17. INTERACTIONS OF THE FOREGOING

17.1 Introduction

All environmental factors are inter-related to some extent. As defined in the Environmental Protection Agency '*Guidelines on the Information to be contained in Environmental Impact Statements'*, a cumulative effect is defined as "*the addition of many small impacts to create one larger, more significant impact*". A synergistic impact occurs where "*the resultant impact is of greater significance than the sum of its constituents"*. Cumulative and synergistic effects are, therefore, those which result from the incremental effect of an action when added to other past, present, and reasonably foreseeable actions. The European Communities Environmental Impact Assessment (Amendment) Regulations, 1998, requires that an EIS describes the impacts and likely significant effects on the interaction between any of the following principal elements of the environment media:

- Human Beings
- Ecology – Flora and Fauna
- Soil and Water
- Traffic
- Air and Climate
- The Landscape

Ultimately, all of the effects of a development on the environment impinge upon human beings, directly and indirectly, positively and negatively. Direct effects include such matters as air and water quality, noise and landscape quality. Indirect effects pertain to such matters as flora, fauna, services and road traffic.

The purpose of this Chapter is to identify and draw attention to significant interactions and interdependencies in the existing environment and sets out the likely interactions of and between effects predicted as a result of the proposed development.

Impact interactions and inter-relationships have been considered throughout the EIA process and in the preparation of the individual, topic specific EIAR chapters so that it can take into account the broader picture of how the proposed scheme may affect the various environmental media.

All environmental topics are interlinked to a degree such that interrelationships exist on numerous levels. A summary matrix has been developed to identify key interactions that exist with respect to this specific project.

The matrix that has been developed is presented in Table 17.1 below.

The matrix is set out in such a fashion whereby receptors that are likely to be affected are listed in the top row across the table. Elements that are likely to impact upon these receptors (impactors) are identified in the first column of the matrix. By cross referencing the relevant receptor with the relevant impactor an indication is provided by a relevant symbol at the intersection point, which provides an indication of the potential impact and its weighted significance.

The remainder of this chapter under Section 17.2 provides a description of the interactions identified in the Matrix.

Table 17.1 Matrix of Interactions

Receptor: / Impactor:	Human Beings	Soil & Geology	Water	Noise & Vibration	Air & Climate	Flora & Fauna	Landscape & Visual	Material Assets	Cultural Heritage (Architecture & Archaeology)
Human Beings				-	-	✓ M	-	✓ M	-
Soil & Geology			-		-		-	-	-
Water		-				✓ M	✓ M	-	
Noise & Vibration	-								
Air & Climate	-	-				-			
Flora & Fauna	✓ M		✓ M		-		✓ M	✓ M	
Landscape & Visual	✓ M	-				✓ M			
Material Assets	-	-	-	-		✓ M			
Cultural Heritage (Architecture & Archaeology)	✓ M	-							

Key	Potential Impact	Definition
-	Neutral	An interaction which does not affect the quality of the environment
✓	Positive	An interaction change which potentially improves the quality of the environment
×	Negative	An interaction change which potentially reduces the quality of the environment

Key	Likely Significance	Definition
I	Imperceptible	Capable of measurement but without noticeable consequences
S	Slight	Causes noticeable changes in the character of the environment without affecting sensitivity
M	Moderate	Alters character of environment consistent with existing and emerging trends
SIG	Significant	By its character, magnitude and duration or intensity alters a sensitive aspect of the environments
P	Profound	Obliterates sensitive characteristics

The above matrix demonstrates that most inter-relationships are neutral or moderately positive in nature. In the interest of clarity all identified interactions are set out and discussed in Tables 17.2 to 17.9 below.

All residual impacts are described with reference to the implementation of the mitigation measures described in this EIAR document. The comprehensive assessments undertaken as part of this EIAR has revealed that the proposal will not result in any significant adverse effects on the environment. Mitigation measures have been proposed to avoid, remedy or reduce identified impacts.

17.2 Description of Interactions and Interrelationships and its Significance

This section provides a description of the interactions identified within the Matrix above and provides a rationale for the identified impact, be it neutral, positive, negative or not applicable and the significance of the impact, be it imperceptible, slight, moderate, significant or profound. All the impacts described below are residual impacts described with reference to and having regard to the implementation of relevant mitigation measures, as identified within individual topic specific chapters of this EIAR.

