the buttress.

- Waste: The construction of the proposed buttress will utilise a mixture of wastes including rock from the operational excavations at Tara Mines and natural superficial soils from third-part development sites. As there are no other wastes to be included within the fill (other than natural soils and rock) and considering that the Waste Rock will be capped with low permeability superficial soils, the sensitivity from a contamination perspective of the waste is considered to be low, with the impact negligible given that there is unlikely to be any measurable change in the attributes of the source materials. As such the impact of utilising the wastes in the construction of the buttress is considered to be imperceptible when compared to potential, less sustainable, alternatives (import of soil and rock excavated from quarries at greater distance from the Site).

12.5 IDENTIFICATION OF LIKELY SIGNIFICANT IMPACTS

12.5.1 Construction Phase

During the construction phase there is not predicted to be any significant impacts on land, soils, geological and human health receptors however best practice would be to take mitigating steps within the CEMP to reduce:

- Temporary impacts on soil structure as a result of soil excavation, smearing and compaction;
- Temporary impacts on soil chemistry as a result of possible spillages of oils, fuels or other construction chemicals, or through the mobilisation of existing sediment following ground disturbance;
- Temporary impacts on off-site receptors, such as neighbouring land users and residents through the inhalation of dust and dermal contact with soil following ground disturbance;
- Erosion of the existing TSF embankments following the topsoil and vegetation strip.

Construction activities such as earthworks, excavations, site preparation, levelling and grading operations result in the disturbance of soils. Exposed soil is more vulnerable to erosion during rainfall events due to loosening and removal of vegetation to bind it, compaction and increased runoff rates.

Surface runoff from such areas can contain excessive quantities of fine sediment, which may, if unmitigated, eventually be transported to watercourses where it can result in adverse impacts on water quality, flora, and fauna. The potential impacts of fine sediment on water quality, flora and fauna are addressed in Chapter 7: Water, while the potential impacts of soil contaminants on human health are addressed herein.

During construction, fuel, hydraulic fluids and other potentially polluting substances will be stored and/ or used on site. Spillages of these substances could pollute nearby surface watercourses or underlying aquifers if their use or removal is not carefully controlled, and spillages enter existing flow pathways or waterbodies directly. The potential impacts of spillages on water quality, flora and fauna are addressed in Chapter 7: Water, while the potential impacts of the migration of these spillages to human health are addressed herein.

12.5.2 Operational Phase

During the operational phase there is not predicted to be any significant impacts on land, soils, geological and human health receptors.

The proposed buttress will not have a typical operational phase as it will act as a permanent earthen structure with no energy demand and no natural resources used beyond those used in the construction of the buttress.

In the context of the wider TSF and Tara Mines operations the slight change of perimeter road alignment over 125m that constitutes the ‘New Lower Road’ would not have a significant impact on the land, soils, geological and human health receptors.

The toe of the proposed buttress extends over the perimeter interceptor channel intermittently and where access ramps will be formed over the interceptor channel. As set out in Chapter 7: Water, the proposed buttress structure will not have any significant impact on the perimeter interceptor and its performance from a drainage perspective owing to appropriate considerations being included within the design, however the additional ground loading applied by the buttress or access ramp could result in settlement locally beneath the earthen structures.

The majority of any settlement induced by the buttress would be expected to occur during the construction phase, particularly in areas where the site investigations have identified loose sands and soft lacustrine sediments. Creep processes may lead to minor ongoing settlement in areas of unconsolidated cohesive soils such as the lacustrine silts though these will not be significant.

The magnitude of the ground settlement that will be induced by the buttress is not thought to be significant given the mitigation that has been adopted at the design stage to avoid placing additional load on the 900mm concrete pipework between Ch2180 and Ch2625. Instead, the loaded areas will overlay the section of the PIC incorporating a nominal 600mm diameter twin wall HDPE filter pipe that has a much greater tolerance for ground settlement and a lower sensitivity to failure.

12.6 DO NOTHING SCENARIO

In the absence of the Proposed Development there is a greater risk of the TSF failing. Such a failure could lead to significant or profound changes to land, soil and geological resource receptors, and indirectly to surface water, groundwater, and human health receptors. Although this is unlikely, the mostly imperceptible impacts identified for the buttress are outweighed by the potentially profound impact such a failure would have on all identified receptors.

12.7 MITIGATION MEASURES

In accordance with the IGI guidance, appropriate mitigation measures are identified to remedy potential impacts in order to determine the residual impacts from the Proposed Development in relation to Land and Soils.

