

OWENINNY TABLE OF CONTENTS

NON TECHNICAL SUMMARY

1.	NON TECHNICAL SUMMARY	1
1. 1	INTRODUCTION	1
1. 2	THE PROJECT	2
1. 3	SCOPING AND CONSULTATION	5
1. 4	CONSTRUCTION	5
1. 5	INDICATIVE PROJECT PHASING	6
1. 6	PROJECT OPERATION	7
1. 7	PROJECT DECOMMISSIONING	7
1. 8	OTHER WIND FARM DEVELOPMENTS IN THE AREA	7
1. 9	EMERGENCY RESPONSE PLAN	8
1. 10	ALTERNATIVES	8
1. 11	POLICY	9
1. 12	SIGNIFICANT IMPACTS AND MITIGATION	11
	Noise	13
	Shadow Flicker	14
	Terrestrial Ecology	15
	Aquatic Ecology	18
	Landscape	20
	Air & Climate	22
	Geology and Soils	23
	Traffic and Transport	25
1. 13	CONCLUSION	32

CHAPTER 1 INTRODUCTION

1.3	METHODOLOGY	1.5
1.3.1	Format	1.5
1.3.2	Presentation	1.6
1.3.3	Contributors	1.7
1.4	SCOPING AND CONSULTATION	1.8
1.4.1	Scoping	1.8
1.4.2	Consultation	1.8
1.5	Consultation Meeting with National Parks and Wildlife Service	1.25
1.6	Consultation with Telecommunication and Signal Providers	1.28
1.7	Public Consultation	1.32
1.7.1	Crossmolina Public Consultation Event	1.34
1.7.2	Bangor Erris Public Consultation Event	1.35

CHAPTER 2 DESCRIPTION

2.	DESCRIPTION OF PROJECT	2.1
2.1	BACKGROUND	2.1
2.2	THE DEVELOPERS	2.1
2.2.1	ESB Wind Development	2.1
2.2.2	Bord na Móna	2.2
2.3	THE SITE	2.3
2.4	PROJECT HISTORY	2.5
2.4.1	Planning at Oweninny	2.5
2.4.2	Delay in Grid Connection	2.8
2.4.3	Duration of Permission	2.8

2.4.4	Integrated Pollution Prevention Control License	2.9
2. 5	DESCRIPTION OF SCHEME	2.10
2.5.1	Scheme Components	2.10
2.5.2	Wind Turbines	2.10
2.5.3	Transformers	2.16
2.5.4	Site entrance	2.16
2.5.5	Access Tracks	2.16
2.5.6	Access to Coillte Teoranta's Cluddaun proposed wind farm site	2.17
2.5.7	Crane stands	2.17
2.5.8	Electrical Substation	2.18
2.5.9	Meteorological masts	2.19
2.5.10	Overhead Transmission Lines and Underground Cables	2.20
2.5.11	Visitor Centre	2.21
2.5.12	Temporary Site Compound	2.23
2.5.13	Batching Plant	2.23
2.5.14	Wastewater treatment facilities	2.24
2.5.15	Borrow pit	2.24
2.5.16	Bord Gáis Network	2.25
2.5.17	Water supply	2.25
2.5.18	Electricity supply	2.25
2.5.19	River and stream crossings	2.25
2. 6	MATERIAL QUANTITIES	2.26
2. 7	PEAT STABILITY RISK ASSESSMENT	2.26
2. 8	INDICATIVE PROJECT PHASING	2.27
2.8.1	Phasing	2.27
2. 9	OPERATION, MAINTENANCE AND DECOMMISSIONING	2.28

2.9.1	Operation and Maintenance	2.28
2.9.2	Decommissioning	2.29
2. 10	MITIGATION OF POTENTIAL IMPACTS	2.30
2. 11	OTHER DEVELOPMENTS	2.31
2. 12	GRID CONNECTION	2.31

CHAPTER 3 PROJECT IMPLEMENTATION

3.	PROJECT IMPLEMENTATION	3.1
3. 1	INTRODUCTION	3.1
3. 2	PROJECT PHASING	3.1
3.2.1	Indicative Phasing	3.1
3. 3	PROJECT CONSTRUCTION	3.2
3.3.1	Scope	3.2
3.3.2	Schedule	3.2
3.3.3	Construction Plant and Machinery	3.4
3.3.4	Construction and Environmental Management Plan	3.5
3.3.5	Site Management	3.6
3. 4	TEMPORARY SITE FACILITIES	3.6
3.4.1	Contractor's Compound	3.6
3.4.2	Temporary Concrete Batching Plant	3.7
3.4.3	Other temporary facilities	3.8
3.4.4	Emissions and emission control	3.8
3.4.5	Decommissioning	3.11
3.4.6	Control of Oils & Fuel	3.11
3. 5	PUBLIC ROADS	3.12
3. 6	TURBINE ACCESS AND CRANEPADS	3.13

3.6.1	Access tracks	3.13
3.6.2	Cranepads	3.14
3.7	WIND TURBINES	3.14
3.7.1	Turbine Bases	3.14
3.7.2	Turbine Installation	3.16
3.7.3	Commissioning	3.17
3.8	ELECTRICAL SUBSTATION	3.17
3.9	OPERATION AND MAINTENANCE (O&M) BUILDING	3.18
3.10	VISITOR CENTRE	3.18
3.11	METEOROLOGICAL MASTS	3.19
3.12	SITE DRAINAGE	3.20
3.13	ASSOCIATED WORKS	3.21
3.13.1	Tree Felling	3.21
3.13.2	Borrow Pit	3.21
3.13.3	Material import	3.22
3.14	CONSTRUCTION WASTE	3.23
3.15	REINSTATEMENT	3.24
3.16	MITIGATION OF IMPACTS	3.24
3.17	EMERGENCY RESPONSE PLAN	3.25
CHAPTER 4 ALTERNATIVES		
4.	ALTERNATIVES	4.1
4.1	Alternative Electricity Generation	4.1
4.1.1	Benefits of Renewable Energy	4.1
4.1.2	Project Context	4.1
4.1.2.1.	Scenario Worldwide	4.2

4.1.2.2. Irish Scenario	4.2
4.1.3 Other Renewable Energy Resources	4.3
4.1.4 Role and Benefits of Wind Energy	4.5
4.2 ALTERNATIVE SITES	4.6
4.2.1 Context	4.6
4.2.2 Site Suitability	4.7
4.2.2.1. Wind Speed	4.7
4.2.2.2. Size and Topography of Site	4.8
4.2.2.3. Other Factors	4.8
4.2.2.4. Renewable Energy Strategy	4.9
4.2.3 Previous Assessments of Site Suitability	4.9
4.2.3.1. Mayo County Council	4.9
4.2.3.2. An Bord Pleanála	4.9
4.2.4 Summary	4.10
4.3 ALTERNATIVE CONFIGURATIONS AND LAYOUTS	4.10
4.3.1 General Approach	4.10
4.3.2 Alternative turbine heights	4.11
4.3.3 Approved and Proposed Layout	4.11
4.3.3.1. Approved Layout	4.11
4.3.3.2. Development of Proposed Layout	4.12
4.3.3.3. Field Survey influence on the design	4.13
4.3.3.4. Scoping Exercise influence on design	4.13
4.3.3.5. Communication signal corridors	4.14
4.3.3.6. Impact of Trees	4.14
4.3.3.7. Final wind farm design	4.15
4.3.3.8. Micrositing	4.15

4.3.4	Proposed Arrangement – Other Components	4.15
4.3.4.1.	Electrical Substation	4.15
4.3.4.2.	Meteorological Masts	4.16
4.3.4.3.	110 kV overhead Transmission Lines	4.16
4.3.5	Summary	4.18
4.3.6	Planning (Wind Energy) Guidelines	4.18

CHAPTER 5 POLICY AND PLANNING

5.	POLICY & PLANNING CONTEXT	5.1
5. 1	INTRODUCTION	5.1
5. 2	ENERGY POLICY – EUROPEAN CONTEXT	5.1
5.2.1	White Paper on Renewables	5.1
5.2.2	Green Paper on Security of Energy Supply	5.2
5.2.3	Renewable Energy Directives 2001 & 2009	5.2
5.2.4	European Commission Energy Roadmap 2050	5.3
5.2.5	Climate Change	5.3
5.2.6	Summary	5.5
5. 3	ENERGY POLICY – NATIONAL CONTEXT	5.5
5.3.1	Policy Evolution	5.5
5.3.2	National Development Plan 2007 – 2013	5.5
5.3.3	Renewable Energy Development - 2006	5.6
5.3.4	Energy White Paper – 2007	5.7
5.3.5	National Climate Change Strategy 2007 - 2012	5.7
5.3.6	Strategy for Renewable Energy, 2012 – 2020	5.8
5.3.7	National Renewable Energy Action Plan	5.8
5.3.8	NREAP First Progress Report	5.10

5. 4	REGIONAL AND LOCAL PLANNING AND POLICY	5.10
5.4.1	Regional Planning Guidelines	5.10
5.4.2	Planning Policy - Mayo County Development Plan	5.12
5.4.3	Mayo County Development Plan 2008 – 2014	5.12
5.4.4	County Landscape Policy	5.14
5.4.5	Mayo Renewable Energy Strategy	5.14
5.4.6	Strategic Environmental Assessment – Draft Renewable Energy Strategy County Mayo	5.15
5. 5	CONCLUSIONS	5.16

