

Wicklow County Council

**N11/M11 Junction 4 to Junction 14
Improvement Scheme**

Option Selection Report
Appendix D3 - Hydrogeology

265455-ARP-EGT-SWI-RP-ZX-0006

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1 Hydrogeology

1.1 Introduction

This report details the environmental assessment of the Stage 2 Project Appraisal Matrix for the N11/M11 Scheme with respect to the Hydrogeology constraints identified in **Section 15** (Hydrogeology) of **Volume B**.

For the corridor assessment, the overall scheme has been split into two sections, i.e. the Northern Section and the Southern Section and the corridor options assessed are those discussed in **Chapter 8** of **Volume A**.

There are three zones associated with each corridor option referred to in the corridor assessment:

- The potential road “footprint” which is the potential landtake required to construct or improve the road;
- The road “corridor” which is a 200m wide corridor centred around the alignment centre line for all off-line corridors. For the on-line Corridor Options 1 (North), 1 (South) and 5 (South), the width is variable, but is typically narrower than the width of the off-line corridors. The “footprint” sits inside the “corridor” boundary; and
- The road "assessment study area" which includes a 250m buffer zone from the road centre line and an overall width of 500m. This buffer zone may increase to consider attributes which extend beyond this zone e.g. along link roads.

A transport assessment forms part of this Stage 2 Project Appraisal Matrix. This assessment is included in **Section 1.5**. The transport scenarios that were assessed are as follows:

- Transport Scenario 5A - Parallel Links + Junction Rationalisation;
- Transport Scenario 5B - N11/M11 Additional Lane(s) + Junction Improvements; and
- Transport Scenario 4 – Bus Service Enhancements.

Section 1.2 outlines the methodology that was used to carry out the study, and **Section 1.3** outlines the assessment criteria which were used. The Stage 2 assessment is presented in **Section 1.4** (Corridors) and **Section 1.5** (Transport Scenarios) and references are listed in **Section 1.6**.

1.2 Methodology

The assessment is undertaken in line with the requirements of the following guidance:

- Transport Infrastructure Ireland (TII), formerly National Roads Authority, Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes¹ (TII Guidelines).
- The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports².
- Transport Infrastructure Ireland (TII) Guidance, formally National Roads Authority (NRA). Environmental Impact Assessment of National Road Schemes – a Practical Guide³.

In line with the TII Guidelines¹, the assessment study area for this corridor assessment is a 250m buffer from the centre line of each corridor. This has been extended on a conservative basis to capture the zones of influence of attributes where appropriate. The assessment study area will therefore be used to assess the potential impacts to hydrogeological features. There is one exception where the design footprint is used for the assessment of impact rather than the assessment study area. When establishing if an option may directly impact part of a groundwater dependent habitat i.e. cut through a marsh etc., it is the footprint that is more relevant rather than the assessment study area.

The TII Guidelines¹ provide criteria for ranking of the identified hydrogeological constraints within the assessment study area. The criteria are presented in **Table 15.1** in **Section 15** (Hydrogeology) of **Volume B**. Criteria for rating an impact significance that may arise at each hydrogeological constraint are provided within Box 4.4 of the TII Guidelines¹ and in **Table 1.1**. The impact significance assessment takes into account of the attribute importance and the predicted scale and duration of the likely impacts.

Table 1.1: Criteria for Rating Impact Significance at Route Selection Stage – Rating of Significant Environmental Impacts at Route Selection Stage from Box 4.4 of the Guidelines¹

Impact Level	Attribute Importance				
	Extremely High**	Very High	High	Medium	Low
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			

¹ NRA (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: <https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf>

² Environmental Protection Agency (EPA), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft 2017. Available from: <https://www.epa.ie/pubs/advice/ea/EPA%20EIA%20Guidelines.pdf>

³ Transport Infrastructure Ireland (TII) National Roads Authority Environmental Impact Assessment of National Road Schemes – a Practical Guide, 2008. Available from: <https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf>

Impact Level	Attribute Importance				
	Extremely High**	Very High	High	Medium	Low
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on Significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

