Chapter 24

Risk of Major Accidents and/or Disasters

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24.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents the assessment of the expected effects deriving from the risks of major accidents and/or disasters. The assessment is considered under two main scenarios:

1. Where the Proposed Scheme may cause a major accident and/or disaster; and
2. Where the Proposed Scheme is vulnerable to hazards resulting from a major accident and/or disaster.

Coordination with and input from the relevant EIA experts and their respective discipline chapters of this EIAR and supporting documents has informed this chapter, including:

- **Chapter 4 – Description of the Proposed Scheme**;
- **Chapter 5 – Description of the Construction Phase**;
- **Chapter 6 – Consultation**;
- **Chapter 7 – Traffic and Transport**;
- **Chapter 8 – Population**;
- **Chapter 9 – Noise and Vibration**;
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- **Chapter 22 – Material Assets: Utilities**;
- **Chapter 23 – Material Assets: Resource and Waste Management**;
- **Flood Risk Assessment**; and
- **Natura Impact Statement**.

24.2 Methodology

The consideration of risk of major accident and/or disasters has followed the overall methodology and guidance relating to the EIA process and EIAR preparation as set out in **Section 1.3.3** of **Chapter 1 – Introduction**. Risk at both the construction and operational phases has been considered by way of a combination of desk-based studies, consultation, and collaboration with the relevant environmental and design specialists.

24.2.1 Legislation, Policy and Guidance

24.2.1.1 Legislation

Article 3 of the EIA Directive (as amended) requires the assessment of expected effects of major accidents and/or disasters within EIA. Article 3(2) of the Directive states that the:

> *"… effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned."*

Annex IV (information for the EIAR) of the 2014 EIA Directive requires:

> *"A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned."*

The 2014 EIA Directive also states:

> *"In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment."*

The Major Accidents (Seveso III) Directive (2012/18/EU) is an EU Directive that seeks to prevent major industrial accidents involving dangerous substances and to limit the consequences of such accidents on people and the environment. In Ireland, the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the 'COMAH Regulations'), implements the Seveso III Directive.

24.2.1.2 Policy

Consideration has been given to the following relevant policy documents in the preparation of this chapter:

- National Risk Assessment for Ireland 2021/2022;
- National Risk Assessment for Ireland 2020;
- Meath County Development Plan 2021-2027;
- Meath County Council's Climate Action Strategy 2019-2024;
- Meath County Council Major Emergency Plan 2020; and
- Meath County Council Flood Emergency Plan 2020.

24.2.1.3 Guidance

There is no topic specific national guidance with regard to the assessment of major accidents and/or disasters for the purposes of EIA however the topic is included in the more general national EIA guidance, notably:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022) which state: "To address unforeseen or unplanned effects the Directive further requires that the EIAR takes account of the vulnerability of the project to risk of major accidents and/or disasters relevant to the project concerned and that the EIAR therefore explicitly addresses this issue. The extent to which the effects of major accidents and / or disasters are examined in the EIAR should be guided by an assessment of the likelihood of their occurrence (risk)." (section 3.7.3 of EPA, 2022)
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018) which state that there are two key considerations under this requirement, namely:
  - "*The potential of the project to cause accidents and/or disasters, including implications for human health, cultural heritage, and the environment*; and
  - "*The vulnerability of the project to potential disasters/accidents, including the risk to the project of both disasters (e.g. flooding) and man-made disasters (e.g. technological disasters).*"

  The Guidelines also require that an EIAR include: *"… the expected effects arising from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project. Where*

appropriate, the description of expected significant effects should include details of the preparedness for and proposed response to such emergencies."

In the absence of a specific approach in national guidance, the approach used to carry out the risk assessment for this EIAR is based on that outlined in the following UK publication:

- Institute of Environmental Management and Assessment (IEMA) Major Accidents and Disasters in EIA: A Primer (IEMA 2020).

24.2.2 Study Area

For the purposes of the risk assessment, the study area includes the extent of the zone of Influence as defined in each of the specialist **Chapters 7 – 23**. Consideration has also been given to sites i.e. Seveso sites, also known as COMAH establishments, that have potential for major accident hazard under the COMAH Regulations 2015 (S.I. No. 209 of 2015). Within the EIA Directive 2014/52/EU, the Proposed Scheme's potential to cause accidents and/or disasters focuses on the impact to human health, cultural heritage and the environment. Environmental receptors are identified as those listed within Article 3 of the EIA Directive.

24.2.3 Sources of Information to Inform the Assessment

In addition to review of the chapters and assessments noted under **Section 24.1** as informing this chapter, information was also derived from a desktop review of existing studies and datasets as summarised in **Table 24-1**.

Table 24-1: Summary of Key Desktop Reports

Title	Source	Year
A Framework for Major Emergency Management[1]	Department of Housing, Local Government and Heritage	2021
National Risk Assessment for Ireland 2021/2022[2]	Irish Government	2021
Meath County Development Plan 2021-2027[3]	Meath County Council	2021
Meath County Council's Climate Action Strategy 2019-2024[4]	Meath County Council	2019
Meath County Council Major Emergency Plan 2020[5]	Meath County Council	2019
Meath County Council Flood Emergency Plan 2020[6]	Meath County Council	2019
GSI Spatial Resources Database[7]	Geological Survey Ireland	2022

24.2.4 Key Parameters for Assessment

The assessment of potential for risk of major accident /disaster has been based on the design and activities associated with the construction and operational phases of the Proposed Scheme as described in detail in **Chapter 4 – Description of Proposed Scheme** and **Chapter 5 – Description of Construction Phase**.

As noted in **Section 24.1** the assessment considers the potential for the Proposed Scheme to cause a major accident and/or disaster and the potential for the Proposed Scheme to be vulnerable to hazards resulting in a major accident and/or disaster.

[1] https://www.gov.ie/en/collection/ca182-a-framework-for-major-emergency-management/
[2] https://www.gov.ie/en/policy-information/795550-national-risk-assessment/
[3] https://www.meath.ie/council/council-services/planning-and-building/development-plans/meath-county-development-plan
[4] https://www.meath.ie/council/council-services/environment/climate-change
[5] https://www.meath.ie/system/files/media/file-uploads/2020-09/Major%20Emergency%20Plan%202020.pdf
https://www.meath.ie/council/council-services/public-safety-and-emergency-services/emergency-planning
[6] https://www.meath.ie/system/files/media/file-uploads/2020-09/Flood%20Emergency%20Plan%202020.pdf
[7] https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx

24.2.5 Assessment Criteria and Significance

This assessment broadly applies the approach set out in Major Accidents and Disasters in EIA: A Primer (IEMA, 2020). Unlike other assessments within the EIAR, the assessment does not deal with likely effects. The scope of this assessment focuses on potential sudden events of low likelihood, which may reasonably occur, resulting in major negative impacts on receptors. This approach directs the assessment to focus on "*low likelihood but potentially high consequence events*" such as a major spill, explosion, fire etc. Smaller incidents (spills, sediment loss etc.) are addressed elsewhere in this EIAR in the relevant topic chapters. This chapter focuses on major events only.

Additionally, other Chapters of the EIAR, which typically apply the standard definitions provided within the EPA 2022 Guidelines, which describe 'significance' as "…*a concept that can have different meanings for different topics*." However, in the context of Major Accidents and Disasters, the understanding of what constitutes a 'significant' effect or impact differs. The IEMA (2020) approach defines a "*significant environmental effect*" as one which *"could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration"* and this definition has been adopted for the purposes of this assessment.

24.2.5.1 Assessment Methodology

In accordance with the approach presented in the IEMA Primer (IEMA, 2020), this assessment follows three stages (screening, scoping, assessment) as follows:

- **Stage 1 Screening:** The IEMA Primer (2020) states that "*during screening it should be sufficient to identify if a development has a vulnerability to major accidents and / or disasters and to consider whether a development could lead to a significant effect*."
- **Stage 2 Scoping:** Scoping is undertaken to determine in more detail whether there is potential for significant effects as a result of major accidents and/or disasters associated with the Proposed Scheme. If the Proposed Scheme is screened in for the assessment of impacts in relation to major accidents and/or disasters at Stage 1, Stage 2 aims to provide a more detailed determination as to whether there is potential for significant effects.

