11 CHAPTER 11 CLIMATE

11.1 INTRODUCTION

FERS was commissioned by Boliden Tara Mines DAC (BTM) to undertake the Climate Chapter of an Environmental Impact Assessment Report for proposed buttressing works to be undertaken on a selection of the dam walls of the Randallstown Tailings Storage Facility (TSF). These works are proposed to be undertaken with a view to increasing the Factor of Safety associated with the dam walls. This chapter of the EIAR assesses the potential of climate related impacts (Greenhouse Gas Emissions and Vulnerability to Climate Change events) associated with the proposed development at the Randallstown Facility, Co Meath.

11.1.1 Authority and Expertise of Authors

The Greenhouse Gas Emissions component of the assessment was undertaken By Dr Kevin Black, director of the Forestry Division of FERS. The forestry division specialises in environmental aspects of forestry, silviculture, particularly in greenhouse gas impacts in the land use sector (see www.fers.ie).

Kevin holds an honours degree in Biology from the University of Durban in South Africa, a Ph.D. in Botany from University College Dublin and a M.Sc. in GIS and Remote Sensing from the University of Ulster Coleraine. He has in excess of 30 years of experience in carrying out land use and climate change research with over 70 published per review papers. Kevin is a climate change policy and forest consultant for Coillte, Bord Na Móna, the Environmental Protection Agency (EPA), COFORD and the Department of Agriculture, Food, and the Marine (DAFM) on climate change, land use and forestry (LULUCF).

Kevin is responsible for design and update of the national forest and land use change greenhouse gas (GHG) inventory submissions to the United Nations Framework Convention on Climate Change (UNFCCC) and the European Union (EU). Kevin is a consultant for the EPA, providing GHG data and projections on the land use sector to aid in the setting of a LULUCF sectoral target under CAP 24.

An overview of the climate/carbon reporting projects which Kevin has undertaken can be found at www.fers.ie/projects.The FERS client list includes the EU (DG CLIMA), the European Investment Bank (EIB), the German community for international development (GIZ), Aether, other NGOs (e.g. VITA), Teagasc, University College Dublin, the Environmental Protection Agency, the Department of Agriculture Food and the Marine, The Department of the Environment, Forest Service and Coillte, IFoRUT, Greenbelt, NewGen forestry in addition to numerous private individuals and forestry companies.

Dr Patrick Moran, the Director of the Environmental Division of FERS, holds a 1st class honours degree in Environmental Biology (UCD), a Ph.D. in Ecology (UCD), a Diploma in EIA and SEA management (UCD) a Diploma in Environmental and Planning Law (King's Inn) and a M.Sc. in Geographical Information Systems and Remote Sensing (University of Ulster, Coleraine). Patrick has in excess of 20 years of experience in undertaking environmental assessments on both an academic and a professional basis. Dr Moran is a member of IAIA (International Association for Impact Assessment). The client list of the Environmental Division of FERS client includes National Parks and Wildlife Service, An Bord Pleanála, various County Councils, the Heritage Council, Teagasc, University College Dublin, the Environmental Protection Agency, Inland Waterways Association of Ireland, the Department of Agriculture, the Office of Public Works and Coillte in addition to numerous private individuals and companies.

11.1.2 Assessment Guidance

The potential climate change impact and vulnerability assessment has been prepared having regard to the following guidelines:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA, 2022a);
- European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the effects of certain public and private projects on the environment (the EIA Directive);
- European Union (EU) Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law');

- 2030 Climate and Energy Policy Framework (European Commission 2014);
- 2030 EU Climate Target Plan (European Commission, 2021b);
- Climate Action and Low Carbon Development (Amendment) Act 2021 (the 2021 Climate Act) (No. 32 of 2021) (Government of Ireland, 2021b).
- Climate Action Plan 2023 (hereafter referred to as the CAP 2023) (Government of Ireland, 2022);
- National Adaptation Framework (hereafter referred to as the NAF) (DECC, 2018);
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme
- Publicly Available Specification (PAS) 2080: 2016 Carbon Management in Infrastructure, BSI, 2016
- Transport Infrastructure Ireland Carbon Tool for Road and Light Rail

11.2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

11.2.1 Rationale

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.

To this end a suitable conservative approach must be taken in terms of the factors of safety to be adopted in scenarios relating to the liquefaction / brittleness of the tailings.

The proposed buttress will be constructed against a selection of the extant embankment walls of the TSF.

- 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.
- 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 Tailings Facility is located approximately 2.8 km north of the mine site in Navan. The facility is constructed as a ring-dike configuration and encloses an area of c. 250 Hectares. Stage 1, 2, 3,4 and 5 have earth fill embankment walls constructed from locally sourced natural materials. The It is proposed to construct a buttress to a selection of the existing embankment walls to increase their strength thus reducing the risk of failure. Stage 6 is a composite lined facility.

Figure11.1: Tailings Facility layout plan

The TSF has been constructed in six main stages during the period from 1974 to present.

- Stages 1, 2 and 3 were built at ground level to a height of c.12 metres.
- Stages 4 and 5 were upstream vertical raises over Stages 1,2 and 3 (6m and 4m raises respectively).
- Stage 6 is a lateral extension to the north of stages 1,2,3,4 & 5.

Refer to Figures 11.2. 11.3 and 11.4

Figure11. 2: Embankments side profile

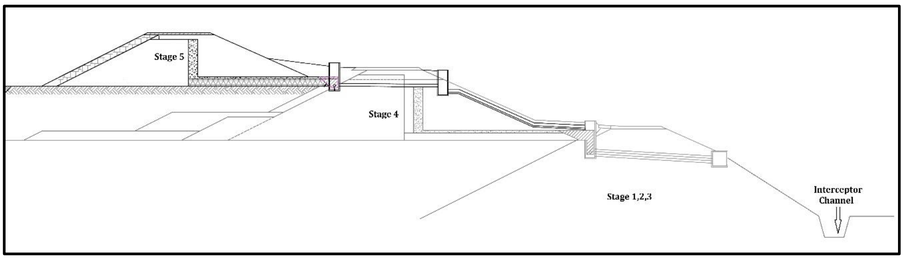

Figure11. 2: Cross section – extant facility embankment

The proposed buttress, to be constructed on the downstream slope of and at the crest of the Stage 1, 2 and 3 starter Embankments, see Figure 11.4, will provide additional support to the Stage 4 dam embankment wall in order to increase the overall stability of the upstream raises i.e. Stage 4 and Stage 5.