***In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)*

The TII Guidelines¹ qualitative significance rating of environmental impacts have been correlated with the equivalent qualitative and quantitative assessment scores from the TII Project Appraisal Guidelines for National Roads Unit 7.0 - Multi-Criteria Analysis⁴ (hereafter referred to as the TII PAG), as shown in **Table 1.2**. It should be noted that only negative potential impacts are considered in the TII Guidelines¹ whereas the TII PAG⁴ multi-criteria assessment is based on the seven-point scale presented below:

- 7 – Major or highly positive;
- 6 – Moderately positive;
- 5 – Minor or slightly positive;
- 4 – Not significant or neutral;
- 3 – Minor or slightly negative;
- 2 – Moderately negative; or
- 1 – Major or highly negative.

For the purposes of this assessment the positive impact level ratings shown in the first column of **Table 1.2** are adopted to relate to the equivalent TII PAG value.

⁴ Transport Infrastructure Ireland Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis, 2016. Available from: <https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf>

Table 1.2: Correlation of TII Guidelines significance rating to an equivalent TII PAG⁴ score

Impact Level (TII Guidelines ¹)	Equivalent TII PAG ⁴ (Description)	Equivalent TII PAG ⁴ (Value)
Profound (Negative)	Major or highly negative	1
Significant (Negative)	Major or highly negative	1
Moderate (Negative)	Moderately negative	2
Slight (Negative)	Minor or slightly negative	3
Imperceptible	Not significant or neutral	4
Slight (Positive)*	Minor or slightly positive	5
Moderate (Positive)*	Moderately positive	6
Significant (Positive)*	Major or highly positive	7

*not defined in TII Guidance¹.

The final stage of the assessment methodology was to ensure that the requirements of the TII PAG⁴ were also met by assigning a score to each corridor option based on the scoring procedure within these TII Guidelines¹. Where a positive score is assigned, they are from the TII PAG⁴ scoring system.

Using the impact scores and professional judgement, the 'Preferred', 'Intermediate' or 'Least Preferred' corridors were identified.

The Constraints Study was primarily a desk study collating hydrogeological information available – refer to **Section 15** (Hydrogeology) of **Volume B**. Additional information obtained during public consultation in relation to the presence of springs was also included within the Constraints Study.

1.3 Assessment criteria

In line with TII Guidelines¹, the hydrogeological attributes which are considered in the corridor options assessment are presented in **Table 1.3**. This table also outlines the assessment criteria that will be applied to each of these features.

Table 1.3: Assessment criteria summary

Hydrogeological features to be assessed	Means of assessment of potential impacts
High yielding water supply wells and springs and increased risk presented by the road scheme	The proximity to the feature. The length of the corridor within protection zone or zones of contribution.
The classification and extent of aquifers underlying each corridor and increased risk presented to them by road scheme	Aquifer classification. Extent of aquifer – provided as the length of the corridor as a percentage which is underlain by a particular aquifer classification. Aquifer vulnerability – provided as the length of the corridor, as a percentage, which is underlain by aquifer which is classified as extreme or high vulnerability. Removal of subsoil cover or part of aquifer (cuttings along corridors) which may give rise to changes in groundwater level and change in aquifer vulnerability.
Karst features along each corridor and the risk presented to them by the road scheme	The proximity to the feature. The length of the corridor within feature protection zone or zone of contribution.
Groundwater dependant habitats and the risk presented to them by the road scheme	The proximity and the position (upgradient or downgradient) to the feature. Removal of subsoil cover or part of aquifer (cuttings along corridor) which may give rise to changes in groundwater level. Removal of part of the habitat by the corridor option.

It should be noted that other low importance hydrogeological features were identified during the desk study phase of the Constraints Study presented in **Section 15** (Hydrogeology) of **Volume B**. This information was gathered to provide the wider context of the scheme, and the features are not as relevant or significant to be considered in detail in this assessment. The features listed in **Table 1.3** have been used in this assessment to compare the corridor options and identify a preferred corridor as per TII Guidelines¹.

1.4 Stage 2 Project Appraisal Matrix – corridor assessment

The Stage 2 assessment for hydrogeological constraints was undertaken for the potential impacts to high yielding water supply wells and springs, aquifers, karst features and groundwater dependant features. Information on these features are outlined in the following sections.