  The IEMA Primer (2020) further states that the assessment of impacts in relation to major accidents and/or disasters may be scoped out if it can be shown that:

  – *"There is no source-pathway-receptor linkage of a hazard that could trigger a major accident and/or disaster or potential for the scheme to lead to a significant environmental effect";* or
  – *"All possible major accidents and/or disasters are adequately covered elsewhere in the assessment or covered by existing design measures or compliance with legislation and best practice."*

  The Primer further notes that:

  – *"A major accidents and/or disasters assessment will be relevant to some developments more than others, and for many developments it is likely to be scoped out of the assessment".*
- **Stage 3 Assessment:** The assessment stage provides further understanding on the likelihood of a risk event occurring and identifies the requirement for further mitigation. If hazard types are screened in at Stage 2, they are brought forward to Stage 3 for detailed consideration of the potential for significant impacts to occur. The following exercises are carried out in the Stage 3 Assessment:
  – Setting out the baseline: Hazard identification and receptor tagging;
  – Assessment:
    ○ Identifying reasonable worst-case impact;
    ○ Selecting the grouped risk events that need further assessment;
    ○ Understanding the likelihood of a risk event occurring; and
  – Mitigation: Identifying the requirements for secondary mitigation.

Risk Classification Approach

Following the steps undertaken in Stage 1 and Stage 2, the potential risk of identified hazards brought forward to the Stage 3 assessment are then evaluated using criteria outlined in **Table 24-2** (likelihood of

occurrence), **Table 24-3** (consequence of impact) and **Table 24-4** (risk assessment), which have been adapted from the following:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022).
- A National Risk Assessment for Ireland 2020 (DoD, 2021); and
- Major Accidents and Disasters in EIA: A Primer (IEMA 2020).

Table 24-2: Classification of Likelihood of Occurrence

Rating	Classification	Description
1	Extremely Unlikely	100 or more years between occurrences
2	Very Unlikely	51-100 years between occurrences
3	Unlikely	11-50 years between occurrences
4	Likely	1-10 years between occurrences
5	Very Likely	Ongoing/Less than one year between occurrences

Table 24-3: Consequence of Impact

Rating	Classification of Potential Impact (Department of Defence, 2021)	Significance of Effects (EPA, 2022)	Description
1	Very Low Impact	Slight	• *People: Deaths less than 1 in 250,000 people for population of interest OR Critical injuries/illness less than 1 in 250,000 OR Serious injuries less than 1 in 100,000 OR Minor injuries only;* • *Environment: Simple, localised contamination only;* • *Economic: Up to 1% of Annual Budget;* • *Social: Limited disruption to community.*
2	Low Impact	Moderate	• *People: Deaths greater than 1 in 250,000 people for population of interest OR Critical injuries/illness greater than 1 in 250,000 OR Serious injuries greater than 1 in 1 100,000;* • *Environment: Simple, regional contamination, effects of short duration;* • *Economic: Greater than 1% of Annual Budget;* • *Social: Community is functioning but with considerable inconvenience.*
3	Moderate Impact	Significant	• *People: Deaths greater than 1 in 100,000 people for population of interest OR Critical injuries/illness greater than 1 in 100,000 OR Serious injuries greater than 1 in 40,000;* • *Environment: Heavy contamination, localised effects of extended duration;* • *Economic: Greater than 2% of Annual Budget;* • *Social: Community is functioning poorly.*
4	High Impact	Very Significant	• *People: Deaths greater than 1 in 40,000 people for population of interest OR Critical injuries/illness greater than 1 in 40,000 OR Serious injuries greater than 1 in 20,000;* • *Environment: Heavy contamination, widespread effects of extended duration;* • *Economic: Greater than 4% of Annual Budget;* • *Social: Community only partially functioning.*

Rating	Classification of Potential Impact (Department of Defence, 2021)	Significance of Effects (EPA, 2022)	Description
5	Very High Impact	Profound	• *People: Deaths greater than 1 in 20,000 people for population of interest OR Critical injuries/illness greater than 1 in 20,000;* • *Environment: Very heavy contamination, widespread effects of extended duration;* • *Economic: Greater than 8% of Annual Budget;* • *Social: Community is unable to function without significant support.*

Hazards scoped in at Stage 2 are evaluated and categorised using a risk matrix, developed using the approach and information outlined in both the national risk assessment documents, provisions outlined in the IEMA Primer, and the EPA Guidelines. This matrix is used to determine the level of significance of each risk for each hazard scenario. Risks have been grouped in three categories outlined in **Table 24-4**; red refers to 'High Risk' scenarios that have an assessment score between 15 and 25, orange refers to 'Medium Risk' scenarios that score between 8 and 12, and green refers to 'Low Risk' scenarios scoring between 1 and 6.

Table 24-4: Risk Matrix

Likelihood	Consequence of Impact					
		1 – Slight	2 – Moderate	3 – Significant	4 – Very Significant	5 – Profound
	5 – Very Likely	5	10	15	20	25
	4 – Likely	4	8	12	16	20
	3 – Unlikely	3	6	9	12	16
	2 – Very Unlikely	2	4	6	8	10
	1 – Extremely Unlikely	1	2	3	4	5

24.3 Description of Existing Environment (Baseline)

The Proposed Scheme is situated within the Slane environs, Co. Meath. Slane is described as a rural village within the wider rural region under the settlement hierarchy as outlined within the Meath CDP (2021-2027). The village is situated along the north bank of the Boyne River (within the Boyne Valley). Due to the rural nature of Slane and its environs, the principal activities in the area consist of local commercial properties and services within the village, agricultural activity, some local industry (e.g. Grassland AGRO), recreational activity (e.g. cycling, walking, river users etc.), and local traffic and transport.

The existing N2 route through Slane village is recognised as deficient, arising from the sub-standard alignment of the road particularly in the vicinity of Slane Bridge, the steep approach gradients in Slane village and approaches to Slane Bridge, and the high percentage of heavy goods vehicles (HGVs) through the village. Traffic safety problems associated with Slane have been recognised as far back as 1985. **Chapters 1** and **2** of this EIAR provide additional regional local and regional context for the existing N2 and the Proposed Scheme.

24.3.1 Seveso Sites / COMAH Establishments

The Major Accidents (Seveso III) Directive (2012/18/EU) is an EU Directive that seeks to prevent major industrial accidents involving dangerous substances and to limit the consequences of such accidents on people and the environment.

In Ireland, the COMAH Regulations 2015 place an obligation on the operators of establishments that store, handle or process dangerous substances above certain thresholds to take all necessary measures to prevent major accidents and to limit the consequences for human health and the environment. Under the Regulations, a COMAH establishment[8] may qualify as upper tier or lower tier, depending on the inventory of dangerous substances; sites that store, handle or process dangerous substances below a certain threshold do not qualify as establishments under the Regulations.

There are three COMAH establishments located in County Meath; two Lower Tier site and one Upper Tier site, outlined in **Table 24-5**. A further five sites are located within adjacent local authorities where their consultation distance overlaps with County Meath (note these do not overlap with the Zone of Influence of the road development). Consultation distances are set for all establishments for health and safety reasons; the COMAH Regulations 2015 define this as: "*a distance or area relating to an establishment, within which there are potentially significant consequences from major accidents to people and/or to the environment from a major accident at the establishment, including potentially significant consequences for developments such as residential areas, buildings and areas of public use, recreational areas and major transport routes*."

Table 24-5: Seveso Sites / COMAH Establishments within County Meath

Name	Tier	Location	Consultation Distance from Facility	Approx. Distance from Proposed Scheme
Grassland AGRO	Lower Tier	The Pound Road, Slane, County Meath	700 m	63 m
Boliden Tara Mines DAC	Upper Tier	Knockumber Road, Navan, County Meath	1,000 m	12 km
Xtratherm Limited	Lower Tier	Liscarton Industrial Estate, Kells Road, Navan, County Meath	1,000 m	13 km

The nearest COMAH establishment to the Proposed Scheme is the Grassland Agro Lower Tier establishment. This establishment is located in the north-east area of Slane village, along the existing N2 route and approximately 63 m from the proposed mainline bypass which will traverse agricultural land to the east of the Grassland Agro site but will not impact directly on the site. The principal activity at this Lower Tier establishment is the production and storage of industrial fertiliser. The consultation distance for this establishment has been cited as 700 m as per the Meath CDP 2021-2027 and the Health and Safety Authority (HSA).[9] The Proposed Scheme is therefore within the consultation distance for this establishment and communication / consultation between MCC, HSA and Grassland Agro will be ongoing throughout the planning, construction and operation of the Proposed Scheme. This has already commenced.

