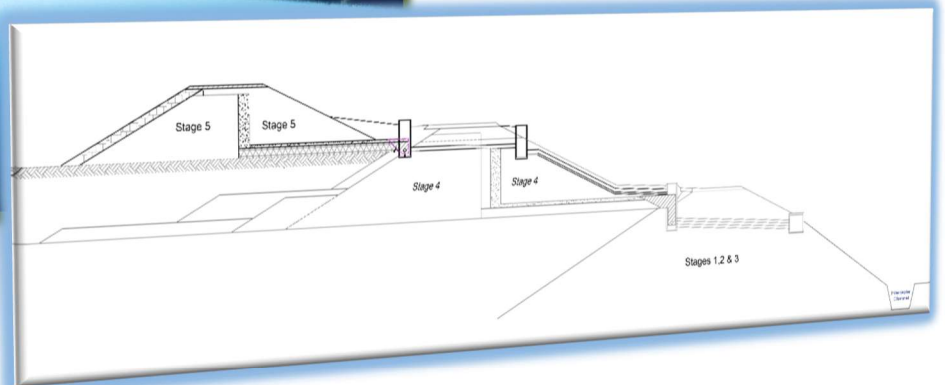
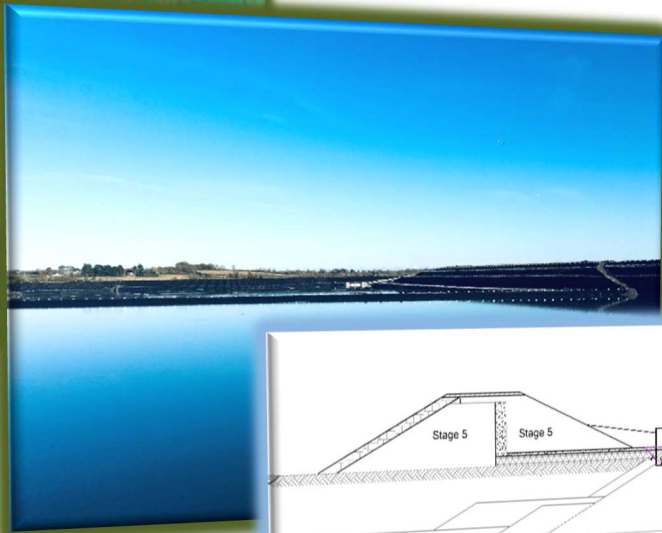


**Environmental Impact Assessment Report (EIAR)
Tailings Facility Embankment Buttress**

**Appendix 7.B
Site Specific Flood Risk Assessment Report**

Appeal Reference Number: ABP-315173-22



Submitted: February 2024

Boliden Tara Mines
Tailings Facility Buttress Embankment
Appendix 7B Flood Risk Assessment Report



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Project Description: Flood Risk Assessment Report for Boliden Tara Mines
Project Number: 20-033
Status: Final Report
Client: Boliden Tara Mines
Client Details: Boliden Tara Mines - Randalstown, Co. Meath

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1	Flood Risk Assessment	MJ	DO'N	FC	02/22
2	Flood Risk Assessment	MJ	DO'N	FC	07/22

Flood Risk Assessment

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1. INTRODUCTION

Coyle Environmental Ltd. Consulting Engineers has been engaged to carry out a Flood Risk Assessment for a proposed buttressing works at The Boliden Tara Mines Tailings Storage Facility (TSF) at Randalstown, Navan, Co. Meath.

This report has been prepared to assess the existing flood risk to the site.

2. METHODOLOGY

2.1 Introduction

This report has been prepared in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' herein referred to as 'The Guidelines' as published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoHLE) in 2009.

2.2 Definition of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

To fully assess flood risk an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors) is required. Figure 2.1 below shows a source-pathway-receptor model.

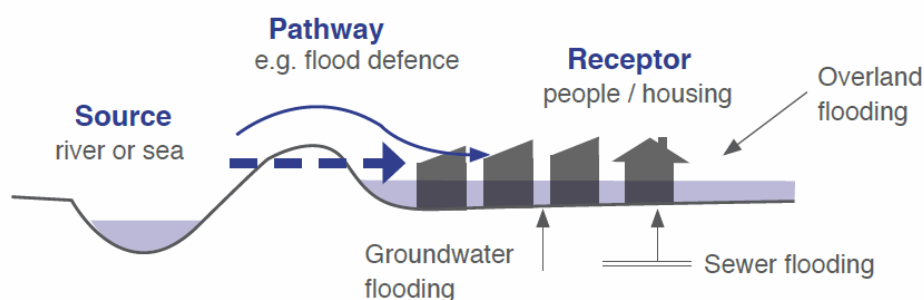


Figure 2.1 Source-Pathway-Receptor Model

The principal sources of flooding are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors can include people, their property and the environment. All three elements as well as the vulnerability and exposure of receptors must be examined to determine the potential consequences.

The guidelines set out a staged approach to the assessment of flood risk with each stage carried out only as needed. The stages are listed below:

- Stage I Flood Risk Identification – to identify whether there may be any flooding or surface water management issues.
- Stage II Initial Flood Risk Assessment – to confirm sources of flooding that may affect an area or proposed development, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps.
- Stage III Detailed Flood Risk Assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

2.3 Likelihood of Flooding

The Guidelines define the likelihood of flooding as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or annual exceedance probability (AEP). A 1% AEP flood indicates a flood event that will be equalled or exceeded on average once every hundred years and has a return period of 1 in 100 years. Annual Exceedance Probability is the inverse of return period as shown in Table 2.1 below.