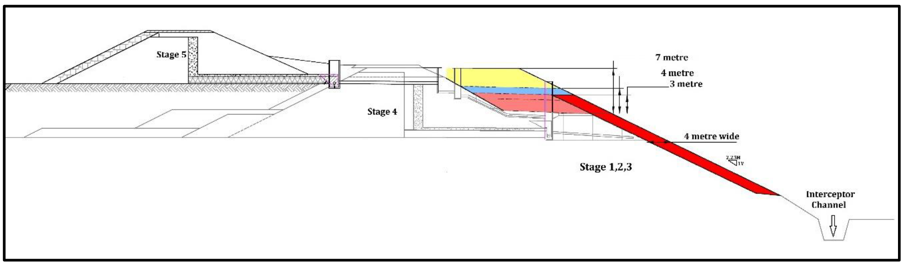

Figure 11.3: Cross section – facility embankment with buttress

11.2.2 Factor of Safety (FoS)

BTM has undertaken a comprehensive liquefaction assessment using Cone Penetration Tests (CPT) and laboratory testing on the existing tailings.

As with all loose tailings, the tailings at Randalstown could potentially liquefy either during dynamic or static liquefaction.

- Dynamic liquefaction occurs as a result of seismic activity, the risk of which is very low in Ireland.
- Static liquefaction occurs when the dam wall has already failed for other reasons and the tailings statically liquefy under the large strains as a result of loss of confinement.

In engineering, a factor of safety (FoS) indicates how much stronger a structure actually is compared to what it needs to be for an intended load.

The original facility design and stability analyses were undertaken using effective strength parameters and monitored piezometric levels in the stack wall which is the traditional procedure. The facility was originally designed and assessed to meet a target design criterion for long-term static slope stability of FoS > 1.5 using effective strength parameters.

However, current industry best practice is to evaluate the stability using peak undrained shear strengths and with further analysis using residual undrained shear strengths. Tailings undrained strength parameters simulates excess pore pressure within the tailings and is therefore, a more conservative analysis. The undrained stability analysis indicates a buttress is required at the toe of the Stage 4 embankment to achieve a factor of safety of 1.5 based on peak undrained shear strength of the fine tailings. The buttress will provide additional support to the Stage 4 dam embankment wall in order to increase the overall stability of the upstream raises (Stages 4 and 5).

For the stability analysis based on residual undrained shear strength, the buttress size will need to be increased in height to achieve the required factor of safety of 1.1. In order to achieve this increase in height, it is necessary to construct a buttress to the starter dam to facilitate the further increase in height.

It has been determined that the addition of a rock fill buttress at the downstream toe of the Stage 4 dam would meet the necessary requirements (endorsed by Independent Tailings Review Board).

- The minimum required FoS of 1.5 is achievable for all static and seismic loading conditions and all failure surface locations when the peak undrained strength of the tailings was considered.
- In order to meet the FOS of 1.1 for the residual undrained strength scenario the analysis indicated that a 4 m wide buttress to the starter dam is required for the majority of the perimeter wall. At the starter dam crest level, the height of the buttress will vary between 3 and 7 m.

The proposed buttress will be approximately 12 m wide at the base and will have an outer slope of 1 V: 2.75 H. This slope will be similar to the downstream slope of the Stage 4 dam wall as well as the downstream slope of the Starter Dams (Stages 1, 2 and 3) at most locations. It should be noted that where the Starter Dam height is greater than 14 m, the slope will be 1 V: 2.5 H. In these scenarios, the outer slope of the buttress will match the more shallow slope of the Starter Dam.

The proposed buttress would be sequenced in two phases which may run concurrently:

- 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 500m 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; and
- 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 500m 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.

Construction material quantities:

Rock Fill (m3)	**Soil (m3)**	**Total (m3)**
265,690	295,650	561,340

11.2.3 Plan and Construction Sequence

The following items are designed and specified for the Works and are listed in order of the proposed Sequence of Works:

- 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; and
- Installation of the Phase 1 Buttress (toe of stage 4)
- Installation of the Phase 2 Buttress (at ground level starter embankments)

Preparatory Works

- Accommodation of Monitoring Instrumentation

  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 instruments 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 report into the Perimeter Interceptor Channel (PIC) and from there will be returned back to the tailings facility.

11.3 PURPOSE OF THIS CHAPTER

The following describes the primary sources of potential climate impacts which have been assessed as part of this EIAR. Please note that the assessment is limited to the site boundary as indicated in Figure 11.1. The impacts associated with works outside of this boundary are as of yet unknown (site where the material will be attained, and distance transported). It must be noted that the imported soil material would otherwise have gone to landfill, but downstream pre-construction emissions are not included in the system boundary (Figure 11.5).

11.4 ASSESSMENT METHODOLOGY

The potential climate change impact and vulnerability assessment has been prepared having regard to the following guidelines:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA, 2022a);
- European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the effects of certain public and private projects on the environment (the EIA Directive);
- European Union (EU) Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law');
- 2030 Climate and Energy Policy Framework (European Commission 2014);
- 2030 EU Climate Target Plan (European Commission, 2021b);
- Climate Action and Low Carbon Development (Amendment) Act 2021 (the 2021 Climate Act) (No. 32 of 2021) (Government of Ireland, 2021b).
- Climate Action Plan 2023 (hereafter referred to as the CAP 2023) (Government of Ireland, 2022);
- National Adaptation Framework (hereafter referred to as the NAF) (DECC, 2018);
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme

- Publicly Available Specification (PAS) 2080: 2016 Carbon Management in Infrastructure, BSI, 2016
- Transport Infrastructure Ireland Carbon Tool for Road and Light Rail

This chapter has been prepared having regard to the following guidelines:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA, 2022a);
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017);
- European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the effects of certain public and private projects on the environment (the EIA Directive);
- European Union (EU) Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law');
- 2030 Climate and Energy Policy Framework (European Commission 2014);
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- Climate Action and Low Carbon Development (Amendment) Act 2021 (the 2021 Climate Act) (No. 32 of 2021) (Government of Ireland, 2021b).
- Climate Action Plan 2023 (hereafter referred to as the CAP 2023) (Government of Ireland, 2022);
- National Adaptation Framework (hereafter referred to as the NAF) (DECC, 2018);
- Meath County Council (MCC) Draft Climate Action Plan 2024 – 2029 (MCC, 2023);
- Transport Infrastructure Ireland (TII) -ENV-01104: Climate Guidance for National Rods, Light Rail and Rural Cycleways (offline & Greenways) – Overarching Technical Document (TII, 2022a);
- Transport Infrastructure Ireland (TII) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document (TII, 2022b);
- UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate (UK Highways Agency, 2019)

- Institute of Environmental Management and Assessment (IEMA) Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition (IEMA, 2022);
- IEMA EIA Guide to: Climate Change Resilience and Adaptation (IEMA, 2020a); and
- IEMA Greenhouse Gas Management Hierarchy (IEMA, 2020b).

11.5 CRITERIA FOR RATING OF IMPACTS

11.5.1 Climate Agreements & Policies

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland 'to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050' (3 (1) of No. 46 of 2015). This is referred to in the Act as the 'national transition objective'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021a) and a third update in December 2022 (Government of Ireland, 2022).