Neither of the other two COMAH establishments are situated in the vicinity of the Proposed Scheme, as they are located approximately 12 km and 13 km from the Proposed Scheme.

24.3.2 Built Service Infrastructure

Known utilities that are within or adjacent to the footprint of the Proposed Scheme include:

- Electricity Supply: ESB Networks;

[8] HSA, List of Seveso establishments. Available at: https://www.hsa.ie/eng/your_industry/chemicals/legislation_enforcement/comah/list_of_establishments/

[9] https://consult.meath.ie/en/system/files/materials/7447/Map%2011.1_Seveso%20Sites.pdf
https://consult.meath.ie/en/system/files/materials/7447/Chapter%2011.pdf

- Water Mains and Foul Sewers: Irish Water; and
- Telecommunications: Eir.

There are no gas utilities within the study area. Utility providers have been contacted in relation to the Proposed Scheme and a description of the utility infrastructure present is presented in **Chapter 22 – Material Assets: Utilities**.

24.3.3 Waste and Licenced Facilities

There are various relevant facilities currently licenced by the EPA under Waste, Integrated Pollution Control (IPC) and Industrial Emissions (IE) licences in County Meath and across the wider Eastern-Midlands Waste Management Region, totalling approximately 83 facilities. These are presented in **Chapter 23 – Material Assets: Resource and Waste Management**. No facilities are traversed or impacted by the routing of the mainline bypass or N51 improvements of the Proposed Scheme.

24.3.4 Contaminated Land and Unlicensed Sites

There are no indications of the presence of contaminated land from tests carried out during the ground investigations to date for the Proposed Scheme.

There are two small unlicensed and disused legacy dump sites close to Slane village, located in the Fennor and Slane Castle townlands, approx. 970 m and 2.3 km respectively, to the west of the Proposed Scheme. There is limited information available on these sites, however Environmental Risk Assessments for Unregulated Waste Disposal Sites undertaken by MCC indicated both sites are classed as 'low risk' due to limited source-pathway-receptor linkages to sensitive receptors. Neither site is crossed by the Proposed Scheme.

24.3.5 Natural Hazards

In relation to natural hazards, the current and evolving climate system in Ireland poses a risk to infrastructure and developments; latest research from the EPA and Met Éireann (Nolan and Flanagan, 2020) predicts the following changes to the Irish climate:

- Projections indicate an increase of 1 to 1.6°C in mean annual temperatures by mid-century (with the largest increases seen in the east of the country). Warming is enhanced for the extremes (i.e. hot or cold days), with highest daytime temperatures projected to rise by 0.7 to 2.6°C in summer and lowest night-time temperatures to rise by 1.1 to 3°C in winter. Averaged over the whole country, the number of frost days (days when the minimum temperature is less than 0°C) is projected to decrease by 50% for the medium-low emission scenario and 62% for the high-emission scenario;
- Significant projected decreases in mean annual, spring and summer precipitation amounts by 2050 with the projected decreases largest for summer, with reductions ranging from 0% to 13% and from 3% to 20% for the medium-to-low and high emission scenarios, respectively. The frequencies of heavy precipitation events show notable increases of approximately 20% during the winter and autumn months. The number of extended dry periods is projected to increase substantially by mid-century during autumn and summer. The projected increases in dry periods are largest for summer, with values ranging from 12% to 40% for both emission scenarios;
- Globally sea levels have been rising at an average rate of approximately 3 mm per year between 1980 and 2010. Sea level is projected to continue to rise at this rate or greater. All major cities in Ireland are in coastal locations subject to tides, any significant rise in sea levels will have major economic, social and environmental impacts. Rising sea levels around Ireland would result in increased coastal erosion, flooding and damage to property and infrastructure; and
- Storms occur when mean wind speeds exceed 65 km/h and gust speeds are in excess of 110 km/h. Studies have projected decreases in the energy content of the wind for the spring, summer and autumn seasons, with the projected decreases largest for summer and no significant trend in winter. The overall number of North Atlantic cyclones is projected to decrease by approximately 10%. Results also indicate that the paths of extreme storms will extend further south, bringing an increase in extreme storm activity over Ireland, although the number of individual storms is projected to be quite small.

There is also potential for increased storm surge in the North Atlantic and the Irish Sea as a result of climate change. Research shows that storm surge heights in the range of 50 to 100 cm are increasing in frequency around all Irish coastal areas.

Ireland's geographic position means it is less vulnerable to extreme disasters and hazards such as earthquakes or tsunamis, which might pose risk to projects/schemes of this nature and scale in other locations. However, in recent times there has been an increase in the number of severe weather events in the country, particularly those leading to flooding and flash flood incidents.

The effects of these weather events are wide ranging and include heavy rainfall resulting in flooding (pluvial, fluvial and coastal), damaging gusts due to violent winds, periods of extreme heat resulting in gorse fires, roads melting, hose pipe ban, impact on delivery of services, and extreme cold resulting in extreme frost conditions and heavy snowfall in locations across the county. Refer also to **Chapter 19 – Climate**.

24.3.6 Flooding and Flood Risk

The following water bodies are within the water and flood risk study area for the Proposed Scheme:

- The River Boyne flows west to east through the Study Area and eventually discharges to the Irish Sea approx. 19 km east. It is subject to tidal influence from the Irish Sea within the Study Area. It drains an area of approximately 2,589 km^2 upstream of the proposed crossing site. The proposed River Boyne crossing site is at Ch. 1350, at the proposed crossing site, the water body Boyne_170 (EPA code IE_EA_07B042150) has been assigned 'Good' WFD ecological status by the EPA for 2013-2018 and is 'Not At Risk' of achieving its environmental objectives.
- The Boyne Navigation canal and associated towpath runs roughly parallel to the River Boyne along various stretches between Oldbridge and Navan. The proposed bridge and pedestrian/cycleway crossings traverse a section of the canal at approx. Ch. 1150. The canal discharges to the Boyne_170 approx. 2 km east of the proposed crossing sites. The section of the canal running through the Study Area is currently disused and is not part of the EPA's WFD monitoring programme for artificial water bodies.
- The tributary of the River Mattock crossed by the mainline bypass at approximately Ch. 3450 is part of the Mattock_030 water body (EPA code IE_EA_07M010300). This tributary runs from the west side of Littlewood Forest and is joined by various tributaries before its confluence with the main channel of the Mattock_030, approximately 4 km to the east. The section of the Mattock_030 traversed by the Proposed Scheme is locally known as the 'Mooretown Stream' (hereafter referred to as the 'Mattock (Mooretown) Stream').

A Flood Risk Assessment (FRA) has been carried out for the Proposed Scheme and records were identified of historical flooding in the area. The OPW's Eastern Catchment Flood Risk and Management Study predicted flood extent indicates that the location of the Proposed Scheme may be at risk from fluvial and coastal flooding along the banks of the Boyne, and to a lesser extent from pluvial flooding. Flood Mapping from MCC also predicts flooding at the Mattock (Mooretown) Stream. Previous flooding incidents from the River Boyne in the vicinity of the proposed route corridor in February 1990 and in November 2002 have also been recorded by MCC.

Flooding and Flood Risk is addressed in **Chapter 17 – Water** and in the **Flood Risk Assessment Report** for the Proposed Scheme (refer to **Volume 4**, **Appendix 17.2 – Flood Risk Assessment**).

24.3.7 Geohazards

No geohazard events are recorded by the GSI in the immediate vicinity of the Proposed Scheme. The closest geohazard event to the Proposed Scheme recorded on the GSI database is situated over 8 km east of Slane village, in the Sheephouse area east of the River Boyne. This event is not dated but was noted as a rotational landslide with a "shallow rotational earth flow" (GSI Event ID - GSI_LS12-0335), the material involved in this event was sandstone and shale till (Lower Palaeozoic), with a bedrock type of Namurian sandstone and shale. The trigger of this geohazard event is unknown, with no apparent impact recorded.

The environs of the Proposed Scheme is not considered to be at risk from geohazards such as landslides and Ireland in general is not prone to seismic activity.

24.3.8 Consultation

Chapter 6 – Consultation includes detail relating to the consultation undertaken as part of the preparation of the EIAR for the Proposed Scheme. The feedback received is summarised in the consultation findings in that chapter which has informed this assessment where relevant.

Table 24-6 outlines a summary of the consultation issues raised during consultation activities undertaken for the Proposed Scheme relevant or overlap with risks relevant to Major Accidents and/or Disasters.