1.4.1 Groundwater resources

There are no groundwater public water supply sources or National Federation of Group Water Scheme groundwater supplies within the study area.

There are also no known significant industrial or commercial abstractions of groundwater in the study area. No Source Protection Zones associated with public supplies are located along the corridor options.

The majority of groundwater abstraction wells identified within the corridors are of low importance. The TII Guidelines¹ suggest that little or no weighting should be given to the number of such wells along each corridor and/or their distance from the centre line when assessing relative impacts. In the case of low yielding water supply wells, the ranking of the level of potential impact is unnecessary, as wells will either have to be replaced or removed.

1.4.2 Aquifers

The aquifers identified in the Constraints Study are presented in **Table 15.4** of **Section 15** (Hydrogeology) of **Volume B**. The potential impact on the aquifer along each corridor is a combination of the type and extent of the aquifer, aquifer vulnerability and presence of deep cuttings along each corridor.

The majority of the corridors are underlain by a Poor Aquifer (Pl). Part of the Northern Section is underlain by a Locally Important Aquifer where the bedrock is moderately productive only in local zones (L1), although the two northern corridor options are concurrent in this location so this is not a differentiator in the comparative assessment. There are two Locally Important Gravel Aquifers (Lg) mapped; one is located in the Northern Section and the other one in the Southern Section.

Corridors underlain by aquifers of lower importance i.e. Poor Aquifer, are considered preferred. Due to the corridor options being in close proximity in both the northern and southern sections, the percentage of each aquifer type underlying each option is very similar across all options in the same section.

Options that include deep cuttings and/or tunnels can impact on the groundwater by causing dewatering of the groundwater in the vicinity where the cut/tunnel extends below the water-table. The deeper the cutting/tunnel below the water-table the more significant and more extensive the impact. In addition, the removal of the soil and bedrock in the excavation can increase the vulnerability of the aquifer at that location, as vulnerability is largely dependent on the depth of subsoil above the aquifer.

Dewatering potential of the tunnel segment of Corridor Option 6 (South) cannot be ruled out at this stage with the level of detail required for Phase 2. Therefore, it is assumed that dewatering of the underground aquifer caused by the tunnel segment is likely, and Corridor Option 6 (South) is assessed on this basis. This dewatering is assumed to occur during the construction phase, and it is assumed that the groundwater will return to normal levels for the operational stage.

It is assumed for the operational stage that there will be no dewatering of the underground aquifer due to the tunnel. The tunnel and tunnel portals are assumed to be watertight. Following construction, it is assumed that the dewatering pumps will be turned off and that the water level would be allowed to rebound. Therefore, there will be no passive or active dewatering of groundwater in the operational stage.

In this assessment the aquifer vulnerability for the corridors are compared by determining the length of the option traversing extreme vulnerability zones. Note, the vulnerability distribution presented in the tables below has been increased, where necessary, to account for deep cuts which could increase the vulnerability to extreme. Construction of the road with the shortest length over extreme vulnerability zones is preferable as this will have a lesser potential impact on the underlying aquifer. It is assumed that the potential impact is only during construction and that once operational, the road will be constructed to TII standards to mitigate potential operational impacts on groundwater quality.

The aquifer impact assessment is presented in **Table 1.4** for the Northern Section and Southern Section.

Table 1.4: Aquifer assessment

Aquifer	Importance Ranking	Corridor Option 1A (North)		Corridor Option 1B (North)		Corridor Option 1 (South)		Corridor Option 2 (South)		Corridor Option 5 (South)		Corridor Option 6 (South)	
		C	O	C	O	C	O	C	O	C	O	C	O
Ll	Medium	Slight	Slight	Slight	Slight	I	I	Slight	Slight	I	I	Slight	I
Pl	Low	Slight	Slight	Slight	Slight	I	I	Slight	Slight	I	I	Slight	I
	THI PAG Qualitative Ranking	Minor or slightly negative		Minor or slightly negative		Not significant or neutral		Minor or slightly negative		Not significant or neutral		Minor or slightly negative	
	THI PAG Value	3		3		4		3		4		3	
Lg	Medium	*	*	*	*	Slight	Slight	Slight	Slight	Slight	Slight	Slight	Slight
	THI PAG Qualitative Ranking	Not Significant or Neutral		Not Significant or Neutral		Minor or slightly negative		Minor or slightly negative		Minor or slightly negative		Minor or slightly negative	
	THI PAG Value	4		4		3		3		3		3	
Length of Option Routes Underlain by Extreme Vulnerability (km)		0	N/A	0	N/A	2.6	N/A	2.7	N/A	3.1	N/A	2.7	N/A
Notes: Ll = Locally important aquifer Pl = Poor aquifer Lg = Locally important gravel aquifer C = Construction O = Operation I = Imperceptible *This corridor option does not impact an aquifer of this importance.													