Following on from Ireland declaring a climate and biodiversity emergency in May 2019, and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme in December 2019, followed by the publication of the Climate Action and Low Carbon Development (Amendment) Bill 2021 (hereafter referred to as the 2021 Climate Bill) in March 2021. The Climate Act was signed into Law on the 23rd of July 2021, giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act (Government of Ireland, 2021b) is to provide for the approval of plans “for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050”. The 2021 Climate Act will also “provide for carbon budgets and a decarbonisation target range for certain sectors of the economy”. The 2021 Climate Act defines the carbon budget as “the total amount of greenhouse gas emissions that are permitted during the budget period”.

In relation to carbon budgets, the 2021 Climate Action and Low Carbon Development (Amendment) Act states ‘A carbon budget, consistent with furthering the achievement of the national climate objective, shall be proposed by the Climate Change Advisory Council, finalised by the Minister and approved by the Government for the period of 5 years commencing on the 1 January 2021 and ending on 31 December 2025 and for each subsequent period of 5 years (in this Act referred to as a ‘budget period’)’. The carbon budget is to be produced for 3 sequential budget periods, as shown in Table 11.1. The carbon budget can be revised where new obligations are imposed under the law of the European Union or international agreements or where there are significant developments in scientific knowledge in relation to climate change. In relation to the sectoral emissions ceiling, the Minister for the Environment, Climate and Communications (the Minister for the Environment) shall prepare and submit to government the maximum amount of GHG emissions that are permitted in different sectors of the economy during a budget period and different ceilings may apply to different sectors. The sectorial emission ceilings for 2030 were published in July 2022 and are shown in Table 11.2.

Table 11.1: Five-Year Carbon Budgets 2021-2025, 2026-2030 and 2031-2035

Sector	Reduction Required	2018 Emissions (Mt CO_2eq)
2021-2025	295 Mt CO_{2eq}	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO_{2eq}	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO_{2eq}	Reduction in emissions of 3.5% per annum for the third provisional budget.

Table 11.2: Sectoral Emission Ceilings 2030

Sector	Reduction Required	2018 Emissions (Mt CO_{2eq})	2030 Emission Ceiling (Mt CO_{2eq})
Electricity	75%	10.5	3
Transport	50%	12	6
Buildings (Commercial and Public)	45%	2	1
Buildings (Residential)	40%	7	4
Industry	35%	7	4
Agriculture	25%	23	17.25
Other (F-Gases, Waste & Petroleum refining)	50%	2	1

In December 2022, CAP23 was published (Government of Ireland, 2022). This is the first CAP since the publication of the carbon budgets and sectoral emissions ceilings, and it aims to implement the required changes to achieve a 51% reduction in carbon emissions by 2030. The CAP has six vital high impact sectors where the biggest savings can be made: renewable energy, energy efficiency of buildings, transport, sustainable farming, sustainable business and change of land-use. CAP23 states that the decarbonisation of Ireland's manufacturing industry is key for Ireland's economy and future competitiveness. There is a target to reduce the embodied carbon in construction materials by 10% for materials produced and used in Ireland by 2025 and by at least 30% for materials produced and used in Ireland by 2030. CAP23 states that these reductions can be brought about by product substitution for construction materials and reduction of clinker content in cement. Cement and other high embodied carbon construction elements can be reduced by the adoption of the methods set out in the Construction Industry Federation 2021 report Modern Methods of Construction. In order to ensure economic growth can continue alongside a reduction in emissions, the IDA Ireland will also seek to attract businesses to invest in decarbonisation technologies.

The Meath County Council Draft Climate Action Plan 2024-2029 (MCC, 2023) was published in November 2023. The document outlines a number of goals and plans to prepare for and adapt to climate change. The plan includes a range of climate mitigation and adaptation actions, aimed at reducing county wide GHG emissions and improving the resilience of the county to the impacts of climate change. These actions are divided across five thematic areas including: governance and leadership; built environment and transport; natural environment and green infrastructure; communities: resilience and transition; and sustainability and resource management. A Baseline Emissions Inventory (BEI) was carried out as part of the action plan to establish the main sources of emissions within County Meath. The main sources of emissions within the county are industrial processes (29%), agriculture (25%), manufacturing and commercial (13%), and transport (10%) respectively. Nine Decarbonising Zones (DZs) were identified, with a BEI undertaken across a range of pre-defined sectors for Ashbourne, Duleek, Dunboyne, Dunshaughlin, Laytown/Bettystown, Kells, Navan, Ratoath and Trim. The nine DZs account for 19% of the total emissions in County Meath, totalling 824 kt CO_2eq. Four main sectors where emissions were material across the nine DZs were residential, manufacturing and commercial, transport and waste. Measures promoted within the draft Action Plan to support the reduction of GHG emissions include increasing energy efficiency by retrofitting commercial buildings and increasing renewable energy, achieving target of 50% electric vehicles, retrofitting residential buildings to B1 BER rating and decreasing black bin waste by 50% in each household. The implementation of these measures will enable the Meath County Council area to adapt to climate change and will assist in bringing Ireland closer to achieving its climate related targets in future years. New developments need to be cognisant of the Action Plan and incorporate climate friendly designs and measures where possible.

11.6 CLIMATE ASSESSMENT SIGNIFICANCE

This climate assessment is divided into two distinct sections – a greenhouse gas assessment (GHGA) and a climate change risk assessment (CCRA).

- Greenhouse Gas Emissions Assessment (GHGA) – Quantifies the GHG emissions from a project over its lifetime. The assessment compares these emissions to relevant carbon budgets, targets and policy to contextualise magnitude.
- Climate Change Risk Assessment (CCRA) – Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a projects vulnerability to climate change and identifies adaptation measures to increase project resilience.

The 2022 IEMA Guidance (IEMA, 2022) sets out the following principles for significance:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible;
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages; and
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered.

11.7 GREENHOUSE GAS EMISSIONS – SCOPE

The Publicly Available Specification (PAS) 2080 (2016) provides guidance for measuring and reporting greenhouse gas emissions for infrastructure projects in order to comply with the greenhouse gas (GHG) reporting requirements as per the revised Environmental Impact Assessment EIA Directive 2014/52/EU.

The scope of PAS 2080 assessments is a complete life cycle analysis, which includes before use, use stage and end of life stage for any infrastructure projects (Figure 11.5). However, the scope of this report assessment only includes the construction process (Stage A5, see **Error! Reference source not found.**) because the project is in the design phase and there is no information available to complete a full life cycles analysis.

