18 INTERACTIONS AND INTER-RELATIONSHIPS OF IMPACTS

18.1 INTRODUCTION

This chapter analyses two types of cumulative effects. The first type is the assessment of effects on receptors or receptor groups, such as local residents, which may be effected by different environmental elements generated by the proposed road project simultaneously or concurrently. This is sometimes referred to as the "inter-relationships" or "in combination effects" between different environmental effects. The assessment includes consideration of particular locations/ receptors where several effects for example noise, air and landscape may all occur.

The second type is the assessment of effects of the proposed road project together with other past, present or reasonably foreseeable projects, where there is potential for overlap spatially or temporally, often referred to as cumulative effects.

The potential for inter-relationship/in-combination effects is described below in **Section 18.2** and the potential for significant cumulative effects is described in **Section 18.3**.

18.1.1 Methodology

For the assessment of Cumulative Effects the methodology and approach is informed by the *Guidelines for the Assessment of Indirect and Cumulative Impacts* (*EC, 1999)* and '*Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*' prepared for the European Commission, EC DG X1Environment, Nuclear Safety and Civil Protection. The latter guidelines provide information on methods, the assessment process and information needed to assess cumulative impacts.

The study area is defined by the study areas of each of the individual environmental topic assessments, which are discussed in the relevant topic EIS **Chapters 5 - 17**.

The receptors considered as part of the In Combination Effects assessment have been sub-divided into four groups:-

a) Residential property and surrounding local community;
b) Ecological features;
c) Economic impact; and
d) Water features.

Within these broad groups, individual receptors or groups of receptors that are affected by the proposed road project have been considered at both construction stage and operation stage. The potential effects acting upon these receptors include; noise, air quality, visual intrusion, water quality, soils, geology and hydrogeology, traffic, waste and socio-economic.

The technical environmental chapters (**Chapter 5 – 17**) have assessed the residual impact as part of their assessment.

For the purposes of this assessment a 'significant In-Combination Effect' has been defined as 'multiple residual effects which will cause a significant effect on the same receptors resulting in a 'significant adverse combined effect'.

The significance of the In-Combination and Cumulative Effects is based on a consideration of the receptor sensitivity and the magnitude of the In-Combination and Cumulative Effects upon them, as presented in the matrix in **Table 18.1** below.

Table 18.1: Significance of Effects Matrix

Magnitude of Effect	Sensitivity of Receptor			
	Negligible	Low	Medium	High
Neutral	Insignificant	Insignificant	Insignificant	Insignificant
Minor (Adverse/ Beneficial Effect)	Insignificant	Insignificant	Minor	Minor
Moderate (Adverse/Beneficial Effect)	Insignificant	Minor	Moderate	Moderate
Major (Adverse/ Beneficial Effect)	Insignificant	Minor	Moderate	Major

The identification of past, present and reasonably foreseeable developments was informed by consultation with a range of organisations including Cork County Council, Utilities Organisations, National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI) as well a review of the relevant Local Authority, An Bord Pleanála (ABP), and Environmental Protection Agency (EPA) registers. The principal developments from which there is a potential for cumulative impacts to arise in combination with the proposed road project are listed in **Table 18.4**.

The determination of interrelated/in combination and cumulative impacts was facilitated through an iterative design process that included a series of workshops throughout the design process. This allowed for dynamic interaction between all parties/topics. Furthermore, the process was informed by extensive consultation with land and property owners, statutory and non-statutory consultees and in particular with the NPWS and IFI. Where a potential exists for interaction/in combination effects between two or more environmental topics or where there is potential cumulative impacts, these have been taken into account as part of the specialist assessments and where possible complimentary mitigation measures have been proposed i.e. noise and landscape.

18.2 IN-COMBINATION EFFECTS/INTER-RELATIONSHIPS

This section describes the significant residual effects that will remain post-mitigation.

The combination of residual effects identified within the environmental technical chapters (**Chapter 5 - 17**) are summarised diagrammatically for both construction and operational phases of the project in **Table 18.2** and **Table 18.3** respectively.

Table 18.2: Construction Stage In-Combination Effects

Phase	Impacts	Receptor	Potential Combined Effects	Mitigation	Residual Combined Effect
Construction	Construction works along the proposed road project	Residential Properties/Communities	**Air Quality & Climatic Factors:** Dust-short term, minor adverse. Greenhouse gas emissions- permanent, minor adverse impact.	Individual environmental topic mitigation measures and **Section 3.13** of **Chapter 3: Description of the Proposed Road Development**.	Overall construction related impacts are short term with **no significant adverse residual impact.**
			Noise and Vibration Effects: Localised construction noise moderate to major adverse; Traffic noise will be minor to moderate adverse; Vibration impacts Minor to Moderate Adverse.		
			Visual Effects: Short term minor to moderate adverse effects locally.		
			Health: Taking into account the level of emissions (air and noise) generated on-site, their intermittent nature/duration and the mitigation measures set out in the EIS, the risk to community health is not of a level to quantify any meaningful adverse health outcome.		
			Traffic Effects: Short term slight to moderate adverse		
			Waste Effects: Minor adverse. Use of material from Raffeen Quarry considered a minor benefit on residential receptors and communities due to reduced HGVs on the road and sustainable use of resources.		
		Ecological	**Designated sites**: No effect; Ecological Receptors: minor to moderate adverse on 3 ecological receptors; Japanese Knotweed minor beneficial.	Individual environmental topic mitigation measures and **Section 5.11** of **Chapter 5: Traffic and Transport**. Habitat and Species Management Plan Traffic Management Plan Dust Minimisation and Management Plan Water Quality monitoring	**No effect to Minor Beneficial** resulting in no significant residual effect.
			Water: Insignificant.		
			Soils, Hydrology and Hydrogeology: Insignificant negative of temporary to permanent duration.		
			Construction Dust: Impact of construction dust on sensitive ecosystems is negligible.		
			Construction Dust: Impact of construction dust on sensitive ecosystems is negligible.		

Phase	Impacts	Receptor	Potential Combined Effects	Mitigation	Residual Combined Effect
		Economic	**Employment**: Short term significant benefit. **Traffic and Transportation:** Short term minor to moderate adverse.	Individual Environmental topic mitigation measures and **Section 3.13** of **Chapter 3: Description of the Proposed Road Development**. Implementation of Traffic Management Plan (**Chapter 5: Traffic and Transport**)	**Overall no significant adverse residual impact.** During the construction phase there will be **significant positive impacts** due to increased employment. Traffic diversions required during the construction phase may result in short term minor to moderate impacts on local industry. This will however be temporary in nature and undertaken/ planned in consultation with local industry/ employers and detailed traffic management plans.
		Water Features	**Water:** Elevation of suspended solids through demolition & Soil stripping; release of pollutants is considered insignificant as it will be a requirement of the Contractor to protect water quality during the construction phase.	Individual environmental topic mitigation measures and **Section 3.13** of	**Neutral to Negligible** resulting in no significant residual effect.