Table 24-6: Summary of Consultation Issues Relevant to Major Accidents and/or Disasters

Consultee, Date	Issues raised	Response
Geological Survey of Ireland, November 2021	• GSI encourage the use and reference of GSI datasets. • Consider geohazards, especially where risks are prevalent in the area. • Consider any potential impact on specific groundwater abstractions and on groundwater resources in general. • Recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' which can be used to inform appropriate mitigation measures. • Consider public water schemes and the interactions between surface water and groundwater. • Effects of any potential contamination/dewatering. • GWClimate data may be useful in relation to Flood Risk Assessment.	• Geohazards, groundwater and geoheritage are addressed in **Chapter 18 – Land Soils, Geology and Hydrogeology**. Surface water is addressed in **Chapter 17 – Water**. • A Flood Risk Assessment (FRA) has been completed for the Proposed Scheme and is available in **Volume 4**, **Appendix 17.2** to **Chapter 17**. • See also **Sections 24.4.1** to **24.4.3** for related risk assessment.
Irish Water, October 2021	• Measures to ensure no negative impacts on drinking water. WFD requires that waters used for abstraction are protected. • Potential impacts on nearby public water supply should be assessed (hydrogeology and any groundwater/surface water interactions). • Waste sampling strategy for a project should ensure waste generated from the Proposed Scheme is inert. • Potential to impact on assimilation capacity of receiving waters in relation to Irish Water discharge outfalls. • Potential to impact on capacity or quality of water abstracted by Irish Water for public supply. • Ensure zero risk to any Irish Water drinking water sources (surface and ground).	• Water is addressed in **Chapter 17 – Water**. • Groundwater and hydrology is also addressed in **Chapter 18 – Land, Soils, Geology and Hydrogeology**. • An FRA has been completed for the Proposed Scheme and is available in **Volume 4**, **Appendix 17.2** to **Chapter 17**. • See also **Sections 24.4.1** to **24.4.3** for related risk assessment.
Health Service Executive (HSE), November 2021	**Construction** • Should assess the impact of construction works. • Sensitive receptors in the vicinity of construction works should be identified and measures implemented to ensure they are protected. • Recommend a site-specific Construction Management Plan is prepared and included in the EIAR. **Drainage** • Natural flood plains or wetlands on or in the vicinity of the site should be identified and measures implemented. • The impact of the Proposed Scheme on watercourses/wetlands further downstream should be assessed. • An integrated approach to surface water management should be implemented.	• Issues relating to water, including drainage and flooding are included in **Chapter 17 – Water**. Groundwater is addressed in **Chapter 18 – Land, Soils, Geology and Hydrogeology**. • Climate impacts are address in **Chapter 19 – Climate** • Traffic and active travel is addressed in **Chapter – 7 Traffic and Transport** and **Chapter 8 – Population**. • Air Quality impacts are addressed in **Chapter 10 – Air Quality**; • Human health impacts are addressed in **Chapter 11 – Human Health.** • An FRA has been completed for the Proposed Scheme and is

Consultee, Date	Issues raised	Response
	Climate • Ensure climate considerations are fully integrated into the planning of the Proposed Scheme. • Assess the vulnerability of the Proposed Scheme against the predicted impacts of a warming climate. • Outline proactive adaption measures to ensure the long-term resilience of the proposed infrastructure to the impacts climate change. **Active Travel** • Implement facilities which promote walking and cycling. • Safe access and connectivity from Slane village. • Consider the impact the Proposed Scheme will have on the proposed Boyne Greenway. **Air** • Investigate the possible impact of increased air emissions on the public or sensitive receptors.	available in **Volume 4**, **Appendix 17.2** to **Chapter 17**. • See also **Sections 24.4.1** to **24.4.3** for related risk assessment.

24.4 Risk Assessment

24.4.1 Stage 1 – Screening

The Proposed Scheme has been screened in for the consideration of major accidents and/or disasters. This is based on the nature and scale of the Proposed Scheme, the construction and operational activities, and the sensitivity of the receiving environment. It is conceivable (although highly unlikely) that:

- The Proposed Scheme could result in a major accident and/or disaster;
- The Proposed Scheme could interact with other (non-scheme related) sources of hazards or events that could conceivably make it vulnerable to a major accident and/or disaster; or
- Should an external (non-scheme related) major accident and/or disaster occur, the Proposed Scheme could conceivably exacerbate the risk of significant (negative) impacts associated with same.

24.4.2 Stage 2 – Scoping

A scoping exercise was undertaken to determine in more detail whether there was potential for significant effects as a result of major accidents and/or disasters associated with the Proposed Scheme. As a starting point, the broad categories in the National Risk Assessment for Ireland 2021/2022 were considered (including strategic headings of transportation, technical, natural/ environmental, geopolitical and social/ economic), along with scheme-specific risks and hazards noted throughout the specialist **Chapters 7 – 23** in the EIAR. Based on the long list of categories and events identified, a number were then scoped out for the following reasons:

a. The potential for the Proposed Scheme to cause a significant environmental impact was minimal;

b. There was sufficient mitigation considered through design and/or there is recognised minimum design standards which have been applied to the design element to consider the hazard not significant;

c. Hazards without a relevant environmental receptor were discounted as they lacked a source-pathway-receptor linkage; or

d. The hazard was otherwise assessed within relevant sections of the EIAR and/or associated documentation.

Hazards considered to have potential significant environmental impact, with a source-pathway-receptor linkage to an environmental receptor were carried to Stage 3 – Assessment.

Table 24-7 and **Table 24-8** identifies the sources of hazard for the Proposed Scheme at construction and operation phase respectively. The hazards that have potential to give rise to major accidents and disasters are considered for Stage 3 – Assessment and further mitigation as relevant in **Table 24-9** in **Section 24.4.3**.

Table 24-7: Stage 2 – Scoping Assessment for Major Accidents and/or Disasters: Construction Phase

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
Transportation Risks (Road, rail, airports etc.)			
Major Construction Road Traffic Accident	The existing N2 route through Slane village is currently sub-standard and has been the source of fatal accidents in the past. The Proposed Scheme aims to improve safety by bypassing the village and undertaking realignment/improvement works along the N51, and designing the road to current TII standards, in addition to the public realm enhancements with traffic management measures: • There is a risk from the Proposed Scheme to cause a major road traffic accident in Slane village or along haulage routes during the construction phase as a result of increased levels of construction traffic and HGVs on motorways, urban and rural roads. • The Proposed Scheme is not considered vulnerable to major construction road traffic accidents.	• Human Health • Population • Water	**Scoped Out:** The traffic hazards at construction phase have been assessed and mitigated in **Chapter 7 – Traffic and Transport**. The following mitigation has been included: • A traffic management plan will be prepared and prior to any construction taking place and adhered to throughout the course of the Proposed Scheme; • Appropriate signage and information will be displayed to alert road users to the presence of construction works, compounds, HGVs, and plant and machinery; • The site start time will ensure that construction workers arrive to site prior to the morning peak hour for traffic on the local network; • The appointed contractor will be required to manage parking and deliveries at the compounds and other areas in such a manner as to ensure that there is no obstruction to general traffic or sightlines during construction; • Consideration has been given to the most appropriate locations for site access locations, appropriate site access points proposed for the mainline works, and suitable haul roads and access roads constructed into the site from these locations; • Abnormal loads will be subject to statutory processes and management; • To safely cater for the expected HGV traffic, including abnormal loads and any mobile cranes brought to site, appropriate maximum gradient of the accesses will be applied (e.g. maximum gradient of the access is limited to 10% for access for the proposed Boyne Bridge construction); and • HGVs will transport materials and waste along selected/ appropriate haulage routes suitable for such vehicles as outlined in **Chapter 5** and **Chapter 7**. In addition, the construction description included in **Chapter 5** has considered the haul routes and access points for