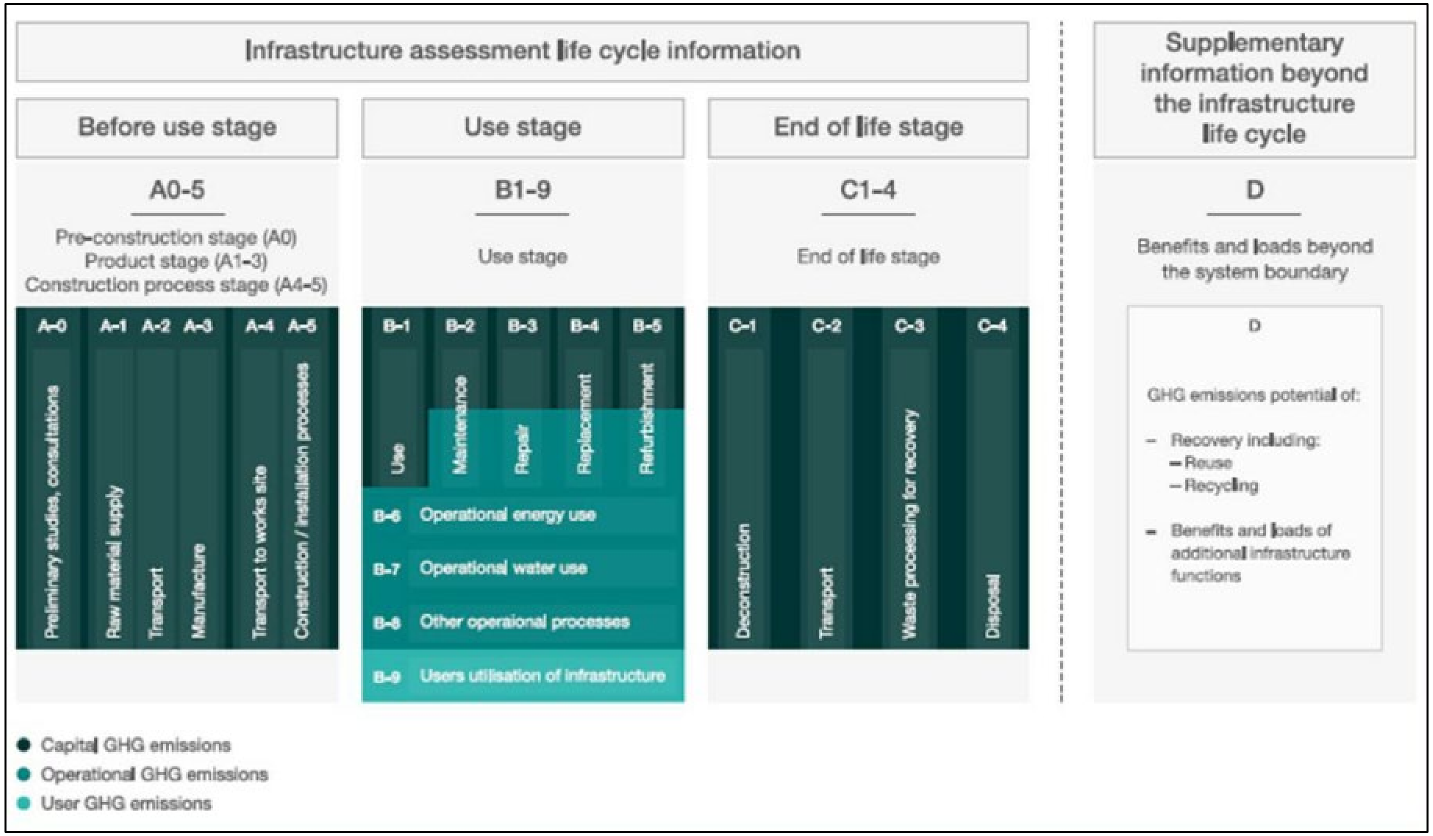

Figure 11.4: *Stages of the Life cycle system boundary used to assess GHG emissions associated with infrastructure projects (PAS 2080).*

Identified emissions associated with Stage A-5 of the tailings pond embankment construction are, therefore, assumed to occur within the project boundary (Figure 11.5). These include:

- Direct land use emissions due to cultivation and construction of the embankment;
    - GHG emissions due to changes in the embankment vegetation
    - GHG emission due to disturbance of soil on the embankment
    - GHG emissions from additional run off of dissolved organic carbon and nitrogen from the embankment slope
- Fossil fuel emissions from cultivation works.

The biology of the tailings pond is assumed not the change, so it is expected that emissions from the water body will not be affected during the construction phase.

The analysis also includes identification of mitigation measures and calculation of the impact of mitigation measures, where possible.

11.8 GREENHOUSE GAS EMISSION METHODOLOGY AND CALCULATIONS

11.8.1 Direct land use Impacts

Estimation of emissions from land use and land use change (LULUCF) activities are based on the International Panel for Climate Change good practical guidance for greenhouse gas inventories (IPCC, 2006), online carbon tools and the literature, where guidance is not available. The overriding principle of conservativeness is applied, where emissions are overestimated when data is limited, or uncertainties are large.

The sources of direct land use emissions and removals of greenhouse gasses (GHGs) include:

- Biomass carbon (C) losses, as carbon dioxide (CO_2) from the grassland due to cultivation of the tailing embankment
- Removals of C (or sequestration) by recolonising grassland
- Mineralisation of nitrogen (N) due to decomposition of biomass and emissions of nitrous oxide (N_20)

11.8.2 Biomass losses (BL)

Biomass GHG profiles are calculated using the stock change method (IPCC, 2006). Although the project activities do not result land use change, biomass C is lost during the cultivation and construction of the embankment. However, the grassland will be re-established, following passive restoration of the original seedbank (see Biodiversity chapter). It is assumed that all existing biomass is oxidised in one year and the biomass stock immediately after cultivation is zero[1]. The biomass carbon stock change will be associated with removal of 169,385 m^2 of grassland, quantified as the net sum of carbon lost on conversion and the carbon added by the first year's growth. The dry matter content of grassland is taken as 13.6 tonnes ha^{-1} and the carbon content of dry matter is 0.5 per cent. The default value of 6 t dry matter ha^{-1} from Table 6.4 Vol 4. of the 2006 IPCC guidelines (IPCC, 2006) is adopted for the carbon stock in the re-established grassland biomass after one year. The carbon stock change in biomass on the area (A, 169385m^2) is then calculated using eq 6.4.1, derived from eq 2.15 from Chapter 2 Vol 4 of the 2006 IPCC guidelines as follows:

$$\Delta C = A * [(C_{after} – C_{before}) + DC_{growth}] \qquad \text{(eq 1)}$$

$$\Delta C = (169385/10000) * [(0-(13.60 * 0.5)) + (6.0*0.5)]$$

ΔC = -64.37tC = **236.01 tCO_2** (emissions of CO_2 are indicated by a positive sign)

Where A is the area of crops converted to temporary grassland in ha.