Phase	Impacts	Receptor	Potential Combined Effects	Mitigation	Residual Combined Effect
			Designated sites: No effect.	**Chapter 3: Description of the Proposed Road Development**.	
			Soils, Hydrology and Hydrogeology: Imperceptible adverse of temporary to permanent duration.		

Table 18.3: Operation Stage In-Combination Effects

Phase	Impacts	Receptor	Potential Combined Effects	Mitigation	Residual Combined Effect
Operation	Operational Phase of the proposed road project	**Residential Properties/community**	**Air Quality & Climatic Factors** Dust Effects and local emissions: Negligible. Greenhouse Gas emissions- Long-term , minor adverse impact Overall a net decrease in the impact of road traffic noise on properties after the construction of the road project. – Minor Benefit	Individual environmental topic mitigation measures Specific Landscape Mitigation Planting	**Minor to Moderate** adverse and **Minor to Moderate Benefit** combined effect resulting in no significant residual effect.
			Noise Effects: Overall net reduction in the number of properties that will be exposed to noise levels greater than 60 dB(A) L_{den} and 57 dB(A) L_{night}. – minor to moderate benefit. At the High Priority Areas identified in the Cork County Noise Action Plan and the Cork Agglomeration Area Noise Action Plan noise levels will be reduced to meet the noise action plan threshold.		
			Visual Effects: Minor to moderate adverse effects at some locations.		
			Traffic Effects: Overall moderate benefit on traffic flows and journey times along the proposed road.		
			Waste: Insignificant		
			Water: Slight benefit- As a result of the proposed development surface water run-off from traffic on the existing N28, which was previously untreated, this traffic will now travel on a road which has been designed to have adequate capacity to collect, treat and discharge run-off generated by the proposed M28 Road Project.		

Phase	Impacts	Receptor	Potential Combined Effects	Mitigation	Residual Combined Effect
			Seveso: The new road will improve the overall emergency response in the Ringaskiddy area and will have a net minor benefit impact in the area		
			Health: The new road will improve capacity and reduce congestion, will reduce residential exposure to air quality and noise over and above what can be achieved through the Do Minimum scenario.		
		Ecological	**Designated sites**: No effect **Protected species**: no significant effect.	Individual environmental topic mitigation measures	**No effect to Minor** Beneficial resulting in no significant residual effect.
			Noise: No effect on designated sites.		
			Hydrology and Drainage: Minor beneficial; short to long term		
			Soils, Geology and Hydrogeology: Imperceptible negative of permanent duration.		
			Air Quality: Slight decrease from the predicted deposition levels from the existing N28 alignment- slight positive.		
		Economic	**Employment**: Moderate to major positive long-term. **Visiting community and Tourism:** Moderate to major positive long-term.	N/A	**Moderate to Major beneficial.**
			Hydrology and Drainage: Minor beneficial; short to long term.		
			Traffic and Transport: Overall moderate benefit on traffic flows and journey times along the proposed road.		
			Seveso: The new infrastructure will improve the overall emergency response in the Ringaskiddy area and have a net minor benefit impact in the area.		
		Water Features	**Hydrology and Drainage**: Minor beneficial; short to long term.	Individual environmental topic mitigation measures	**Minor beneficial** resulting in no significant residual effect.
			Soils, geology and hydrogeology: Imperceptible negative of permanent duration.		

The construction phase has potential in-combination impacts that will result in short-term moderate to major adverse effects upon the residential receptors. These individual impacts will be mitigated through the measures proposed in the EIS and NIS together with any conditions and/or restrictions attached to any approval/consent as may be granted. Those living in closest proximity to the construction site will experience a period of combined moderate to major adverse impact. The construction stage will also have short-term beneficial effects in terms of employment for the local economy. Overall the operational phase has potential for in combination impacts that will result in long term minor to moderate benefit effects as well as long minor to moderate adverse effects (landscape and visual) on residential receptors, economy and water resulting in no significant residual impacts.

18.3 CUMULATIVE EFFECTS

A list of projects that have been considered as part of the cumulative assessment is provided in **Table 18.4** below**.** Large scale applications and developments considered relevant to the assessment by virtue of their nature and scale were considered as part of the assessment.

The following cumulative impacts assessment has been prepared based on the headings of the technical chapters of this EIS as set out below-

- Traffic and Transport
- Socio Economic and Community
- Agricultural Land Uses
- Hydrology and Drainage
- Aquatic Ecology
- Soils, Geology and Hydrogeology
- Terrestrial Ecology
- Air and Climate Factors
- Noise and Vibration
- Cultural Heritage
- Landscape and Visual
- Material Assets

18.3.1 Cumulative Effects of the M28 Road Project and Individual Projects

Table 18.4 below addresses in detail the potential for cumulative effects, where relevant, of the proposed M28 Road Project occurring with each existing or potential project in the study area under Human Environment and Natural Environment.

Table 18.4: Existing and Future Projects in the Study Area Considered as Part of the Cumulative Effects