The consideration of impact interactions has been addressed during the preparation of the EIA in each of the individual impact chapters. The following section provides a series of tables identifying the key impact interactions and interrelationships.

17.2.1 Human Beings

The following table provides an overview of the receptor interactions and interrelationships with Human Beings.

Table 17.2 Human Beings - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Air & Climate Neutral	Impacts on air quality may occur due to emissions of dust from construction works, traffic and transport of materials. Impacts on air quality may also occur due to changes in traffic levels and exhaust emissions. Dust levels are likely to increase in localised areas during the various phases of construction but these increases will be short-term and will remain insignificant due to the mitigation measures employed, as proposed in Section 9.4 of the EIAR. Chapter 9 of the EIAR concludes that the operational phase of the proposed development would not result in any perceptible adverse impacts. Thus, the operation of the proposed development will not have any adverse impacts on the air quality or the climate of the region. Accordingly, the likely permanent effects of the proposed development on human beings are considered to be neutral.
Flora & Fauna Neutral	This interaction is described in Table 17.7.

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Soil & Geology Neutral	This interaction is described in Table 17.4.
Noise & Vibration Neutral	Construction works during the development will temporarily contribute to noise levels, but the effects in the vicinity of neighbouring residences will be relatively short-term, transient and restricted to daylight hours. Once the construction phase has been completed, the only noise sources will be associated with building services noise and traffic on the internal road network. Noise levels associated with both sources will be imperceptible at nearby receptors. The potential for vibration levels to be experienced in the vicinity of neighbouring residences during the construction phase is limited to construction vehicles and will not be detectable at the closest residence. No permanent vibration impacts have been identified or is envisaged to result from the operation of the proposed development Accordingly, the likely permanent effects of the proposed development on human beings are considered to be neutral.
Landscape & Visual Neutral	Potential visual impacts during the construction phase are related to temporary works, site activity and vehicular movement within and around the boundaries of the subject site. The development is envisaged to be constructed in 3 phases, which will limit the amount of construction being carried out in one tranche. The impact of the construction stage for each of the phases will therefore be short–term. The impact during construction phase will be mitigated through appropriate site management measures and work practices to ensure the site is kept tidy and that public areas are kept free from building material and site rubbish. The proposed development will result in the insertion of 9 new 5-10 storey buildings into the existing environment, together with associated access and service roads and drop-off car parking, shared surfaces, recreational amenity spaces, and a shared surface plaza. The proposed development will not be out of context in terms of the developing character of this area of the campus. The development itself will impact on the landscape in varying degrees and due to the nature of the development it will be deemed to have a permanent visual impact on the existing environment. Once the landscape planting scheme has established and is properly maintained, along with the proper maintenance of the new buildings and hard landscape, there is

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
	the potential for a neutral impact
Material Assets (Traffic; Water & Utilities) Positive (Moderate)	In terms of **Traffic**, Chapter 12 of the EIAR concludes that additional construction traffic movements to and from the temporary construction access and associated revised junction arrangement will have negligible impact due to the relatively low traffic volumes. Mitigation measures, including a phased parking strategy and temporary construction parking will ensure adequate car parking provision for the duration of the construction period. Furthermore, notwithstanding the significant planned increase in campus population, the proposed UCD Student Residences Masterplan will ensure that there will not be any material increase in external traffic impact on the surrounding road and street network during the morning and evening peak commuter periods. The UCD Student Residences Masterplan when completed will effectively remove the commuter peak periods traffic demand for c.3,000 students as they will be based on campus. In terms of **Water Infrastructure & Utilities**, there is adequate capacity in existing infrastructure and therefore the proposal will have no significant impacts on human beings. Accordingly, the envisaged residual impact associated with the proposed development is likely to be positive and moderate.
Cultural Heritage Neutral (Moderate)	The primary impact during the construction phase of development is the potential impact on archaeological deposits or features that may survive beneath the current ground level within the area, especially in the open areas that exist. In this regard mitigation measures are proposed whereby the removal of any overburden within the proposed development area be monitored by a suitably qualified archaeologist. In terms of Architecture & Cultural Heritage, no works are proposed to any Protected Structure. The proposed construction will impact on the four architectural elements of merit identified, namely Roebuck Castle (a Protected Structure), the remnant stone wall of the eastern boundary, the Glebe Lodge (a Protected Structure) and the Crannog Lodge. Chapter 15 finds that having the overall impact of the proposed development, when mitigation measures are taken into account, is neutral.