CHAPTER 6 HUMAN BEINGS

6.	HUMAN BEINGS	6.1
6. 1	INTRODUCTION	6.1
6. 2	METHODOLOGY	6.1
6. 3	RECEIVING ENVIRONMENT	6.1
6.3.1	Population, Employment and Socio-economics	6.1
6.3.1.1.	State population	6.1
6.3.1.2.	Mayo Population	6.2
6.3.1.3.	Population in District Electoral Divisions at Oweninny site	6.3
6.3.2	Socio-economics	6.3
6.3.2.1.	Summary	6.4
6.3.3	Public Attitudes	6.5
6.3.4	Health and Safety	6.6
6.3.5	Electromagnetic Fields	6.6
6.3.6	Ice shedding	6.6
6.3.7	Shadow Flicker	6.6

6.3.8	Noise		6.7
6. 4	POTENTIAL IMPACTS OF THE DEVELOPMENT CONSTRUCTION PHASE		6.7
6.4.1	Population, Employment and Socio-economics		6.7
	6.4.1.1. Local Level		6.7
	6.4.1.2. National Level		6.8
6.4.2	Public Attitude to Wind Farms		6.9
	6.4.2.1. Ireland		6.9
	6.4.2.2. Britain & Northern Ireland		6.10
6.4.3	Community Benefit		6.11
6.4.4	Health & Safety		6.13
	6.4.4.1. Electromagnetic Radiation		6.13
	6.4.4.2. Structural Integrity of Turbines	:	6.16
	6.4.4.3. Hazard from Falling Ice		6.16
	6.4.4.4. Summary:		6.17
6.4.5	Other Issues		6.17
6. 5	MITIGATION		6.17
6.5.1	General		6.17
6.5.2	Health & Safety		6.17
6.5.3	Electromagnetic Radiation		6.18
6.5.4	Structural Integrity of Turbines	:	6.19
6.5.5	Hazards from Falling Ice		6.19
6. 6	CONCLUSION		6.20
 CHAPTER 7 NOISE			
7.	NOISE		7.1
7. 1	INTRODUCTION		7.1

7.2	APPROACH AND METHODOLOGY	7.1
7.2.1	Background Noise and Wind Speed Monitoring	7.2
7.2.2	Turbine Noise Prediction Modelling	7.5
7.2.3	Corrections for Existing Wind Farm Noise	7.6
7.3	RECEIVING ENVIRONMENT	7.7
7.3.1	Summary background noise	7.9
7.4	IMPACT OF THE DEVELOPMENT	7.9
7.4.1	Sources of Noise	7.9
7.4.2	Construction Noise	7.12
7.4.3	Operational Noise Impact	7.15
7.4.3.1.	Method of Assessment and Noise Limits	7.15
7.4.3.2.	Predicted Noise	7-17
7.4.3.3.	Predicted Operational Noise	7-18
7.4.3.4.	Predicted Cumulative Impacts	7.19
7.4.3.5.	Summary of noise impacts	7.20
7.5	CUMULATIVE IMPACTS	7.21
7.5.1	Construction phase	7.21
7.5.2	Cumulative Impact Operational Phase	7.22
7.5.3	Decommissioning Phase	7.22
7.6	MITIGATION	7.22
7.6.1	Construction phase	7.22
7.6.2	Operational phase	7.23
7.6.3	Decommissioning	7.24
7.7	CONCLUSIONS	7.24
7.8	Glossary and Defined Terms	7.25

CHAPTER 8 SHADOW FLICKER

8.	SHADOW FLICKER	8.1
8. 1	INTRODUCTION	8.1
8. 2	RECEIVING ENVIRONMENT	8.1
8. 3	IMPACT OF THE DEVELOPMENT	8.2
	8.3.1. Predicted Impact	8.2
	8.3.2. Assessment	8.7
8. 4	CUMULATIVE IMPACTS	8.9
8. 5	MITIGATION	8.9
8. 6	CONCLUSIONS	8.10

CHAPTER 9 TERRESTRIAL ECOLOGY

9.	TERRESTRIAL ECOLOGY	9.1
9. 1	INTRODUCTION	9.1
	9.1.1 Locational and General Information	9.1
9. 2	SURVEY METHODS AND DATA COLLATION	9.2
	9.2.1 Habitats and Vegetation	9.2
	9.2.2 Bird Surveys	9.3
	9.2.2.1. Summer bird surveys	9.3
	9.2.2.2. Winter bird surveys	9.7
	9.2.2.3. Autumn bird surveys	9.8
	9.2.3 Bat Survey	9.8
	9.2.4 Otter Survey	9.9
	9.2.4.1. Survey route distance & survey timing	9.9
	9.2.5 Other Mammals, Amphibians and Reptiles	9.10
	9.2.6 Criteria for Evaluation of Ecological Resources and Impact Assessment	9.10

9.3	RECEIVING ENVIRONMENT	9.11
9.3.1	Sites Designated for Nature Conservation	9.11
9.3.1.1.	Special Areas of Conservation (SAC)	9.11
9.3.1.2.	Special Protection Areas (SPA)	9.12
9.3.1.3.	Natural Heritage Areas (NHA)	9.13
9.3.1.4.	Proposed Natural Heritage Areas (pNHA)	9.13
9.3.1.5.	Statutory Nature Reserves	9.13
9.3.1.6.	National Parks	9.14
9.3.2	Habitats, Vegetation and Flora	9.14
9.3.2.1.	Description of habitats on site	9.14
9.3.3	Vegetation descriptions at construction areas	9.32
9.3.3.1.	Turbines and tracks	9.32
9.3.3.2.	Sub-stations	9.33
9.3.3.3.	Borrow pit and gravel storage area	9.33
9.3.3.4.	Peat deposition area	9.33
9.3.3.5.	Powerline routes	9.34
9.3.4	Otters and Other Terrestrial Mammals	9.36
9.3.4.1.	Otters	9.36
9.3.4.2.	Badger	9.36
9.3.4.3.	Pine Marten	9.37
9.3.4.4.	Irish Hare	9.37
9.3.4.5.	Deer	9.37
9.3.4.6.	Fox	9.37
9.3.4.7.	Others	9.37
9.3.5	Bats	9.37
9.3.5.1.	Desk study results	9.37

9.3.5.2. Bat field survey results	9.37
9.3.6 Amphibians and Reptiles	9.39
9.3.7 Birds	9.39
9.3.7.1. Breeding and summering birds	9.39
9.3.7.2. Wintering birds	9.42
9.3.7.3. Autumn birds	9.44
9.3.7.4. Birds of conservation importance	9.46
9.3.8 Evaluation Of Conservation Importance Of Site	9.60
9.3.8.1. Habitats and flora	9.60
9.3.8.2. Fauna	9.61
9.3.8.3. Birds	9.62
9.4 IMPACT ASSESSMENT 9.64	
9.4.1 Characteristics of the Development	9.64
9.4.2 Loss of Habitats	9.64
9.4.3 Changes to Habitats as a Result of Works	9.66
9.4.3.1. Habitats affected directly by construction works	9.66
9.4.4 Changes to habitats during operation phase	9.66
9.4.5 Potential Hydrological Impacts on Flush Systems	9.66
9.4.6 Potential Pollution of Watercourses	9.68
9.4.7 Potential Impacts from Peat Slippage	9.68
9.4.8 Potential Impacts on Birds of Conservation Importance	9.70
9.4.8.1. Impacts on Annex I and/or Red Listed bird species	9.70
9.4.8.2. Impacts on Amber Listed species	9.73
9.4.9 Potential Impacts on Terrestrial Mammals	9.75
9.4.9.1. Otter	9.75
9.4.9.2. Badger	9.75

9.4.9.3. Other mammal species	9.75
9.4.10 Potential Impacts on Bats	9.76
9.4.10.1. Adjudged likely impact of the proposed development on bats	9.77
9.4.11 Potential Impacts on Amphibians and Reptiles	9.77
9.4.12 Potential Impacts on Sites Designated for Nature Conservation	9.77
9.4.12.1. European Sites	9.77
9.4.12.2. Other designated Sites	9.80
9.4.12.3. Proposed Natural Heritage Areas	9.80
9.4.12.4. Statutory Nature Reserves	9.81
9.4.12.5. National Parks	9.81
9.5 MITIGATION MEASURES	9.81
9.5.1 Habitat Avoidance	9.81
9.5.2 Sensitive Design to Maintain Habitat Integrity	9.82
9.5.3 Measures Specific for Protection of Bellacorick Iron Flush SAC	9.83
9.5.3.1. Access restrictions	9.83
9.5.3.2. Hydrological monitoring	9.83
9.5.3.3. Vegetation monitoring	9.83
9.5.4 Measures to Maintain Bog Remnants	9.83
9.5.5 Measures to Reduce and Prevent Water Pollution during Construction Works	9.84
9.5.6 Measures to Reduce and Prevent Water Pollution during Tree Felling	9.85
9.5.7 Measures to Maintain Peat Stability	9.86
9.5.7.1. Mitigation Measure for Areas of Insignificant Risk	9.86
9.5.7.2. Mitigation Measures for Areas of Significant Risk	9.87
9.5.7.3. Substantial Risk Mitigation Measures	9.89
9.5.7.4. Peat Stability Risk Conclusions and Recommendations	9.91
9.5.8 Measures for Construction of Overhead Power Lines	9.92