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
Cork Lower Harbour Main Drainage Scheme (CLHMDS)	Ongoing: Granted 24/06/2009, currently under construction due to be completed in 2019.	Construction of a new Wastewater Treatment Plant at Shanbally, Circa. 14 new pumping stations and the upgrading of 4 existing pumping stations. Approximately 30km of new sewers and a drilled crossing under the Estuary.	This scheme is currently undergoing construction and will be completed prior to the commencement of the construction phase of the M28 therefore cumulative effects during the construction phase are not considered further. During the operation of the WWTP positive impacts will include improved water quality in Cork Lower Harbour resulting in positive effects to human health and facilitating in the enhancement and increased residential commercial and recreational development in the harbour. This project in combination with the proposed M28 Road Project has therefore the potential to result in positive cumulative impacts as the road will also result in an improvement to water quality through provision of a new improved drainage system. There will be negligible increases in NO_2 and PM_{10} as a result of the CLHMDS therefore no cumulative adverse air quality impacts will occur. No impacts from noise are anticipated as part of the CLHMDS during its operation stage therefore no cumulative effects with the proposed	This scheme is currently undergoing construction and will be completed prior to the commencement of the construction phase of the M28 therefore cumulative effects during the construction phase are not considered further. During the operation of the WWTP the overall Conservation value of Cork Harbour and water quality will improve this in combination with the improved road drainage design proposed as part of the proposed M28 Road Project it is likely to result in a potentially positive cumulative effect to aquatic ecology and water quality. Loss of hedgerows is considered to be imperceptible as part of the CLHMDS and not significant from the proposed M28 Road Project therefore with the planning and mitigation proposed within this EIS no significant cumulative effects will occur to ecology. Any potential for spillages and impacts to surface water and groundwater has been addressed	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required. No additional mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			M28 Road Project are anticipated. After mitigation there are no residual impacts on archaeology arising from either of the projects therefore there is no potential for significant effects. The EIS for the CLHMDS project has predicted long term and permanent landscape effect with moderate to significant visual effects. The project components are however in the majority of cases are well separated from the proposed M28 Road Project and are also predominantly set low in the landscape to prevent any significant cumulative landscape or visual effects.	through the drainage design of both projects.	
Ballyhemiken/ Raffeen Quarry	Ongoing: Granted quarrying permitted from July 2008 to 2038.	Continuation of quarrying activities to include processing of aggregates, landscaping, restoration and associated works.	The cumulative effects on Raffeen Quarry are assessed on the basis that the quarry has permission and therefore can extract anytime between now and 2038. It is proposed to utilise material from the quarry where feasible for the construction phase of the proposed M28 road project. This has a slight positive cumulative effect for air quality and climate, noise and traffic as a result of reduced transport requirements on the local and regional road network and in turn air and noise emissions during the construction phase of the road and the operation phase of the quarry. There is however a heightened risk of	Quarrying operations at Raffeen would result in the disturbance (direct and indirect) of semi-natural habitats under the quarry footprint, access routes and adjoining areas including in-situ wetland habitats, scrub, semi-natural grassland and areas of recolonising bare ground which support pennyroyal (*Mentha pulegium*), a plant species protection under the Flora Protection Order, 2015. Quarrying operations may affect breeding bird activities upon areas of quarried cliff face, principally through indirect	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required. No additional mitigation required.** **Implementation of a Habitat and Species Management Plan as part of the M28 Road Project at the Quarry**.

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			windblown dust from materials handling and noise from the construction phase of the proposed road project and of the quarrying activity occurring simultaneously impacting on properties in the immediate vicinity of the quarry. This risk will be mitigated through the mitigation measures which will be carried out under the quarry's current planning permission and the mitigation measures proposed as part of this application with respect to dust and noise minimisation.	disturbance, which have previously supported breeding Peregrine. Quarrying activities may also result in increased release of dust and particulate matter which can reduce photosynthetic potential for plants associated with in-situ and adjacent semi-natural habitats. Construction of the road will also result in the disturbance and removal of semi natural habitats and pennyroyal resulting in the potential for cumulative effects to these species during the construction phase of the road and the operation phase of the quarry. A Habitat and Species Management Plan has been development for the M28 Road Project to reduce negative effects from the road resulting in Negligible Impacts over the short to medium term and thus the potential for cumulative impacts associated with quarrying activities is avoided. There is potential for cumulative impacts on sensitive ecosystems from dusts and particulate matter during the construction and operational phases of the road	