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
			construction of the Proposed Scheme with a view to minimising risks. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Technical Risks (Physical Infrastructure, Energy, Design etc.)			
Impact on Critical Utilities / Infrastructure	Works will be required both directly to and in the vicinity of existing utilities. The Proposed Scheme includes for local service diversions, including the proposed undergrounding of existing overhead utilities in Slane village as part of the public realm proposals. The scope of utility diversions required is described in **Chapter 5** of the EIAR: • There is a risk from the Proposed Scheme to cause damage to critical Infrastructure (existing overground and underground utilities) during the construction phase, notably water mains and foul sewer, electricity and telecommunications. This could lead to interruption of critical services, contamination of drinking water etc. Overhead line diversion has been included during the construction phase in recognition of potential for a mobile crane jib to fall over, and this will avoid snagging/accidents. • There is a risk to the Proposed Scheme from the presence of utilities during site clearance and earthworks, in particular where underground electricity cables/ gas services may be encountered. Consultation with service providers has been ongoing throughout the design development.	• Population • Human Health • Material Assets: Utilities	**Scoped Out:** The hazards relating to critical utilities infrastructure during the construction phase have detailed in **Chapter 5 – Description of Construction Phase**. This presents the outcome of consultation with service providers to identify the nature and location of above-ground and underground services. This information has been used to inform the design in terms of relocation/ modification of services. In addition, the critical infrastructure hazards at construction phase have been assessed and mitigated in **Chapter 22 – Material Assets: Utilities**. Mitigation includes: • Ongoing and proactive engagement with service providers to agree service interruptions schedules; • Early warning to local stakeholders of any interruptions to key services and provision of alternatives where necessary; • Application of health and safety protocols from all service providers and the HSA to ensure safety of construction personnel; and • Overhead line diversion has been included during construction phase in recognition of potential for crane jib to fall over and this will avoid snagging/accident. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Accidents at Seveso Sites / COMAH Establishments	Grasslands AGRO, is a COMAH establishment which produces and stores fertiliser. It is located in the northeast area of Slane village, along the existing N2 route and approximately 63 m from the proposed N2 bypass route. The proposed bypass is within the consultation distance associated with the site (700 m) but it does not traverse the boundary of the site: • There is a risk from the Proposed Scheme to increase the risk of accident during the	• Human Health • Population • Material Assets Non-Agriculture • Air Quality	**Scoped In:** The hazard arises from a third-party site and requires coordination with the Proposed Scheme to manage risk to an acceptable level; see **Table 24-9**.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	construction phase in relation to the use and storage of flammable substances such as fuel at construction compounds. Furthermore, the Proposed Scheme will require the movement of utilities which could lead to risk of fire or explosion. • There is a risk to the Proposed Scheme from accident caused by the nearby COMAH establishment during the construction phase. There is a risk of fire/explosion or equipment/ infrastructure failure at the site which can present a risk to the Proposed Scheme and construction workers in the vicinity. In the event of an accident, the COMAH establishment will have an emergency response plan registered with the HSA.		
Earthworks Failure/ Slope Instability	The majority of the Proposed Scheme will be in cut which requires extensive earthworks. Temporary stockpiles of soil and rock will also be required during construction. Planting of 1:2 slopes (instead of grassing alone) will also be required in order to achieve sufficient depth of visual screening in some instances: • There is a risk from the Proposed Scheme to cause a major accident and/or disaster from earthworks or stockpile slope instability causing failure or collapse during the construction phase. Planting on 1:2 cut slopes can contribute to embankment instability during the establishment stage as additional topsoil needs to be added to the slope to facilitate the planting. • The Proposed Scheme is not considered vulnerable to earthworks failure or slope instability from outside the Proposed scheme.	• Land, Soils, Geology and Hydrogeology • Human Health • Population • Material Assets • Biodiversity • Water	**Scoped Out:** The geotechnical hazards at construction phase have been assessed and mitigated through design. The following design measures has been included: • Geophysical investigations/surveys have been undertaken to inform design and further investigations will be undertaken prior to construction works; • All relevant geotechnical and TII earthworks standards have been followed in the design as presented in **Chapter 5**; • Erosion and sediment controls will be employed and implemented on site; • Stockpiles will be: – Located away from drains, rivers and water bodies; – Seeded or provided with other surface protection measures appropriate to the length of time the stockpile is in place; – Provided with earth bunds or ditches on adjacent higher ground or slopes to prevent surface run-off reaching the stockpile; and – Provided with silt fences around the toe of a stockpile to trap any sediment in runoff from the stockpile.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
			• Mitigation planting on 1:2 slopes will require the appointed landscaping contractor to apply site-specific safety protocols. The full scope of design and construction considerations and measures in terms of earthworks are outlined in **Chapters 4** and **5**. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Collapse / Damage to Structures – Bridge	Cranes with approximate jib heights up to 80 m are required to construct the proposed Boyne Bridge. The cranes will operate off the temporary working platforms on the banks of the Boyne, which is also within the floodplain of the river and within the European sites of the River Boyne and River Blackwater SAC and SPA: • There is a risk from the Proposed Scheme to cause an accident and/or disaster from a crane collapse/toppling over which has the potential to damage existing structures/ utilities (e.g. overhead electricity lines), to injure construction workers during the construction phase or to lead to environmental damage to biodiversity and water quality. • There is a risk to the Proposed Scheme from other (external) sources or activity to cause collapse/ damage to structures associated with the Proposed Scheme during the construction phase.	• Human Health • Population • Material Assets • Biodiversity • Water Quality	**Scoped In:** The construction strategy for the bridge is vulnerable to extreme weather conditions which could lead to an accident/ disaster for human life and environmental conditions; see **Table 24-9**.
Environmental / Natural (Weather, Geological etc.)			
Release of Pollutants into Surface and Groundwater Bodies, Water Supplies and Sensitive Ecological Receptors	The Proposed Scheme requires a new bridge crossing of the River Boyne which is a designated European site (SAC and SPA) with water-dependent habitats and species. Culverts are also required on tributaries of the Mattock_030 water body which is connected to the Boyne. The Proposed Scheme is also in proximity but downstream of the source protection area for the Slane Public Water Supply: • There is a risk from the Proposed Scheme to cause an accident in terms of works near surface	• Human Health • Population • Water • Biodiversity	**Scoped In:** Surface and groundwater bodies, water supplies and sensitive ecological receptors are at risk during construction which could lead to an accident/ disaster for human life and environmental conditions; see **Table 24-9**.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	and groundwater bodies, water supplies, and sensitive ecological receptors, during the construction phase. Works near water pose a risk to the environment, namely from accidental spillage or release of contaminated materials, as well as sediment-laden run-off. There are also potential health and safety risk to construction workers and the general public as there are construction activities on both banks of the river. • There is a risk to the Proposed Scheme from other (external) sources or activity causing an accident in terms of works near surface and groundwater bodies, water supplies, and sensitive ecological receptors during the construction phase.		
Extreme Weather – Flood Events	The Proposed Scheme will require a new crossing of the River. While the piers for the bridge are situated outside of the river channel to avoid hydraulic effects on flows, the piers will be within the floodplain of the Boyne, and there will be a temporary increase in the area of hardstanding to facilitate construction: • There is a risk from the Proposed Scheme to cause or exacerbate extreme flood events during the construction phase. The Proposed Scheme can exacerbate the risk of flooding during construction by temporarily increasing areas of hard standing in areas that are currently greenfield and floodplain. During a prolonged weather event or flood conditions, there is a potential risk to the safety of construction site workers. Plant/construction equipment itself are potential sources of contaminants. • The is a risk to the Proposed Scheme from extreme flood events to cause accident or damage during the construction phase. Extreme flood events (heavy rainfall events, storms, prolonged flooding of the River Boyne) have the potential to flood the temporary working platforms on the southern bank of the River Boyne construction sites from which the cranes and	• Surface water and groundwater • Biodiversity • Population • Human Health	**Scoped Out:** Flood risk at construction phase has been assessed and mitigated in the FRA for the Proposed Scheme (**Volume 4**, **Appendix 17.2**. The FRA identified that there is potential for the construction process to cause an increased risk of flooding from the River Boyne at the location of the proposed River Boyne bridge crossing or elsewhere due to temporary loss of flood storage through temporary working platform in the floodplain. The temporary working platform within the flood plain may reduce the available flood water storage volume within a flood plain leading to increased flooding elsewhere. Temporary storage of materials within the floodplain may also cause an increase in flood risk. The proposed temporary working platform will be built within Flood Zone A and Zone B. Detailed hydraulic modelling was recommended to establish the potential impact of the platform on flood risk elsewhere. This modelling was undertaken to inform the construction platform design to minimise flood risk both to the construction works and to properties along the river. In addition, the construction description included in **Chapter 5** has considered both the sensitivity of the receiving environment and the flood risk to develop a bespoke construction strategy which has reduced the risk of damage to water and biodiversity to acceptable levels.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	other plant will operate. During a prolonged weather event or flood conditions, there is a potential risk to the safety of construction site workers and environmental damage.		Specific mitigation includes: • Continuous weather monitoring will be undertaken to identify specific weather windows to work in if required, and also to predict when river flood events might occur; • A river level/ flow gauge will be installed upstream to monitor and act as an early warning for increasing water levels, triggering when water levels pass a critical threshold. In the event of flood conditions, workers and plant/ machinery will be evacuated off platforms until safe to return; • An emergency response plan will be prepared by the contractor to deliver the mitigation measures from this EIAR and the FRA for such Extreme Weather (Flooding) situations; • Road drainage systems have been designed to minimise the potential for pollution and flooding, in line with TII Standards, DN-DNG-03022, Drainage Systems for National Roads (including Amendment No. 1 dated June 2015) and DN-DNG-03065, Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) to ensure that flood risk is minimised. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Extreme Cold Weather – Snow and Ice	• There is considered to be no risk from the Proposed Scheme to exacerbate cold weather events during the construction phase during construction. • The Proposed Scheme is not considered vulnerable to cold weather events during construction.	• Population • Human Health	**Scoped Out:** With regard to extreme weather events such as severe snowfall, blizzard and hailstorm events, or prolonged cold weather events, the Proposed Scheme has been designed to operate under a range of environmental conditions in accordance with all relevant local authority and TII standards. In addition, where weather emergencies are judged to impact public safety at national level, the National Emergency Coordination Group (NECG) is activated by the Office of Emergency Planning. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Gale Force Winds/ Storms	• There is considered to be no risk from the Proposed Scheme to exacerbate storm events.	• Population • Human Health	**Scoped In:** The construction strategy for the bridge is vulnerable to extreme weather conditions which could lead