Table 2.1 Correlation between return period and AEP

Return Period (years)	Annual Exceedance Probability (%)
1	100
10	10
50	2
100	1
200	0.5
1000	0.1

2.4 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and are split into three categories in The Guidelines:

Flood Zone A

Flood Zone A where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation, would be considered appropriate in this zone.

Flood Zone B

Flood Zone B where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 or 0.5% or 1 in 200 for coastal flooding);

Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone. In general however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

Flood Zone C

Flood Zone C where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all plan areas which are not in zones A or B.

Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

It is important to note that when determining flood zones the presence of flood protection structures should be ignored. This is because areas protected by flood defences still carry a residual risk from overtopping or breach of defences and the fact that there is no guarantee that the defences will be maintained in perpetuity.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 2.4 OPW The Planning System and Flood Risk Management, Classification of vulnerability of different types of development

2.5 Objectives and Principles of the Planning Guidelines

The principle actions when considering flood risk are set out in the planning guidelines and are summarised below:

- *“Flood hazard and potential risk should be determined at the earliest stage of the planning process...”*
- *“Development should preferentially be located in areas with little or no flood hazard thereby avoiding or minimising the risk...”*
- *“Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available...”*
- *“Where development is necessary in areas at risk of flooding an appropriate land use should be selected”*
- *A precautionary approach should be applied, where necessary, to reflect uncertainties in flooding datasets and risk assessment techniques...”*
- *“Land required for current and future flood management... should be proactively identified...”*
- *“Flood risk to, and arising from, new development should be managed through location, layout and design incorporating Sustainable Drainage Systems (SuDS) and compensation for any loss of floodplain...”*
- *Strategic environmental assessment (SEA) of regional planning guidelines, development plans and local area plans should include flood risk as one of the key environmental criteria...”*

2.6 The Sequential Approach and Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 2.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.

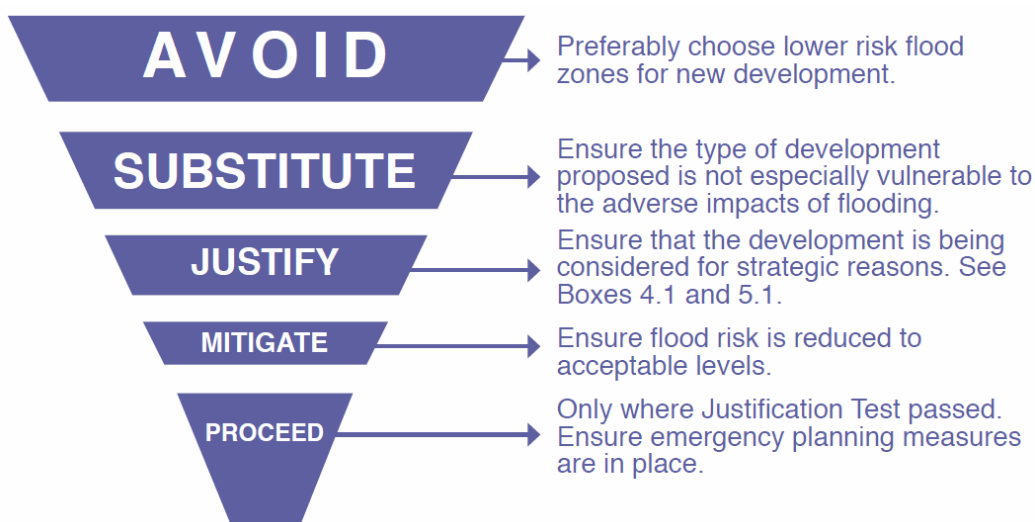


Figure 2.2 Sequential Approaches (Source: The Planning System and Flood Risk Management)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 2.2 below illustrates the types of development that would be required to meet the Justification Test.

Table 2.2 Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test (Source: The Planning System and Flood Risk Management)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

3. STUDY AREA

The Tailings Facility is located approximately 2.8 km north of the mine site in Navan, and enclosed an area of c. 250 Hectares. The facility is constructed as a ring-dike configuration with stages 1 to 5 enclosed by earth fill embankment walls constructed from locally sourced natural materials. Stage 6 is composite lined (construction completed in 2022).

Site Location is shown in Figure 3.1., proposed Site Layout is shown in Figures 3.2 to 3.6.





Figure 3.1 – Site Location

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.
- Stage 6 is a lateral extension to the north of stages 1,2,3,4 & 5.