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
				and quarrying activities. Dusts and particulate matter can be deposited on the leaves of plants reducing the photosynthetic potential. The literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 1000 $mg/m^2/day$. As such, once dust deposition rates are maintained within the standard guideline for human nuisance ($350mg/m^2/day$), as set out in the mitigation measures specified in **Chapter 13: Air and Climatic Factors**, the impact of construction dust on sensitive ecosystems is considered negligible.	
DePuy Synthes Turbine	Future. Granted 19/08/2016. Unknown start. Construction Phase 6 months.	Erection of a wind turbine with hub height of up to 100m, rotor radius of up to 50.5m and overall height from ground to tip of rotor of up to 150.5m, upgrade of existing site roads, and all other associated works.	No significant cumulative effects to humans are expected during the construction phase as it is anticipated that should planning be granted the turbine will be constructed prior to the commencement of works on the proposed M28 Road Project. During the operation stage there is potential for impacts from the turbine on landscape and visual receptors. The construction of the other turbines in the harbour area had been completed at the time of the assessment for the	No significant cumulative effects to natural environment are expected during the construction phase as it is anticipated that should planning be granted the turbine will be constructed prior to the commencement of works on the proposed M28 Road Project. No impacts to habitats, birds, water or mammals were identified in the EIS for the turbine therefore no significant	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			proposed development and these turbines formed part of the baseline for this landscape and visual impact assessment. The DePuy wind turbine if constructed will be consistent with the wind farm landscape now found around Ringaskiddy and is a separate distinctive feature than the proposed development that is located at lower levels and not visually dominant across the wider landscape like the turbine. No significant cumulative effects were predicted for the combination with this planned project. The carbon impact of this turbine is positive and cumulatively will reduce the adverse impacts predicted with the proposed M28 Road Project. There are no recorded Archaeological sites within the proposed development site therefore there is no potential for cumulative effects on archaeology and cultural heritage. Residual impacts to noise and air are considered negligible therefore no significant cumulative effects will occur on the human environment.	cumulative effects will occur on the natural environment.	
Redevelopment of existing port facilities at Ringaskiddy	Ongoing: Granted 28/05/2015 currently under construction	Redevelopment of existing port facilities at Ringaskiddy, Co. Cork, incorporating: ▪ Ringaskiddy East	Construction stages of Phase 1 and 2 will be completed prior to the commencement of the M28 Road Project and construction of Phase 3 of the Port of Cork plans will not	Construction stages of Phase 1 and 2 will be completed prior to the commencement of the M28 road project and construction of phase 3 of the Port of Cork plans	**Implementation of the mitigation measures as set out in planning documents for both projects.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
	due to be completed over 3 phases with Phase 3 - Ringaskiddy East: RoRo dependent on the M28 being operational.	(Container berths and Multi-Purpose berth); ▪ Ringaskiddy West (Deepwater Berth Extension) ▪ Paddy's Point amenity area; ▪ Road improvements and external road works; and ▪ Associated development works	commence until the M28 road project is in operation therefore cumulative effects on the human environment during the construction phase will not occur. The construction of the Port of Cork project had commenced at the time of the assessment for the proposed road project and the harbour has formed part of the baseline for the landscape and visual impact assessment. There is limited visual or landscape connection between the proposed road project and the Port of Cork project however the proposed Service Area is located within the port area. The separation distance and intervening topography between the majority of the proposed road project and the port area prevent significant cumulative impacts. The SA is similar in character to the characteristics of the port area and will blend with the wider port redevelopment plans. No significant cumulative effects were therefore predicted on the landscape and visual resource. Traffic volumes associated with the Port of Cork have been factored into the baseline traffic modelling and in turn the air and noise predictions for the proposed road and therefore no	will not commence until the M28 road project is in operation therefore cumulative effects during the construction on the natural environment will not occur. No significant residual effects upon terrestrial or aquatic ecology or soils, geology and hydrogeology during the operation phase are predicted from both projects therefore no significant cumulative effects are likely to occur.	**No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			cumulative effects are predicted to human receptors from air and noise during the operation phase. There are no known archaeological features within the port area. The potential for cumulative effects associated with unknown finds will be addressed during the construction stage of the proposed road project and the redevelopment of the port lands existing planning permission conditions.		
Dunkettle Interchange Improvement Motorway Scheme 2012 - CPO / EIS	Future: Granted 30/04/2013, construction expected to commence in Q3 of 2018 and due to be completed Q1 2022. (3.5 year construction period).	Improvement Motorway Scheme to include 43 major structures of various forms comprising: ▪ 1 overbridge, 7 underbridges, 2 railway bridges, 1 footbridge, 7 retaining walls, several culverts and 24 gantries; ▪ Modification of the northern approach structure to the Jack Lynch Tunnel; ▪ Pedestrian and cyclist facilities, together with ancillary and consequential works.	It is expected that the construction phase of the Dunkettle Interchange will be complete prior to the commencement of the construction phase of the M28 therefore no cumulative effects during the construction phase are anticipated on the human environment. The future year traffic analysis assumes no "bottleneck" for traffic at Dunkettle and therefore the Dunkettle scheme has been included in the baseline assessment for Traffic. Positive long-term cumulative effects are anticipated to human beings and economy of the Cork area should both projects be constructed due to reduced traffic delays, bottlenecks, commuting times and improved access to IDA lands, Pharma, Strategic Employment Area of	It is expected that the construction phase of the Dunkettle Interchange will be complete prior to the commencement of the construction phase of the M28 therefore no cumulative effects during the construction phase are anticipated on the natural environment. This development is unlikely to contribute to cumulative or in-combination effects on the natural environment as best practice and mitigation measures, including in particular provision of landscaping and attenuation for both projects. Residual impacts on water quality for the Dunkettle Interchange are	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			Ringaskiddy and Little Island, etc. The noise and air quality Chapters of the EIS assumes the proposed upgrade of the Dunkettle Interchange and the associated traffic flows in their overall assessments.	considered to be neutral, long term, negligible as are the residual impacts from the M28.	
East Tip Remediation Project	Ongoing: Granted on the 01/05/2014. The remediation of the East Tip is due to commence under licence from the EPA (Licence Register W0289-01) in early 2017 and will take 18-24 months to complete with a likely start date of late Q2/early Q3 2017.	Remediation of the East Tip site including demolition and site clearance, construction of a perimeter engineered structure (PES) and an engineered capping system with surface water drainage system, provision of a public park on the site and improved access.	Due to the timing of the works for the remediation project which is expected to be completed in advance of construction of the M28 no cumulative effects are anticipated during the construction phase on the human environment. Long term positive cumulative effects to humans are considered likely due to the provision of an amenity site which can be readily accessed via the proposed M28 Road Project. The primary objective of the East Tip project is to remediate the East Tip thereby ensuring that potential risks to humans and the wider environment are minimised. Therefore the drainage design of the proposed road project and the remediation of the East Tip cumulatively will reduce the risk of contamination of waster courses and associated risks to humans resulting in potential positive cumulative effects to humans due to improved water quality. The residual impact of the remediation	Due to the timing of the works for the remediation project which is expected to be completed in advance of construction of the M28 no cumulative effects are anticipated during the construction phase on the natural environment. The design principles and the mitigation measures employed during the construction and operation phase of the M28 road project and the East Tip Remediation Project will prevent any negative cumulative effects with neighbouring developments on soils, geology, hydrogeology and water. It is anticipated that the remediation project will result in an overall positive effect to Cork Harbour by reducing the potential for pollution from the East Tip site and this together with the robust drainage design to be provided by the road	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			project will be a long-term positive moderate impact to air quality. The residual impact to local receptors in Ringaskiddy Village from the proposed road project is considered to be negligible as outlined in **Chapter 13: Air and Climate**, therefore the cumulative effects at a local level to the closest receptors to both projects in Ringaskiddy Village is considered to be negligible to slightly positive.	project will result in positive cumulative effects to Cork Harbour.	
Martello Tower Site Reprofiling	Future: Granted 27/10/2016, dependent on East Tip schedule. 11month construction phase which is due to start in Q1/Q2 2018.	Excavation of soil and topsoil materials from the site and transporting same to the East Tip site on Haulbowline. Subsequent re-profiling and remediation of the site.	The Martello Tower Site Re-profiling is linked to the East Tip Remediation project as the materials excavated from the proposed site will be transferred from one site to the other. Due to the timing of the works which are expected to be completed in advance of construction of the M28 no cumulative effects are anticipated during construction. It is proposed to reinstate the development site to rough grassland habitat therefore no long-term cumulative impacts will occur on the human environment.	As part of the Martello Tower project it is proposed to reinstate the development site to rough grassland habitat. The post remediation stage of the development will not result in impacts to ecological receptors either within the study area footprint, or those areas fringing or adjoining the proposed development site therefore there is no potential for cumulative effects with the proposed road project.	The implementation of traffic management plans and dust minimisation plans required for both projects will ensure that cumulative effects from dust and traffic on the human environment is minimised during the construction phase should the timeframes for the projects overlap. **Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
Indaver Waste to Energy Facility	Awaiting Planning Decision. Expected duration of construction 10 years.	Construction of a Waste to Energy Facility	The site for the proposed building of the Waste to Energy Project lies directly to the east of the proposed M28 Road Project. This proposal has however yet to receive planning permission. Should the proposal receive planning the construction phases of both projects are likely to overlap. This could potentially result in cumulative positive effects to employment in the area. However should the construction phases overlap increased traffic associated with both project is likely to result in negative cumulative effects to human beings due to increased noise and dust. The M28 road project however poses strict controls on construction noise and dust and from a review of the planning permissions for the Indaver application it is considered that appropriate control measures would also be in place for both developments. There is potential for the landscape and visual impacts arising from the operational phase of the Indaver facility, to have an effect on the cultural heritage features of the area such as Martello Tower and Spike Island, and on the tourism potential and the residential and recreational amenity of the area. It is considered that given the	It is likely that the construction of the M28 road project and the Indaver Waste to Energy Facility (should permission be granted) will result in severance of wildlife corridors and loss of hedgerows and treelines. However appropriate mitigation measures in the form of planting and landscaping as part of this M28 road project and the Indaver development in the area will reduce the potential for significant cumulative effects. No significant impacts to designated sites, flora and fauna and biodiversity are predicted from both projects therefore the potential for significant cumulative effects is low. The implementation of mitigation measures for both projects will ensure the potential for significant effects to soils, geology, hydrology and hydrogeology remain low.	The implementation of traffic management plans and dust minimisation plans required for both projects will ensure that cumulative effects from dust, noise and traffic on the human environment is minimised during the construction phase should the timeframes for the projects overlap. **Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			already industrial nature of the area and the proposed planting proposed as part of the M28 road project that there are no predicted residual impacts associated with the M28 on the visual or cultural setting of Martello Tower therefore there is no potential for significant cumulative effects on landscape or archaeology. Once operational, the Indaver facility will emit levels of combustion gases (NO_x, CO, etc.), particulates (dust, PM_{10}, metals, etc.) and other waste incineration pollutants (dioxins, etc.) under licence from the EPA. The EIS for the Indaver facility notes that background NO_2, in addition to NO_2 from the road traffic serving the facility will result in an annual average concentration of 12μg/m^3 in 2020 in the area around the facility. Other major sources in the area (pharma-chem operators in Ringaskiddy, ESB Aghada, BGE Whitegate) are predicted to contribute a further 2.9μg/m^3 as an annual average. Operations at Indaver are predicted to contribute a further 1.2μg/m^3 of NO_2 resulting in a cumulative annual average of 16.1μg/m^3 compared to the limit of 40μg/m^3.		