Eq 1. Assumes that the cultivated area is passively restored with the original seedbank as part of the biodiversity mitigation action (see Habitat and Biodiversity Management and Conservation Plan), so this scenario represents a mitigation case. There is no IPCC guidance on a land use change without re-seeding, but it is reasonable to assume that natural regrowth would be slower

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[1] The Habitat and Biodiversity Management and Conservation Plan outlines the preservation of grass sods where possible, but there is no information on the extent of sod preservation or the GHG impacts. Therefore, biomass emissions are conservatively over estimated.

without passive restoration. Therefore, under the no mitigation scenario the regrowth of grass is assumed to be half of what would of occurred with passive restoration. Substituting the regrowth value of 3 t dwt ha^{-1} in Eq1 derives a no mitigation a value of 89.77 tC (**329.17tCO_2**).

11.8.3 Additional biomass sequestration (BS)

The new embankment slope will cover a larger grass land area (247,000 m^2) than the original structure. Therefore, the additional removal of CO_2 from the atmosphere should be estimated:

$$\Delta C = [(A_{after} - A_{before}) * DC_{growth}] \qquad \text{(eq 2)}$$

$$\Delta C = ((247000-169385)/10000)) * (6.0*0.5)]$$

ΔC = 23.28tC = **-85.38 tCO_2**

The no mitigation action additional sequestration is estimated to be -42.68 tCO_2, using the same assumptions outlined above and eq 2.

11.8.4 Mineralisation emissions associated with biomass losses (F_{CR})

These direct N_2O emissions are associated with N inputs from biomass, mineralisation of organic N, and production of N_20 in the soil due to nitrification and denitrification (see C11 Vol 4 of the 2006 IPCC guidelines, 2006).

The amount of N from grassland returned to the soil is calculated using a modified eq 11.6 of the IPCC guidelines (Ch11 Vol4, IPCC, 2006):

$$F_{CR} = \sum(Crop * [A * R_{AG} * N_{AG} * (1 - Frac_{remov}]) + A * Frac_{renew} * R_{BG} * N_{BG}]) \qquad \text{(eq.3)}$$

F_{CR}= annual amount of grass residue (above and below ground) from grassland renewal, kgN yr^{-1}

Crop = harvested/removed annual dry matter (13.6 t d.wt ha^{-1})

Area = area of the original embankment (16.98 ha)

$Frac_{Renew}$ = fraction of total area that is renewed annually. For the embankment grassland this is assumed to be a renewal period of 1 year

R_{AG} = ratio of aboveground biomass residues to the harvested yield of the crop, this is assumed to be 1 because grass is not harvested but incorporated into the soil

N_{AG} = N content of biomass residues (0.015 kg dwt-1, see value for perennial grasslands Table 11.2 Ch 11 Vol4 IPCC, 2006)

$Frac_{Remove}$ = fraction of biomass removed, assumed to be 1- no removals

R_{BG} = ratio of below ground biomass residues to the harvested yield of the crop, this is assumed to be 1 because grass is not harvested but incorporated into the soil

N_{BG} = N content of biomass residues (0.012 kg dwt-1, see value for perennial grasslands Table 11.2 Ch 11 Vol4 IPCC, 2006)

Substituting eq 3 with the available values equates to:

F_{CR} = 13.6*[(16.98 * 1 *0.015 *(1-1))+(16.98*1*1*0.0012)

F_{CR}= 2.76 Kg N yr^{-1}

The amount of N emitted as N_20 is then calculated using the tier 1 emission factors (EF_1=0.01) as derived from table 11.1 in Ch 11 Vol 4 (IPCC, 2006):

Direct N_2O-N = F_{CR} *EF_1

Direct N_2O-N = 2.76*0.01 = 0.0276 kg N_20

The convert to N_2O the molecular weight conversion is 44/28 and the CO_2 equivalent is calculated using the IPCC 2019 global warming potential of 265 (IPCC, 2019), therefore

Direct N_20 from biomass inputs to soils = 0.0276 *(44/28) *265 = **11.52 tCO_2 eq**.

11.8.5 Cultivation losses from soils (Soils)

The IPCC guidelines only consider cultivation CO_2 losses from histosols. The soil type associated with the site in question is an alkaline grown earth, a mineral soil. However, a recent literature review by Haddaway et al. (2017) suggest cultivation/tillage of mineral soils in the boreal/temperate region results in losses of 4.6 tC/ha over a 10-year period, an annual value of 0.46tC or 1.68 tCO_2 per ha. This is a conservative estimate and would be equivalent to a loss of 28.56 tCO_2 due to cultivation of the 16.93 ha.

Mineralisation losses (FSOM) as a result of C loss form soils are estimated using eq 11.8 11.1 in Ch 11 Vol 4 (IPCC, 2006):

$$F_{SOM} = \sum \left\{ \frac{(\Delta C_{soil} *) * 1000}{} \right\} \qquad \text{(eq. 4)}$$

DCSoil = is the C loss from soils i.e. 28.56*(44/12) =7.79.6 tC ha_{-1}

R is the C;N ratio, the default value is 15

Using eq.4 the FSOM value is 519 kgN yr^{-1}, which equates to N20 emission of 5.19 kg N20 (using EF_1) or **1.365 tCO_2 eq**

11.8.6 Emissions from run-off (DOC)

The IPCC GPG (IPCC, 2006) identifies losses of inorganic carbon (DOC) from soils linked to specific site hydrology and minerology of the soil. However, no generic IPCC methodology is currently available for grassland soils. Accurate quantification of DOC losses from the site requires a site-specific hydrological model and soil water chemistry sampling. However, an indicative estimate of DOC can be derived from rough estimates of surface and sub-surface run-off from the embankment slope and published relationships between runoff and leached DOC (Garnier et al., 2022):

$$DOC = k * Runoff \qquad \text{(eq.5)}$$

DOC = DOC export, all assumed to be emitted to the atmosphere kg ha-^{1} yr^{-1}

k= a constant = 0.04 as derived form (Garnier et al., 2022)

Runoff= Is the runoff of water from the slope of the embankment in mm yr^{-1}

Runoff was estimated (J Rush, AECOM *personal communication*) using EPA Hydrotool on EPA Maps and recharge coefficients for the slopes and vegetation types. The long term mean rainfall for the site is 852 mm yr^{-1} and the evapotranspiration is 517 mm, leaving 335 mm yr^{-1} for effective rainfall. The current recharge coefficient along the current slopes of the tailing embankments is mapped as 20-22.5%, based on soil drainage, permeability, aquifer type and aquifer vulnerability (GSI groundwater recharge mapping on Data and maps (gsi.ie)). This suggests that the current runoff coefficient would be 77.5-80%, equating to a runoff volume of 260-268mm yr^{-1} for the current facility. Using equation 5 the DOC for the current site is 264*0.04= 10.56 kgC ha. yr^{-1}

The impact of grassing of slope runoff is derived from run-off coefficients derived from the Rational Method Runoff Coefficient - CivilWeb Drainage Design Spreadsheets (civilweb-spreadsheets.com). The reported upper ranges for bare earth cover is 0.5. Grass cover runoff coefficients vary from 0.21-0.62, which means that grass cover can decrease or increase runoff, relative to bare earth cover. Therefore, we assume surface cover will have no additional impact on the runoff from the embankment, so the DOC value of 10.56 kgC ha. yr^{-1} is assumed for both the mitigation and no mitigation action scenarios.