17.2.2 Soil and Geology

The primary environmental interactions associated with Soil and Geology is Water with respect to potential contamination and Archaeology in terms of removal or damage / loss of archaeological remains.

The following table provides an overview of the receptor interactions and interrelationships with Soil and Geology.

Table 17.3 Soil and Geology - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Neutral	This interaction is described in Table 17.2.
Water Neutral	The construction phase of development will result in significant earthworks and removal of sub and top soil. Thus, there is a potential impact on the groundwater environment during construction arising from spills or leaks of fuels and oils from machinery and vehicles. Mitigation measures include the establishment and implementation of a Construction and Environmental Management Plan to minimise the potential risk of adversely impacting the soil/subsoil, geology and hydrogeology environments. It is not anticipated that there will be any significant residual impact on the geology or hydrogeology environments.
Air & Climate Neutral	Construction activities are likely to increase air pollution through dust deposition levels in the area above what would normally be expected from earthmoving works and landscaping. Dust levels are likely to increase in localised areas during the various phases of construction but these increases will be short-term and will remain insignificant due to the mitigation measures employed. There are no measurable adverse impacts predicted for the operational phase of the proposed development. In this regard the implementation of landscaping proposals will contribute towards air quality and micro climatic conditions over time as vegetation and planting becomes established and mature.
Landscape & Visual Neutral	Development of the site would involve extensive stripping of the topsoil and excavation of subsoil layers and stockpiling thereof to facilitate site development works. Landscaping for the developments will reduce the initial and temporary impacts from the construction phase. The range of proposed mitigation measures in this EIAR would ensure that there is a 'Neutral Impact' on Landscape as a result of Soils and Geology.
Material Assets Neutral	This interaction is described in Table 17.9.

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Cultural Heritage Neutral	The primary impact during the construction phase of development is the potential impact on below surface archaeological remains due to soil disruption and heavy traffic movements. No likely residual impacts are identified for the operational phase of development. The detailed range of mitigation measures provided in this EIAR document will ensure that the impact is likely to be 'Neutral'.

17.2.3 Water

The primary environmental interaction associated with water is flora and fauna.

The following table provides an overview of the receptor interactions and interrelationships with Water.

Table 17.4 Water - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Soil & Geology Neutral	This interaction is described in Table 17.3.
Landscape & Visual Positive (Moderate)	Subject to the implementation of water and landscaping mitigation and enhancement measures described in the relevant sections of this EIAR, the impact of landscaping and Sustainable Urban Drainage Systems principles on water bodies and water quality should be moderately positive.
Flora & Fauna Positive (Moderate)	One of the key and more direct interactions with Flora and Fauna is water. Surface water run-off of untreated, or poorly treated surface water can result in the release of pollutants (e.g. particulates and hydrocarbon compounds) into local water courses. The incorporation of Sustainable Urban Drainage Systems (SUDS) principles on site will contribute towards cumulative positive impacts to water quality and will ensure a moderate positive improvement over the existing drainage situation.
Material Assets Neutral	The proposed development is designed to comply with the recommendations of the GDSDS including the provision of SUDS and is therefore unlikely to have any residual impacts in terms of the impact on surface water drainage.

17.2.4 Noise and Vibration

Noise and vibration impacts have the potential to affect quality of life. Thus, in order to assess the likely noise impact associated with the proposed development. Thus, the most prominent interaction between noise and vibration is with human beings and other living organisms in the area or fauna.

The following table provides an overview of the receptor interactions and interrelationships with Noise and Vibration.

Table 17.5 Noise and Vibration - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Neutral	This interaction is described in Table 17.2.

17.2.5 Air and Climate

Air quality in the area is influenced by traffic volumes and to a lesser extent by the fuels used to meet the energy requirements of the buildings and humans for heating purposes. Thus, the most prominent interaction between air and climatic factors is with human beings. Humans are the most sensitive receptors in the study area and could potentially be affected by the quality of air.

The following table provides an overview of the receptor interactions and interrelationships with Air and Climatic factors.