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
			Emissions from the proposed M28 road project are predicted to contribute a further 2-4μg/m^3 as an annual average NO_2 along the alignment of the new road in the Ringaskiddy area but with a negligible impact at distances greater than 50 metres from the proposed road. Combining the annual average background levels of NO_2 (12μg/m^3) with the existing major sources in the area (2.9μg/m^3) and the direct impact from the Indaver facility (1.2μg/m^3) presents a potential impact of 16.1μg/m^3 in the area east of Ringaskiddy. The worst case cumulative impact of the M28 in the Ringaskiddy area (based on a further 2-4μg/m^3 increase) on top of this "existing" level would be 18.1-20.1μg/m^3. This cumulative impact represents a negative air quality impact as a result of increased exposure of the population in this area to combustion pollutants. However, the predicted levels remain well below the statutory limits for the protection of human health and the cumulative impact is considered to be a slight adverse impact in the long term.		

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
Shannon Park Housing Development- Phase 1	Future: Phase 1 granted 09/09/2016. Expected date to be completed by is2021. Additional Phases to be submitted for planning in the future.	There is a masterplan for the development of housing at Shannonpark that may happen in the future. Construction of Phase 1 of the residential development is permitted and further phases will be subject to subsequent planning applications. Phase 1 works will include demolition of existing structures and construction of a mixed use development consisting of residential development of 297 no. residential units, neighbourhood centre, public transport interchange and all ancillary site development works. Access to the proposed development will be via a new spine road from the Carrigaline Road which will also serve possible future phases of development should permission be granted. The proposed roadworks include road widening	Future development of lands within the Masterplan for Shannonpark may occur at the same time as construction of the proposed M28 Road Project. The main impacts anticipated from the Shannonpark Housing Estate development will be through increased traffic related impacts once the Masterplan lands have been fully developed. The expected traffic figures from the Masterplan have been factored into the traffic data employed in determining the impacts of the proposed road project and a result in the potential for cumulative impacts to humans from traffic, air and noise. Housing is typical of the Shannonpark area and construction requirements are not significant. There will be no potential cumulative landscape and visual impacts during operation/ completion of the proposed Masterplan for housing.	This development is unlikely to result in cumulative or in-combination effects to European sites. The footprint of this development does not support suitable habitat for avifaunal species associated with Cork Harbour SPA and the findings of avifaunal surveys completed for this development did not identify this area as a suitable or viable site for over-wintering avifauna associated with Cork Harbour SPA. Drainage design and water attenuation mitigation is proposed for both projects restricting un-attenuated run-off to receiving watercourses including the Glounatouig Stream which supports connectivity to Monkstown Creek designated as part of Cork Harbour SPA. The Masterplan lands are underlain by limestone bedrock which is susceptible to karstification as is the proposed M28 in places and the potential for the occurrence of unidentified karst features could lead to subsidence and subsequent damage to structures for both projects. Both the EIS for the M28 road project and Shannonpark	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
		and the provision of a new signalised junction opposite the existing entrance to Carrig na Curra.		have provided mitigation to avoid impacts should karst be encountered during the construction works. In addition the proposed M28 road project provides for a robust drainage system and therefore in the long-term has potential for positive cumulative effects associated with road run off from vehicles accessing Shannonpark during the operation stage.	
GE Healthcare Life Sciences Biopark	Future: Awaiting Planning Decision – Third Party appeal (13/03/2017) to Bord Pleanála.	A BioPark and all ancillary site development works including landscaping, fencing and signage. The proposed BioPark consists of no. 2 storey bio-manufacturing buildings, 4 no. 2 storey administration/laboratory buildings with roof top plant room, a 2 storey warehouse building with 6 storey storage tower, a 2 storey hydration facility building, a 2 storey central utilities building with external boiler flues, and a 2 storey canteen and administration building with roof top plant room and service	No cumulative effects are anticipated during the construction phase on the human environment as the work within GE Healthcare will be constructed prior to the commencement of the M28 road project should permission be granted. Biopharma plant operations typically have a considerably lower chemical input and waste output and hence have significantly lower emissions to atmosphere. No negative cumulative impact for air quality predicted. The traffic, noise and air quality assessments within the EIS for the M28 Road Project consider future traffic in the opening year of 2020 and the design year of 2035 taking account of the Carrigaline Electoral Area Local Area Plan and land use planning for residential development and industry	No cumulative effects are anticipated during the construction phase on the natural environment as the work within GE Healthcare will be constructed prior to the commencement of the M28 road project should permission be granted. No significant ecological residual impacts are predicted from either the proposed GE Healthcare application or the proposed M28 Road Project therefore significant cumulative effects on ecology will not occur. With mitigation measures in place for both projects there will be no significant cumulative impacts to surface water and groundwater.	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
		yard. Primary access to the proposed development is from the R613 with a secondary access via an existing entrance from the L2496.	development in in the area. Therefore potential cumulative effects due to increased traffic, noise and air during the operation phase have been factored in the baseline assessment and no significant cumulative effects are anticipated. With landscape planting in place for both projects there will be no significant cumulative effect on landscape. The application for the GE Healthcare project identified the potential for a slight permanent negative impact on a boundary wall in the vicinity of Barnahely due to groundworks. The M28 Road Project has been designed to avoid any direct impacts on walls associated with the Castle or graveyard at Barnahely. Therefore no significant cumulative impacts to archaeology will occur.		
Janssen Biologics	Future: Granted 17/02/2017 and will be constructed over a 5 month period.	Consists of site development works including: site excavation and regrading, creation of new landscaped berms along the north western site boundary, relocation of 3 existing single-storey 360m2 pre-fabricated temporary modular office	No cumulative effects are anticipated during the construction phase as the work within Janssen will be constructed prior to the commencement of the M28 road project should permission be granted. During the operation phase there are no predicted residual impacts from noise and air predicted to human receptors from the buildings therefore	No cumulative effects are anticipated during the construction phase as the work within Janssen will be constructed prior to the commencement of the M28 road project should permission be granted. The EIS for the proposed Janssen project predicts residual negative	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
		units to the existing car park and erection of 1no. single-storey 360m2 pre-fabricated temporary modular office unit at the existing car park for a period of 5 years. The works will also include the construction of 95 no. temporary car park spaces, for a period of 5 years, to replace the car park spaces required to accommodate the temporary modular office units and the relocation of 2 no. existing fire water storage tanks and an existing firewater pump house and all associated works, including modification of internal underground services and drainage at the existing facility at Barnahely, Ringaskiddy, Co. Cork.	there is no potential for significant cumulative effects with the proposed M28 road project. This site is licensed by the EPA with strict controls on air quality and noise. Further the traffic, noise and air quality assessments within this EIS for the M28 Road Project consider future traffic in the opening year of 2020 and the design year of 2035 taking account of the Carrigaline Electoral Area Local Area Plan and land use planning for industrial/Pharma development in in the area. Therefore potential cumulative effects due to increased traffic, noise and air during the operation phase have been factored in the baseline assessment and no significant cumulative effects are anticipated There is no significant residual change to the broader landscape character of the area as a result of the Janssen proposals therefore no significant cumulative effects with the proposed M28 road project are considered likely. There is potential for cumulative effects to unknown finds associated with both projects, this however will be mitigated through pre-construction testing and monitoring required as part of the planning application for both projects.	impacts to Yellow hammer at a local scale. The EIS for the M28 road project predicts no significant impacts on avifauna therefore no Significant cumulative effects are anticipated.	