Using the derived DOC value for the site, DOC emissions from the increased surface area (24.7 ha) of the embankment after construction 0.74 tCO_2, compared to 0.51tCO_2 for the current structure (16.9 ha), an additional emission of **0.23 tCO_2.**

11.8.7 Construction emissions ($GHG_{f.est}$)

Fossil fuel emissions are based on estimated fuel consumption of the buttress wall (Pat Keating, Priority construction, *personal communication*). The following Assumptions are used:

- Quantity of construction material to be moved = 550 km^3 approx.
- Period over 3 years
- 167k m^3 of materials to be placed each year
- Approx. 48 weeks per year (weather dependent)
- 153,300 litres of fuel used each year
- Total 459,900 litres of fuel used over the three years
- Fuel type -Low sulphur gas oil

A potential mitigation scenario has been identified, which involves the use of Hydrotreated Vegetable Oil (HVO) instead of diesel. The 2006 IPCC guidelines exclude CO_2 emissions from renewable HVO because CO_2 is removed from the atmosphere during the production of energy crops, but methane and nitrous oxide emissions are still estimated (ca 10% of the total GHG emission as CO2 eq.). This is why HVO emissions, based on life cycle analysis, are estimated to be 90% less than diesel emissions (https://knowledge.premaenergy.co.uk/help-center/green-house-gas-emission-savings-explained). The scope of the system boundary used in this study, however, is restricted to only A5 (see Figure 11.5) reductions associated with upstream production of energy crop to produce HVO is not considered.

Fossil fuel emissions ($GHG_{fest.}$) are based on diesel consumption (D_c=459,900l) and a mean emission factor of 2.683 kg CO_2 eq/l diesel (https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/)

$$GHG_{f.est} = EF_{diesel} \times Dc_i \quad \text{(eq.6)}$$

$GHG_{f.est}$= 459,900 * 2.683 =**1233.91 tCO2 eq.**

11.9 GREENHOUSE GAS EMISSIONS – RESULTS AND SIGNIFICANCE

Total estimated Greenhouse Gas Emissions, both with and without identified mitigations actions are presented in Table (identified mitigation measures are presented in Table 11.5).

Table 11.3: Estimated emissions (A5 only) associated with construction of the tailing pond embankment

A5 sources		**GHG emission/removals (tCO_2 eq.)**	
	Code	**With Mitigation**	**Without Mitigation**
Biomass Losses	BL	236.01	329.17
Biomass sequestration	BS	-85.38	-42.68
Mineralisation of biomass	F_{CR}	11.52	11.52
Cultivation losses from soils	Soils	1.37	1.37
Runoff emissions	DOC	0.00	0.23
Fossil fuels from construction *	GHG_{fest}	1233.91	1233.91
Total GHG emissions	**Total**	**1397.43**	**1533.52**

* HVO emissions are assumed to be the same as diesel under the system boundary used in the study

Emissions without any mitigation action would result in an 8.9% increase of emissions, when compared to the with mitigation scenario (Table). The total emissions including mitigation measures are estimated to be 1397.43 tCO_2 eq. for the construction phase (A5), which represents ca. 0.001% of the total national GHG emissions for 2021 (69,448 $ktCO_2$ eq., EPA, 2023). The UNFCCC reporting guidelines (see paragraph 37 of 24/CMP19, https://unfccc.int/process-and-meetings/conferences/past-conferences/warsaw-climate-change-conference-november-2013/cop-19/cop-19-decisions) recommends that emissions less than 0.05% of the national emissions and less than 500$ktCO_2$ eq. can be regarded as insignificant and would not need to be included in national GHG inventory submissions. Therefore, emissions associated with the proposed development are also not going to significantly impact proposed climate change targets under the EU effort sharing decision ((EC) No 401/2009 and (EU) 2018/1999) nor the National Climate change action plan budgets (CAP2023).

Emissions associated with land use activities is also very small and subject to a high uncertainty. CAP 2023 does not include targets for the LULUCF sector. There is currently no methodology available for the current national GHG inventory to report LULUCF activity emissions associated with waterbodies or infrastructural projects. In contrast, fossil fuel emissions are captured in the national GHG inventory, but the contribution of project associated emission to the total national transport and energy budgets under CAP 23 will not be significant.

11.10 VULNERABILITY ASSESSMENT

Impacts as a result of climate change will evolve with a changing future baseline, changes have the potential to include increases in global temperatures and increases in the number of rainfall days per year. Therefore, it is expected that the baseline climate will evolve over time and consideration is needed with respect to this within the design of the proposed development.

Ireland has seen increases in the annual rainfall in the north and west of the country, with small increases or decreases in the south and east including in the region where the proposed development will be located (EPA, 2021b). The EPA have compiled a list of potential adverse impacts as a result of climate change including the following which may be of relevance to the proposed development (EPA, 2021b):

- More intense storms and rainfall events;
- Increased likelihood and magnitude of river and coastal flooding;
- Water shortages in summer in the east;
- Adverse impacts on water quality; and
- Changes in distribution of plant and animal species.

The EPA's State of the Irish Environment Report (Chapter 2: Climate Change) (EPA, 2020c) notes that projections show that full implementation of additional policies and measures, outlined in the 2019 Climate Action Plan, will result in a reduction in Ireland’s total GHG emissions by up to 25 per cent by 2030 compared with 2020 levels. Climate change is not only a future issue in Ireland, as a warming of approximately 0.8°C since 1900 has already occurred. The EPA state that it is critically important for the public sector to show leadership and decarbonise all public transport across bus and rail networks to the lowest carbon alternatives. The report (EPA, 2020c) underlines that the next decade needs to be one of major developments and advances in relation to Ireland’s response to climate change in order to achieve these targets and that Ireland must accelerate the rate at which it implements GHG emission reductions. The report states that mid-century mean annual temperatures in Ireland are projected to increase by between 1.0°C and 1.6°C (subject to the emissions trajectory). In addition, heat events are expected to increase by mid-century (EPA, 2020c). While individual storms are predicted to have more severe winds, the average wind speed has the potential to decrease (EPA, 2020c).

TII’s Guidance document PE-ENV-01104 (TII 2022a) states that for future climate change a moderate to high Representative Concentration Pathways (RCP) should be adopted. RPC4.5 is considered moderate while RPC8.5 is considered high. Representative Concentration Pathways (RCPs) describe different 21st century pathways of GHG emissions depending on the level of climate mitigation action undertaken.

