

17 Risk of Major Accidents and/or Disasters

17.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of the likely significant adverse effects on the environment arising from the vulnerability of the Proposed Project to risks of major accidents and/or natural disasters.

The assessment of the vulnerability of the Proposed Project to major accidents and natural disasters is included in this EIAR following changes to EU legislation. The revised EIA Directive 2014/52/EU (new EIA Directive) entered into force on 16 May 2017 and states the need to assess *‘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 natural disasters which are relevant to the project concerned’*.

The underlying objective of the assessment is to ensure that appropriate precautionary actions are taken for those projects which *“because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment”*.

Based on the requirements of the new EIA Directive, this chapter answers the following questions:

- What major accidents and/or natural disasters could the Proposed Project be vulnerable to?
- Could these major accidents and/or natural disasters result in likely significant adverse environmental effect(s) and if so what would these be?
- What measures are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment?

17.2 Assessment Methodology

17.2.1 Introduction

The starting point for the scope and methodology of this assessment is that the Proposed Project will be designed, built and operated in line with best international current practice and, as such, major accidents will be very unlikely.

The following sections set out the requirements as stated in the new EIA Directive and in the EPA draft *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)*. The scope and methodology presented is based on the new EIA Directive, the draft EPA guidelines, on other published risk assessment and on professional judgement.

A risk analysis based approach methodology which covers the identification, likelihood and consequence of major accidents and/or natural disasters has been used for the assessment. This type of risk assessment approach is an accepted methodology. The sections below provide further detail on this approach.

Major accidents or natural disasters are hazards which have the potential to affect the Proposed Project. These include accidents during construction and operation caused by operational failure or natural hazards. The assessment of the risk of major accident and/or disaster has considered all factors defined in the new EIA Directive, i.e. population and human health, biodiversity, land, soil, water, air and climate and material assets, cultural heritage and the landscape.

17.2.2 Legal and Regulatory Framework

The following paragraphs set out the requirements of the new EIA Directive (2014/52/EU) in relation to major accidents and/or natural disasters.

Recital 15 of the new EIA Directive states that:

(15) 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. In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council¹ and Council Directive 2009/71/Euratom², or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met.

It is clear from the directive that a major accident and/or natural disaster assessment should be mainly applied to COMAH sites or nuclear installations. However, this assessment is carried out for completeness.

Article 3 of the new EIA Directive requires that the EIA shall identify, describe and assess in the appropriate manner, the direct and indirect significant effects on population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape deriving from (amongst other things) the “*vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned*”.

Annex IV of the new EIA Directive:

The information relevant to major accidents and/or disasters to be included in the EIA Report is set out in Section 8 of Annex IV of the new EIA Directive as follows:

¹Directive 2012/18/EU of the European Parliament and the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ L 197, 24.7.2012, p. 1).

² Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172, 2.7.2009, p. 18).

“(8) 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. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies”.

17.2.3 EPA Draft Guidelines 2017

The 2017 EPA Draft guidelines on the information to be contained in an EIAR refer to major accidents and/or disasters in a number of sections:

Characteristics of the Project – the draft guidelines state that the project characteristics should include a description of *“a description of the Risk of Accidents – having regard to substances or technologies used.”*

Impact assessment - the draft guidelines state that the impact assessment should include *“the risks to human health, cultural heritage or the environment (for example due to accidents or disasters)”*.

Likelihood of Impacts - the draft guidelines state the following:

“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). This may be supported by general risk assessment methods or by systematic risk assessments required under other regulations e.g. a COMAH (Control of Major Accident Hazards involving Dangerous Substances) assessment.”

17.2.4 EPA Guidance on Assessing and Costing Environmental Liabilities

The approach used in this assessment is derived from the EPA’s Guidance Document ‘Guidance on Assessing and Costing Environmental Liabilities 2014.’ This guidance presents a systematic approach for assessing and costing environmental liabilities associated with:

- Closure and restoration/aftercare; and
- Incidents.