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
Maryborough Ridge Housing Development	Future: Awaiting Planning Decision.	Residential development works to include 200 no. residential units, crèche and all associated ancillary development works including the completion of a roundabout and road improvements onto Maryborough Hill, footpaths and cycle lanes, bus stop, foul and storm water drainage, boundary treatments, landscaping and amenity areas and the removal of existing electricity transformer/substation and construction of new electricity substation.	No cumulative effects are anticipated during the construction phase as it is considered the Maryborough Ridge development will be constructed prior to the commencement of the M28 road project should permission be granted. The traffic, noise and air quality assessments within this EIS for the M28 Road Project consider future traffic in the opening year of 2020 and the design year of 2035 taking account of the Carrigaline Electoral Area Local Area Plan and land use planning for residential development in in the area. Therefore potential cumulative effects due to increased traffic, noise and air during the operation phase have been factored baseline assessment and no significant cumulative effects are anticipated Housing is typical of the Maryborough area with landscape proposals in place for both projects there will be no potential significant cumulative landscape and visual impacts during operation/completion of the proposed development.	No cumulative effects are anticipated during the construction phase as it is considered the Maryborough Ridge development will be constructed prior to the commencement of the M28 road project should permission be granted. This development is unlikely to contribute to cumulative or in-combination effects to aquatic ecology or terrestrial ecology as best practice and mitigation measures will be implemented for this project to attenuate emissions to receptors such as air, watercourses and the surrounding terrestrial and coastal environments	**Implementation of the mitigation measures as set out in planning documents for both projects.** **No further mitigation required.**
Novartis	Ongoing construction activities	Construction of new production facilities, storage units and ancillary upgrade works. No EIS or Environmental	The traffic, noise and air quality assessments within the EIS for the M28 Road Project consider future traffic in the opening year of 2020 and the design year of 2035 taking account of	No residual ecology, soils, geology impacts were noted in a review of the planning files for the Novartis site therefore no significant cumulative effects are	**Implementation of the mitigation measures as set out in planning documents for both projects.**

Development	Approximate Timeframe	Summary Description	Summary of Potential for Significant Effects Human Environment	Summary of Potential for Significant Effects Natural Environment	Mitigation Measures
		Reports prepared for the application.	the Carrigaline Electoral Area Local Area Plan and land use planning for residential development in in the area. Therefore potential cumulative effects due to increased traffic, noise and air during the operation phase have been factored into the baseline assessment and no significant cumulative effects are anticipated.	predicted with the proposed M28 Road Project.	**No further mitigation required.**

18.3.2 Cumulative- In Combination Effects of all Projects

This section addresses the potential for cumulative effects and in combination effects should all projects listed in **Table 18.4** above proceed within the study area simultaneously (worst case scenario).

Traffic and Transport

A number of transportation studies and strategies relevant to the area have been considered including the N40 Demand Management Study, Douglas Land Use and Transportation Study and Carrigaline Area Transportation Study. None of these studies/strategies contained recommendations that are currently "committed". The only significant transportation project considered to be committed is the proposed N8/N25 Dunkettle Interchange Improvement Scheme and is thus considered to be completed in the future year Do Minimum scenario as TII have confirmed that the Dunkettle Interchange Scheme will be constructed and open to traffic in advance of the proposed M28 road project. Thus, the future year analysis assumes that the future year Do-Minimum road network will be the same as the base year network plus the proposed upgrade of the Dunkettle Interchange. Therefore, the future year analysis assumes no "bottleneck" for traffic at Dunkettle. No significant adverse cumulative effects as a result of this project are envisaged as a result.