1.4.3 Karst features

There are no known karst features present in the assessment study area.

1.4.4 Groundwater dependant habitats

All groundwater dependant habitats identified in the Constraints Study are presented in **Table 15.8** of **Section 15** (Hydrogeology) of **Volume B**.

Groundwater dependent habitats which are present within the assessment study area of the corridors comprise two proposed Natural Heritage Areas (pNHA), alluvial woodlands within Glen of the Downs Special Area of Conservation (SAC) and several calcareous tufa springs, which are Annex I type habitats. The Dargle River pNHA is not located within the current study area buffer and is upgradient of the development and outside any deep cuts associated with options. Therefore, it is not considered further in this assessment.

Biodiversity impacts on groundwater dependent habitats are assessed as part of the Biodiversity Assessment, refer to **Appendix D1** (Biodiversity) of **Volume D**. Petrifying springs, although priority Annex I habitat, are groundwater dependant features, and the hydrogeological assessment of groundwater dependent habitats focuses on the groundwater components of the features i.e. changes to groundwater level which may impact recharge to the feature, or changes to groundwater quality.

The proximity of the habitat to the corridor is considered with regard to increased pollution risk from untreated surface water run-off or accidental spillage of fuel from the road affecting groundwater quality. However, as per **Section 4.4** of the TII¹ Guidelines, the assessment has considered where the application of standard mitigation and best practice during construction is unambiguous and success is highly likely. Therefore, it is assumed that standard drainage measures will be put in place to reduce the risk of run-off from the road affecting groundwater quality, reducing this risk.

Based on the potential dewatering assumption noted prior, the presence of dewatering associated with deep cuttings and tunnelling is assessed in conjunction with the corridor location up or down gradient of the habitat for the potential impact to groundwater level.

If part of the habitat may be removed by a corridor option, impact to the general groundwater regime in this area is considered. The design “footprint” has been used to establish if an option may directly impact the habitat.

Deep cuttings and habitat removal are therefore considered the primary potential impacts to groundwater dependent habitats and the local groundwater regime. The assessed impacts to groundwater dependent habitats and the areas considered in this assessment are outlined below and summarised in **Table 1.5**.

A conservative approach was taken regarding these habitats in advance of detailed survey and groundwater monitoring.

These features have been assessed as if they are dependent on surface water and groundwater, refer to **Appendix D4** (Hydrology) of **Volume D** – Stage 2 Project Appraisal Matrix for the Hydrology Assessment of these features.

1.4.4.1 Kilmacanoge Marsh pNHA

Kilmacanoge Marsh pNHA is valued on an international scale, so is of extremely high importance. Two priority Annex I habitats have been identified in Kilmacanoge Marsh pNHA. These are Alluvial woodland [91E0*] and Orchid-rich calcareous grassland [6210*]. These habitats are valued on an international scale, so are of extremely high importance. As the corridor options overlap in this section, there is no difference in the potential impact between the options on Kilmacanoge Marsh pNHA, and as the potential impact is not higher than the impact on other habitats outlined below, it is not a differentiator in this assessment and is thus not included in the assessment tables.

1.4.4.2 Glen of the Downs Alluvial Woodlands

Priority Annex I habitat [91E0*] Alluvial woodland has been identified in Glen of the Downs SAC. This habitat is valued on an international scale, so is of extremely high importance. The degree of groundwater dependence of this feature has been classified as low based on the hydrogeologist site walkover (undertaken 23rd-24th March 2021). The stream that flows through this alluvial woodland however is dependent on groundwater for baseflow and therefore any impacts on groundwater levels and quality could result in an indirect impact to the stream and the habitat.