17.2.5 Current Practice

As discussed above, the starting point for the scope and methodology of this assessment is that the Proposed Project will be designed, built and operated in line with best international current practice and, as such, major accidents will be very unlikely.

Current EIA practice already includes an assessment of some accidents and disasters such as pollution incidents to ground and watercourses as well as assessment of flooding events. Refer to the relevant sections of the EIAR such as Chapter 4 ‘*Proposed Project Description*’, Chapter 12, ‘*Land, Soil and Water*’ and Appendix 4.1 Outline Construction Environmental Management Plan (CEMP). There are also a number of mechanisms which currently manage accidents outside of the EIA process.

17.2.6 Site Specific Risk Assessment Methodology

The site specific risk assessment identifies and quantifies risks due to the Proposed Project focusing on: unplanned, but possible and plausible events occurring during the construction and operational phases. This approach is derived from EPA’s Guidance Document “Guidance on Assessing and Costing Environmental Liabilities 2014”.

The impact ratings are taken from the Guide to Risk Assessment in Major Emergency Management (Department of the Environment, Heritage & Local Government, 2010), and are outlined in **Table 7.1** and **Table 7.2**.

Risk Identification, Likelihood and Consequence

The following steps were undertaken as part of the preparation of the site specific risk assessment:

- Risk identification;
- Risk classification, likelihood and consequence;
- Risk evaluation.

Risk Identification

Risks were reviewed through the identification of plausible risks in consultation with relevant specialists, focusing on abnormal but plausible incidents that may occur at the proposed College Green plaza.

Risk Classification- Likelihood

Having identified the potential risk, the likelihood of its occurrence is assessed. An analysis of existing safety procedures and proposed environmental controls was considered when estimating likelihood of identified potential risks occurring. **Table 17.1** defines the likelihood ratings. As outlined, the impact ratings are taken from the Guide to Risk Assessment in Major Emergency Management (Department of the Environment, Heritage & Local Government, 2010).

Table 17.1: Risk Classification Table- Likelihood

Ranking	Category	Description
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communities; and / or little opportunity, reason or means to occur; May occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisations worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Risk Classification- Consequence

The consequence of the impact if the event occurs is assigned as per **Table 17.2**.

It should be noted that when categorising the Consequence Rating, the rating assigned assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster.

In addition, Dublin City Council have in place a 'Major Emergency Plan' which, if implemented as intended, will work to reduce the effect of any major accident or disaster.

As outlined, the impact ratings are taken from the Guide to Risk Assessment in Major Emergency Management (Department of the Environment, Heritage & Local Government, 2010).

Table 17.2: Risk Classification Table - Consequence

Ranking	Classification	Impact	Description
1	Minor	Life, Health, Welfare Environment Infrastructure Social	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment. No contamination, localised effects <0.5M Euros Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare Environment Infrastructure Social	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements.

			Simple contamination, localised effects of short duration 0.5-3M Euros Normal community functioning with some inconvenience.
3	Serious	Life, Health, Welfare Environment Infrastructure Social	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support. Simple contamination, widespread effects or extended duration 3-10M Euros Community only partially functioning, some services available.
4	Very Serious	Life, Health, Welfare Environment Infrastructure Social	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated Heavy contamination, localised effects or extended duration 10-25M Euros Community functioning poorly, minimal services available
5	Catastrophic	Life, Health, Welfare Environment Infrastructure Social	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated. Very heavy contamination, widespread effects of extended duration. >25M Euros Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

Risk Evaluation

The likelihood and consequence ratings are multiplied to form a risk score for risk evaluation.

A risk matrix outlined in **Table 17.3** provides a broad indication of the critical nature of each risk. This risk matrix will then be applied to the risk evaluation.

The risk matrix is colour coded to provide a broad indication of the critical nature of each risk. The red zone represents 'high risk' scenarios, the amber zone represents 'medium risk scenarios' and the green zone represents 'low risk scenarios.'