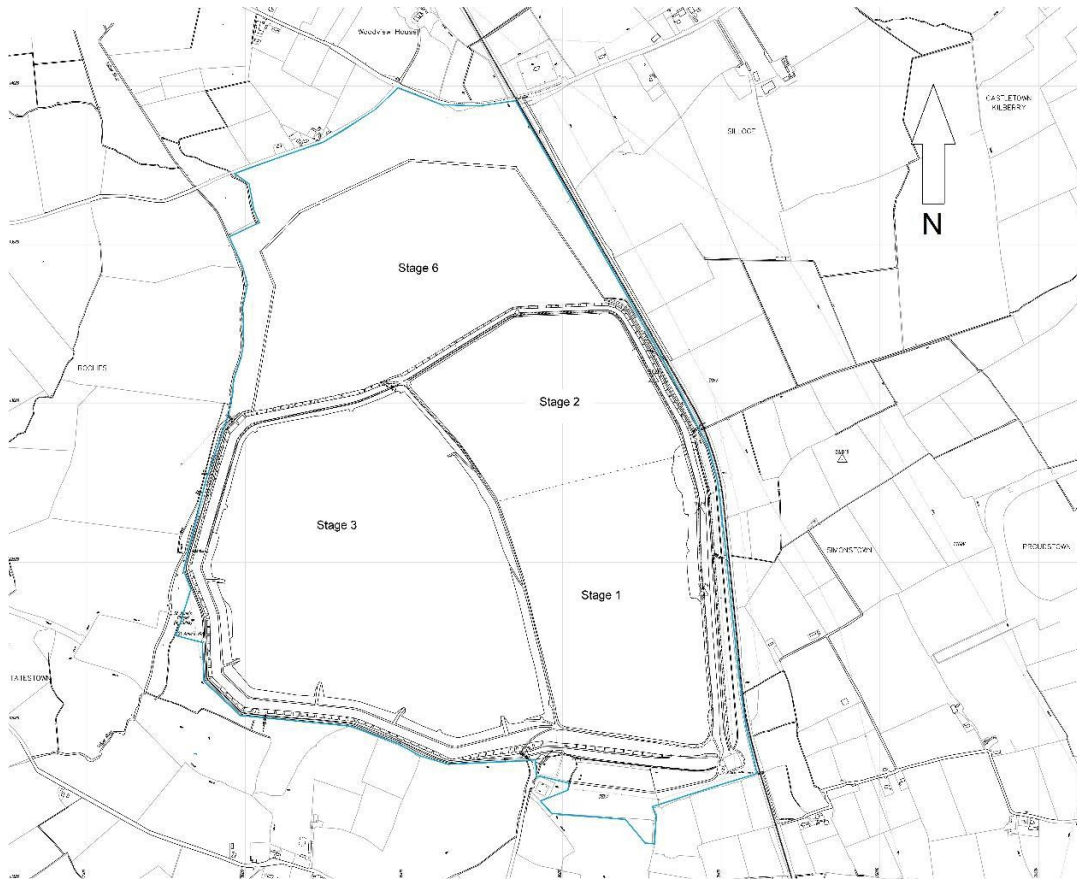


Figure 3.2 – Site Layout and extend of proposed works.

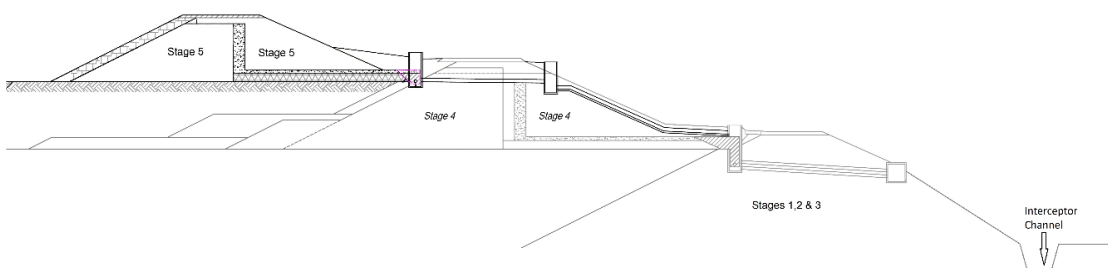


Figure 3.3 - Cross Section. Extant facility embankment

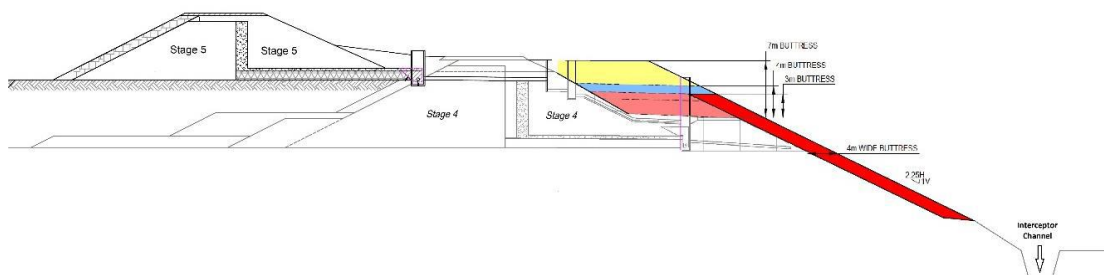


Figure 3.4 - Cross Section. Facility embankment with buttress

The tailings storage facility (TSF) is constructed as a ring-dike configuration, enclosed by earth fill embankment walls constructed from locally sourced natural materials.

The facility encloses an area of approximately 200 Hectares and has been enlarged in a number of (#6) lateral and vertical extensions over its 47 year existence using combinations of permanent and temporary embankment dams.

The facility serves as containment for mine tailings to settle and consolidate, as well as a storage dam for water which is re-circulated to the processing plant for reuse.

Stages 1, 2 3, 4 and 5 are enclosed by a Perimeter Interceptor Chanel (PIC).

The PIC, located at the toe of the embankment/dam-wall, is an integral component of the internal drainage system.

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

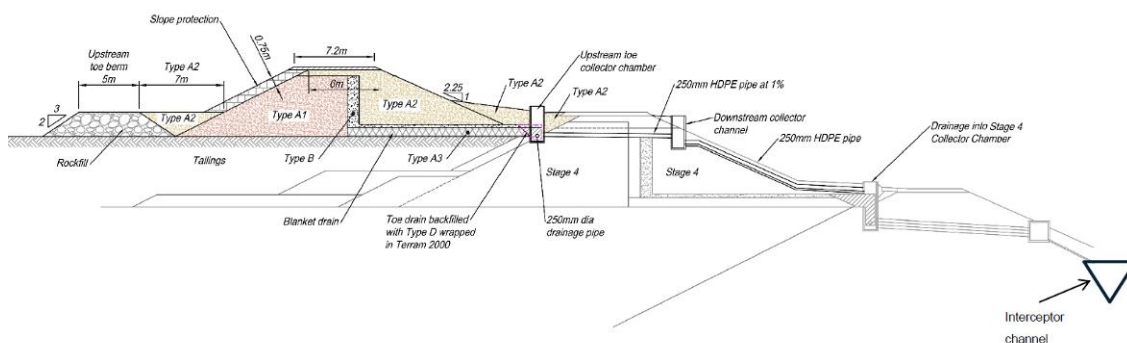


Figure 3.5 - C. S. Embankment wall. Internal drainage system and PIC

The PIC captures water from:

- i. Draining through the internal drainage system
- ii. Runoff from the downstream embankment walls
- iii. Seepage /underdrainage from the dam.
- iv. Groundwater

The water collected in the interceptor channel flows by gravity to a single sump at the south of the facility. See figure 3.6.