Future climate predictions undertaken by the EPA have been published in ‘Research 339: High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach (EPA 2020d). The future climate was simulated under both Representative Concentration Pathway 4.5 (RCP4.5) (medium-low) and RCP8.5 (high) scenarios. This study indicates that by the middle of this century (2041–2060). Mid-century mean annual temperatures are projected to increase by 1 to 1.2°C and 1.3 to 1.6°C for the RCP4.5 and RCP8.5 scenarios, respectively, with the largest increases in the east. Warming will be enhanced at the extremes (i.e. hot days and cold nights), with summer daytime and winter night-time temperatures projected to increase by 1 to 2.4°C. There will be a substantial decrease of approximately 50% which is projected for the number of frost and ice days. Summer heatwave events are expected to occur more frequently, with the largest increases in the south. In addition, precipitation is expected to become more variable, with substantial projected increases in the occurrence of both dry periods and heavy precipitation events. Climate change also has the potential to impact future energy supply which will rely on renewables such as wind and hydroelectric power. Wind turbines need a specific range of wind speeds to operate within and droughts or low ground water levels may impact hydroelectric energy generating sites. More frequent storms have the potential to damage the communication networks requiring additional investment to create resilience within the network.

The EPA's Critical Infrastructure Vulnerability to Climate Change report (EPA, 2021b) assesses the future performance of Irelands critical infrastructure when climate is considered. With respect to road infrastructure, fluvial flooding and coastal inundation/coastal flooding are considered the key climate change risks with snowstorm and landslides being medium risks. Extreme winds and heatwaves/droughts are considered low risk to road infrastructure. One of the key outputs of the research was a framework that will provide quantitative risk-based decision support for climate change impacts and climate change adaptation analysis for infrastructure.

11.10.1 Construction

Examples of potential climate impacts are included in Annex D (Climate proofing and environmental impact assessment) of the technical guidance on the climate proofing of infrastructure (European Commission, 2021a). Potential impacts of climate change of the proposed development include:

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding;
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather;
- Reduced temperatures resulting in ice or snow;
- Geotechnical impacts; and
- Major Storm Damage – including wind damage.

During construction, the Contractor will be required to mitigate against the effects of extreme rainfall /flooding through site risk assessments and method statements. The Contractor will also be required to mitigate against the effects of extreme wind/storms, temperature extremes through site risk assessments and method statements. During construction, the Contractor will be required to mitigate against the effects of fog, lighting and hail through site risk assessments and method statements.

11.10.2 Operation

Stages 1 to 5 extant embankment walls (the first stage of which was built in the 1970's) 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.

The proposed 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

Vulnerability is determined by combining the sensitivity and the exposure of the proposed development to various climate hazards.

- Vulnerability = Sensitivity x Exposure

The vulnerability assessment takes any proposed mitigation into account through a vulnerability matrix (see Table 5). TII guidance (TII, 2022a) and the EU technical guidance (European Commission, 2021a) note that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. The impact from climate change on the proposed development can therefore considered to be not significant. However, where residual medium or high vulnerabilities exist the assessment may need to be progressed to a detailed climate change risk assessment and further mitigation implemented.

The sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below.

- **High sensitivity**: The climate hazard will or is likely to have a major impact on the asset category. This is a sensitivity score of 3.
- **Medium sensitivity**: It is possible or likely the climate hazard will have a moderate impact on the asset category. This is a sensitivity score of 2.
- **Low sensitivity**: It is possible the climate hazard will have a low or negligible impact on the asset category. This is a sensitivity score of 1.

Once the sensitivities have been identified the exposure analysis is undertaken. The exposure analysis involves determining the level of exposure of each climate hazard at the project location irrespective of the project type for example: flooding could be a risk if the project location is next to a river in a floodplain. Exposure is assigned a level of High, Medium or Low as per the below criteria.

- **High exposure**: It is almost certain or likely this climate hazard will occur at the project location i.e. might arise once to several times per year. This is an exposure score of 3.
- **Medium exposure**: It is possible this climate hazard will occur at the project location i.e. might arise a number of times in a decade. This is an exposure score of 2.
- **Low exposure**: It is unlikely or rare this climate hazard will occur at the project location i.e. might arise a number of times in a generation or in a lifetime. This is an exposure score of 1.

Table 11.4: Vulnerability Matrix

		Exposure		
		High (3)	**Medium (2)**	**Low (1)**
Sensitivity	**High (3)**	9 - High	6 – High	3 - Medium
	Medium (2)	6 - High	4 - Medium	2 - Low
	Low (1)	3 - Medium	2 – Low	1 - Low

In order to determine the vulnerability of the proposed development to climate change the sensitivity and exposure of the development to various climate hazards must first be determined. The following climate hazards have been considered in the context of the proposed development: flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning, hail, landslides and fog. It must be noted that the purpose of the proposed development is to increase the factor of safety of the existing dam wall, minimising any exposure to landslide – as such sensitivity of the proposed development is considered low.

Table 11.6 details the sensitivity of the proposed development on a scale of high (3), medium (2) and low (1). Once the sensitivity has been established the exposure of the proposed development to each of the climate hazards is determined, this is the likelihood of the climate hazard occurring at the project location and is also scored on a scale of high (3), medium (2) and low (1). The product of the sensitivity and exposure is then used to determine the overall vulnerability of the proposed development to each of the climate hazards.

Table 11.5: Vulnerability of proposed development

Climate Hazard	Sensitivity	Exposure	Vulnerability
Flooding (coastal, pluvial, fluvial)	1 (Low)	1 (Low)	1 (Low)
Extreme Heat	1 (Low)	2 (Medium)	2 (Low)
Extreme Cold	1 (Low)	2 (Medium)	2 (Low)
Drought	1 (Low)	2 (Low)	1 (Low)
Extreme Wind	1 (Low)	2 (Medium)	1 (Low)
Lightning & Hail	1 (Low)	1 (Low)	1 (Low)
Fog	1 (Low)	1 (Low)	1 (Low)

Climate Hazard	Sensitivity	Exposure	Vulnerability
Landslides	1 (Medium)	2 (Medium)	2 (Low)
Wildfire	2 (Medium)	1 (Medium)	2 (Low)

The proposed development (in light of the nature of the proposed development to increase the factor of safety relative to the existing TSF and mitigation measures) has a worst-case low vulnerability to the identified climate hazards. In light of predicted changes associated with climate change, the design of the proposed development entails adaptation to changes associated with climate change, **decreasing the vulnerability** of the existing Tailings Storage Facility to those events associated with climate change when in operation.

11.11 RECEIVING ENVIRONMENT

The existing walls of the embankments largely comprise seminatural grassland of a mosaic of types, depending on the existing environmental conditions. For example, in the vicinity of the Interceptor Ditch, areas of wet grassland (GS4) occur, while on south-facing slopes the grassland could be categorised as GS1, and indeed a high number of orchids, including Common Spotted Orchid and Bee Orchid occur here.