9.5.8.1. Substation No. 1 line	9.92
9.5.8.2. Substation No. 2 line	9.92
9.5.9 Habitat Management and Enhancement	9.92
9.5.9.1. Re-establishment and promotion of wetland habitats	9.92
9.5.10 Removal of self-seeded conifers and Rhododendron	9.94
9.5.10.1. Removal of pine trees	9.94
9.5.10.2. Removal of Rhododendron	9.94
9.5.11 Measures Specific for Wintering Hen Harriers	9.95
9.5.11.1. Construction restrictions	9.95
9.5.11.2. Operation measures	9.95
9.5.12 Measures for Sensitive Breeding Birds	9.95
9.5.13 Measures Applicable to All Breeding Birds	9.96
9.5.14 Monitoring for Birds during Operation Phase	9.97
9.5.15 Measures for Otters	9.97
9.5.16 Measures for Badgers	9.97
9.5.17 Measures for Bats	9.97
9.5.1.1. Trees	9.98
9.5.1.2. Lighting restrictions	9.98
9.5.1.3. Bridges	9.98
9.5.1.4. Vegetation-free buffer zone	9.98
9.5.18 Measures for Common Frog	9.98
9.5.19 Project Ecologist	9.99
9.5.20 Cumulative Impacts with Other Wind Farms	9.99
9.1.1.5. Cumulative impacts on habitats	9.99
9.1.1.6. Cumulative impacts on birds	9.100
9.6 CONCLUSION	9.100

CHAPTER 10 WATER QUALITY, FISHERIES AND AQUATIC ECOLOGY

10.	WATER QUALITY, FISHERIES AND AQUATIC ECOLOGY	10.1
10.1	INTRODUCTION	10.1
10.1.1	Relevant legislation	10.2
10.1.2	Hydrology of the site	10.3
10.2	APPROACH AND METHODOLOGY	10.3
10.2.1	Electrofishing	10.4
10.2.2	Stream Invertebrate Sampling	10.7
10.2.3	Biological Water Quality Assessment Criteria	10.8
10.3	RECEIVING ENVIRONMENT	10.9
10.3.1	General Catchment Information	10.9
10.3.2	Inland Fisheries Ireland – Oweninny Report 2012	10.10
10.3.3	Fishery Value	10.11
10.3.4	Electrofishing surveys	10.13
10.3.5	Electrofishing Summary	10.18
10.3.6	EPA Biological analyses	10.19
10.3.7	Aquafact Biological analyses.	10.23
10.3.8	Ecological Importance and Designated areas	10.23
10.4	POTENTIAL IMPACT OF THE DEVELOPMENT	10.25
10.4.1	Construction Phase Impacts Pollution of Streams with Suspended Solids	10.25
10.4.2	Pollution with Nutrients Decomposition of Brash After Forestry Clearfelling	10.26
10.4.3	Pollution with Nutrients Decomposition of Brash in Repository Areas	10.28
10.4.4	Construction - Pollution with Nutrients due to Ground Disturbance and Clearfelling Operations	10.29
10.4.5	Construction - Pollution with Other Substances	10.30

10.4.6	Potential Operational Impacts Long-Term Aquatic Effects	10.31
10.4.7	Hydrological impacts	10.31
10.4.8	Decommissioning phase	10.32
10.5	MITIGATION	10.32
10.5.1	Construction Phase Mitigation - Reduction and Prevention of Suspended Solids Pollution	10.32
10.5.2	Construction Phase Mitigation - Forestry Clearfelling	10.34
10.5.3	Construction Phase Mitigation - Pollution of Watercourses with Nutrients	10.35
10.5.4	Construction Phase Mitigation - Pollution of Watercourses with nutrient from Repository areas.	10.35
10.5.5	Construction Phase Mitigation - Turbine Foundations, Cable Trenches and Upgrade of Tracks	10.35
10.5.6	Construction Phase Mitigation – General Management of Pollution	10.36
10.5.7	Operational Phase Mitigation - Wastewater treatment system	10.37
10.5.8	Operational Phase Mitigation - Habitat Loss	10.37
10.5.9	Operational Phase Mitigation - Obstruction to Movement of Aquatic Fauna	10.37
10.5.10	Operational Phase Mitigation - Hydrological Impacts	10.38
10.5.11	Procedures, Monitoring and Maintenance	10.38
10.5.12	Residual Impacts post mitigation	10.39
10.6	CUMULATIVE IMPACTS	10.39
10.7	CONCLUSION	10.40
 CHAPTER 11 LANDSCAPE		
11.	LANDSCAPE	11.1
11.1	Basis of Visual Assessment	11.1
11.1.1	Introduction	11.1
11.2	METHODOLOGY	11.1

11.2.1	Zone of Visual Influence	11.1
11.2.2	Design Guidelines	11.2
11.2.3	Survey Methods	11.2
11.2.4	Definition of Visual Impact	11.3
11.2.5	Summary	11.5
11.3	RECEIVING ENVIRONMENT	11.5
11.3.1	Site Context	11.5
11.3.2	Landscape Character	11.5
11.3.3	Physical characteristics (Topography, Landform)	11.5
11.3.4	Social (Land use)	11.6
11.3.5	Experiential (Scale and exposure)	11.6
11.3.6	Visual	11.6
11.3.7	Planning Context (Refer to Figure 11.1)	11.6
11.3.8	Landscape Character County Mayo	11.7
11.3.9	Principle Policy Area:	11.7
11.3.10	Areas designated for ecological importance	11.9
11.3.11	Protected views and prospects	11.11
11.3.12	Walking routes	11.13
11.3.13	Cycling Routes	11.15
11.3.14	Céide Fields	11.16
11.3.15	Ballycroy National Park	11.16
11.3.16	Proposed Nephin Wild Project	11.16
11.3.17	Renewable Energy Development	11.17
11.4	CHARACTERISTICS OF THE PROPOSAL	11.17
11.4.1	The Proposal	11.17
11.4.2	Spatial Layout Characteristics	11.17

11.4.2.1. Relationship to Site, Topography and Landscape	11.17
11. 5 IMPACT OF THE DEVELOPMENT	11.18
11.5.1 Introduction	11.18
11.5.2 Zones of Theoretical Visibility (Refer to Figures 11.4 & 11.5)	11.19
11.5.3 Principal Views (Refer to Figure 11.6)	11.19
11.5.4 Landscape and Visual Effects (Refer to Figure 11.7)	11.21
11.5.5 Cumulative effects	11.56
11.5.6 Cumulative effects – Conclusion	11.57
11.5.7 Effects of warning lights	11.58
11.5.8 Summary of Landscape and Visual Effects	11.58
11.5.9 Summary of effects on viewpoints	11.58
11.5.10 Visual Effects	11.59
11.5.11 Landscape Effects	11.60
11.5.12 Effects on Natural Heritage Areas and Natura 2000 sites	11.61
11.5.13 Effects on Scenic Routes and Protected Views	11.62
11.5.14 Effects on Walking Routes	11.66
11.5.15 Effects on Cycling Routes	11.68
11.5.16 Effects on Céide Fields	11.68
11.5.17 Effects on Ballycroy National Park	11.68
11.5.18 Effects on the proposed Nephin Wild Project	11.69
11.5.19 Summary of Effects on Designated Areas	11.69
11.5.20 Effects on Built-Up Areas	11.69
11.5.21 Effects on Roads within the study area	11.70
11.5.22 Connection to the National Grid	11.72
11. 6 MITIGATION	11.72
11.6.1 Sitting, Design and Layout	11.72

11.6.2	Comparison of alternative turbine heights	11.73
11.6.3	Design of Site Access Roads	11.73
11.6.4	Colour	11.73
11.6.5	Planting	11.74
11.6.6	Decommissioning	11.74
11.7	CONCLUSIONS	11.74

CHAPTER 12 AIR QUALITY AND CLIMATE

12.	AIR QUALITY & CLIMATE	12.1
12.1	RECEIVING ENVIRONMENT	12.1
12.1.1	Air Quality	12.1
12.1.1.1.	Legislative Context	12.1
12.1.1.2.	Baseline Air Quality	12.2
12.1.2	Atmospheric Emissions	12.3
12.1.2.1.	Legislative Context	12.3
12.1.2.2.	Greenhouse Gas Emissions	12.4
12.1.2.3.	Other Emissions	12.6
12.1.3	Local Emission Sources and Receptors	12.7
12.2	IMPACT OF THE DEVELOPMENT	12.7
12.2.1	Construction Phase impacts	12.7
12.2.1.1.	Atmospheric Emissions	12.7
12.2.1.2.	Air Quality	12.9
12.2.2	Operational phase impacts	12.10
12.2.2.1.	General	12.10
12.2.2.2.	Loss of Forestry	12.10
12.3	MITIGATION	12.10