The following mitigation measures have either been incorporated into the design (i.e., embedded mitigation) or are standard construction or operational practices. These measures have, therefore, been taken into account during the impact assessment.

12.7.1 Construction Phase

- Prior to construction starting onsite, a CEMP will be prepared by the E&C Contractor to be approved by the planning authority. The CEMP will detail the measures necessary to avoid, prevent and reduce adverse effects where possible upon soil and geological receptors.
- To minimise the potential for adverse impacts to soil structure and quality during construction Waste Rock and Soil materials will be stored temporarily within the Site in managed stockpiles that will not be allowed to dry out, to avoid generation of wind-blown dust.
- Any stockpiled material will be managed in accordance with best practise guidelines (such as Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009)). When required, pre-earthwork drainage will be put in place to avoid sediment being washed off site.
- The E&C Contractor will be required to prepare a Construction Traffic Management Plan (CTMP) to minimise site traffic and, if relevant, damage to soil structure from smearing and compaction (To minimise the potential for adverse impacts to soil chemistry and to water quality during construction). The construction of the Proposed Development will be in accordance with good practice as detailed in Chapter 3: Description of the Proposed Development.
- The E&C Contractor will be required to include measures in the CEMP for minimising erosion by reducing disturbance and stabilising exposed materials. The plan will also consider control measures to minimise the release of mobilised sediment. The CEMP will also include methods of handling and storing chemicals and fuels, followed by an Emergency Response Plan to be implemented in the event of a spill or leak.
- Water quality monitoring will be undertaken pre and during-construction, details of which will be included in the CEMP. This will be based on a combination of visual observations, in situ testing using handheld water quality probes, and periodic sampling for laboratory analysis.
- The E&C Contractor will be required to ensure the safe storage of any hazardous materials or chemicals required onsite. Storage areas for flammable/ toxic/ corrosive materials will be located in a separate, locked, impermeable bunded and fenced off area. Material data sheets will be available for all these materials and the COSHH (Control of Substances

Hazardous to Health) assessments kept within the relevant Risk Assessment for the task, all subject to the Applicant's approval. Storage will not be within 30m of a watercourse and designated storage areas will be bunded to 110% of storage capacity to contain the effects of any spills. These areas will be cleared and re-instated following completion of the Site.

- A Site Waste Management Plan will be prepared, and all relevant contractors will be required to seek to minimise waste arising at source and, where such waste generation is unavoidable, to maximise its recycling and reuse potential. Recycling of materials will primarily take place off-site where noise and dust are more easily managed and less likely to impact on surrounding properties.

The EPA will be notified of the intention to utilise alternative waste materials at the TSF, in accordance with the Licence. The environmental protections built into the IE Licence will continue to apply to the Proposed Development.

Should significant contamination occur as a result of construction stage activities, Meath County Council, EPA and Inland Fisheries will be notified and appropriate corrective actions will be agreed and undertaken.

Construction works will be carried out in such a way as to prevent, contain, or limit, as far as reasonably practicable, any adverse effects arising from the presence of contaminated land or materials (if encountered) in compliance with the CEMP. Examples of these measures are as follows:

- The E&C Contractor will ensure that any significant contamination not identified during previous site investigations is recorded and dealt with in line with the EPA's "Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites";
- Should ground with significant levels of unknown contamination be encountered during construction, working methods and procedures for handling and disposal of material will be employed to minimise risk in line with the EPA's "Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites". If required, the material will be disposed of at a suitably licensed waste facility;
- 'Clean' and 'dirty' (contaminated) work areas will be divided by internal fencing if/where contamination is encountered;

- Personal Protective Equipment (PPE) will be worn by ground workers and other staff; and
- Those construction workers potentially at risk will be made aware of potential site hazards via site safety induction procedures.

To minimise the potential for adverse impacts to off-site receptors and construction workers, the following is an outline of the general mitigation measures that will be in place (see Chapter 8: Air Quality and Chapter 11 Climate for more detail).

The E&C Contractor has a duty under the Safety, Health and Welfare at Work Act 2005 and the Control of Substances Hazardous to Health (COSHH) Regulations 2002 to protect their employees against hazardous substances encountered at work. To that end and in accordance with CIRIA guidance R132 *A guide for safe working on contaminated sites* (1996), the E&C Contractor will be required undertake a COSHH assessment before any work is carried out at the Site which is likely to expose staff to substances hazardous to health. No hazardous substances were identified during the site investigation; however, it would be best practice for the Contractor to ensure that all employees (construction workers) are issued with PPE appropriate to the hazards identified.