Table 17.3: Risk Matrix

Likelihood Rating	Very likely	5					
	Likely	4					
	Unlikely	3					
	Very unlikely	2					
	Extremely Unlikely	1					
			Minor	Limited	Serious	Very Serious	Catastrophic
			1	2	3	4	5
Consequence Rating							

17.3 The Proposed Project

17.3.1 Construction Phase

The construction phase of the Proposed Project is scheduled to be carried out over a period of approximately 12-18 months, subject to planning and other approvals.

The Construction and Environmental Management Plan (CEMP), (refer to Appendix 4.1 of the EIAR) outlines the site safety procedures that will be implemented during the construction phase. The effective implementation of the CEMP will help to reduce the risks associated with the construction phase of the Proposed Project.

17.3.2 Operational Phase

The Proposed Project involves the development of a civic plaza at College Green and the introduction of traffic management measures. The overall site area is approximately 13, 960m².

Once operational, the civic plaza will have the following features:

- The Thomas Davis memorial will be repositioned to the ‘circus’ area at the junction with Foster Place. A minimal repositioning of the Henry Grattan statue is also proposed.
- A total of 22 new trees will be planted in place of the eight that currently exist- ten in a single line along the south side of the plaza, and a further twelve forming an avenue at the approach to the space from Dame Street.
- Street furniture including seating, litter bins, bollards, cycle stands, planters and tree grilles will be selected to be consistent throughout and relate to the design of the space.
- It is proposed to install the infrastructure to make provision for special events.
- A fountain in the form of a number of stainless steel plates imbedded in the paving. When not in operation, the plates are nearly invisible and events can take place above them. When in operation, 32 jets of water can rise from 1m to 6m in height.
- Light and dark granite setts will be used to create the design wedge pattern. Existing setts in Foster Place will be removed, stored on/off-site and re-laid.

- Tall lighting columns are proposed along the northern and southern boundary of the plaza to further define the space, leaving the centre of the space for temporary events.
- It is proposed to complement the existing drainage system with the installation of a Sustainable Urban Drainage System (SuDS), where possible.

As part of the Proposed Project, all vehicular through traffic will be removed from the College Green area. Buses will continue to run along the same route as the new Luas tracks in front of Trinity College.

Buses which currently traverse College Green from Dame Street, Grafton Street and College Street will be diverted onto other routes. Those buses which will continue to use Dame Street will turn around at College Green, in a new turning circle at the junction of Foster Place and Church Lane.

Parliament Street will be public transport only from 7am to 7pm, Monday to Friday; however, access to loading vehicles will be permitted up until 11am. Works on Dame Street are required to tie in with the plaza at the eastern end of Dame Street and to provide cycling and pedestrian facilities between the civic plaza and South Great George's Street.

Alternative taxi ranks and loading bays will be provided in the study area, to make up for those which are to be removed as part of the Proposed Project. These are proposed at Dame Street, Trinity Street and Church Lane.

Two one-way cycle lanes on either side of Dame Street will join at the central turnaround and run along the south side of the plaza as a two-way dedicated cycle route that joins with the College Street route at the north-east end of Grafton Street.

Refer to Chapter 4 of this EIAR for further detail on the Proposed Project

17.4 Predicted Impacts- Risk of Major Accidents and/or Disasters

17.4.1 Impact Assessment

A Risk Register has been developed which contains all the risks identified with the construction and operation of the Proposed Project. This is presented in **Table 17.4**.

Table 17.4: Risk Register

Risk ID	Event	Possible cause
1	Luas Accidents	Contact of cyclist with tram
2		Contact of person with tram
3		Derailment on network
4		Contact with infrastructure
5	Fire/Explosion	<ul style="list-style-type: none"> - Unpermitted vehicles on Luas line - Object on the Luas line - Failure of safety critical functions and control systems - Driver error - Pedestrian/cyclist error - Deliberate collisions- act of terrorism - Unclear surface demarcations/ signage
		<ul style="list-style-type: none"> - Road vehicle striking an Overhead Contact System (OCS) support pole