12. 4	CONCLUSION	12.11
--------------	-------------------	--------------

CHAPTER 13 GEOLOGY AND SOILS

13.	SOILS and GEOLOGY	13.1
13. 1	INTRODUCTION AND METHODOLOGY	13.1
13. 2	RECEIVING ENVIRONMENT	13.1
13.2.1	Soils	13.1
13.2.2	Bedrock	13.3
13.2.3	Groundwater	13.3
13.2.4	Geological Heritage and Resources	13.5
13.2.5	Borrow Pit and Peat Repository	13.5
13.2.6	Ground Investigation and Slope Stability	13.5
	13.2.6.1. Ground Investigation	13.5
	13.2.6.2. Peat and Slope Stability	13.6
13. 3	POTENTIAL IMPACT OF THE DEVELOPMENT	13.6
13.3.1	Construction Phase	13.6
	13.3.1.1. General	13.6
13.3.2	Operational Phase	13.8
13.3.3	Decommissioning phase	13.9
13. 4	MITIGATION OF POTENTIAL IMPACTS	13.9
13.4.1	Construction Mitigation	13.9
	13.4.1.1. General	13.9
	13.4.1.2. Soil Management	13.9
	13.4.1.3. Materials and Fuels	13.10
	13.4.1.4. Water and Effluents	13.11
	13.4.1.5. Transmission Lines and HDD	13.12

13.4.1.6. Geoheritage	13.12
13.4.1.7. Slope Stability	13.12
13.4.2 Operational Mitigation	13.13
13.4.3 Decommissioning Mitigation	13.14
13.5 CONCLUSIONS	13.14

CHAPTER 14 TRAFFIC AND TRANSPORT

14. TRAFFIC AND TRANSPORT	14.4
14.1 INTRODUCTION	14.4
14.2 TURBINE COMPONENT HAUL ROUTE ASSESSMENT	14.4
14.2.1 Methodology	14.4
14.2.2 Alternatives reviewed	14.5
14.2.3 Potential haul route options	14.5
14.2.4 Assessment of Potential Routes	14.7
14.3 TRAFFIC AND TRANSPORT ASSESSMENT	14.7
14.3.1 Methodology	14.7
14.3.2 Receiving Environment	14.7
14.3.3 Traffic Volumes	14.8
14.3.3.1. Traffic Counts	14.8
14.3.3.2. Annual Average Daily Traffic (AADT) Counter Mulranny	14.9
14.3.4 Existing Road Capacity	14.11
14.3.5 Public Transport	14.12
14.3.6 Accident Record	14.12
14.3.7 Proposed Site Access	14.12
14.3.7.1. Site Access Road Safety Audit	14.13
14.3.8 Trip Generation and Distribution	14.14

14.3.8.1.	Construction Phase	14.14
14. 4	IMPACT OF THE DEVELOPMENT	14.16
14.4.1.1.	Future Background Traffic Flows	14.16
14.4.2	Project Construction	14.18
14.4.2.1.	Miscellaneous Construction Vehicles	14.18
14.4.2.2.	Concrete Foundations and Piles	14.18
14.4.2.3.	Track Construction & Turbine Hardstands	14.19
14.4.2.4.	Abnormal Loads	14.19
14.4.2.5.	Electrical Equipment & Building Materials	14.20
14.4.2.6.	Cranes	14.20
14.4.2.7.	Worst case traffic scenario	14.20
14.4.3	Assessment of Potential Traffic Routes – Wind Turbine Components	14.21
14.4.4	Assessment of Construction Impacts	14.22
14.4.5	Project Operation	14.23
14.4.5.1.	Wind Farm Maintenance	14.23
14.4.5.2.	Road Safety	14.23
14.4.5.3.	Visitor Centre traffic	14.24
14.4.6	Project Decommissioning	14.24
14. 5	MITIGATION OF POTENTIAL IMPACTS	14.25
14.5.1	Delivery of Wind Turbine Components	14.25
14.5.2	Maximising use of existing ground conditions and existing on site tracks	14.26
14.5.3	Potential Reduction in the traffic movements	14.26
14.5.3.1.	On-site borrow pit	14.26
14.5.3.2.	On site Concrete Batching Plant	14.26
14.5.4	General Construction Traffic	14.26
14.5.5	Traffic Management Plan	14.27

14.5.6	Landtake	14.27
14.5.7	Access points	14.28
14. 6	CUMULATIVE IMPACTS	14.28
14. 7	CONCLUSION	14.29

CHAPTER 15 FORESTRY

15.	FORESTRY	15.1
15. 1	INTRODUCTION	15.1
15. 2	APPROACH AND METHODOLOGY	15.1
15. 3	RECEIVING ENVIRONMENT	15.1
15.3.1	Forest Management Plans	15.1
15.3.2	Local Context	15.2
15.3.3	Sustainable Forest Management	15.3
15.3.4	Effect of Trees	15.4
15.3.5	Forest Management at Oweninny	15.5
15.3.5.1.	Tree Felling Methodology	15.5
15. 4	IMPACT OF THE DEVELOPMENT	15.8
15.4.1	Timber harvesting	15.8
15.4.2	Replanting	15.9
15.4.3	Potential Site Impacts	15.9
15.4.4	Change in Local Hydrology	15.9
15.4.5	Water quality - nutrient enrichment	15.10
15.4.6	Water quality - increase in suspended matter	15.10
15.4.7	Loss (or Change) of Habitat	15.10
15.4.8	Noise Disturbance During Felling	15.10
15.4.9	Increase of Extraction Road Traffic	15.10

15. 5	CUMULATIVE IMPACTS	15.10
15. 6	MITIGATION	15.11
15. 7	CONCLUSIONS	15.12

CHAPTER 16 MATERIAL ASSETS

16.	MATERIAL ASSETS	16.1
16. 1	INTRODUCTION	16.1
16. 2	TOURISM & AMENITY	16.1
16.2.1	Approach and methodology	16.1
16.2.2	Receiving Environment	16.1
16.2.2.1.	General	16.1
16.2.2.2.	Local	16.2
16.2.3	Impact of the Development	16.3
16.2.4	Mitigation	16.6
16.2.5	Conclusions	16.6
16. 3	ENERGY SUPPLY	16.7
16.3.1	Receiving Environment	16.7
16.3.2	Impact of the Development	16.9
16.3.3	Mitigation	16.10
16.3.4	Conclusions	16.10
16. 4	AIR NAVIGATION	16.10
16.4.1	Receiving Environment	16.10
16.4.2	Impact of the Development	16.11
16.4.3	Mitigation	16.11
16.4.4	Conclusions	16.11

16. 5	TELEVISION and COMMUNICATIONS SIGNALS	16.11
16.5.1	Receiving Environment	16.11
16.5.2	Impact of the Development	16.12
16.5.3	Mitigation	16.12
16.5.4	Conclusion	16.13
16. 6	WIND FARMS AND PROPERTY PRICES	16.13
16. 7	CONCLUSIONS	16.14

CHAPTER 17 CULTURAL HERITAGE

17.	CULTURAL HERITAGE	17.1
17. 1	INTRODUCTION	17.1
17. 2	METHODOLOGY	17.1
17.2.1	Desk Study	17.1
17.2.2	Field Inspection	17.2
17.2.3	Assessment Methodology	17.2
17. 3	RECEIVING ENVIRONMENT	17.3
17.3.1	Local History	17.3
17.3.2	Settlement History	17.8
17.3.3	Archaeology	17.9
17.3.4	Results from previous documented relevant archaeological reports	17.22
17.3.5	Reported archaeological artefacts	17.22
17.3.6	Summary of Archaeological Heritage	17.31
17.3.7	Architectural Heritage	17.32
17. 4	IMPACTS OF THE DEVELOPMENT	17.42
17.4.1	Construction Phase	17.42
17.4.2	Operational Phase	17.45

17.4.3	'Do-Nothing' Scenario	17.46
17.5	MITIGATION MEASURES	17.46
17.5.1	Construction Phase	17.46
17.5.2	Operational Phase	17.47
17.6	PREDICTED IMPACTS	17.48
17.6.1	Construction Phase	17.48
17.6.2	Operational Phase	17.48
17.6.3	'Worst Case' scenario	17.48
17.7	CUMULATIVE IMPACTS	17.48
17.8	CONCLUSION	17.48

CHAPTER 18 IRON FLUSH HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT

18.	IRON FLUSH HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT	18.1
18.1	INTRODUCTION	18.1
18.2	APPROACH AND METHODOLOGY	18.2
18.2.1	NPWS and An Taisce consultation process	18.2
18.2.2	Sources of information	18.2
18.3	DESK STUDY REVIEW	18.3
18.3.1	Rainfall & evaporation	18.3
18.3.2	Regional and Local Hydrology	18.4
18.3.3	Geology	18.4
18.3.4	Hydrogeology	18.5
18.3.5	Review of previous investigation findings	18.6
18.4	IRON FLUSH HYDROGEOLOGICAL INVESTIGATION	18.7