Figure 11.5: Slopes of the existing embankment comprise the habitat GS - semi natural grassland

Figure 11.6: Bee Orchid occur in suitable habitat along the embankment of the dam

The existing semi-natural grassland habitat supports numerous species of avifauna of conservation concern, including the red-listed Meadow Pipit and Yellowhammer. There has been little human intervention in the form of insecticide/pesticide within the habitats occurring along the tailings embankments/walls and as a result the habitats provide a rich habitat assemblage for invertebrates, upon which ground/near ground nesting species such as Meadow Pipit and Yellowhammer require for successfully breeding.

Figure11. 7: The Red-listed Meadow Pipit breeds extensively at the Tailings Facility

Figure11.8: Yellowhammer are also abundant within the subject area

Grassland habitat within Ireland requires management in the form of grazing and/or mowing to maintain a sward as woodland is the climax vegetation. The existing grassland habitat is largely maintained by a healthy population of hare and rabbit (in addition to invertebrates). There are large numbers of Irish Hare throughout the subject area.

Figure 11.9: Irish Hare are common withing the Tailings Facility, being free from persecution

In addition, the semi-natural grassland habitat and the invertebrate population supported provides foraging for a range of bat species.

Of note, post-works, the existing habitats present (i.e. semi natural grassland) will be passively restored, with minimal possible impact on biodiversity and landuse.

11.12 DO NOTHING SCENARIO

Under the Do Nothing Scenario no construction works will take place and the site will remain as it currently is. The climate baseline will continue to develop in line with current trends. This scenario is considered neutral in relation to climate. The proposed development entails adaptation to changes associated with climate change, **decreasing the vulnerability** of the existing Tailings Storage Facility to those events associated with climate change, decreasing the risk of a catastrophic dam breach owing to, for example increased rainfall events associated with climate change.

11.13 MITIGATION MEASURES

During the construction phase the best practice measures listed in Table 11.6 shall be implemented on site to prevent significant GHG emissions and reduce impacts to climate. During the operational phase of the proposed development, all mitigation measures as prescribed in the Biodiversity Chapter of the EIAR, Natura Impact Statement, Habitat and Biodiversity Conservation and Management Plan will be implemented. These mitigation measures will aim to restore and enhance biodiversity levels at the site, and sequester carbon through a system of natural, sustainable ecosystem such as is currently present (semi-natural grassland grazed primarily by small mammals and invertebrates).

Table 11.6: Mitigation measures

Character of potential impact	Mitigation measure
Construction Phase	
Impacts to climate through the release of GHGs associated with construction	Embodied carbon associated with construction materials will be reduced during detailed design, by incorporating the IEMA GHG Management Hierarchy;
	Creating a construction program which allows for sufficient time to determine reuse and recycling opportunities for construction wastes;
	Integrate and maintain measures to manage construction surface water runoff;
	Design will be optimised to minimise the requirements for raw materials;
	Appointing a suitably competent contractor who will undertake waste audits detailing resource recovery best practice and identify materials can be reused/recycled;
	Materials will be reused on site within where possible;
	Construction traffic generated by the project will be managed via a transport strategy to ensure efficient movement of materials;
	Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods;
	Ensure all plant and machinery are well maintained and inspected regularly;
	Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site. Appointed contractor(s) to prepare and implement a Waste Management Plan adopting measures to minimise waste, manage materials effectively and prioritise reuse and recycling on site; and

Character of potential impact	Mitigation measure
	Sourcing materials locally where possible to reduce transport related CO_2 emissions.
Operational Phase	
Impacts to climate through the release of GHGs	All mitigation measures as prescribed in the Biodiversity Chapter of the EIAR, Natura Impact Statement, Habitat and Biodiversity Conservation and Management Plan will be implemented. These mitigation measures will aim to restore and enhance biodiversity levels at the site, and sequester carbon through a system of natural, sustainable ecosystem such as is currently present (semi-natural grassland grazed primarily by small mammals and invertebrates).

11.14 RESIDUAL IMPACTS

II state that the crux of assessing significance is “not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050”. The proposed development has proposed some best practice mitigation measures and is committing to reducing climate impacts where feasible. The proposed development comprises and adaptation to climate change, reducing the risk of catastrophic failure of the Tailings Dam owing to, for example, an extreme rainfall event and knock on effects on Greenhouse Gas Release associated with any such event. The residual impact must, therefore, be determined to be long term positive.

The impact of the proposed development in relation to GHG emissions is considered long-term, neutral - positive and not significant in EIA terms.

In relation to climate change vulnerability, it has been assessed that there are no significant risks to the proposed development as a result of climate change, indeed, the proposed development will decrease the vulnerability of the TSF associated with climate change.

11.15 INTERACTIONS ARISING

Climate has the potential to interact with a number of other environmental attributes. The impact associated with hydrology/hydrologeology have been determined in the EIAR. The overall impact of this interaction is considered negative and not significant in EIA terms.

Interactions across many areas can be used to minimise the GHG emissions associated with construction of the buttressing. For instances, waste management measures will be put in place to minimise the amount of waste entering landfill, which has higher associated embodied carbon emissions than other waste management such as recycling or incineration. The overall impact of this interaction is considered negative and slight in EIA terms.

The risk to design in terms of material vulnerability to climate change, specifically extreme heat and cold, has been considered. The overall impact of this interaction is considered negative and not significant in EIA terms.

11.16 RISK OF ACCIDENTS & DISASTERS

The purpose of the proposed development is to increase the factor of safety of the tailings storage facility and mitigate against increased risk of severe weather events associated with climate change. There is the potential for climate change to alter weather patterns in future years resulting in increased rainfall events and the potential for flooding impacts. A detailed hydrological analysis has been undertaken within the EIA. Therefore, the impact is predicted to be imperceptible.

11.17 MONITORING

During the detailed design phase GHG emissions shall be further mitigated and monitored to ensure any design changes do not impact the GHG. Opportunities will be taken in order to further reduce the impact of the Proposed Development) potential renewable energy on site.

The successful contractor should monitor and report GHG emissions during construction. The obligations will be included as part of a CEMP. The elements to be monitored include:

- Embodied carbon from products;
- Transportation of staff, materials, waste etc;
- Water use;
- Raw material extraction;
- Fuel usage, and
- Waste

11.18 CONCLUSIONS

Emissions associated with the proposed development is not going to significantly impact proposed climate change targets under the EU effort sharing decision ((EC) No 401/2009 and (EU) 2018/1999) nor the National Climate change action plan budgets (CAP2023). However, this analysis only includes construction phase (A5) and does not assess the upstream and downstream emissions over the complete life cycle of the proposed project. In light of the purpose of the proposed buttressing development, which entails adapting the current TSF in order to decrease the vulnerability of the TSF to dam failures in future years associated with climate change, and with the implementation of mitigation measures as laid out in the EIAR and ancillary documents, it can be concluded that within the constraints of the assessment undertaken, the long-term impact of the proposed development is negligible – slight positive in terms of climate change.

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