Risk ID	Event	Possible cause
		<ul style="list-style-type: none"> - Electrical fault on Luas or with OSC/ overhead cables - Explosion at gas connection in front of Church Lane - Tram and vehicle collision. - Vehicle and vehicle collision - Act of terrorism
6	Vehicles on pedestrian plaza	<ul style="list-style-type: none"> - Driver error - Failure of vehicle control systems - Act of terrorism
7	Major road traffic accident (at west end of the proposed plaza- at the proposed turning circle, or at the junction of College Street and Dame Street)	<ul style="list-style-type: none"> - Driver error - Object on road - Failure of vehicle control systems - Cyclist/pedestrian error- dangerous crossings/movements
8	Spillage or longer term seepage of pollutants into watercourse	Construction phase spills or leakages
9	Contamination of groundwater table	Construction phase spills or leakages
10	Extreme weather (flood)	Periods of heavy rainfall, taking into account climate change and natural disasters
11	Collapse/ damage to structures or monuments	<ul style="list-style-type: none"> - Earthquake - Construction activities - Events taking place at proposed plaza
12	Crime/ risk to personal safety in plaza- particularly at night	<ul style="list-style-type: none"> - Robbery - Assault
13	Pedestrian/cyclist collision	<ul style="list-style-type: none"> - Improper use/ non-use of designated cycle track by cyclists at plaza - Cycle track difficult to distinguish for visually impaired

These risks were assessed against the risk classification tables provided and the resulting risk analysis is given in **Table 17.5**. The risk register is based upon possible risks associated the proposed project.

Table 17.5: Proposed College Green Project- Risk Analysis

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
1	Luas Incidents Contact of cyclist with tram	<ul style="list-style-type: none"> - Failure of safety critical functions and control systems - Driver error - Pedestrian/cyclist error - Unclear surface demarcations/signage - Deliberate collisions-terrorism 	Injury or loss of life	4	<p>According to the 2015 Railway Safety Performance in Ireland Report (Commission for Railway Regulation, 2016), a significant majority of incidents where contact is made between trams and pedestrians occur in and around Dublin City Centre. A total of 7 such incidents occurred in 2015, in line with the trend of 7-8 since 2012, of these 2 were cyclists.</p> <p>The pedestrian crossing being installed as part of the Luas Cross City Project to the south of the gates of Trinity College will be modified as part of the Proposed Project in order to provide for the safe passage of cyclists and pedestrians. The pedestrian crossings will be changed to Tucan crossings to facilitate safe crossing of the Luas tracks by cyclists. The alignment of the crossing will be changes slightly to better align with the proposed plaza. In addition, the existing crossing will be narrowed, and a second crossing will be installed at the northern side of the gates of Trinity College. Separate</p>	2	Although localised, this hazard could result in loss of life of a cyclist.	8

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					designated signals will be provided to regulate cycle movements through the pedestrian crossings. Given these statistics and the design measures, the likelihood of contact between trams and pedestrians is considered to be 'likely'			
2	Contact of pedestrian with tram	<ul style="list-style-type: none"> - Failure of safety critical functions and control systems - Driver error - Pedestrian/cyclist error - Unclear surface demarcations/signage - Deliberate collisions-Terrorism 	Injury or loss of life	4	<p>According to the 2015 Railway Safety Performance in Ireland Report (Commission for Railway Regulation, 2016), a significant majority of incidents where contact is made between trams and pedestrians occur in and around Dublin City Centre. A total of 7 such incidents occurred in 2015, in line with the trend of 7-8 since 2012, of these 5 were pedestrians.</p> <p>The pedestrian crossing being installed as part of the Luas Cross City Project to the south of the gates of Trinity College will be modified as part of the Proposed Project in order to provide for the safe passage of cyclists and pedestrians. The pedestrian crossings will be changed to Tucan crossings to facilitate safe</p>	2	Although localised, this hazard could result in loss of life of a pedestrian.	8