18.4.1	Field Investigations	18.7
18.4.2	Vegetation survey	18.8
18.4.3	Drainage	18.8
18.4.4	Window Sampling, Peat Augering and Water Level Monitoring	18.10
18.4.5	Groundwater & peat water level monitoring installations	18.11
18.4.6	Water Levels	18.13
18.4.7	Hydrochemistry	18.16
18.5	RECEIVING ENVIRONMENT BELLACORICK IRON FLUSH	18.25
18.5.1	Introduction	18.25
18.5.2	Geology	18.25
18.5.3	Hydrology	18.27
18.5.4	Hydro-geology	18.28
18.5.5	Hydrochemistry	18.30
18.5.6	Surface Water Input (i.e. rainfall)	18.33
18.5.7	Shallow Ground Water (peat iron accumulation theory)	18.33
18.5.8	Discrete Deep Groundwater upwells (iron rich bedrock groundwater)	18.34
18.5.9	Flush Surface Water Catchment & Groundwater Recharge Area	18.34
18.5.10	Summary Hydro-geological Conceptual Model	18.36
18.6	IMPACT OF THE DEVELOPMENT - BELLACORICK IRON FLUSH	18.37
18.6.1	Introduction	18.37
18.6.2	Components of development which could impact on the iron flush	18.37
18.6.3	Description of Borrow Pit Area	18.38
18.6.4	Disruption of Groundwater Flow Paths Towards the Iron Flush	18.40
18.6.5	Reduction in Groundwater Recharge to the Iron Flush	18.41
18.6.6	Impact on Groundwater Levels in the Vicinity of the Iron Flush	18.41

18.6.7	Potential Release of Hydrocarbons & other Chemicals	18.42
18.6.8	Alteration of Surface Water Drainage in the Vicinity of the Iron Flush	18.42
18.6.9	Potential Hydrochemical Effects on the Flush due to Introducing Concrete Piles	18.42
18. 7	MITIGATION MEASURES BELLACORICK IRON FLUSH	18.42
18.7.1	Disruption of Groundwater Flow Paths Towards the Iron Flush	18.42
18.7.2	Reduction in Groundwater Recharge to the Iron Flush	18.42
18.7.3	Impact on Groundwater Levels in the Vicinity of the Iron Flush	18.43
18.7.4	Potential Release of Hydrocarbons & other Chemicals	18.43
18.7.5	Alteration of Surface Water Drainage in the Vicinity of the Iron Flush	18.43
18.7.6	Potential Hydrochemical Effects on the Flush due to the Introducing Concrete Piles	18.43
18. 8	CONCLUSIONS ON BELLACORICK IRON FLUSH	18.43
18. 9	WIDER HYDROLOGICAL STUDY	18.44
18.9.1	Introduction	18.44
18.9.2	Schedule and methodology	18.44
18. 10	WIDER AREA HYDROLOGY & HYDROGEOLOGY	18.44
18.10.1	Locations assessed	18.45
18. 11	WIDER AREA IMPACT ASSESSMENT	18.48
18. 12	CONCLUSION ON WIDER AREA	18.49
 CHAPTER 19 HYDROLOGY AND SEDIMENT		
19.	HYDROLOGY AND SEDIMENT	19.1
19. 1	INTRODUCTION	19.1
19. 2	RECEIVING ENVIRONMENT	19.2
19.2.1	Site Characterization	19.2
19.2.2	Water Balance	19.3

19.2.3	Flooding	19.4
19.2.4	Cutaway Bog Rehabilitation	19.4
19.2.5	Sensitive Receptors	19.6
19.3	POTENTIAL IMPACT OF THE DEVELOPMENT	19.6
19.3.1	Working in Cutaway Peatland	19.6
19.3.2	Windfarm Activities	19.7
19.4	MITIGATION	19.7
19.4.1	Approach	19.7
19.4.2	Water Quantity	19.8
19.4.3	Sediment Control	19.9
19.4.4	Access Tracks	19.12
19.4.5	Turbines, Substations and Buildings Hardstanding	19.13
19.4.6	Borrow pit	19.14
19.4.7	Peat Repository	19.14
19.4.8	Batching plant	19.14
19.4.9	Tree Felling	19.15
19.4.10	Other Construction Settlement Control Measures	19.16
19.5	MONITORING AND MAINTENANCE DURING CONSTRUCTION	19.16
19.5.1	Monitoring	19.16
19.5.2	Operational Phase	19.17
19.5.3	Decommissioning Phase	19.17
19.6	CUMULATIVE IMPACTS	19.18
19.7	CONCLUSIONS	19.18

CHAPTER 20 INDIRECT AND INTERACTION OF IMPACTS

20.	INDIRECT AND INTERACTION OF IMPACTS	20.1
------------	--	-------------

20.1	INTRODUCTION	20.1
20.2	APPROACH AND METHODOLOGY	20.1
20.3	INDIRECT IMPACTS (Secondary Impacts)	20.1
20.3.1	Economic	20.2
20.3.2	Road Maintenance	20.2
20.3.3	Noise	20.2
20.3.4	Air and Climate	20.3
20.3.5	Indirect impact from mitigation	20.3
20.4	INTERACTIONS	20.3
20.4.1	Human Beings / Noise	20.5
20.4.2	Human Beings / Landscape	20.5
20.4.3	Human Beings / Roads & Traffic	20.5
20.4.4	Human Beings / Material Assets	20.6
20.4.5	Ecology / Landscape	20.6
20.4.6	Geology and Soils/Water	20.6
20.4.7	Geology and Soils/Ecology	20.7
20.4.8	Geology & Soils/Ecology	20.7
20.4.9	Aquatic Ecology / Water	20.7
20.4.10	Forestry /Ecology	20.7
20.4.11	Forestry /Water Quality	20.8
20.4.12	Forestry/Air and Climate	20.8
20.4.13	Landscape / Material Assets	20.8
20.4.14	Air & Climate / Roads & Traffic	20.8
20.4.15	Geology & Soils / Cultural Heritage	20.9
20.5	EPA GUIDANCE	20.9
20.6	CONCLUSIONS	20.9

LIST OF TABLES

Chapter 1 Introduction

Table 1 1: Oweninny wind farm project townlands	1.2
Table 1 2: Issues raised by key consultees	1.10
Table 1 3: Issues raised by National Parks and Wildlife Service	1.25
Table 1 4: List of Mobile/Signal Communication Companies	1.29
Table 1 5: List of Mobile/Signal Communication Companies Information provided	1.30
Table 1 6: Public Consultation events	1.33
Table 1 7: Public Consultation Event Advertisement	1.33

Chapter 2 Project Description

Table 2 1: History of planning at Oweninny	2.5
Table 2 2: Candidate Wind Turbines	2.11
Table 2 3: Locations of Turbines	2.14
Table 2 4: Electrical Substation Locations (Centre point)	2.18
Table 2 5: Meteorological Mast	2.19
Table 2 6: Borrow Pit Location	2.24
Table 2 7: Estimates of material quantities	2.26

Chapter 3 Project Implementation

Table 3 1: Indicative Project Phasing	3.1
Table 3 2: Construction Schedule and Nominal Time Scales	3.3
Table 3 3: Estimated Typical Construction Plant and Equipment	3.4
Table 3 4: Construction Waste and their Sources	3.23

Chapter 4 Alternatives

Table 4 1: Global Deployment of Wind Power	4.2
Table 4 2: Fuel Mix for All-Ireland Electricity Generation 2011	4.3
Table 4 3: Planning Applications for Wind Farms – Republic of Ireland	4.7
Table 4 4: Wind Classification	4.8
Table 4 5: Wind turbine locations identified by IPCC as potential issues	4.14
Table 4 6: Suitability of 110 kV Ovehead line route	4.17
Table 4 7: Evaluation of potential Line Routes from Substation 1 against Assessment Criteria.	4.17
Table 4 8: Evaluation of potential Line Routes from Substation 2 against Assessment Criteria.	4.18

Chapter 5 Policy and Planning

Table 5 1: National Renewable Energy Targets	5.7
Table 5 2: National 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport	5.9

Chapter 6 Human Beings

Table 6 1: Population Change 2002-2011	6.3
Table 6 2: Number of Persons in Employment by Industry - Co. Mayo	6.4
Table 6 3: Distance of neighbouring houses to OHL and substation locations	6.15

Chapter 7 Noise

Table 7 1: Representative Noise Sensitive Locations monitored for background	7.2
Table 7 2: Coillte Cluddaun Noise Sensitive Locations monitored for background	7.2
Table 7 3: Description of monitored locations around Oweninny site	7.3
Table 7 4: Background noise monitoring location and cluster represented	7.4

Table 7 5: Wind Masts and association with noise measuring locations	7.4
Table 7 6: Representative turbines specification	7.5
Table 7 7: Correction factors for background noise due to existing wind farm noise	7.6
Table 7 8: Day time background noise levels: corrected for existing wind farm noise	7.7
Table 7 9: Night time background noise levels: corrected for existing wind farm	7.8
Table 7 10 Day time and night time background noise for H46: corrected for existing wind farm	7.8
Table 7 11: Construction and decommissioning noise sources	7.13
Table 7 12: Typical Noise Impact of Construction Activities	7.14
Table 7 13: National Roads Authority (NRA) Construction Noise Limits	7.14
Table 7 14: Recent An Bord Pleanála decisions with respect to Planning	7.15
Table 7 15: Wind Speed and Day time Limit Values dB(A) at Oweninny	7-17
Table 7 16: Noise Predictions for Oweninny (112T – SWT-3-101) Acting Alone (dB LA90)	7.19
Table 7 17: Noise Predictions for Oweninny (112T SWT-3-101), Cluddaun and Corvoderry (dB LA90)	7.20
Table 7 18: Day time predicted and background noise levels at 8m/s	7.21