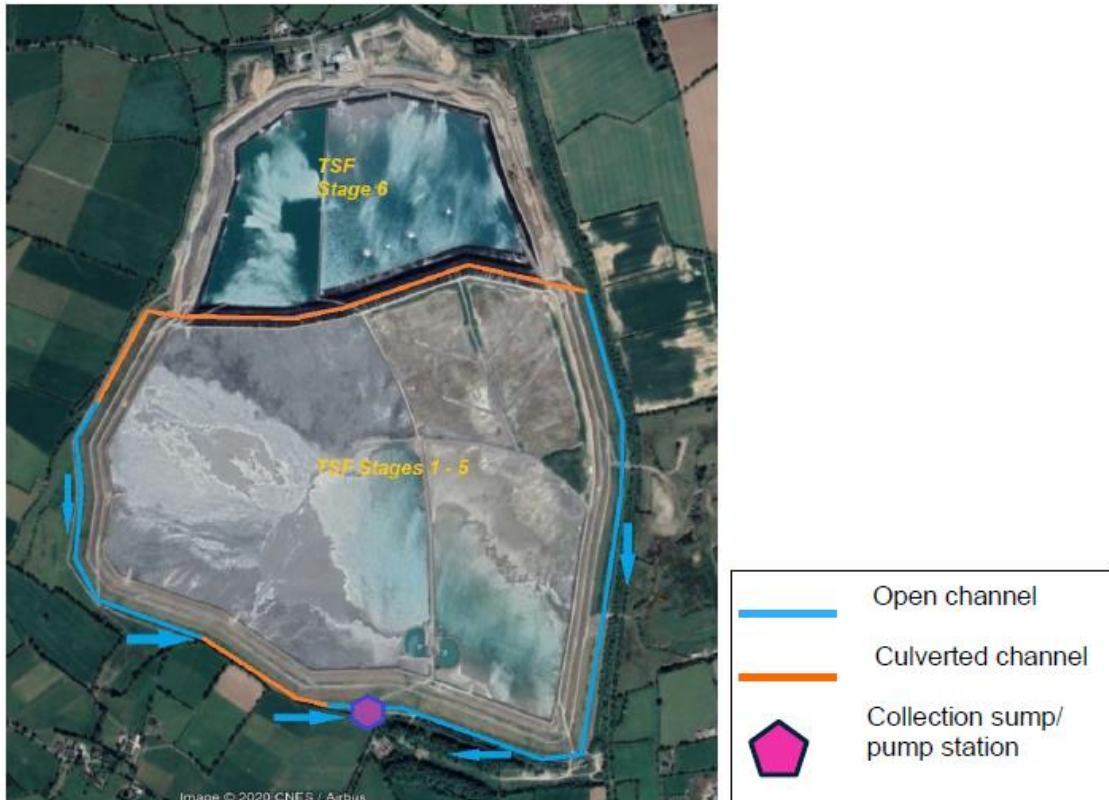


Figure 3.6 - TSF perimeter interceptor channel.

Water flows from north to south. All the water collects in a collection sump where automatic pumps pump the water back into the dam.

4. STAGE 1 – FLOOD RISK IDENTIFICATION

4.1 General

This Stage I Flood Risk Identification includes a review of the existing information and the identification of any flooding or surface water management issues in the vicinity of the proposed site.

4.2 Information Sources Consulted

The following information sources were consulted as part of the Stage I Flood Risk Identification:

Table 4.1 Information Sources Consulted

Source	Comments
OPW Flood Info maps consulted	Fluvial, Pluvial, Coastal and Groundwater flooding examined; http://www.floodinfo.ie/map/floodplans/ https://www.floodinfo.ie/map/floodmaps/
Catchment Flood Risk Assessment and Management Study (CFRAM)	https://www.floodinfo.ie/map/floodmaps/
OPW flood records	www.floodmaps.ie
Geological Survey of Ireland (GSI) Maps	GSI Teagasc subsoils map consulted to identify if alluvium is present at development site that may indicate the presence of a watercourse and floodplain

4.2.1 Catchment Flood Risk Assessment and Management Study

The CFRAM programme led by the OPW are available for just south from study location. Refer to Eastern CFRAM Study - Navan Fluvial Flood Extend.

National Indicative Fluvial Mapping is available for study location.

Evidence of estimated flooding within or in the vicinity of the site is shown below at Figures 4.2.2.