The noise and air quality assessments within the EIS use data from **Chapter 5: Traffic and Transportation** which considers future traffic in the opening year of 2020 and the design year of 2035. High growth traffic rates were used and future traffic growth was distributed locally taking account of the Carrigaline Electoral Area Local Area Plan and land use planning for residential development and industry development in in the area. The cumulative noise and air quality effects from traffic generated from new housing and future employment uses in the Ringaskiddy Strategic Employment Area have already been considered as part of the baseline within these assessments and therefore built into the assessment of the proposed road project.

At the operational stage, the proposed M28 Road Project will have no direct impact on the five COMAH establishments in the area and will not alter the risk profile of these operations. The reduced travel time on the proposed M28 will facilitate a faster response time for emergency medical services from Cork University Hospital and/or additional fire services if required from Ballincollig. As a result, the new infrastructure will improve the overall emergency response in the Ringaskiddy area.

Socio-Economic and Community

In the event that the construction phase of one of the projects listed in **Table 18.4** and the M28 Road Project coincide there is potential for short term cumulative impacts associated with the construction of the both projects on human beings due to increased traffic, noise and air. These impacts have been addressed as part of the mitigation measures outlined in **Chapter 5: Traffic and Transportation**, **Chapter 13: Air and Climate** and **Chapter 14: Noise and Vibration**.

The operation of the proposed M28 Road Project in combination with the projects listed above is likely to generate long-term positive cumulative effects to the resident, working and visiting community due to reduced journey times and reduced congestion and the potential to open up employment opportunities within the area as a result.

Negative effects may arise in some cases due to increased noise or air pollution during the operation phase of the road and other planned or existing development in the area, however as outlined below (under the noise and air sections) this is not considered to be a significant cumulative effect as the traffic model has already factored in future traffic scenarios in the model, which has in turn been used to predict cumulative noise and air impacts.

Agriculture and Landuse

The residual impact of the proposed road on agriculture in the State and County Cork is assessed as not significant. Given the lands to be developed with the projects listed above in **Table 18.4** are primarily zoned for industry or housing significant cumulative effects to agriculture and landuse will not occur.

Hydrology and Drainage

If the M28 Road Project does not proceed, ongoing activities would continue within the study area including continued increase in traffic, localised quarrying at Raffeen and the potential progression of residential, commercial and industrial developments. These activities would be likely to result in localised and small scale cumulative negative impacts to the hydrology and drainage characteristics within the study area. The surface water drainage network on the existing N28 is limited to the area at Bloomfield/ Rochestown with drainage provided at the existing roundabouts along the route. Currently surface water run-off generated along the N28 is discharged over the existing embankments and makes its way to existing surface watercourses nearby.

The M28 road project has been designed to provide a robust drainage system and therefore in the long-term has potential for positive cumulative effects associated with road run off from HGVs and cars accessing other permitted and proposed development sites in the area i.e. Port of Cork where traffic currently travel along a national road where the drainage system is not as efficient.

As all new developments must obtain agreement from CCC for their drainage systems and any IPPC/waste license companies must receive a discharge license from the EPA, which ensures the requirements of the WFD are met, no cumulative effects on drainage as a result of neighbouring developments is predicted.

Due to the linear nature of the proposed M28 Road Project, the project has been designed to accommodate the 1 in 100 year flood flow plus an allowance of 20% to account for climate change in line with the requirements of the OPW and the NRA DMRB (Design Manual for Roads and Bridges). Flood risk assessment and management of all development is undertaken with an aim of not increasing flood risk of the land take and any third party land. Furthermore, cumulative risks from flooding is likely to be controlled through any future planning and consent process insofar as development cannot be permitted to the detriment of other projects or existing receptors. As all new developments are required to demonstrate compliance with *The Planning System and Flood Risk Management Guidelines (OPW, 2009)*, therefore no cumulative effects with regards flood risk is identified as a result of other developments.

Aquatic Ecology

The M28 road projects construction methodology and operational design ensures that surface water and groundwater pollution is managed to prevent deterioration. Operationally the principal direct risk to the water environment is from road run-off pollution from traffic. The assessment undertaken has used predicted AADT data from a traffic model, which includes key future development allocations. The impacts on the water environment are therefore reflective of cumulative effects taking into consideration those developments that could generate increases in traffic flows. The proposed road project has been designed to best practice drainage design standards and therefore increases in road traffic runoff from the proposed road project and any other development in the area will be better served by the new M28 than the existing N28, which currently experiences un-attenuated outfalls and runoff. The overall cumulative effect is therefore considered to be positive on water quality and the receiving aquatic environment in the long-term.

Soils, Geology and Hydrogeology

The design approach and the mitigation measures proposed as part of the proposed M28 road project will prevent any negative cumulative effects with other developments on soils, geology and hydrogeology during both the construction and operational stages.

Terrestrial Ecology

Whilst there is potential for landtake effects as a result of loss of semi-natural habitat as a result of the proposed road project and other developments in the area, the mitigation proposed in the EIS provides for landscape planting, translocation of habitats and species such that no significant residual impact arise.

It is likely that the construction of the M28 road project and other projects in the area will also result in severance of wildlife corridors and loss of hedgerows and treelines i.e. the Indaver Waste to Energy Facility. However appropriate mitigation measures in the form of planting and landscaping as part of this M28 road project and other projects in the area will reduce the potential for significant cumulative effects.

The Cork Harbour area supports a number of developments that have been granted planning permission that could have in-combination effects with the proposed M28 Road Project resulting in cumulative or in-combination effects to Cork Harbour SPA. However, the large infrastructural developments in the Cork Harbour area have been granted planning permission on the basis that targeted and site specific mitigation is completed to address any potential impacts to Cork Harbour SPA. Further the remote connectivity of the Great Island Channel SAC to the proposed M28 Road Project means that potential impacts are unlikely. The implementation of best practice design, construction and operational measures will negate any potential impacts to the integrity of this European site.

All possible sources of effects from the proposed road project, in combination with all other sources in the existing environment and any other effects likely to arise from other proposed plans or projects have been identified, considered and assessed.

No pathway of in-combination effects upon sites designated for nature conservation importance has been identified. The proposed road project is therefore not likely to give rise to significant ecological impacts alone, cumulatively or in-combination with other proposed and approved developments.

Air Quality and Climatic Factors

There is potential for dust impacts on the same receptors in any area where the proposed road project is in close proximity to other planned and permitted development i.e. Shannonpark Masterplan or Indaver should they be constructed at the same time. The proposed road project however includes strict controls on construction dust and from a review of the planning permissions applications for other project in the area it is considered that appropriate control measures would also be in place for other developments.

Short term operational dust events are experienced periodically from the operations in the Port of Cork, in particular from grain handling. Construction of the proposed road project in the Ringaskiddy area has the potential for cumulative negative dust impacts for residents in the village where the construction dusts coincide with an operational dust event from the port.