Chapter 8 Shadow Flicker

Table 8 1: Potential Shadow Flicker Occurrence for turbines with Rotor Diameters of 112 m and Hub Heights of 120 m	8.4
Table 8 2: Potential Shadow Flicker Occurrence for Turbines with Rotor Diameters of 120 m and Hub Heights of 116 m	8.6

Chapter 9 Terrestrial Ecology

Table 9 1: Summer bird survey periods	9.4
Table 9 2: Vantage point locations	9.6
Table 9 3: Winter bird survey periods	9.7

Table 9 4: Autumn bird survey periods	9.8
Table 9 5: Approximate length of survey route for otter.	9.9
Table 9 6: Impact significance criteria	9.11
Table 9 7: Summary of habitat types found on site. Classification is after Fossitt (2000). Where relevant, the corresponding Annex 1 habitat of the EU Habitats Directive is given.	9.14
Table 9 8: Typical species list for grassland on old railway tracks.	9.20
Table 9 9: Typical species list for dry heath habitat.	9.21
Table 9 10: Substantial bog remnants	9.23
Table 9 11: Typical species list for lowland blanket bog habitat.	9.24
Table 9 12: Typical species list for cutover bog habitat.	9.27
Table 9 13: Typical species list for rich fen habitat.	9.30
Table 9 14: Distance from nearest bog remnants to construction area	9.33
Table 9 15: Details of bare peat cover and vegetation associated with powerline structures leading away from Substation No. 1.	9.34
Table 9 16: Details of bare peat cover and vegetation associated with powerline structures leading away from Substation No. 2.	9.35
Table 9 17: Adjudged local status of Irish bat species at Oweninny site.	9.38
Table 9 18: Breeding status of species recorded within Oweninny wind farm during 2010, 2011 and 2012 breeding seasons. Red and Amber listed species (after Lynas et al. 2007) & Annex I species of the EU Birds Directive are highlighted.	9.40
Table 9 19: Winter occurrences of species recorded on Transect sections 1-11 (7.3 km) within Oweninny wind farm during winters 2011/12 and 2012/13. Red and Amber listed species are highlighted (after Lynas et al. 2007).	9.43
Table 9 20: Autumn occurrences of species recorded on Transect sections 1-11 (7.3 km) within Oweninny wind farm during October 2011 and August to October 2012. Red and Amber listed species are highlighted (after Lynas et al. 2007).	9.45
Table 9 21: Bird species of conservation importance recorded on site, 2010-2013	9.46
Table 9 22: Whooper Swan records	9.47
Table 9 23: Summary of Hen Harrier activity at roost, winters 2011/12 and 2012/13.	9.51

Table 9 24: Hen Harrier arrival and departure routes at winter roost site, winters 2011/12 and 2012/13.	9.54
Table 9 25: Record of Golden Plover	9.57
Table 9 26: Skylark Record	9.59
Table 9 27: Legal status of protected fauna encountered or considered likely to occur within the study area.	9.62
Table 9 28: Distance from nearest bog remnants to construction area	9.65
Table 9 29: Peat Stability Risk Assessment Risk Rating	9.69
Table 9 30: Result of PSRA	9.69
Table 9 31: Survey target species	9.96

Chapter 10 Water Quality, Fisheries and Aquatic Ecology

Table 10 1: Location co-ordinates semi quantitative electrofishing.	10.6
Table 10 2: Duration of electrofishing times at each site studied	10.7
Table 10 3: Location co-ordinates for kick-sampling stations and water sampling site in Lough Dahybaun.	10.8
Table 10 4: Biotic Index of Water Quality	10.9
Table 10 5: Results of the electrofishing survey – Sheskin, Oweninny and Owenmore River.	10.14
Table 10 6: Salmon capture rates, minimum density estimates and capture rates per m ² per min, separate calculations for first run and second run fishings.	10.14
Table 10 7: Length frequency distributions of salmon captured at each site (>0+ salmon highlighted in red)	10.15
Table 10 8: Length frequency distribution of brown trout captured at all sites during the survey.	10.18
Table 10 9: EPA Biological Monitoring Data	10.21
Table 10 10: Q-value result for each station	10.23
Table 10 11. Results of analyses on a sample collected in L. Dahybaun, January, 2013. All values as mg/l.	10.24

Chapter 11 Landscape

Table 11 1: Definition Of Magnitude / Degrees Of Visual Effects Resulting From The Proposal	11.4
Table 11 2: Criteria For The Assessment Of Magnitude Of Effects On Landscape Character	11.4
Table 11 3: List Of Landscape Character Units (Lcu) Fully Or Partially Contained Within The Study Area	11.8
Table 11 4: List Of Principle Policy Areas (Ppa) Fully Or Partially Contained Within The Study Area	11.8
Table 11 5: List of Natura 2000 (Csac And Spa) Sites Within The 30km Study Area	11.9
Table 11 6 : List of Natural Heritage Areas Within The 30km Study Area	11.10
Table 11 7 County Mayo - List Of Scenic Routes And Highly Scenic Views Within The Study Area	11.12
Table 11 8 County Sligo - List Of Scenic Routes Within The Study Area	11.13
Table 11 9: Definitions To Determine Cumulative Effects On Landscape And Visual Effects	11.56
Table 11 10: Summary Of Landscape, Visual And Cumulative Effects As Illustrated In Photomontages 1 – 27	11.58
Table 11 11: List Of Scenic Routes Within The Study Area	11.62
Table 11 12: List Of Highly Scenic Views Within The Study Area	11.65

Chapter 12 Air and Quality

Table 12 1: Summary of air quality assessment in Zone D	12.2
Table 12 2: EPA 2012 Air Quality Bulletin for monitoring stations in County Mayo	12.3
Table 12 3: Greenhouse Gas Emissions in Ireland (in Mt of CO ₂ equivalent)	12.4
Table 12 4: Table 12.2: Annual Air Emissions	12.6
Table 12 5: Approximate Annual Equivalent Air Emissions	12.8

Chapter 13 Soils and Geology

Table 13 1: Groundwater Vulnerability Classification	13.2
--	------

Table 13 2: Groundwater Resource Protection Matrix	13.4
--	------

Chapter 14 Traffic and Transport

Table 14 1: Potential Turbine Component Haul Routes	14.6
Table 14 2: Summary of Automatic Traffic Counter Results June/July 2012*	14.8
Table 14 3: Summary of Automatic Traffic Counter Results July 2012 (Cluddaun)	14.9
Table 14 4. Existing Mulranny (2012) Two Way Traffic Volumes Summary	14.10
Table 14 5. Estimated Available Capacity on the N59	14.11
Table 14 6: Summary results for fatal and injury collisions (RSA Website)	14.12
Table 14 7: Phase 1 Predicted Traffic Movements	14.15
Table 14 8: Phase 2 Predicted Traffic Movements	14.15
Table 14 9: Phase 3 Predicted Traffic Movements	14.16
Table 14 10: NRA derived Traffic Expansion Factors	14.17
Table 14 11: Phase 3 Predicted Future Year AADT volumes and capacities	14.17
Table 14 12: Typical Wind turbine components	14.20
Table 14 13: Maximum predicted vehicle movements per hour and per day	14.21
Table 14 14: Predicted Excess Capacity in AADT during construction period	14.22
Table 14 15: Predicted cumulative AADT and Remaining Capacity on N59	14.29

Chapter 15 Forestry

Table 15 1: Areas by Management Objectives for Shannetra Forest	15.2
Table 15 2: Planting year and area	15.2
Table 15 3: Coillte felling schedule	15.3

Chapter 16 Material Assets

Table 16 1: Overseas Visits (Thousands) to Ireland	16.1
Table 16 2: Response to question as to whether wind farms spoil the look of the countryside	16.5
Table 16 3: Electricity System Records	16.7
Table 16 4: Transmission Demand Forecast (MW)	16.8
Table 16 5: Avoided Fuel Imports	16.9

Chapter 17 Cultural Heritage

Table 17 1: Description of Potential impacts	17.2
Table 17 2: List of archaeological monuments within overall study area	17.10
Table 17 3: Site CH-1	17.11
Table 17 4: Site CH-2	17.11
Table 17 5: Site CH- 3	17.13
Table 17 6: Site CH-4	17.15
Table 17 7: Site CH-5	17.15
Table 17 8: Site CH- 6	17.16
Table 17 9: CH - 7	17.17
Table 17 10: Site CH - 8	17.17
Table 17 11: Site CH - 9	17.18
Table 17 12: Reported Archaeological Artefacts	17.23
Table 17 13: Site CH - 11	17.33
Table 17 14: Site CH - 11	17.33
Table 17 15: Site CH - 12	17.34
Table 17 16: Site CH - 13	17.35
Table 17 17: Site CH - 14	17.36
Table 17 18: Site CH - 15	17.36

Table 17 19: Site CH - 16	17.37
Table 17 20: Site CH - 17	17.37
Table 17 21: Site CH - 18	17.38
Table 17 22: Site CH -19	17.38
Table 17 23: Site CH - 20	17.39
Table 17 24: Site C - 21	17.40
Table 17 25: Site 22	17.41
Table 17 26: Site 23	17.41
Table 17 27: Site 24	17.42