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	• There is a risk to the Proposed Scheme from storm events. Storms have the potential to destabilise cranes on the temporary working platforms on the southern bank of the River Boyne construction sites from which the cranes and other plant will operate. During a prolonged storm event, there is a potential risk to the safety of construction site workers and environmental damage.		to an accident/ disaster for human life and environmental conditions; see **Table 24-9**.
Storm Surge	See entry above for *Extreme Weather – Flood Events*. The FRA for the Proposed Scheme found no risk for tidal flooding.	• Surface water and groundwater • Biodiversity • Population • Human Health	**Scoped Out:** See entry above for *Extreme Weather – Flood Events*. The FRA for the Proposed Scheme found no risk for tidal flooding.
Geopolitical	• There is considered to be no risk from the Proposed Scheme to cause or exacerbate geopolitical risks which could result in major accident and/or disaster. • The Proposed Scheme is not considered vulnerable to external geopolitical risks which could result in major accident and/or disaster.	• Population • Human Health • Material Assets	**Scoped Out:** No pathway for impact in terms of major accident and/or disaster identified for the Proposed Scheme.
Social / Economic	• There is considered to be no risk from the Proposed Scheme to exacerbate social/ economic risks. • The Proposed Scheme is not considered vulnerable to external social/ economic risks which could result in major accident and/or disaster.	• Population • Human Health • Material Assets	**Scoped Out:** No pathway for impact in terms of major accident and/or disaster identified for the Proposed Scheme.

Table 24-8: Stage 2 – Scoping Assessment for Major Accidents and/or Disasters: Operational Phase

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
Transportation Risks (Road, Rail, Airports etc.)			
Major Road Traffic Accidents	This existing N2 route through Slane village is currently sub-standard and has been the source of accidents in the past. The Proposed Scheme aims to improve safety by bypassing the village and removing HGV traffic from the existing substandard N2 as HGV traffic will continue on the N51 through the village centre. The design of the new road infrastructure has taken into consideration the existing and future traffic figures and the roads has been designed to current TII standards. In addition, public realm enhancements include specific traffic management measures within the village to improve safety for all road users. • There is considered to be no risk from the Proposed Scheme in terms of major road traffic accidents during the operational phase. The road has been designed to current TII standards. • The Proposed Scheme is not considered vulnerable to major construction road traffic accident. The risk of major traffic accidents occurring during the operational phase of the Proposed Scheme would then be no different to other national routes.	• Human Health • Population	**Scoped Out:** The Proposed Scheme design detailed in **Chapter 4** has considered the design standards for the road category required to safely provide for predicted AADT and vehicle mix. The Proposed Scheme is designed to current TII standards. Furthermore, the bypass will remove traffic from the village centre and reduce the risk of pedestrian/ cyclist collision with private cars and HGVs which currently must pass through the village centre on the national N2 route. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Technical Risks (Physical Infrastructure, Energy, Design etc.)			
Accidents at Seveso Sites / COMAH Establishments	Grasslands AGRO, a COMAH establishment produces and stores fertiliser. It is located in the northeast area of Slane village, along the existing N2 route and approximately 63 m from the proposed N2 bypass route, noting that the existing N2 is directly adjacent to the establishment. The proposed bypass is within the consultation distance associated with the site (700 m) but it will not traverse the boundary of the site: • There is considered to be no risk from the Proposed Scheme to cause accident to the nearby COMAH establishment during the operational phase. The Proposed Scheme does not traverse the COMAH establishment property boundary and	• Population • Human Health • Material Assets: Non-Agricultural Properties • Air Quality	**Scoped In:** The hazard arises from a third-party site and requires coordination with the Proposed Scheme to manage risk to an acceptable level; see **Table 24-9**.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	operational and maintenance activity associated with Proposed Scheme does not have the potential to cause an accident at the COMAH establishment. • There is considered to be a limited risk to the Proposed Scheme from an accident caused by nearby COMAH establishment during the operational phase. There is a risk of fire/explosion or equipment/infrastructure failure at the establishment which can present a risk to the Proposed Scheme and users of the operational bypass when in the vicinity via, for example, debris falling on the road, smoke affecting driver visibility, drivers being distracted by viewing an accident and not seeing other slowing/ stopping vehicles etc. In the event of an accident, the establishment will have an emergency response plan registered with the HSA.		
Earthworks Failure / Slope Instability	The majority of the Proposed Scheme will be in cut, and mitigation planting is required on some 1:2 slopes in order to provide visual screening: • There is no risk from the Proposed Scheme in terms of the potential to cause a slope instability. While a significant proportion of the proposed bypass is in cut and this necessitates earthwork slopes, the proposed earthworks have been designed in line with all relevant TII and geotechnical standards. Planting on 1:2 cut slopes can contribute to embankment instability during the establishment stage as additional topsoil needs to be added to the slope to facilitate the planting; however regular monitoring of planting establishment on 1:2 slopes and a tailored approach to the maintenance regime for this planting will ensure no risk of topsoil instability/failed tree establishment. • There is considered to be no risk to the Proposed Scheme from a mass wasting event. It is not predicted that there is potential for other (non-scheme related) mass wasting events in the vicinity that would pose risk to the Proposed Scheme. The	• Material Assets • Human Health • Population • Biodiversity	**Scoped Out:** The geotechnical hazards during the operational phase have been assessed and mitigated through design. The following design measures have been included: • All relevant geotechnical and TII earthworks standards have been followed in the design as presented in **Chapters 4** and **5**. • Monitor 1:2 slopes for successful planting establishment. • Maintenance regime for the Proposed Scheme landscaping to be tailored to safely maintain planting on 1:2 slopes. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	risk of loose debris/ slope failure would be no different from other national routes in Ireland.		
Collapse / Damage to Structures – Bridge	The Proposed Scheme includes for a new bridge crossing over the River Boyne: • There is considered to be no risk from the Proposed Scheme in terms of bridge damage/ failure during operational phase. • The Proposed Scheme is not considered vulnerable to bridge damage/ failure from outside the Proposed Scheme.	• Human Health • Population • Material Assets • Biodiversity • Water Quality	**Scoped Out:** The bridge has been designed in line with all relevant design standards and has a 120 year design lifespan. A scour assessment on the bridge piers was completed as part of the design and it achieved the lowest risk rating with no further action required beyond routine bridge inspections. The bridge has been specifically designed to accommodate the use and maintenance of the Boyne Navigation in the future thereby avoiding any potential for collision. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Riverbank Collapse	The Proposed Scheme includes for a new bridge crossing over the River Boyne: • There is considered to be risk of the Proposed Scheme to cause a riverbank collapse event during the operational phase as a result of scouring effects during over-bank flow around the base of the proposed Boyne Bridge piers. As this is a large structure situated close to the riverbank, there is a risk that over time, the potential for localised scouring could cause local bank collapse. • The Proposed Scheme is vulnerable to a riverbank collapse caused by external factors during the operational phase.	• Hydrology • Hydrogeology • Biodiversity	**Scoped In:** The bridge has been designed in line with all relevant design standards however the Proposed Scheme is considered vulnerable to scour risk over time; see **Table 24-9**.
Environmental / Natural (Weather, Geological etc.)			
Release of Pollutants into Surface and Groundwater Bodies, Water Supplies and Sensitive Ecological Receptors	As with any national road, there is potential for accident which may lead to release of pollutants to nearby waterbodies. Given the sensitive nature of the receiving environment, which includes European designated sites and water-dependant qualifying interests, any major accident of spill could lead to major accident or disaster for biodiversity: • There is considered to be no risk from the Proposed Scheme to cause accident in terms of spillage of pollutants during the operational phase.	• Water • Hydrogeology • Biodiversity • Human Health	**Scoped In:** As with any national road, there is potential for accident which may lead to release of pollutants to nearby water bodies; see **Table 24-9**.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	• The Proposed Scheme is vulnerable to other sources or activity leading to risk of spillage.		
Extreme Weather – Flood Events	• There is considered to be risk from the Proposed Scheme to exacerbate/intensify extreme flood events during the operational phase. The Proposed Scheme may intensify flooding in the area due to increased presence of artificial hardstanding in the form of road development in what is currently greenfield land. • There is considered to be risk to the Proposed Scheme from extreme flood events to causing accident or damage during the operational phase. The Proposed Scheme may to be vulnerable to flooding in the area. There is a risk that extreme flood events have the potential to flood the southern bank of the River Boyne. During a prolonged weather event or flood conditions, there is a potential risk to the safety of maintenance workers/ public.	• Water • Biodiversity • Human Health • Material Assets: Agricultural Properties	**Scoped Out:** Flood risk during the operational phase has been assessed and mitigated in the FRA for the Proposed Scheme (**Volume 4**, **Appendix 17.2** to **Chapter 17**). Risk of extreme flooding is mitigated where possible through designed-in measures: • In addition, where weather emergencies are judged to impact public safety at national level the National Emergency Coordination Group (NECG) is activated by the Office of Emergency Planning. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Extreme Cold Weather – Snow and Ice	With regard to extreme weather events such as severe snowfall, blizzard and hailstorm events or prolonged cold weather events, the Proposed Scheme has been designed to operate under a range of environmental conditions, in accordance with all relevant local authority and TII standards: • There is considered to be no risk from the Proposed Scheme to exacerbate snowfall, blizzard and hailstorm events or prolonged cold weather events. • The Proposed Scheme does have the potential to be impacted by such events (e.g. prolonged cold weather events resulting in ice on the road) which could affect traffic using the Proposed Scheme, increasing the risk of traffic accident.	• Population • Human Health	**Scoped Out:** With regard to extreme weather events such as severe snowfall, blizzard and hailstorm events or prolonged cold weather events, the Proposed Scheme has been designed to operate under a range of environmental conditions, in accordance with all relevant local authority and TII standards. In addition, where weather emergencies are judged to impact public safety at national level the National Emergency Coordination Group (NECG) is activated by the Office of Emergency Planning. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Gale Force Winds / Storms	With regard to extreme weather events such as gale force winds and storms, the Proposed Scheme will be designed to operate under a range of environmental conditions, in accordance with all relevant local authority and TII standards:	• Population • Human Health	**Scoped Out:** With regard to extreme weather events such as severe snowfall, blizzard and hailstorm events or prolonged cold weather events, the Proposed Scheme has been designed to operate under a range of environmental