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					<p>crossing of the Luas tracks by cyclists. The alignment of the crossing will be changes slightly to better align with the proposed plaza. In addition, the existing crossing will be narrowed, and a second crossing will be installed at the northern side of the gates of Trinity College. Separate designated signals will be provided to regulate cycle movements through the pedestrian crossings.</p> <p>Given these statistics, the likelihood of contact between trams and pedestrians is considered to be 'likely.'</p>			
3	Derailment on network	<ul style="list-style-type: none"> - Unpermitted vehicles on Luas line - Object on the Luas line - Failure of safety critical functions and control systems - Driver error - Pedestrian/cyclist error 	Injury or loss of life	2	According to the 2015 Railway Safety Performance in Ireland Report (Commission for Railway Regulation, 2016), there have been no tram derailments in Ireland since 2010.	3	The derailment of a Luas, particularly at peak times could result in mass injury or even death.	6

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
4	Contact with Infrastructure	<ul style="list-style-type: none"> - Unpermitted vehicles on Luas line - Object on the Luas line - Failure of safety critical functions and control systems - Driver error - Pedestrian/Cyclist error 	Injury or loss of life	2	A useful indicator is the number of Emergency Brake (EB) applications which tram drivers make. There were 589 EB applications made in 2015 representing about an 18% increase on 2014 figures. Operator analysis of this long term trend since 2009 indicates EB applications are linked to a number of reasons, including 'new infrastructure'.	2	Contact of tram with infrastructure could result in injury or death of Luas passengers, a disruption to utilities or fire/explosion.	4
5	Fire/Explosion	<ul style="list-style-type: none"> - Road vehicle striking an OCS support pole or electricity pole - Electrical fault on Luas or with OSC/overhead cables - Explosion at gas connection in front of Church Lane - Tram and vehicle collision. - Vehicle and vehicle collision - Act of terrorism 	Injury or loss of life	3	<p>Where electricity or gas lines/ infrastructure exist, there is always a risk of fire/explosion.</p> <p>According to the Luas Safety Statistics presentation (Urban Transport Forum, 2016), no incidents relating to fire/explosion at/on the Luas have been recorded since 2008.</p> <p>However, from 2005- 2008, at least one incident a year was recorded.</p> <p>During the construction phase, and as outlined in the CEMP, the Contractor will maintain an emergency response action plan which will cover all foreseeable</p>	3	<p>A fire/explosion could result in mass injury or even death, damage to buildings, structures or infrastructure, loss of income.</p> <p>However, according to the Luas Safety Statistics presentation (Urban Transport Forum, 2016), tram accidents amounted to four fatalities between 2005- 2015, and there was never more than one fatality occurring in any given year. The largest number of people to have to have had hospital treatment following a</p>	9

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					<p>risk, i.e. fire. Appropriate site personal will be trained as first aiders and fire marshals.</p> <p>Thus, while there is a risk of fire/ explosion, it is considered it is a risk of 'low' likelihood.</p>		<p>Luas incident was four people in 2009.</p> <p>Thus a consequence rating 'serious' is applied.</p>	
6	Unpermitted vehicles on pedestrian plaza	<ul style="list-style-type: none"> - Unpermitted vehicles gaining access to plaza area accidentally, due to driver or vehicle failure - Terrorist attack 	Injury or loss of life	3	<p>It has recently been cited by An Garda Síochána that Ireland is "not immune" from the threat of terrorism, but that the possibility of an attack remains unlikely.</p> <p>The design of the plaza incorporates metal planters and retractable bollards to the west of the plaza. These will hinder any vehicles entering the plaza from the turning circle, or from Church Lane. It is presumed that at any public events/ gatherings or marches, these metal planters will remain in place.</p> <p>As outlined in Chapter 4 of the EIAR, A Management Plan will be prepared and maintained by DCC in respect of the management and maintenance of the civic space. An Garda Síochána will be consulted in relation to policing issues</p>	4	Acts of terrorism can result in mass causality of loss of life	12