Chapter 18 Hydrology and Hydrogeology iron Flush Areas

Table 18 1: Summary of Subsoil Water Level Monitoring Data (2003 – 2011).	18.6
Table 18 2: Results of Rising Head Tests (EDA, 2003).	18.6
Table 18 3: Summary of Site Investigation Methods.	18.7
Table 18 4: Total Flush Discharge Measurements from D4.	18.9
Table 18 5: Site investigation and related water monitoring locations	18.11
Table 18 6: Summary of Piezometer Network	18.12
Table 18 7: Summary of Permeability Analysis.	18.13
Table 18 8: Water Level Data for Phreatic Piezometers.	18.14
Table 18 9: Water Level Data for Deep Peat/Subsoil Interface Piezometers.	18.15
Table 18 10: Water Level Data for Mineral Subsoil Piezometers.	18.15
Table 18 11: Water Level Data for Perimeter Boreholes.	18.16
Table 18 12: Surface Water Field Hydrochemistry.	18.16
Table 18 13: Phreatic Surface Field Hydrochemistry.	18.17
Table 18 14: Deep Peat Field Hydrochemistry.	18.18
Table 18 15: Mineral Subsoil Field Hydrochemistry.	18.19

Table 18 16: Hydrochemical Results for Round 1 of Sampling.	18.19
Table 18 17: Hydrochemical Results for Round 2 of Sampling.	18.20
Table 18 18: Hydrochemical Results for Round 3 of Sampling.	18.21
Table 18 19: Hydrochemical Results for Round 4 of Sampling (Part 1).	18.22
Table 18 20: Hydrochemical Results for Round 4 of Sampling (Part 2).	18.23
Table 18 21: Summary of Water Type Analysis.	18.24
Table 18 22: Development Setback Distances from cSAC Boundary.	18.38
Table 18 23: Results of Wider Study Hydrochemical Analysis	18.47

Chapter 19 Hydrology and Sediment

Table 19 1: Catchments and Turbines	19.3
Table 19 2. River Risk and Design Rainfall Return Periods	19.10

Chapter 20 Indirect and Interaction of Impacts

Table 20 1: Potential interaction of effects	20.4
Table 20 2: Summary of Potential Interactions during the Construction stage	20-10

LIST OF PLATES

Chapter 1 Introduction

Plate 2 1: Bellacorick power station	2.22
--------------------------------------	------

Chapter 6 Human Beings

Plate 6 1: Electric and Magnetic Field comparisons	6.14
--	------

Chapter 9 Terrestrial Ecology

Plate 9 1: View of a dystrophic lake within a bog remnant area with bog islands.	9.16
Plate 9 2: An artificial lake in cutover bog west of the existing windfarm. Note the absence of fringing wetland vegetation.	9.17
Plate 9 3: River Muing in the south of the site with fringing acid grassland and conifer forest plantation.	9.18
Plate 9 4: A view of calcareous spring vegetation with calcium carbonate visible on the surface.	9.19
Plate 9 5: Dry heath vegetation dominated by <i>Calluna vulgaris</i> is frequent on the low hills in the south-east of the site.	9.22
Plate 9 6: A view of intact lowland blanket bog within a bog remnant in the south-east of the site.	9.25
Plate 9 7: Drains through bog remnants	9.25
Plate 9 8: Soft rush and common bog-cotton dominate large areas of re-vegetating cutover bog.	9.29
Plate 9 9: Bare peat surface	9.29
Plate 9 10: Tributary of Oweninny River on which Otters were previously recorded.	9.36

Chapter 10 Water Quality, Fisheries and Aquatic Ecology

Plate 10 1: Electrofishing Site 1	10.4
-----------------------------------	------

Plate 10 2: Electrofishing Site 2	10.5
Plate 10 3: Electrofishing Site 3	10.5
Plate 10 4: Electrofishing Site 4	10.6
Plate 10 5: Length frequency distributions of salmon captured at each site and during each fishing run in the case of sites 2, 3 and 4.	10.17

Chapter 15 Forestry

Plate 15 1: Typical example of a Forest Harvester (Courtesy of Coillte)	15.6
Plate 15 2: Typical example of a forest forwarder (Courtesy of Coillte)	15.7

Chapter 17 Cultural Heritage

Plate 17 1: Extract from the 1585 Map – Northwest Mayo	17.4
Plate 17 2: Extract from the 1587 Map – Northwest Mayo	17.4
Plate 17 3: Extract from Bald’s Map of 1813 (Bellacorick – Eskeragh and area north	17.6
Plate 17 4: Extract from Bald’s Map of 18 13 (Ballymonnelly - Bellacorick and area to north	17.7
Plate 17 5: Former ESB Bellacorick Power Station	17.8
Plate 17 6: Boulder located adjacent published location for Site CH-1	17.13
Plate 17 7: Site CH-3	17.14
Plate 17 8: North-facing enclosing bank/wall to SITE CH-3	17.15
Plate 17 9: View of Site CH-3 from the east	17.15
Plate 17 10: Site CH - 6	17.16
Plate 17 11: Site CH - 7	17.17
Plate 17 12: Site CH-9A	17.20
Plate 17 13: Site CH-9B	17.20
Plate 17 14: Site CH-9C	17.21
Plate 17 15: Site CH-9D	17.21

Plate 17 16:Site CH-9F	17.21
Plate 17 17: Decorated Wooden Vessel – Corvoderry – NMI Reg: 1960:609 (From Prendergast & Lucas, 1962, p. 161)	17.23
Plate 17 18: Wooden Vessel – Croaghaun West – MNI Reg: 1958:16, (Lucas et al, 1960, p. 25)	17.24
Plate 17 19: Wooden Vessel – Shanvolahan – NMI Reg: 1959-57 (From Lucas et al, 1961, p. 105)	17.27
Plate 17 20: Wooden Bog Butter Container – Sheskin – NMI Reg: 1958:13, (From Earwood, 1997, p. 30)	17.28
Plate 17 21: Wooden Methers – Tawnaghmore – NMI Reg: 1960:620, (From Prendergast & Lucas, 1962, 166)	17.31
Plate 17 22: CH-10 Srahnakilly – Peat-formed Field Boundary	17.33
Plate 17 23: SITE CH-11A - Srahnakilly – Cottage & Outbuilding	17.34
Plate 17 24: CH-11B Srahnakilly – Field Boundary	17.34
Plate 17 25: Site CH-12 - Cottage	17.35
Plate 17 26: Site CH-13 – Srahnakilly – Cottage Ruins	17.35
Plate 17 27: Site CH-14 - Srahnakilly - Bridge	17.36
Plate 17 28: Site CH-15 - Srahnakilly – Bord na Móna Bridge	17.36
Plate 17 29: Site CH-16 – Srahnakilly – Bridge	17.37
Plate 17 30: Site CH-17 - Srahnakilly - Road Bridge	17.37
Plate 17 31: Site CH-18 – Srahnakilly – Railway Bridge	17.38
Plate 17 32: Site CH-19 – Detail to surface of railway bridge	17.38
Plate 17 33: Site CH-20 – Belacorick Bridge	17.39
Plate 17 34: Site CH-20 – Bellacorick – Former Stable Block	17.40
Plate 17 35: Site CH-21 – Tawnaghmore – Ballymonnelly Church	17.40
Plate 17 36: Site CH-22 – Moneynierin – Road Bridge	17.41
Plate 17 37: Site Ch-23 – Moneynierin – Industrial Complex	17.41
Plate 17 38: Site Ch-24 – Moneynierin – Ruined Cottages	17.42

Plate 17 39: Exposed Edge to Internal Access Road showing peat overlying gravelly sandy subsoils	17.43
Plate 17 40: Exposed edge showing peat overlying gravelly subsoil	17.43
Plate 17 41: Exposed peat overlying sandy subsoil	17.44
Plate 17 42: Exposed Gravelly Subsoil	17.44

Chapter 18 Hydrology and Hydrogeology Iron Flush Areas

Plate 18 1: Bellacorick Iron Flush Mineral Subsoil Water Level Monitoring (2003 – 2011).	18.5
Plate 18 2: Coupled Piezometers within cSAC	18.2
Plate 18 3: Continuous Water Level Plot	18.4
Plate 18 4: Exposed Subsoils to the East of the Flush.	18.15
Plate 18 5: Mineral subsoils beneath flush area.	18.16
Plate 18 6: Flush Discharge on the Northern Boundary of cSAC (D4).	18.18
Plate 18 7: Sources of Iron to the Flush	18.22
Plate 18 8: Schematic of Iron Mass Balance for the Flush	18.23
Plate 18 9: Iron Oxide on the Surface of Flush.	18.24
Plate 18 10: Spring/seepage area on the southeast of wind farm site.	18.35
Plate 18 11: Poor flush area on the east of wind farm site.	18.36

Chapter 19 Hydrology and Sediment

Plate 19 1: Area Prior to Rewetting	19.5
Plate 19 2: The Same General Area as Plate 19 2, In 2010.	19.5
Plate 19 3: Typical Stone Check Dam in a Drainage Ditch	19.11

LIST OF FIGURES

Non Technical Summary

Figure 1: Oweninny Site Location Map	34
Figure 2: Proposed wind farm layout	35
Figure 3: Indicative Project Phasing	36
Figure 4: Predicted Noise Contour Map –Oweninny Acting alone	37
Figure 5: Predicted Noise Contour map – Oweninny acting in conjunction with Cluddaun and Corvoderry	38
Figure 6: Rivers Draining the Oweninny site	39
Figure 7: Zone of Theoretical Visibility at 176m Blade Tip Height	40
Figure 8: View North northeast from the N59 across Lough Dahybaun (existing and post development)	41
Figure 9: View north from Nephin Beg Mountain approximately 250m northeast from the summit	42
Figure 10: Oweninny access points off the N59	43