The C&E Contractor will implement measures to minimise the amount of dust produced during the construction phase, including the preparation of a Dust Management Plan (DMP). There will be a Duty of Care on the E&C Contractor to ensure that dust-raising activities are located away, and upwind where possible, from sensitive receptors as much as feasibly possible, the duration be kept to a minimum when in proximity to a receptor, and the spread of dust be controlled by judicious use of water, the most effective and efficient way being in the form of a fine spray.

Mitigation measures for construction works, including soil handling, should be incorporated into the CEMP to be implemented by the E&C Contractor.

The works will be undertaken under geotechnical supervision to ensure construction is robust and the effectiveness of the proposed buttress.

12.7.2 Operational Phase

The proposed buttress is not expected to have an operational impact on the TSF. The Proposed Development will operate within conditions of existing IEL P0516-04. These conditions were set out to limit and minimise the impacts to air, soil, surface and groundwater, and the effects on environment and human health;

The TSF will continue to operate in line with appropriate standards and the operator will implement and maintain an Environment Management System (EMS) which will be certified to International Standards Organisation (ISO) 14001. The EMS will outline requirements and procedures required to ensure that the Proposed Development is operating to the appropriate standard;

When required, sampling and analysis of pollutants will occur. This includes monitoring emissions levels in accordance with the IE Licence.

12.8 RESIDUAL IMPACTS

Given the assessment of potentially significant land, soil, geological and human health impacts identified in Section 12.5 and, assuming the mitigation measures set out in Section 12.7 are successfully adopted, there will be no significant residual impacts from the Proposed Development.

12.9 INTERACTIONS ARISING

This section of the chapter assesses the likelihood of effects of the Proposed Development when considering the potential effects of other development schemes (referred to as ‘cumulative developments’) within the surrounding area, as listed within Chapter 14: Interactions of this EIAR.

12.9.1 Land, Soil and Geology

Based on a review of planning applications and permitted developments, as presented in Chapter 14: Interactions, there are no significant projects proposed that are likely to give rise to cumulative effects in conjunction with the Proposed Development.

12.9.2 Human Health

Based on a review of planning applications and permitted developments, as presented in Chapter 14: Interactions, the other development schemes with the potential to impact on human health and have potential cumulative/ in-combination effects on the identified receptors during operation, are Development Ref. PL17.247707 within the TSF site, Development Ref. 22924 within 1km of the TSF site, and Development Ref. 2360198 within 0.5km of the TSF site.

Similar mitigation measures are proposed for the Proposed Development and the Submitted Developments, and no significant cumulative effects are anticipated should the schemes proceed.

12.10 REFERENCES

1. BTM, 2022. Specified Engineering Works.
2. BTM, 2023. Buttress Construction Works – Tender Documents.
3. Meath County Council, 2021. Meath County Development Plan 2021-2027.
4. Environmental Protection Agency (EPA), 2022. Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
5. EPA, 2003. Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.
6. EPA, 2013. Management of Contaminated Land and Groundwater at EPA Licensed Sites.
7. Institute of Geologists of Ireland (IGI), 2013. Guidelines for Preparation of Soils, Geology, Hydrogeology Chapters of Environmental Impact Statements.
8. Ordnance Survey of Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale and aerial photographs;
9. Geological Survey Ireland (GSI) website for Public Viewer Geoheritage, Geotechnical, Geochemistry, Geohazards Natural Resources (Minerals/Aggregates) and borehole data;