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					including the preparation of policing plans for any major public events.			
7	Major road traffic accident	Traffic accidents which might occur at the west end of the proposed plaza- at the proposed turning circle or at the junction of College Street and Dame Street	Injury or loss of life	4	<p>According to The Dublin City Council Road Safety Strategy 2016-2020 (Dublin City Council, 2016), annual collision trends in the Dublin City Council administrative area ranged from 614-903 between 2004-2013.</p> <p>In addition, a total of 112 road fatalities occurred within Dublin City Council's administrative boundary between 2006-2015.</p> <p>Traffic management measures- such as speed restrictions and traffic re-routing at the turning circle will reduce the risk of major road accidents.</p>	2	Road traffic accidents could result in injury or even death and as such, the consequence is considered to be 'moderate.'	8
8	Spillage or longer term seepage of pollutants into watercourse	Construction phase spills or leakages	Destruction of aquatic life, illness	2	<p>As per the proposed mitigation measures outlined in Section 12.8 of the EIAR, run-off will be controlled to minimise the water effects in the outfall areas. Any spillage or seepage into the watercourse is deemed negligible.</p> <p>As outlined in the CEMP, appropriate staff will be trained in</p>	3	Contamination of nearby watercourses- in this instance, the River Liffey could result in 'moderate' damage to the environment as it could lead to illness/disease, and the death of aquatic life.	6

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					environmental issues and spill response procedures.			
9	Contamination of groundwater table	Construction phase spills or leakages	Illness or loss of life	2	<p>The groundwater table is approx. 2-4m bgl. The bedrock has been proven at 3.2 mbgl which is overlain by clay. This clay will limit the potential for contamination to infiltrate into the underlying aquifer. No excavations are anticipated to the bedrock.</p> <p>As outlined in the CEMP, appropriate staff will be trained in environmental issues and spill response procedures.</p>	3	Contamination of the groundwater table could result in a major impact on the environment, in particular population and human health- if the groundwater is also a source of drinking water. The consequence could be widespread disease, illness or even death. A 'major' consequence is therefore determined.	6
10	Extreme weather (flood)	Periods of heavy rainfall, taking into account climate change and natural disasters	Destruction of property, injury, loss of life	3	As outlined in Section 12.5.1.6 of the EIAR, there is a minor risk of pluvial flooding to the site, however this will be mitigated by the design of the surface water drainage network.	3	<p>Pluvial flooding can result in disruption to transport, disruption to access, damage to buildings, structures or infrastructure, loss of income.</p> <p>The consequence rating is thus determined to be 'serious.'</p>	9
11	Collapse/ damage to structures or monuments	<ul style="list-style-type: none"> - Earthquake - Construction activities - Events 	Destruction of property, injury, loss of life	3	Construction works associated with the Proposed Project are not expected to be intensive.	2	In the event of a building collapse, injury or death could occur to a large number of people.	6

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					<p>The risk of an earthquake of any significant magnitude in Dublin is considered low.</p> <p>Crowd control will be implemented at any events which are to be held in the proposed plaza.</p>			
12	Crime/ risk to personal safety in plaza- particularly at night	<ul style="list-style-type: none"> - Robbery - Assault 	Injury, trauma or loss of life	4	<p>High. Crime rates are generally high in urban centres.</p> <p>However, as outlined in Section 4.1, a Management Plan will be prepared and maintained by DCC in respect of the management and maintenance of the civic space and An Garda Síochána will be consulted in relation to policing issues including the preparation of policing plans for any major public events.</p>	2	Impacts would generally be localised, and minor.	8

Risk ID	Potential Risks	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
13	Pedestrian/cyclist collision	<ul style="list-style-type: none"> - Improper use/ non-use of designated cycle track by cyclists at plaza - Cycle track difficult to distinguish for visually impaired 	Injury	4	<p>It is acknowledged that the proposed cycle route across College Green is indirect, especially in the west to east direction, and that there is a possibility of some cyclists cycling outside the designated cycle track provided.</p> <p>However, a number of design measures will be implemented to ensure that cyclists traversing the plaza will cycle slowly, carefully and within designated areas as much as possible. (Refer to Chapter 4 for further information).</p>	1	A small number of people would be affected. No fatalities would occur, but small number of minor injuries requiring first aid treatment.	4

The risk evaluation provided in **Table 17.6** ranks each of the potential risks by their ‘risk score.’ A corresponding risk matrix is provided in **Table 17.7**, which is colour coded in order to provide an indication of the critical nature of each risk.