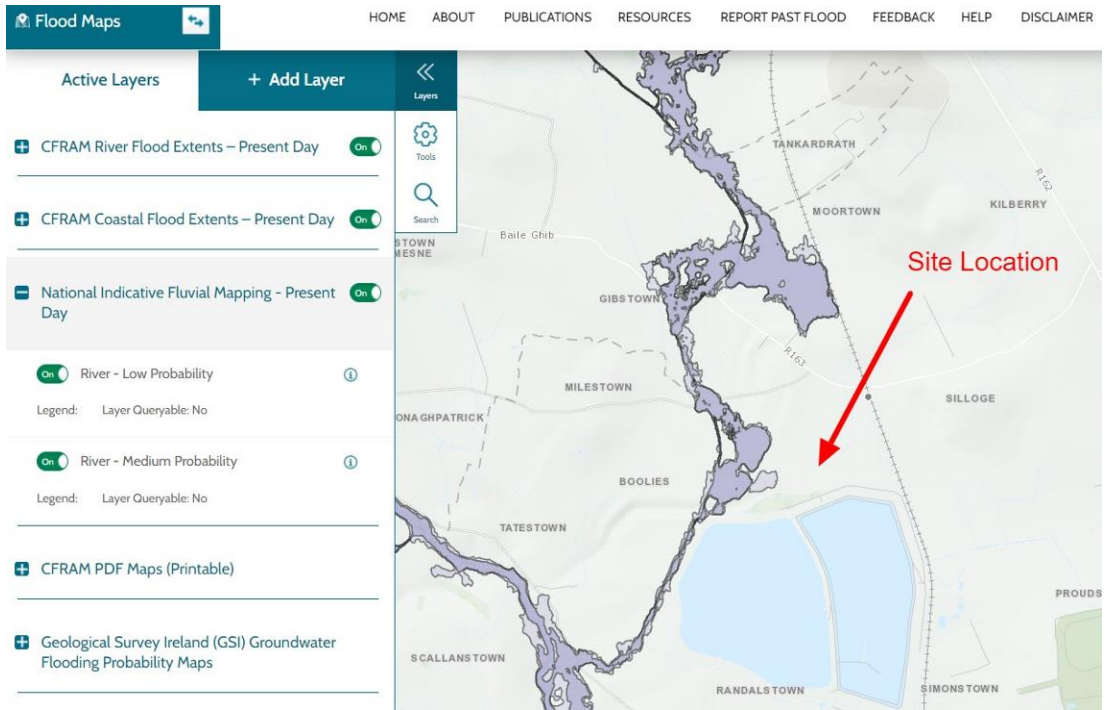


Figure 4.2.1 River Flood Extend - All Probabilities

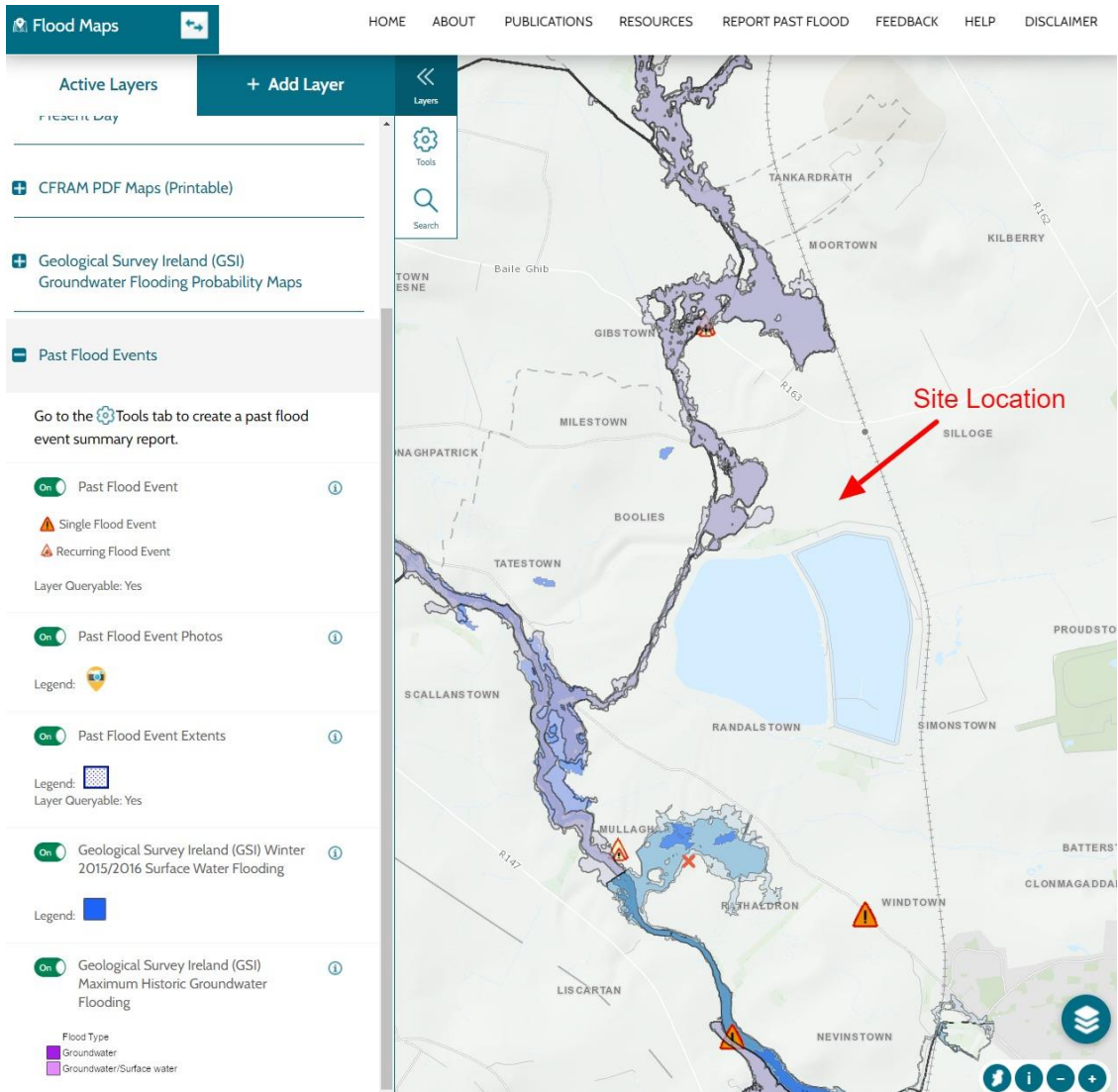


Figure 4.2.2 Past Flood Events and GSI Flood Events

Stage 6 is now constructed to the north of the TSF cells shown. OPW Flood Maps used at the time of modelling were correct, however Stage 6 now covers indicative flood location removing any potential risk of flooding.