Chapter 1 Introduction

Figure 1 1: Oweninny Site Location Map	1.36
--	------

Chapter 2 Project Description

Figure 2 1: Site Layout	2.33
Figure 2 2: Typical turbine components (ESB Curryfree wind farm)	2.34
Figure 2 3: Typical Wind Turbine Nacelle (Courtesy of Nordex)	2.35
Figure 2 4: Access locations to Oweninny site off the N59	2.36
Figure 2 5: Typical tower structure	2.37

Figure 2 6: Borrow pit and gravel storage area	2.38
Figure 2 7: Oweninny Visitor Centre- Site Plan	2.39
Figure 2 8: Oweninny Visitor Centre Elevation	2.40
Figure 2 9: Contractors typical site compound layout	2.41
Figure 2 10: Typical batching plant layout	2.42
Figure 2 11: Project indicative phasing	2.43
Figure 2 12: Location of other projects near Oweninny	2.44

Chapter 4 Alternatives

Figure 4 1: Trend in Wind Turbine Sizes	4.20
Figure 4 2: Growth of Wind Energy in Ireland	4.20
Figure 4 3: Average wind velocity at hub height across the EU.	4.21
Figure 4 4: Oweninny Initial Constraints Map	4.22
Figure 4 5: Planning approved and proposed wind farm layout	4.23
Figure 4 6: Proposed wind farm layout issued for Scoping Report	4.24
Figure 4 7: Communication signal corridors with final proposed layout	4.25
Figure 4 8: Final Constraints Map	4.26
Figure 4 9: Alternative 110 kV Overhead Line Routes	4.27

Chapter 5 Policy and Planning

Figure 5 1: County Mayo Renewable Energy Wind Map – (Reproduced from the County Mayo Renewable Energy Strategy)	5.18
---	------

Chapter 6 Human Beings

Figure 6 1: District Electoral Divisions at Oweninny	6.21
Figure 6 2: Investment Contributions	6.22

Figure 6 3: Irish Wind Jobs by Category 6.23

Figure 6 4: Favourability to More Wind Farms 6.24

Chapter 7 Noise

Figure 7 1: Wind farm layout with noise sensitive locations 7.28

Figure 7 2: Representative Noise Monitoring Locations 7.29

Figure 7 3: Predicted long term wind speed and direction at Mast 1 @ 50m 7.30

Figure 7 4: Predicted long term wind speed and direction at Mast 2 @ 50m 7.31

Figure 7 5: Predicted long term wind speed and direction at Mast 3 @ 50m 7.32

Figure 7 6: Predicted Noise Level Contour Map with Siemens SWT-3-101 wind turbines – Oweninny only 7-33

Figure 7 7: Predicted Cumulative Noise Level Contour Map with Siemens SWT-3-101 wind turbines – Oweninny, Cluddaun and Corvoderry 7-34

Chapter 8 Shadow Flicker

Figure 8 1: Potential Shadow Flicker Receptors at Oweninny for Turbines with 112 m Rotor Diameters 8.11

Figure 8 2: Potential Shadow Flicker Receptors at Oweninny for Turbines with Rotor Diameters of 120 m 8.12

Chapter 9 Terrestrial Ecology

Figure 9 1: Habitat and vegetation map 9.102

Figure 9 2: Bog Remnant locations 9.103

Figure 9 3: Bird survey transects 9.104

Figure 9 4: Bird survey vantage point locations 9.105

Figure 9 5: Otter survey routes 9.106

Figure 9 6: Designated and protected areas within 15 km 9.107

Figure 9 7: Distribution of selected breeding birds	9.108
Figure 9 8: Hen Harrier winter roost locations	9.109
Figure 9 9: Hen Harrier winter flight lines to winter roost	9.110
Figure 9 10: Hen Harrier departing flight lines from winter roost	9.111

Chapter 10 Water Quality, Fisheries and Aquatic Ecology

Figure 10 1: Oweninny Site Rivers	10.41
Figure 10 2: Oweninny River Catchments	10.42
Figure 10 3: Electrofishing survey assessment locations	10.43
Figure 10 4: EPA Biological Assessment Sites	10.45
Figure 10 5: Aquafact Biological Water Quality monitoring sites	10.46
Figure 10 6: Location of Freshwater Pearl Mussel recorded populations on the Deel river	10.47
Figure 10 7: Lough Dahybaun catchment	10.48

Chapter 11 Landscape

Figure 11 1: Landscape designations - Photomontage Locations	11.77
Figure 11 2: Landscape Character Areas	11.78
Figure 11 3: Natural Heritage Areas and Natura 2000 Sites	11.79
Figure 11 4: Zone of Theoretical Visibility at Hub Height 120 metres	11.80
Figure 11 5: Zone of Theoretical Visibility with Blade Tip 176 metres	11.81
Figure 11 6: Visual Impact	11.82
Figure 11 7: Nature of Visibility at 176 metres Blade Tip Height	11.83

Chapter 12 Air and Climate

Figure 12 1: Air quality Zones	12.12
--------------------------------	-------

Figure 12 2: Air quality monitoring locations	12.13
Figure 12 3: Greenhouse gas emissions in 2011 by Sector	12.14
Figure 12 4: Greenhouse Gas Emissions in Ireland 1990 – 2011	12.15

Chapter 13 Soils and Geology

Figure 13 1: Soil Formations	13.15
Figure 13 2: Groundwater Vulnerability Mapping	13.16
Figure 13 3: Bedrock Formation	13.17
Figure 13 4: GSI Resource Mapping	13.19

Chapter 14 Traffic and Transport

Figure 14 1: Oweninny County Roads	14-31
Figure 14 2: Oweninny Traffic Count Locations	14-32
Figure 14 3: Oweninny Site Access Locations	14-33
Figure 14 4: Turbine blade in transportation	14-34
Figure 14 5: Access route of Cluddaun Wind Farm through Oweninny Wind Farm (Courtesy of Coillte Cluddaun Wind Farm)	14-35

Chapter 15 Forestry

Figure 15 1: Oweninny Coillte and Private Forest Plantation	15.13
Figure 15 2: Oweninny Forest Clearfell Corridors	15.14

Chapter 16 Material Assets

Figure 16 1: Fáilte Ireland survey of tourist attitudes to wind farms	16.15
Figure 16 2: Fáilte Ireland Wind farm influence on decision to visit Ireland	16.16
Figure 16 3: Tourist centres in the vicinity of Oweninny wind farm	16.17

Figure 16 4: Annual Electricity Demand	16.18
Figure 16 5: Scoping phase wind turbine layout showing communication signal corridors	16.19
Figure 16 6: Communication signals crossing the site	16.20

Chapter 17 Cultural Heritage

Figure 17 1: Locations Of Cultural Heritage Sites	17.52
---	-------

Chapter 18 Hydrology and Hydrogeology Iron Flush Areas

Figure 18 1: Bellacorick Iron Flush Site Location Map	18.1
Figure 18 2: regional Hydrology Map	18.2
Figure 18 3: Local Soils Map	18.3
Figure 18 4: Local Subsoils Map	18.4
Figure 18 5: Bellacorick Iron Flush cSAC Drainage and Vegetation Map	18.5
Figure 18 6: Bellacorick Iron Flush cSAC Local Drainage Map	18.6
Figure 18 7: Peat Depth Map	18.7
Figure 18 8: Bellacorick Iron Flush cSAC Site Investigation Network	18.8
Figure 18 9: Bellacorick Iron Flush cSAC Hydrochemistry Map	18.9
Figure 18 10: Durov Hydrochemistry Plot	18.10
Figure 18 11: Hydrogeological Cross Section A	18.11
Figure 18 12: Hydrogeological Cross Section B	18.12
Figure 18 13: Bellacorick Iron Flush cSAC Groundwater Contour Plot	18.13
Figure 18 14: Bellacorick Iron Flush cSAC Regional Groundwater Catchment	18.14
Figure 18 15: Bellacorick Iron Flush Recharge Area	18.15
Figure 18 16: Wider Hydrological Study	18.16
Figure 18 17: Wider Hydrological Study Flush Location Map	18.17
Figure 18 18: Wider Hydrological Study Formoyle Flush Catchment	18.18

Chapter 19 Hydrology and Sediment

Figure 19 1: Oweninny Site And Main River Catchments	19.21
Figure 19 2: Oweninny Site Hydrology	19.22
Figure 19 3: Water Level Recession Curve	19.23
Figure 19 4: River Sub-Catchments	19.24
Figure 19 5: Sample Of The Wind Farm Layout Showing Drainage Arrangement	19.25
Figure 19 6: Lough Dahybaun Catchment	19.26
Figure 19 7: Relationship Of Oweninny Wind Farm Site to Freshwater Pearl Mussel Records on the Deel River	19.27
Figure 19 8: Borrow Pit And Drainage	19.28
Figure 19 9: Peat Deposition Area	19.29
Figure 19 10: Batching Plant And Substation 1 Drainage	19.30