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	• There is considered to be no risk from the Proposed Scheme to exacerbate gale force winds or storm events. • The Proposed Scheme does have the potential to be impacted by gale force winds or storm events, as these can occur in Ireland, however, their destructive force tends to be much less compared to other parts of the world. There is a low risk of structural damage to the Proposed Scheme once operational, with the exception of trees planted as part of the screening mitigation and public realm enhancement proposals in the village potentially blowing over. Extreme wind events may exacerbate flooding along the extents of the Proposed Scheme (see entry for *Extreme Weather – Flood Events*). Gale force winds/ storms could affect traffic using the Proposed Scheme. The Proposed Scheme has been designed to operate under a range of environmental conditions, in accordance with all relevant local authority and TII standards.		conditions, in accordance with all relevant local authority and TII standards. In addition, where weather emergencies are judged to impact public safety at national level the National Emergency Coordination Group (NECG) is activated by the Office of Emergency Planning. The measures included are sufficient to reduce the risks to appropriate levels for the nature of the Proposed Scheme.
Storm Surge	Although infrequent, storm surge events do occur in Ireland's marine and coastal waters. There is also potential for increased storm surge in the North Atlantic and the Irish Sea as a result of climate change. Research shows that storm surge heights in the range 50 to 100 cm are increasing in frequency around all Irish coastal areas (Nolan and Flanagan, 2020). The River Boyne is subject to tidal influence from the Irish Sea within the Study Area: • There is considered to be no risk from the Proposed Scheme to exacerbate storm surge event during the operational phase of the Proposed Scheme. • The Proposed Scheme is not vulnerable to tidal flooding.	• Water • Biodiversity • Human Health • Material Assets: Agricultural Properties	**Scoped Out:** See entry for *Extreme Weather – Flood Events*. The FRA for the Proposed Scheme found no risk for tidal flooding; see **Table 24-9**.
Sinkholes / Karst / Fault Line Movement	The geology of the study area does have potential to host karst features and a swallow hole is recorded on the GSI Karst Database approximately 650 m to the east-south-east of the proposed bypass route. The results of the ground investigations including	• Land, Soils, Geology and Hydrogeology • Human Health	**Scoped In:** Karst features are present in the study area for the Proposed Scheme.

Hazard Type	Scoping Assessment	Potential Receptors	Scoping Outcome
	geophysical surveys indicate the potential presence of karst features along the proposed bypass route. A second geophysical survey was conducted during design stage in the River Boyne floodplain to ensure the stable location of the bridge piers. The GSI bedrock geology records fault lines within the study area and a number of these were confirmed or confirmed as likely from geophysical surveys undertaken for the design stage of the Proposed Scheme: • There is considered to be no risk from the Proposed Scheme to cause the creation of a sinkhole or karst/fault line movement during the operational phase. • There is considered to be limited risk to the Proposed Scheme from sinkholes/ karst/ fault line movement during the operational phase.		
Geopolitical	• There is considered to be no risk from the Proposed Scheme to cause or exacerbate geopolitical risks which could result in major accident or disaster. • The Proposed Scheme is not considered vulnerable to external geopolitical risks which could result in major accident or disaster.	• Population • Human Health • Material Assets	**Scoped Out:** No pathway for impact in terms of major accident and disaster identified for the Proposed scheme.
Social / Economic	• There is considered to be no risk from the Proposed Scheme to exacerbate social/ economic risks. • The Proposed Scheme is not considered vulnerable to external social/ economic risks which could result in major accident or disaster.	• Population • Human Health • Material Assets	**Scoped Out:** No pathway for impact in terms of major accident and disaster identified for the Proposed scheme.

24.4.3 Stage 3 – Assessment

The Stage 3 assessment involves a more detailed appraisal of the short list of major events or hazards identified and assessed during Stage 2 Scoping. In some cases, events or hazards scoped into Stage 3 may mean that these risks need to remain on the design risk register until closed out through design.

The shortlist and assessment of those events and/or hazards scoped in for Stage 3 are presented in **Table 24-9**. Events and hazards are assessed based on their likelihood and impact and resulting level of significance, and scored and ranked as Low, Medium or High (based on the process outlined in **Section 24.2**).