1.4.4.3 Tufa springs

Calcareous springs mapped in the north-eastern corner of Glen of the Downs SAC, in Druids Glen and along Ballywaltrim Lane are considered to be priority Annex I habitat Petrifying springs with tufa formation (Cratoneurion) [7220*]. These springs are valued on an international scale and are of extremely high importance. There is potentially priority Annex I habitat Alluvial woodland [91E0*] in the same area as the springs in the Ballywaltrim Lane Ecological Site (numbered EC45 in **Section 12** (Biodiversity) of **Volume B**).

As part of the hydrogeological assessment of the priority Annex I habitat Petrifying springs with tufa formation (Cratoneurion) [7220*], a preliminary zone of contribution (PZOC), which is the area that contributes water to the spring, has been delineated. This is explained in further detail in **Section 15.3.5** (Groundwater dependent habitats) of **Section 15** (Hydrogeology) of **Volume B**.

The assessment is summarised in **Table 1.5**.

Table 1.5: Groundwater dependent habitats assessment

Corridor Option	Biodiversity features dependent on water	Attribute Importance	Potential impact: Temporary/permanent Impact on 'X' proportion of attribute (from Table 1.2) Box 4.4 ¹	Box 4.4 ¹ Impact level	TII PAG qualitative ranking	TII PAG Value
Corridor Option 1A (North)	Kilmacanoge Marsh pNHA	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
	Priority habitat in Ballywaltrim Lane	Extremely High	Significant (Temporary)	Significant	Major or highly negative	1
Negligible (Permanent)			Moderate			
Corridor Option 1B (North)	Kilmacanoge Marsh pNHA	Extremely High	Significant (Temporary)	Moderate	Major or highly negative	2
	Priority habitat in Ballywaltrim Lane	Extremely High	Significant (Temporary)	Significant	Major or highly negative	1
Small (Permanent)			Profound			
Corridor Option 1 (South)	Glen of the Downs SAC (Alluvial Woodlands)	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
	Glen of the Downs Tufa PZOC	Extremely High	Negligible (Temporary)	Slight	Minor or Slightly Negative	3
	Druids Glen Tufa PZOC	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
Corridor Option 2 (South)	Glen of the Downs SAC (Alluvial Woodlands)	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
	Glen of the Downs Tufa PZOC	Extremely High	Negligible (Temporary)	Slight	Minor or Slightly Negative	3
	Druids Glen Tufa PZOC	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
	Glen of the Downs SAC (Alluvial Woodlands)	Extremely High	Small (Temporary)	Moderate	Moderately negative	2

Corridor Option	Biodiversity features dependent on water	Attribute Importance	Potential impact: Temporary/permanent Impact on 'X' proportion of attribute (from Table 1.2) Box 4.4¹	Box 4.4¹ Impact level	TII PAG qualitative ranking	TII PAG Value
Corridor Option 5 (South)	Glen of the Downs Tufa PZOC	Extremely High	Negligible (Temporary)	Slight	Minor or Slightly Negative	3
	Druids Glen Tufa PZOC	Extremely High	Small (Temporary)	Moderate	Moderately negative	2
Corridor Option 6 (South)	Glen of Downs SAC (Alluvial Woodlands)	Extremely High	Significant (Temporary)	Significant	Major or highly negative	1
	Glen of the Downs Tufa PZOC	Extremely High	Significant (Temporary)	Significant	Major or highly negative	1
	Druids Glen Tufa PZOC	Extremely High	Small (Temporary)	Moderate	Moderately negative	2

1.4.5 Summary

The Stage 2 Project Appraisal Matrix for the corridor options in the northern and southern sections are summarised in **Table 1.6** and **Table 1.7**. The worst-case scenario is considered from the temporary and permanent impacts during both the construction and operational stages.