4.2.2 Other Sources

The following sources were also examined to identify areas that may be liable to flooding:

Table 4.2 Other Sources

GSI Maps	GSI Teagasc subsoils map shows the proposed development site is underlain by made ground. No evidence of Karst features has been identified within the vicinity of the site.
Flow Estimations	CFRAM programme and Strategic Flood Risk Assessment have been processed at site location, no additional flow estimation is required.

Extract from GSI map Viewer is shown below at Figures 4.2.7

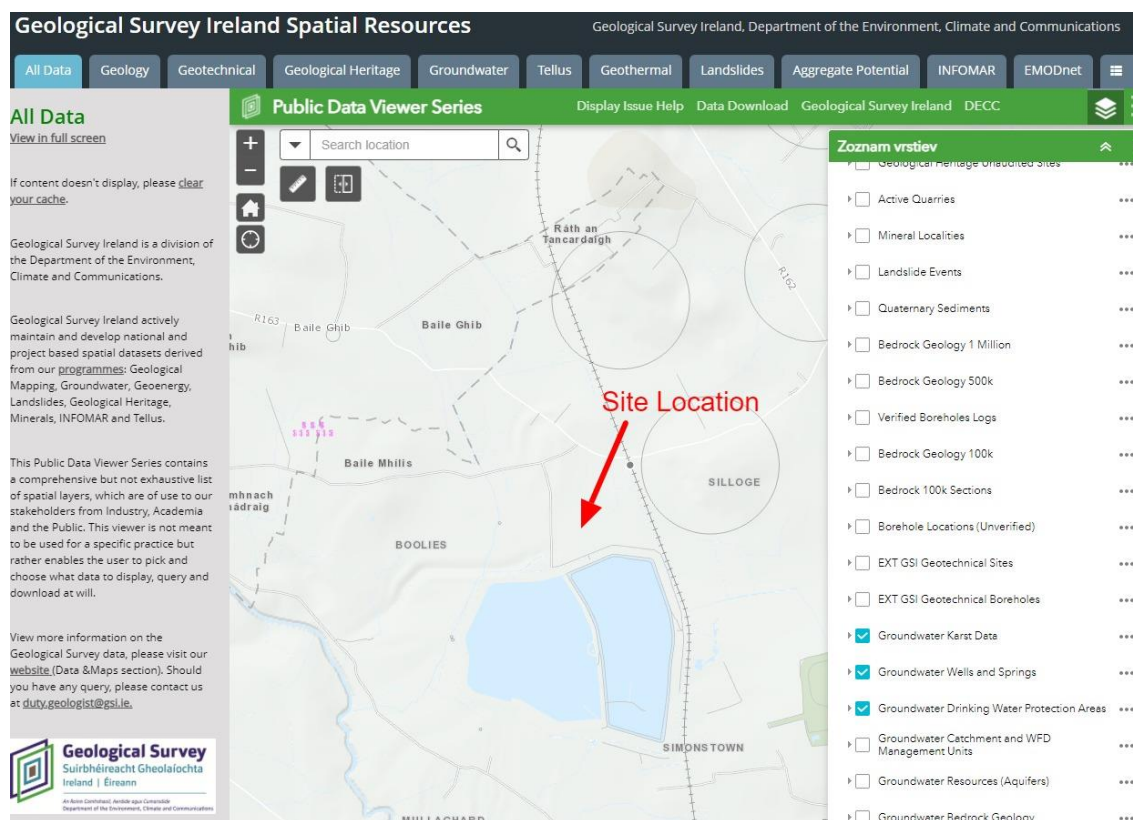


Figure 4.2.3 Extract from the GSI Map Viewer.

STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

4.3 General

A Stage 2 FRA (initial flood risk assessment) was undertaken to:

- Confirm the sources of flooding that may affect the subject site;
- Appraise the adequacy of existing information as identified by the Stage 1 FRA

4.4 Sources of Flooding

Groundwater Flooding

Ground water flooding is a result of upwelling in occurrences where the water table or confined aquifers rises above the ground surface. This tends to occur after long periods of sustained rainfall and/or very high tides. High volumes of rainfall and subsequent infiltration to ground will result in a rising of the water table. Groundwater flooding tends to occur in low - lying areas, where with additional groundwater flowing towards these areas, the water table can rise to the surface causing groundwater flooding.

The sources consulted such as the CFRAM mapping and available GSI records show no indication that the proposed site location is subject to Groundwater derived flooding. The proposed site is not considered to require a detailed flood risk assessment with respect to groundwater flooding.

According to the Geological Survey of Ireland (GSI) online groundwater mapping tool, the Meath, Liscarton and Old Red Sandstone formations, which underlie part of the TMF and the area to the south and west, are classified as locally important aquifers, described as bedrock which is moderately productive only in local zones. The Rathkenny Formation, which underlies part of the TMF and the area to the north, is classified as a poor aquifer, described as bedrock which is generally unproductive except for local zones.

Pluvial Flood Risk

Pluvial flooding results from heavy rainfall that exceeds ground infiltration capacity or more commonly in Ireland where the ground is already saturated from previous rainfall events. This causes ponding and flooding at localized depressions. Pluvial flooding is commonly a result of changes to the natural flow regime such as the implementation of hard surfacing and improper drainage design.