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11. SLR, 2015. Hazardous Waste Assessment of Mine Tailings for Randalstown TMF.
12. WSP Golder, 2022. Geochemistry Assessment: Mine Waste Rock. Buttress Design for Randalstown TSF.
13. WSP Golder, 2022. Buttress Construction Works. Engineering Design Report.
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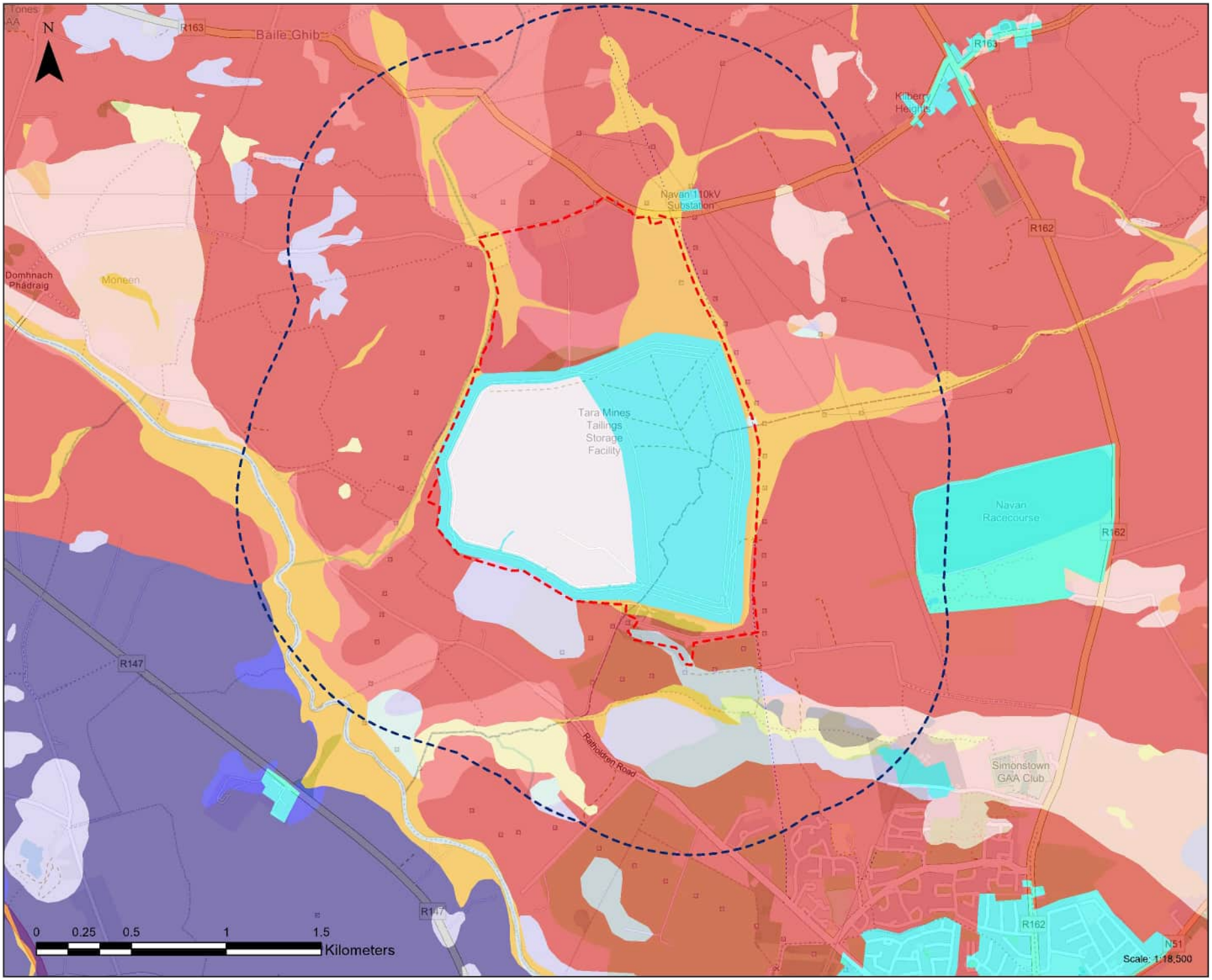

AECOM

PROJECT

Randalstown Tailings Storage Facility Buttress EIAR

CLIENT

Boliden Tara Mines

CONSULTANT

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LEGEND

- Study Area
- Proposed Development
- Mineral alluvium
- Acid Brown Earths / Brown Podzolics
- Surface water Gleys / Ground water Gleys Acidic
- Surface water Gleys / Ground water Gleys Shallow
- Podzols Peaty
- Lithosols / Regosols
- Grey Brown Podzolics / Brown Earths Basic
- Surface water Gleys / Ground water Gleys Basic
- Surface water Gleys / Ground water Gleys Shallow
- Lithosols Peats
- Renzinas / Lithosols
- Cut - Raised Bog cutaway/cutover
- Lac
- Made
- Water