1.4.5.1 Northern Section

Table 1.6: Corridor option assessment summary – Northern Section

Assessment Criteria	Corridor Option 1A (North)	Corridor Option 1B (North)
Aquifer	3	3
Habitats (Ballywaltrim Lane)	1	1
Habitats (Kilmacanoge Marsh)	2	2
Qualitative Assessment	Major or Highly Negative	Major or Highly Negative
Score / Impact Level	1	1
Preference	Preferred	Least Preferred

The preference for Corridor Option 1A (North) has been determined based on the potentially more significant impact on the Ballywaltrim Lane Tufa Springs associated with Corridor Option 1B (North). While both options encroach on the PZOC and therefore would result in an impact on hydrogeology of the feature, the cut due to the underpass at Junction 7 (Bray South) in this location associated with Corridor Option 1B (North) introduces a higher risk of dewatering of the springs during construction and operation than Corridor Option 1A (North). Therefore, while the magnitude of impact of both options is *major or highly negative*, Corridor Option 1A (North) is preferred.

1.4.5.2 Southern Section

Table 1.7: Corridor Option Assessment – Southern Section

Assessment Criteria	Attribute	Corridor Option 1 (South)	Corridor Option 2 (South)	Corridor Option 5 (South)	Corridor Option 6 (South)
Aquifer	Gravel Aquifer	3	3	3	3
	Bedrock Aquifer	4	3	4	3
Groundwater dependent habitats	GoD Alluvial Woodland	2	2	2	1
	GoD Tufa Springs	3	3	3	1
	Druids Glen Tufa Springs	2	2	2	2
Qualitative Assessment		Moderately Negative	Moderately Negative	Moderately Negative	Major or Highly Negative
Score / Impact Level		2	2	2	1
Preference		Preferred	Intermediate	Preferred	Least Preferred

The assessment is based on the following predicted impacts on each of the key criteria:

Aquifers

- Gravel aquifer: There is no significant difference between the corridor options at this location, which is in the Druids Glen area, and the impact level is based on TII Guidance¹.
- Bedrock Aquifer: It is assumed that the tunnel associated with Corridor Option 6 (South) will require dewatering along the tunnel route to below the base of the tunnel during the construction phase. As such, this represents a significant drawdown. Corridor Option 2 (South) includes some significant deep cuts through the bedrock aquifer which is likely to result in significant dewatering. The impact level here is limited by the low aquifer importance, in accordance with TII Guidelines¹.

Groundwater dependent habitats

- Glen of the Down Alluvial Woodlands:
 - This represents a small subset area of the main SAC and following the hydrogeologist site walkover is considered to have a low groundwater dependence. The proximity of Corridor Options 1 and 5 (South) and the location of the site down-gradient of the construction area means the potential for small temporary impacts cannot be entirely ruled out.
 - The significant dewatering associated with the tunnel for Corridor Option 6 (South) may result in drawdown of the water-table at the woodland location and reduction in baseflow to the stream which the woodlands are dependent on.
 - The cuts associated with Corridor Option 2 (South) are located further away from the alluvial woodland and at a higher elevation and therefore a lower potential impact is assigned.
- Glen of the Downs Calcareous Spring: There is a significant potential impact to the tufa springs PZOC in the Glen of the Downs associated with the tunnel dewatering for Corridor Option 6 (South), which is assumed to lead to significant drawdown of the water-table in this area and may as a result dry out the spring during the construction stage. The other corridor options do not encroach on the PZOC and are located down-gradient of the site. Only a potential slight impact is assumed due to these corridor options.
- Druids Glen Calcareous Springs: All of the options transect the PZOC for this habitat and therefore there is no differential between the corridors based on this criterion.

1.5 Stage 2 Project Appraisal Matrix – transport assessment

Transport Scenario 5A and 5B have been assessed in relation to the impact on hydrogeological features of importance. The transport scenarios present little difference in terms of their impact on groundwater as there are no additional excavations or dewatering on the proposed corridor options and there are no additional works proposed in water dependant habitats.

Transport Scenario 4 has been assessed to consider the potential impact on hydrogeology. There is no discernible difference to hydrogeological features of importance if this option is included as a supplementary measure to Transport Scenarios 5A and 5B.

1.6 References

Environmental Protection Agency (EPA), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft 2017. Available from: <https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf>

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