Table 17.6 Air and Climate - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Neutral	This interaction is described in Table 17.2.
Soils & Geology Neutral	This interaction is described in Table 17.3.
Flora & Fauna Neutral	Construction activities are likely to increase air pollution through dust deposition levels in the area above what would normally be expected. One of the contribution sources in this regard is earthmoving works and landscaping. Wind transfer of pollutants due to removal of vegetation could also contribute in this regard. Dust levels are likely to increase in localised areas during the construction stage but these increases will be short-term and will remain insignificant due to the mitigation measures employed. There are no measurable adverse impacts predicted for the operational phase of the proposed development.

17.2.6 Flora and Fauna

The following table provides an overview of the receptor interactions and interrelationships with Fauna and Flora.

Table 17.7 Flora and Fauna - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Positive (Moderate)	Flora and Fauna has a direct and indirect impact on Human Beings by influencing the quality of the environment and by providing habitats and enhancing biodiversity as an important indirect role in eco-system services. The site can be described as highly disturbed in nature, with buildings, roads, playing fields and other artificial surfaces. Horticultural hedges and ornamental trees are mostly of low biodiversity value although mature trees, of a variety of species, are of local significance. Generally, areas of woodland are not to be reduced in size as a result of this project and any removals will be offset by significant new tree planting. The proposed soft landscaping of the site will have positive effects on biodiversity by creating habitat and attracting birds and insects. This should be encouraged as contact with nature has been demonstrated to be of considerable benefit for human mental health and well-being.
Water Positive (Moderate)	This interaction is described in Table 17.4.
Air & Climate Neutral	This interaction is described in Table 17.6.
Landscape & Visual Positive (Moderate)	Currently the site is of low biodiversity value due to poor habitat provision on site. The extent of soft landscape areas and tree planting proposed has the potential to support an increased level of biodiversity, in the form of insects and birds. A high proportion of trees selected will be native (Ash, Rowan and Birch) as in general native trees will attract more insects and birds than non-native species. Low level groundcover planting will provide food and cover for insects.
Material Assets Positive (Moderate)	This interaction is described in Table 17.9.

17.2.7 Landscape and Visual Impact

The key interaction with Landscape is Flora and Fauna.

The following table provides an overview of the receptor interactions and interrelationships with Landscape and visual impacts.

Table 17.8 Landscape and Visual Impact - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Positive (Moderate)	This interaction is described in Table 17.2 above.
Soils & Geology Neutral	This interaction is described in Table 17.4.
Flora & Fauna Positive (Moderate)	Landscaping and enhancement measures may result in moderate positive impacts in terms of increased biodiversity value of the site, nature conservation and a greater awareness by the visiting public. This interaction id described in more detail in Table 17.7 above.

17.2.8 Material Assets

The following table provides an overview of the receptor interactions and interrelationships with material assets.

Table 17.9: Material Assets - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Neutral	This interaction is described in Table 17.2.
Soils & Geology Neutral	Construction of the proposed development will require the removal of topsoil and earthworks to facilitate the construction of the road and infrastructure service provision, storage systems, etc. These initial and short term adverse impacts would be ameliorated through the re-use of soils for fill, levelling and landscaping works resulting in a neutral impact.
Water	This interaction is described in Table 17.4

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Neutral	
Flora & Fauna Positive (Moderate)	Construction works and site clearance would have a negative impact on fauna and flora. However, mitigation, landscaping and enhancement measures identified in this EIAR would enhance the biodiversity value of the site, resulting in a moderate positive impact.

17.2.9 Cultural Heritage

The key interaction with Cultural Heritage is Human Beings. Generally, the retention, preservation and conservation of archaeological features and the protection and preservation of other heritage features, such as protected structures, is likely to have a beneficial impact on humans.

The following table provides an overview of the receptor interactions and interrelationships with cultural heritage.

Table 17.10 Cultural Heritage - Key Impact Interactions and Interrelationships

Interaction Nature & Significance of Interaction	Description of Key Impact Interactions and Interrelationships
Human Beings Negative (Moderate)	This interaction is described in Table 17.2.
Soil and Geology Neutral	This interaction is described in Table 17.3.

17.3 Conclusion

In summary, it is concluded that the proposed development will not result in any significant synergistic or cumulative adverse impacts on the environment. Accordingly, and as the comprehensive assessments undertaken as part of this EIAR has revealed, the proposal will not result in any significant singular adverse effects on the environment, it is considered that the environmental impact of the proposed development is acceptable.