Table 24-9: Stage 3 – Assessment of Remaining Risks Associated with Proposed Scheme

Hazard Type	Source and/or Pathway Receptor Linkage	Reasonable worst consequence if event did occur	Mitigation	Risk Evaluation		Level of Significance	Secondary Mitigation Required?
				Likelihood	Potential Impact		
Accidents at Seveso Sites / COMAH Establishments	Construction / Operational Phases: • Risk of fire/ explosion of equipment/ infrastructure failure at the site which can present a risk to the Proposed Scheme.	• Fire or explosion event impacting local population and/or the environment e.g. reduced driver visibility. • Pollution event impacting local population and/ or the environment. • Injury or death to site workers/ general public. • Debris falling on the road. • Distracted drivers viewing an accident and not seeing other slowing/ stopping vehicles.	• The Proposed Scheme traverses the consultation distance (700 m) for the Grasslands AGRO COMAH Establishment Lower Tier site (which produces and stores fertiliser). • In the event of an accident, the establishment will have an emergency response plan registered with the HSA. • The Proposed Scheme does not require any works within the establishment's boundary itself and does not have the potential to cause an accident at the establishment. • Consultation will be carried out by MCC with Grassland AGRO and the HSA prior to works commencing and where required throughout the Proposed Scheme.	2 – V. Unlikely	3 – Significant	6 – Low	**No – dealt with through COMAH Establishment Emergency Response Plan**
Collapse / Damage to Structures - Bridge	Construction Phase: • Construction of the bridge requires cranes to operate off temporary working platforms on the southern bank of the River Boyne. Extreme weather has potential to impact on cranes	• Crane collapse and damage resulting in injury or death to site workers / general public. • Damage to existing structures/ infrastructure/ utilities (e.g. overhead lines).	• Full scope of design and construction considerations and measures in terms of construction of the Proposed Scheme and use of cranes are outlined in **Chapter 4**. • Health and safety measures, guidelines, and standards will be adhered to in relation to the movement and operation of cranes. • Cranes will not be operated where orange or red wind or flood risk weather warnings are in place affecting Slane. • The fall-zone for the crane will be mapped and actions identified to ensure any	2 – V. Unlikely	3 – Significant	6 – Low	**No**

Hazard Type	Source and/or Pathway Receptor Linkage	Reasonable worst consequence if event did occur	Mitigation	Risk Evaluation		Level of Significance	Secondary Mitigation Required?
				Likelihood	Potential Impact		
	(jib height up to 80m).	• Damage to occupied buildings.	occupied properties within the fall zone can be alerted. The plan will also identify emergency measures to manage access to roads, towpaths etc within the impact zone during high-risk weather conditions. • EOP to include a requirement for preparation of an ERP specific to crane operations.				
Release of pollutants into Surface and Groundwater Bodies, Water Supplies and Sensitive Ecological Receptors	Construction Phase: • Construction of new bridge crossing of the River Boyne which is a designated SAC and SPA with water-dependent habitats and species. • Installation of new culverts on tributaries of the Boyne i.e. the Mattock_030 water body. • Proximity to, but downstream of, the source protection area for the Slane Public Water Supply. • Dewatering of groundwater during construction,	• Accidental spillage or release of contaminated materials, or sediment-laden run-off; effecting European site and associated Qis. • Impact on Slane Public Water Supply. • Pollution to surface water which connects with groundwater, potentially affecting local drinking water supply.	• To minimise impact on groundwater and surface water from material spillage, all oils, solvents, paints and other potential contaminants used during construction will be stored within suitably designed bunded areas in accordance with CIRIA Report 163 – Construction of Bunds for Oil Storage Tanks, Enterprise Ireland, Oil Storage Guidelines, BPGCS005 and EPA best practice. • All chemical and fuel filling locations will be contained within bunded areas. • On-site facilities including surface and foul water collection will be designed and provided at both site compounds to manage surface water and foul water arising from the compounds and tinkering for removal off-site. • Welfare facilities will be served by temporary mobile sanitation units – location of such welfare facilities will not be permitted within the River Boyne and Blackwater SAC and SPA. • On completion of the Proposed Scheme, site compounds will be decommissioned and all materials removed from the site. All decommissioning will be carried out in compliance with relevant regulations and legislation.	3 – Unlikely	2 – Moderate	6 – Low	**No**

Hazard Type	Source and/or Pathway Receptor Linkage	Reasonable worst consequence if event did occur	Mitigation	Risk Evaluation		Level of Significance	Secondary Mitigation Required?
				Likelihood	Potential Impact		
	particularly sections in cut. Operational Phase: • Operation of new bridge crossing of the River Boyne which is a designated SAC and SPA with water-dependent habitats and species.		• Groundwater filter drains will be installed where appropriate. • To assist with the proposed treatment of surface water run-off and to provide measures to reduce peak water flows to outfalls, six attenuation ponds together with vortex grit separators and petrol interceptors are proposed as part of the Proposed Scheme. • Interceptor ditches will be provided. • Attenuation ponds will be operational during construction. • To reduce the risk of sediment laden run-off entering watercourses, the construction sequencing of the earthworks has been analysed and divided into phases and zones with the proposed construction sequencing including the following: – Pre-earthworks ditches and drain diversions; – Culverts; – Attenuation ponds and appropriate drainage infrastructure; – Use of silt barriers; – Earthworks plugs; – Other general sediment control measures will include; – Vehicle wheel washing in controlled zones prior to leaving the sites; – Early vegetation establishment on stockpiles to prevent erosion of topsoil; – Protection of stockpile locations with ditches and silt fences to prevent run=off towards the stockpile and the				

Hazard Type	Source and/or Pathway Receptor Linkage	Reasonable worst consequence if event did occur	Mitigation	Risk Evaluation		Level of Significance	Secondary Mitigation Required?
				Likelihood	Potential Impact		
			runoff of sediment from the stockpile; and – Weather monitoring to avoid exposing earthworks slopes and the temporary protection of earthworks slopes prior to forecasted large rainfall events. • Road drainage systems will be designed to minimise the potential for pollution and flooding, in line with TII Standards, DN-DNG-03022, Drainage Systems for National Roads (including Amendment No. 1 dated June 2015) and DN-DNG-03065, Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) to ensure that pollution and spillage risk is minimised. • Full scope of design and construction considerations and measures in terms of construction of the Proposed Scheme and mitigation and management of spillage, pollutants, and sediment controls is detailed in **Chapter 5**. • Where groundwater is encountered, it will be dealt with separately to rainfall and captured before it becomes contaminated with sediment. Methods will be utilised as necessary, such as slope drains and pump-out to tankers for removal off-site. • See also **Chapters 16**, **17** and **18** for detailed mitigation relating to surface and groundwater pollution.				
Sinkholes / Karst / Fault Line Movement	Construction / Operational Phases: • Karst potential in the general geology for N2 and potential	• Sinkhole, fault line movement or ground movement resulting in injury/ death.	• As outlined in Chapter 4 the bridge structure will have reinforced concrete bored pile foundations. Each pier and abutment reinforced concrete pile cap will be founded on two rows of approximately 1.2 m diameter bored piles, with 14 piles required for each abutment. The depth of	2 – V. Unlikely	3 – Significant	6 – Low	**No**

Hazard Type	Source and/or Pathway Receptor Linkage	Reasonable worst consequence if event did occur	Mitigation	Risk Evaluation		Level of Significance	Secondary Mitigation Required?
				Likelihood	Potential Impact		
	areas traversed by the Proposed Scheme. • Fault lines present in the vicinity of the bridge crossing.	• Sinkhole, fault line movement or ground movement resulting in damage to infrastructure, notably the bridge crossing.	the pile toe level will vary for each abutment and pier. The governing design criteria for the pile being that a 3 m rock socket is formed in suitably identified rock. This form of foundation is not sensitive to underlying ground conditions above bedrock. • Bedrock profiles and levels have been confirmed by the geophysical investigation; as such, none of the bridge foundations are situated on any fault line. A detailed ground investigation programme will be carried out to further inform detailed design prior to construction.				
Riverbank Collapse	Construction/ Operational Phase: • Large structures situated close to the riverbank resulting in risk/ potential for localised scouring could cause local bank collapse.	• Riverbank collapse resulting in environmental damage to water and biodiversity. • Riverbank collapse resulting in damage to infrastructure.	• As noted in Chapter 4 hydraulic modelling for the river at the bridge crossing reach included estimation of out-of-bank flow velocities, and a bridge scour assessment was completed in accordance with DMRB BD97/12 (Highways Agency, 2012). Each of the piers were subject to scour assessment using conservative values for input parameters (i.e. 1 in 1,000 year event, 50 mm diameter bed material). The result of the assessments gave the bridge a risk rating of 5 which is the lowest risk rating; no further action was recommended other than routine inspections in accordance with DMRB CS 450 (Highways England, 2021); see **Chapters 4** and **5** for further information.	2 – V. Unlikely	3 – Significant	6 – Low	**No**

24.5 Chapter References

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