Table 17.6: Risk Evaluation

Risk ID	Potential Risks	Likelihood Rating	Consequence Rating	Risk Score
6	Unpermitted vehicle on pedestrian plaza	3	4	12
5	Fire/Explosion	3	3	9
10	Extreme weather (flood)	3	3	9
7	Major Road Traffic Accident	4	3	8
1	Contact of Cyclist with Tram	4	2	8
2	Contact of Pedestrian with Tram	4	2	8
3	Derailment on Network	2	3	8
12	Crime/ risk to personal safety in plaza- particularly at night	4	2	8
8	Spillage or longer term seepage of pollutants into watercourse	2	3	6
9	Contamination of groundwater table	2	3	6
11	Collapse/ damage to structures or monuments	3	2	6
4	Contact with Infrastructure	2	2	4
13	Pedestrian/cyclist collision	4	1	4

As outlined in **Section 17.2.8**, the red zone represents ‘high risk’ scenarios’, the amber zone represents ‘medium risk scenarios’ and the green zone represents ‘low risk scenarios.’

Table 17.7: Risk Matrix

Likelihood Rating	Very likely	5					
	Likely	4	13	1,2,12	7		
	Unlikely	3		11	5, 10	6	
	Very unlikely	2		4	3,8,9		
	Extremely Unlikely	1					
			Minor	Limited	Serious	Very Serious	Catastrophic
			1	2	3	4	5
Consequence Rating							

From examining the plausible risks presented in **Table 17.6**, the scenario with the highest risk score in terms of a major accident and/or disaster was identified as ‘unpermitted vehicle on pedestrian plaza’.

17.4.2 Unpermitted vehicle on pedestrian plaza

In a pedestrianized area, there is always a risk that a driver will unintentionally access the space through a matter of driver error.

As previously outlined, An Garda Síochána have recently cited that Ireland is “not immune” from the threat of terrorism, but that the possibility of an attack remains unlikely. As seen in recent years, there has been a rise in the number of vehicle related terrorist attacks in major urban centres, resulting in mass injury and loss of life of civilians.

The risk of unpermitted vehicles gaining access to the proposed plaza was given a risk score of 12- indicating a scenario that is ‘Unlikely’ to occur, but would have ‘Very Serious’ consequences should it do so.

17.5 Mitigation Measures

The design of the plaza incorporates metal planters and retractable bollards to the west of the plaza, where vehicles could gain access. These will hinder any vehicles entering the plaza from the turning circle, or from Church Lane. It is intended that at any public events/ gatherings or marches, these metal planters will remain in place. In addition, signage will be implemented which will indicate that the plaza is a pedestrian priority area.

As outlined in Chapter 4 of this EIAR, a Management Plan will be prepared and maintained by DCC in respect of the management and maintenance of the civic space. In addition, an application for outdoor public event licence will need to be approved by Dublin City Council in advance of an event taking place.

A number of discussions have taken place with An Garda Síochána in relation to security issues at the proposed College Green civic plaza and other public places in Dublin City. These consultations will continue through the detailed design phase and any mitigation required by An Garda Síochána will be implemented at that stage, including physical intervention measures. In addition, as is current policy, policing plans will be prepared for any major public events.

17.6 Residual Impacts

The risk of a major accident and/or disaster due to the Proposed College Green Project based on a detailed risk analysis is considered ‘medium’ as defined in the risk evaluation, Table 17.7, with regards unpermitted vehicles gaining access to the pedestrian plaza.

17.7 References

Dublin City Council Road Safety Strategy - 2020 (Dublin City Council, 2016)

Guidance on assessing and costing environmental liabilities (Environmental Protection Agency, 2014)

A Framework for Major Emergency Management (Department of Environment, Heritage and Local Government, 2010)

Luas Safety Statistics- Urban Tram Forum (Morely, R, 2017)

Railway Safety Performance in Ireland (Commission for Railway Regulation, 2016)