CREDITS

ISSUE PURPOSE

DRAFT

PROJECT NUMBER

60628825

FIGURE TITLE

Soils Geology

FIGURE NUMBER

Figure 1

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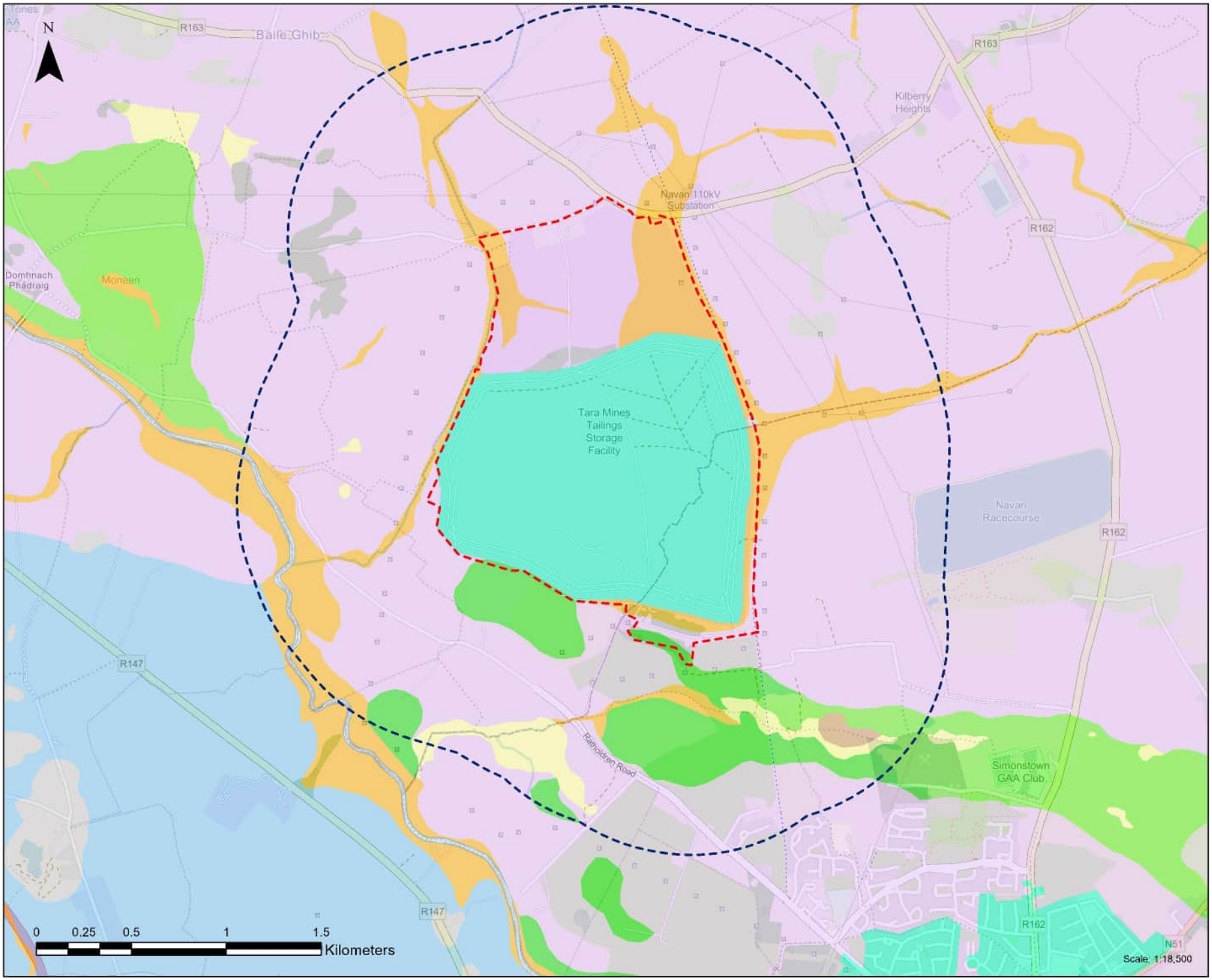

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LEGEND

- Study Area
- Proposed Development
- Alluvium
- Cut over raised peat
- Gravels derived from Lower Paleozoic sandstones and shales
- Gravels derived from Limestones
- Karstified bedrock outcrop or subcrop
- Lacustrine sediments
- Bedrock outcrop or subcrop
- Till derived from Lower Paleozoic sandstones and shales
- Till derived from limestones
- Tailings Pond
- Urban
- Water