In terms of air quality, the levels of control that have been applied to each of the construction and operational phases of the development are such, that individually dust impacts should not be significant. Furthermore, the relative scheduling of the projects is such that the potential for cumulative dust impacts is low and these are considered negligible.

An examination of the various EIAs for the major projects in the area (**Table 18.4** above) indicate the following Green House Gas (GHG) emissions from the construction stage:-

- Indaver – not quantified but not considered significant;
- Port of Cork – 210,600 tonnes of CO_{2eq};
- East Tip – 17,899 tonnes of CO_{2eq};
- Shannonpark Housing Estate – not quantified but not considered significant; and
- Martello Tower – (included within the quantities reported in the East Tip EIS).

Based on the above data the cumulative GHG emissions from the proposed development in addition to other major infrastructure projects in the study area will be a minimum of 282,908 tonnes of $CO_{2eq.}$

In terms of the operational stage, Indaver estimate annual GHG emissions of 83,310 tonnes of CO_{2eq} for 30 years of operation (2,499,300 tonnes of CO_{2eq} in total). Note this excludes carbon savings from the recovery of energy from waste which has a positive impact in terns of GHG reductions. The East Tip will have no operational emissions and the Port of Cork operational emissions are not quantified.

The cumulative impact of greenhouse gas emissions from both the construction and operational phases of each of the developments are considered a permanent slight adverse impact.

Noise and Vibration

Planning permission has been approved for a number of developments within the vicinity of the proposed road project as outlined in **Table 18.4** above. Whilst it is expected that most of these projects will be completed before the construction of the proposed M28 Road Project, should the construction of any of these developments coincide with the construction of the proposed road project it is likely that noise levels within the vicinity of the works will increase temporarily. The mitigation measures set out in the EIS for the M28 Road Project have considered this possibility and the noise levels will be required to be below the limits given in **Table 14.2** of **Chapter 14: Noise and Vibration.**

A noise model of the operational phase of the approved developments in combination with the proposed M28 Road Project was generated. The model considered noise from the port development at Ringaskiddy and the DePuy Synthesis Ireland wind turbine as these are the most relevant developments that will emit noise following construction. The Dunkettle Interchange will also emit noise following construction; however it is at a sufficient distance away from the proposed M28 Road Project so as not to have an impact on noise levels in the vicinity. The noise model showed that following the insertion of the port development at Ringaskiddy and DePuy wind turbine that noise levels in the vicinity increased by less than 1 dB. In accordance with **Table 14.2** this increase is classed as barely perceptible. **Table 18.5** shows the difference in noise levels between the 'Do-Something' with Mitigation scenario and the Cumulative Impact model in the area of the port development at Ringaskiddy and the proposed DePuy wind turbine.

Table 18.5: Cumulative Impact L_{den} Noise Levels

Noise Sensitive Location	'Do-Something' with Mitigation L_{den} dB(A)	'Do-Something' with Mitigation Cumulative Impact L_{den} dB(A)	Difference in Noise Level L_{den} dB(A)
Warren's Court 1	55.7	56.0	0.3
St. Carthege Place 1	56.0	56.2	0.2
Bloomfield 1	52.0	52.3	0.3
Bloomfield 2	55.0	55.1	0.1
Old Post Office Road 1	53.0	53.2	0.2
Old Post Office Road 2	52.0	52.4	0.4
Old Post Office Road 3	57.9	57.9	0
Ringaskiddy Community Centre	53.3	53.9	0.6
Church (Ringaskiddy)	61.6	61.6	0
Shamrock Place 1	60.3	60.4	0.1
Shamrock Place 2	58.6	58.6	0
Shamrock Place 3	58.6	58.6	0
Martello Park 1	56.9	57.0	0.1
Martello Park 2	53.5	54.1	0.6
Ringaskiddy 1	57.0	57.5	0.5
Ringaskiddy Lower Harbour National School	60.2	60.2	0

Noise levels from port development were modelled as 55 dB at the site boundary. The planning permission requires that the noise level be 55 dB at the nearest sensitive receptor and therefore the noise model represents a worst case scenario. A correction was added to the port development in the noise model to account for the requirement for lower noise levels during the evening and night-time periods. Data for the DePuy wind turbine was obtained from the EIS for the turbine. It is not envisaged that there will be any cumulative vibration impacts as a result of the proposed developments in the area.

Furthermore, the noise assessment within the EIS is based on data from **Chapter 5: Traffic and Transportation** which considers future traffic in the opening year of 2020 and the design year of 2035 for a medium growth scenario. High growth traffic rates were used for the noise assessment and future traffic growth was distributed locally taking account of the Carrigaline Electoral Area Local Area Plan and land use planning for residential development and industry development in in the area. As such, the cumulative noise effects from traffic generated from new housing and future employment uses in the Ringaskiddy Strategic Employment Area have already been considered as part of the baseline within these assessments.

Cultural Heritage

A number of other infrastructural projects are proposed or planned in the area surrounding the proposed M28 Road Project; these include the materials extraction scheme at the Martello Tower and the Du Puy Turbine, both of which are located in the vicinity of Ringaskiddy. This assessment had consideration for these projects in order to identify any resulting cumulative impacts. No cumulative impacts to archaeological features are predicted in combination with any proposed or planned projects in the vicinity of the proposed M28 proposed project.

As with any project, there is potential for cumulative effects to unknown finds, this however will be mitigated through pre-construction testing and monitoring required as part of the consenting process for the M28 road project and any other future projects in the area.

Landscape and Visual

The proposed M28 Road Project is likely to have slight negative to moderate impact on visual amenity and receptors during the construction phase should the timing of construction of the proposed M28 Road Project coincide with other future development in the area. With the planting proposals in place for the M28 and the projects listed in **Table 18.4** above, no long-term significant cumulative effects are predicted in- combination with any other projects within the area.

Material Assets

There are no anticipated cumulative impacts associated with waste management predicted as a result of the proposed M28 Road Project. The principles of the waste hierarchy have been incorporated into the Construction and Demolition Waste Management Plan prepared for the project. Further there are a range of suitable permitted waste sites with capacity to accommodate any material that cannot be reused from the M28 project or other projects within the area.

18.4 SUMMARY

No significant adverse residual effects are likely to occur through in-combination and/or cumulative impacts. Any effects identified can be mitigated through management of the construction and operation processes by adherence to the mitigation measures set out in the EIS together with any conditions/restrictions in any approval/consent as may be granted.