The sources consulted such as the OPW Flood Maps and OPW Flood Plans mapping show no indication that the proposed site is subject to pluvial derived flooding.

Fluvial Flood Risk

A fluvial, or river flood, occurs when the water level in a river, lake or stream rises and overflows onto the surrounding banks, shores and neighbouring land. The water level rise could be due to excessive rain or snowmelt.

The sources consulted such as the CFRAM mapping, OPW Flood Maps and OPW Flood Plans mapping show indication that the proposed site is subject to fluvial derived flooding at low and medium probability.

The low and medium probability shows the modelled extent of land that might be flooded by rivers in a very extreme flood event however Stage 6 is now constructed

to the north of the TSF cells shown in Figure 3.6. OPW Flood Maps used at the time of modelling were correct, however Stage 6 covers indicative flood location

Low Probability flood events have an indicative 1-in-a-1000 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 0.1%.

Medium Probability flood events have an indicative 1-in-a-100 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 1%.

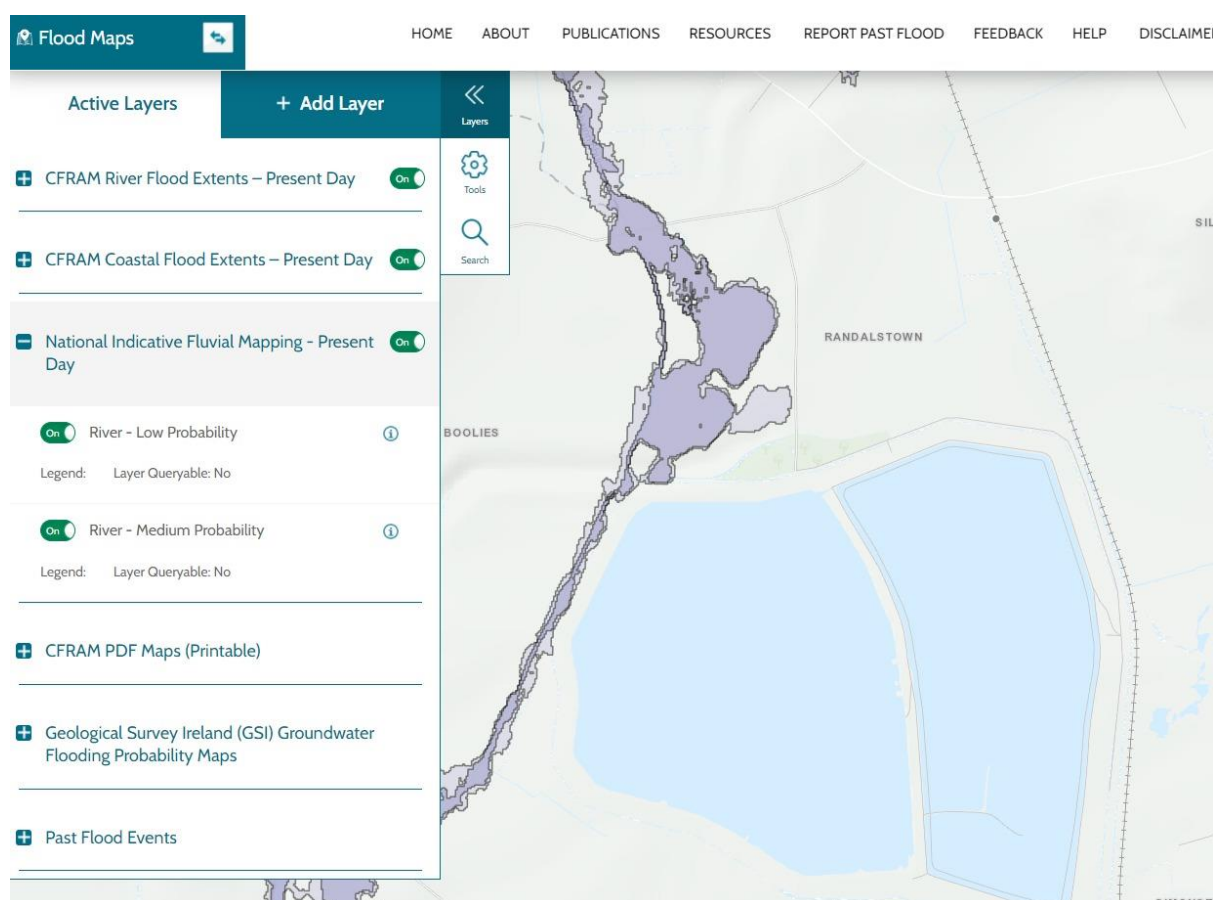


Figure 4.4.1 Extract from the OPW Flood Maps.

Reason for OPW Flood Maps to pick study area as prone to flooding is that this area used to be used for mining associated activities with some local low points, however Stage 6 is now constructed to the north of the TSF cells shown, see Figure 3.6. Proposed 10-12 metres high embankments from existing ground level at Stage 6 would eliminate any chance of flooding.

Coastal Flood Risk

Coastal flooding is the inundation of land areas along the coast by seawater. Common causes of coastal flooding are intense windstorm events occurring at the same time as high tide (storm surge), and tsunamis.

Storm surge is created when high winds from a windstorm force water onshore — this is the leading cause of coastal flooding and often the greatest threat associated with a windstorm. The effects increase depending on the tide - windstorms that occur during high tide result in devastating storm surge floods. In this type of flood, water overwhelms low-lying land and often causes devastating loss of life and property.

The sources consulted such as the OPW Flood Maps and OPW Flood Plans mapping show no indication that the proposed site is subject to coastal derived flooding.