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PROJECT NUMBER

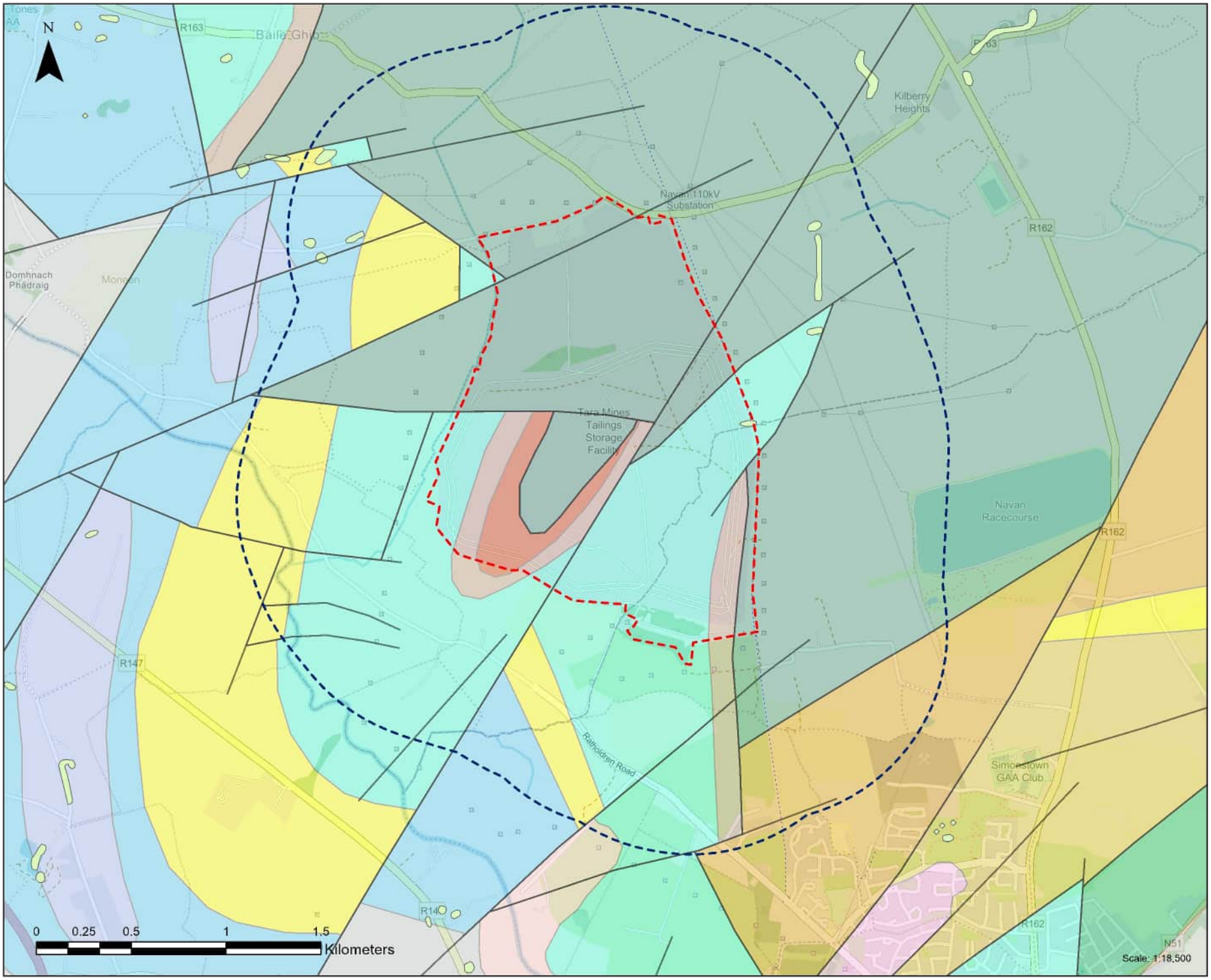
60628825

FIGURE TITLE

Subsoils Geology

FIGURE NUMBER

Figure 2



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PROJECT

Randalstown Tailings Storage Facility Buttress EIAR

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LEGEND

- Study Area
- Proposed Development
- Faults

- Bedrock Outcrop
- Brittstown Formation
- Liscarton Formation
- Meath Formation
- Moathill Formation
- Ballysteen Formation
- Boyne Formation
- Lucan Formation
- Boulder Conglomerate
- Navan Beds
- Waulsortian Limestones
- Old Red Sandstone
- Hill Of Slane Formation
- Syenite
- Rathkenny Formation
- White Island Bridge Formation

CREDITS

ISSUE PURPOSE

DRAFT

PROJECT NUMBER

60628825

FIGURE TITLE

Bedrock Geology

FIGURE NUMBER

Figure 3