4.5 Conclusion of Stage 2 FRA

The information provided in this section identifies that there are no potentially elevated levels of coastal, pluvial, and groundwater flood risk. Fluvial risk is present as per National Indicative Fluvial Mapping for Low and Medium Probability; however, this is due to man-made features as this area is currently being used for mining associated activities with some local low points.

Stage 6 is constructed to the north of the TSF cells and flood risk area removed.

Based on above site would be allocated as **Flood Zone B**.

5. STAGE 3 – DETAILED FLOOD RISK ASSESSMENT

5.1 Conclusion of Stage 3 FRA

Stages 1 and 2 of the flood risk assessment of proposed site have indicated that the site is not subject to flooding in medium or low probability exceedance events up to 0.1% AEP (1 in 1000 chance in any given year) from coastal, pluvial, fluvial and groundwater sources.

Based on this site would be allocated as **Flood Zone B**.

6. FLOOD RISK ON ZONED LANDS

6.1 Introduction

Meath County Council have requested that additional information is submitted in form of a Justification Test in accordance with Flood Risk Management Guidelines for the proposed works at Tara Mines, Navan.

The following information in the form of the Justification Test is submitted to show that it is acceptable under Flood Risk Management Guidelines for the proposed site in accordance with the requirements of the Flood Risk Management Guidelines.

The specific additional information request is as follows:

“Having regard to Meath County Development Plan in which it is a policy to consider the DOEHLG / OPW publication ‘The Planning System and Flood Risk Management, Guidelines for Planning Authorities and with reference to Meath County Council’s Mapinfo flood mapping and the OPW NIFM flood mapping for the relevant area the proposed development site is situated in Flood Zone A and Flood Zone B, i.e. it is at medium to high risk of flooding. In accordance with the aforementioned guidelines the applicant shall apply the ‘development management Justification test’ as set out in Chapter 5 of the same guidelines to rigorously assess the appropriateness of the proposed development and shall submit all matters relating to this Justification test and all matters relevant to flood risk on the proposed development site to the Planning Authority for their further consideration.”

6.2 Compliance with Flood Risk Management Guidelines

Chapter 5 of “The Planning System and Flood Risk Management – Guidelines for Planning Authorities” outlines the approach to be taken regarding development in and in the vicinity of flood risk areas.

Section 5.28:” Assessment of Minor Proposals in Areas of Flood Risk” states that “Applicants for minor developments... are unlikely to raise significant additional flood issues, unless they obstruct important flow paths, introduce significant additional number of people into flood risk areas or entail the storage of hazardous substances”. It is deemed that application should be acceptable in this section.

6.3 Land Use Zoning Objectives

The lands in question are currently not zoned within the RU zoning objective -‘to protect and provide for the development of agriculture and rural amenity’. As per Meath County Councils’ Record of Executive Business and Manager’s Order’ for the proposed house the planning application is in compliance with the zoning.

The vulnerability of the uses which are generally permitted or open to consideration on the various land use zonings (as per Land Use Zoning Matrix) considered in conjunction with the Flood Zone in which the particular area of land is located guides the need for the application of the Justification Test.

Table 2.2 set out the various land use zoning objectives and the respective vulnerabilities of each zone having regard to the land uses which are generally permitted and open for consideration as per the Land Use Zoning Matrix.

There were areas which were located within Flood Zone A and Flood Zone B which had been zoned to accommodate highly vulnerable and less venerable land uses having regard to existing patterns of development and existing land uses.

These areas were subjected to the Justification Test, where development did not pass the Justification Test responses which had to be considered included.

- Removal of the zoning objective
- Rezoning to a less venerable or water compatible uses
- Development of specific objectives to address the issues
- Phasing of development within zoned areas

6.4 Justification Test

Whereas part of the preparation and adoption of a Development Plan, a Planning Authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in the Guidelines, the “Justification Test for Development Plans” must be satisfied. Please refer to table 6.1

Table 6.1 Site subject to assessment: Land at Tara Mines, Navan		
Justification Test Criteria	Criteria Satisfied	Comments
1. The urban settlement is targeted for growth under the National Spatial Strategy, Regional Planning Guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000 (as amended)	✓	The Framework Plan for Navan, distinguishes the Metropolitan area from the Hinterland area with distinct development strategies for each area. Tara Mines are located outside of Generalised Zone Types and are not proposed for urban settlement.
2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper and sustainable planning of the urban settlement and in particular:	✓	It is not proposed to zone the lands. The majority of the site in question is located outside of Flood Zone A and Flood Zone B however there are no residentially zoned lands. Flood Zone A and B are very closely aligned.
i. Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement;	✓	
ii. Comprises significant previously developed and/or under-utilised lands;	✓	
iii. Is within or adjoining the core of an established or designated urban settlement;	✓	
iv. Will be essential in achieving compact or sustainable urban growth;	✓	
v. There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	✓	
3. A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere	✓	In addition to this Flood Risk Assessment any development proposals which provide for new buildings etc on the subject lands will be required to be supported by a Site Specific Flood Risk Assessment.
Note: The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.		

7. CONCLUSIONS

National Indicative Fluvial Mapping is available for study location with indication of flooding from fluvial sources in medium or low probability exceedance events. This is due to man-made features as this area is currently being used for mining associated activities with some local low points, see figure 4.4.2.

There is no evidence of coastal, pluvial and groundwater derived flooding.

Proposed site is located within **Flood Zone B** as per Table 2.2. Proposed site is defined as **Appropriate Development** as per OPW The Planning System and Flood Risk Management, Figure 2.4.

Proposed Finished Floor Level is above low probability exceedance event level, it is not at the risk of flooding, will not obstruct or impede important flow paths, exacerbate flooding in the immediate vicinity or wider area and will not result in residual risk to the area.